Departamento de Personalidad, Evaluación y

Tratamiento Psicológico

Centro de Investigación Mente, Cerebro y Comportamiento

(CIMCYC)

UNIVERSIDAD
DE GRANADA

PROGRAMA DE DOCTORADO EN PSICOLOGÍA (B.13.56.1)

TESIS DOCTORAL

LA MENTE DEL HOMBRE MALTRATADOR:

UNA PERSPECTIVA NEUROCIENTÍFICA

Natalia Bueso Izquierdo

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Editor: Universidad de Granada. Tesis Doctorales
Autora: Natalia Bueso Izquierdo
ISBN: 978-84-9163-778-3
URI: http://hdl.handle.net/10481/49520

El presente trabajo de investigación ha sido financiado a través del programa de Formación de Personal Investigador (FPI; Ministerio de Economía Industria y Competitividad de España), al que ha estado vinculada la doctoranda desde Abril de 2015.

La doctoranda Natalia Bueso Izquierdo pertenece al Departamento de Personalidad, Evaluación y Tratamiento Psicológico de la Universidad de Granada y es miembro del Centro de Investigación Mente, Cerebro y Comportamiento de la Universidad de Granada, España.

Editor: Universidad de Granada. Tesis Doctorales

Autora: Natalia Bueso Izquierdo

ISBN:

URI:

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Granada, 1 de Diciembre de 2017

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CAPÍTULO 0

¡Qué viva la vida!

"Por largo tiempo me parecía que la vida estaba a punto de comenzar. La vida de verdad. Pero siempre había algún obstáculo en el camino, algo que resolver primero, algún asunto sin terminar, tiempo por pasar, una deuda que pagar. Sólo entonces la vida comenzaría. Hasta que me di cuenta que esos obstáculos eran mi vida". (Eduardo Galeano).

AGRADECIMIENTOS

Durante estos años de Tesis Doctoral, en uno de esos momentos "bajos" de la vida que todos y todas tenemos, sentí como si a ratos estuviera corriendo descalza en una carrera de fondo de muchos kilómetros (por no tener esos años una beca, ni un sueldo fijo para realizar la Tesis). Después cambió mi suerte y he podido disfrutar de una Beca FPI por cuatro años, pero al final la vida me demostró que estaba muy equivocada...

Me di y me doy cuenta que SIEMPRE he tenido lo más importante: toda esa gente que ha estado durante todo el camino animándome estos años hasta llegar a la meta, que hoy es leer la Tesis, aunque sólo es un destino más de lo que me queda…

Por eso, no olvido mis orígenes, lo bien y lo mal que lo he pasado y los momentos en los que parecía que iba a abandonar… cuando me caí y cuando me levanté. GRACIAS.

ESTO ES PARA VOSOTROS Y VOSOTRAS: (Estos agradecimientos los he estado escribiendo mientras he ido realizando la Tesis en todo este tiempo (2012-2017).

No podía ser de otra manera…

En primer lugar, quiero dar las gracias a mis dos directores de tesis:

A Miguel Pérez García. Por todo tu apoyo incondicional hacia mí. He tenido la oportunidad de conocerte en cuatro roles: como profesor, como jefe, como director de Tesis, y el global: como persona. En los cuatro, me has enseñado grandes cosas sobre la vida y el mundo académico. Has estado ahí desde el inicio, explicándome cualquier duda que he tenido, sacándome una sonrisa cuando más lo necesitaba. Siempre recordaré cuando casi no nos conocíamos, en mi primer congreso en Valencia en 2011, donde me dijiste que yo podía ser investigadora, doctora y profesora si era lo que yo quería: muchas gracias por haber apostado por mí. Gracias por tantos cafés con integrales de tomate y risas, hablando sobre la vida que me han hecho sentirme muy cercana. Siento que has confiado mucho en mí en estos años y eso es algo que valoro y me ha hecho desarrollarme como una investigadora segura. Y gracias por haberme enseñado el campo de la Neuropsicología, porque gracias a ti, me apasiona.

Me has apoyado en estos siete años cada día: Eres como un padre para mí.

Quiero dar las gracias también a mi otra directora de tesis: **Natalia A. Hidalgo Ruzzante**. Has sido y eres una persona muy importante y fundamental en todo mi recorrido como investigadora y en mi vida personal. Gracias por tu delicadeza, por esos ratos de charla con café americano, por formarme, por ser un maravilloso ejemplo de mujer, de feminista guerrera y de gran profesional. Gracias por esas conversaciones más íntimas junto a Jesús, Adri y Gara, esas lindas personas que forman tu familia y me hacen sentir parte de ella. Y gracias Nati por esa noche maravillosa bailando en Huelva a mi lado.

Por tanto, Gracias a Miguel y a Nati, por cuidarme tantísimo y

por demostrarme una y otra vez que mi “techo” no está donde yo lo pienso.

Quiero dar las gracias a todo mi grupo de investigación: **PNÍNSULA CTS-581**. Estos años he aprendido lo bonito y enriquecedor que es trabajar en equipo; me siento muy orgullosa de formar parte de él. Este grupo está lleno de personas valientes y resilientes. Gracias por tantos momentos tan divertidos e imposibles de olvidar. Os llevo y os llevaré dentro de mi corazón siempre.

Gracias **Antoñita**, porque siempre me has recibido en tu despacho con los brazos abiertos. Gracias a **Antonio Puente** por tener detalles conmigo tan especiales como el viaje a Washington D.C. Gracias a **Nieves Pérez Marfil** y a **Paco Cruz** por ser tan amables cuando hemos compartido docencia.

Quiero dar las gracias a toda la gente del **Centro Penitenciario de Albolote y del CIS de Granada**. A **Cloti Berzosa, Adela Ruz, Miguel Carreño y Antonio Baena**, por su incansable ayuda a la hora de recabar participantes para esta investigación. Y gracias a **todos/as los autores/as** que han participado en los artículos de esta Tesis.

Aunque seguramente no les llegue nunca esta Tesis a sus manos, **gracias a todos los hombres** que han participado en los estudios. Porque sin su colaboración, no tendría acabado este trabajo. Me han demostrado en estos años, que la gente comete equivocaciones a veces muy grandes en la vida, pero que no está reñido con ser educado y amable con los demás. Espero que mi Tesis sirva para ayudarlos un poco más, en ese camino a veces tan difícil de buscar ayuda o conseguir la reinserción en esta sociedad.

Thanks to **Stephen Hart, Kelly A. Watts, Randy Kropp, Kevin Douglas, Nicole and Nancy**. My double research stay of three months in Vancouver (Canada) were moments that have made me grow as a person; but this last stay of the summer of 2017 was shocking to me. Thanks to Steph and Kelly for giving me an unforgettable trip to Tofino Island and for taking care of me in a delicate moment of my life. Thank you for your patience with my English, your daily hugs and time spent all together in Caylan, because all of you made me feel at home.

Gracias a mis **amigas de Psicología** por darme unos años de Universidad inolvidables. Gracias a mi compi y amiga de Máster **Ali** por haber estado tan pendiente de mí durante la estancia. Gracias **Salva** por animar siempre a tu "vechina" en momentos duros. Gracias a mi profe **Estanis** por transmitirme pasión por la docencia y por la música. Gracias **Fernando G. Quero** por tu apoyo en el inicio de la Tesis y durante todos los años que estuvimos juntos. Gracias a mi "peque" **Martita** por mostrarme lo que significa una amistad para siempre. Y gracias a mi grupo **"Girls on fire"** por provocarme tantas carcajadas en estos últimos meses.

Quiero dar las gracias a: **Ele Delgado** (por darme tan buenos consejos y calmarme en mis momentos más delicados). A **Carlitis Valls** (por tantas risas y confesiones únicas que siempre me han hecho sentirme yo misma). A **Juan Verdejo** (por toda tu grandísima ayuda con mi Tesis y nuestras anécdotas vividas) y a **Mery Vélez** (por sacarme tantas sonrisas en momentos duros y por compartir noches vogue-míticas).

Me gustaría dar las gracias a mi “sosia”: **Alba**. Ha sido compañera mía desde que empecé la carrera y por circunstancias varias hasta empezar el doctorado, no intimamos de verdad. Gracias por cada palabra que me ha animado a seguir adelante, por tantos kínder buenos sanadores, por tantas cervezas y pacharanes infinitos. No lo olvides nunca: “Eres luz que va llenando cada espacio hueco que se va encontrando”.

Gracias también a **Ana Luque**: mi “primi” por ser tan sincera conmigo y estar ahí “caiga quien caiga” tras 22 años de amistad y los que nos quedan. Gracias por cantar juntas tantas canciones que nos han marcado para siempre y por abrazarme fuerte cuando he temblado de miedo.
¡”Gracias mis Suris”!

Gracias a mi “guerrera”: **Mari**. Por compartir conmigo: Japón, las Alpujarras o un banco del García Lorca en Granada y sentirme libre. Gracias por quererme tanto y tan bien.

Gracias a mi “sis” **Julia**. Por tu ayuda con el “fucking english” durante la Tesis. Pero lo más importante, gracias por ser como eres. Es impresionante como una persona de diferente idioma de origen, país, edad y personalidad distinta, la sienta tan cercana como una hermana que siempre está y estará presente toda mi vida. Gracias por ser mi espejo.

Gracias a gente de mi familia y "familia":

A mi **Tita Paqui** por mandarme esos Whatsapps tan bonitos cuando he estado de estancia.

Gracias a mi **cuñado Víctor** por empeñarse en que sonría con la boca bien abierta.

Gracias a mi "familia": **Los Rodríguez Garzón y los Matilde-José** por su cariño conmigo y hacia mi madre.

Gracias a mis hermanas: Lore y Patri; Por cuidar a la "peque" de la familia y animarme cada vez que lo he necesitado personal y profesionalmente. Gracias por estar siempre preocupadas por vuestra hermana pequeña. Por abrazarme cuando he estado mal (que han sido un "par" de veces). No podría tener mejor familia que vosotras, junto a papá y a mamá.

Y gracias a mis tres sobrinos por convertirme en la "tata-tati" más afortunada del mundo:

Gracias a mi **Sobri Pablo** porque ver la vitalidad y la alegría de un niño tan bueno, me recuerda que la vida es maravillosa y está llena de buenas personas.

Y gracias a mi sobrinos: **"Mi Sofi" y a "Mi Leito"**, esas personas de las que nada más conocerlas, me dejaron enamorada y cuando bajan a Granada a verme, me alegran el alma.

Y por último y fundamental… MIS RAÍCES:

En primer lugar: Gracias Mamá: porque siempre has sido y eres una persona luchadora y sufridora por tus tres hijas. Me has enseñado muchas cosas en la vida, pero sin duda de las más importantes: el que quiero parecerme a ti en muchos aspectos como persona y como madre, si algún día lo soy. Tengo tu parte tímida y desconectada de lo social a veces; y la verdad, me encanta. Gracias por haberme apoyado en cada paso que he decidido ir dando y por haberme dado una educación y un cariño incondicional. Gracias por impulsarme en cada proyecto o estancia en el que sin tu ayuda, no lo hubiese conseguido. Y gracias por "recogerme", "acogerme" y "soportarme" todas las veces que he necesitado ir a tu casa a resguardarme de las "tormentas".

Gracias por hacer todos estos años de padre y madre, no ha tenido que ser fácil…

Por último y ya acabo, quería finalizar estos agradecimientos tan especiales con una persona muy importante en mi vida, aunque ya no esté presente físicamente y no pueda leerlo:

Gracias Papá: Tú me enseñaste a tratar bien a las personas, a hacerlas reír y ayudarlas en todo lo que pudiese. Siempre tenías una sonrisa para los demás y me enseñaste junto a mamá, que podría ser lo que quisiera en la vida si trabajaba duro en ello.

Durante el tiempo de la Tesis, he pensado muchísimo en ti y en lo que me habrías dicho en algunos momentos de este camino, a veces duro, a veces durísimo sin tu presencia.

Estés donde estés y aunque la vida decidió que tenías que irte cuando yo estaba en cuarto de psicología, y no hayas podido ver todo lo que soy ahora…

SIEMPRE TE SIENTO, SIEMPRE MUY CERCA.

MAMÁ Y PAPÁ: OS DEDICO A LOS DOS ESTA TESIS DOCTORAL.

ÍNDICE

ÍNDICE

RESUMEN

Resumen

La violencia de género (VG) es un problema social a nivel mundial, debido al gran impacto en términos de morbilidad y mortalidad (Organización Mundial de la Salud, 2013). La severidad de este problema justifica los estudios que se están llevando a cabo para entender el comportamiento violento del hombre maltratador (Corvo y Johnson, 2013). Este tipo de violencia debe analizarse desde una perspectiva multidimensional que contemplaría: factores patriarcales-sociales (Cunningham et al., 1998), factores psicopatológicos (Hart, Dutton y Newlove, 1993), factores relacionados con el aprendizaje social, teorías del aprendizaje social y familiar (Wareham, Boots y Chávez, 2009) y factores biológicos (Corvo et al., 2015; Pinto et al., 2010).

Entre todos los mencionados anteriormente, el desarrollo de la ciencia está cada vez más empezando a aplicar una perspectiva neurocientífica a la investigación con hombres maltratadores (Corvo y Dutton, 2015). El papel de los factores biológicos ha sido analizado a través de diferentes variables con un creciente interés en: 1) el funcionamiento neuropsicológico, en concreto las funciones ejecutivas donde están implicadas respuestas emocionales y del comportamiento (Gioia et al., 2000); y 2) en el funcionamiento cerebral, aunque no se ha llegado todavía a ningún perfil específico (Corvo y Dutton, 2015; Corvo y Johnson, 2013; Pinto et al., 2010).

Basándonos en previas investigaciones, el objetivo principal de la presente Tesis Doctoral es analizar el funcionamiento neuropsicológico y el funcionamiento cerebral de los hombres maltratadores comparados con otros hombres condenados por otros delitos.

Para llevar a cabo esto, la Tesis Doctoral consta de un total de trece capítulos. En el capítulo 1 se introducen los conceptos de violencia de género y violencia general, sus modelos y tipología de hombres maltratadores. El capítulo 2 expone el papel que la neurociencia puede aportar en el problema de la violencia de género. En el capítulo 3, 4 y 5 se revisan los estudios previos sobre funcionamiento neuropsicológico, del sistema nervioso y otras variables biológicas implicadas en hombres maltratadores. En el Capítulo 6 se presenta la justificación y objetivos de la presente Tesis. Del Capítulo 7 al 11 se recoge la parte empírica donde se presentan los cinco estudios que componen la Tesis Doctoral.

Considerando la parte empírica, el primer estudio tuvo como objetivo comparar el funcionamiento neuropsicológico de un grupo de hombres maltratadores comparado con un grupo de hombres condenados por otro tipo de delitos. Los resultados mostraron un perfil neuropsicológico concreto del hombre maltratador diferente al de otros hombres condenados por otro tipo de delitos, siendo los hombres maltratadores más inflexibles, pero menos impulsivos. El segundo estudio consistió en evaluar el procesamiento emocional en hombres maltratadores comparados con hombres condenados por otro tipo de delitos, y encontramos que los hombres maltratadores tuvieron un procesamiento emocional diferente en emociones de ira y sorpresa. A continuación, el tercer estudio tuvo como objetivo analizar el funcionamiento cerebral ante imágenes de violencia de género en hombres maltratadores, comparados con hombres condenados por otros delitos. Los resultados mostraron que los hombres maltratadores tuvieron un perfil de funcionamiento cerebral diferente al ver imágenes de contenido de violencia de género.

El cuarto estudio incluyó la evaluación de las regiones cerebrales relacionadas con el procesamiento emocional a nivel estructural. En nuestros resultados los hombres maltratadores, comparados con hombres condenados por otros delitos, tuvieron menor grosor cortical en regiones prefrontales (orbitofrontal), en la línea media (cíngulo anterior y posterior) y áreas límbicas (ínsula, parahipocampal). Además, el grosor de la corteza cingulada posterior dorsal en el grupo de hombres maltratadores, correlacionó con la puntuación total en la prueba de percepción emocional de Ekman. Por último, el quinto estudio analizó si las diferencias en funcionamiento cerebral de los anteriores trabajos estaban relacionadas con daño cerebral en los hombres maltratadores. Los hombres maltratadores no presentaron alteraciones cerebrales estructurales relacionadas con daño cerebral en comparación con hombres condenados por otros delitos. Por tanto las diferencias encontradas a nivel estructural y funcional no se deben a lesiones provocadas por daño cerebral o a la existencia de regiones anormales en el cerebro.

Todos estos resultados indican que para analizar el comportamiento del hombre maltratador, la perspectiva neurocientífica es muy importante y debe ser tomada en cuenta junto con las demás variables ya que se ha encontrado un funcionamiento neuropsicológico y cerebral específico para los hombres que cometen delitos de violencia de género. En el Capítulo 12 se realiza la discusión general, conclusiones, y perspectivas futuras. Por último, el Capítulo 13 está reservado para la mención de la Tesis como Doctorado Internacional.

SUMMARY

Summary

Intimate partner violence is a social problem worldwide, due to its great impact in terms of morbidity and mortality (World Health Organization, 2013). The severity of this problem justifies the studies that are being carried out to understand the violent behavior of the abusive men (Corvo & Johnson, 2013). This type of violence must be analyzed from a multidimensional perspective that contemplates: patriarchal-social factors (Cunningham et al., 1998), psychopathological factors (Hart, Dutton & Newlove, 1993), factors related to social learning, theories of social learning and family (Wareham, Boots & Chavez, 2009) and biological factors (Corvo et al., 2015; Pinto et al., 2010).

Among all those factors mentioned above, the development of science is increasingly beginning to apply a neuroscientific perspective to research with male batterers (Corvo & Dutton, 2015). The role of biological factors has been analyzed through different variables with a growing interest in: 1) neuropsychological functioning, specifically the executive functions where emotional and behavioral responses are involved (Gioia et al., 2000); and 2) brain functioning, although no specific profile has been reached yet (Corvo & Dutton, 2015; Corvo & Johnson, 2013; Pinto et al., 2010).

Based on previous research, the main objective of this Doctoral Thesis is to analyze the neuropsychological and brain functioning of male batterers compared to other men convicted of other crimes. To this end, the Doctoral Thesis consists of a total of thirteen chapters. Chapter 1 introduces the concepts of intimate partner violence and general violence, and their models and types of male batterers. Chapter 2 discusses the role that neuroscience can play in the problem of intimate partner violence.

In chapter 3 ,4 and 5 we review the previous studies on neuropsychological functioning, the nervous system, and other biological variables implicated in violent behaviors among male batterers. Chapter 6 presents the justification and objectives of this Thesis. Chapters 7 to 11 include the empirical section, presenting the five studies that make up the Doctoral Thesis.

With regard to the empirical section, the first study aimed to compare the neuropsychological functioning of a group of male batterers to group of men convicted of other types of crimes. Results demonstrated a specific neuropsychological profile for male batterers which was different from that of other men who were condemned for other types of crimes. These findings showed male batterers to be more inflexible but less impulsive. The second study evaluated emotional processing in male batterers compared to men convicted of other types of crimes, and found that male batterers had different emotional processing of anger and surprise. Next, the third study aimed to analyze and compare the brain functioning of male batterers and men convicted of other crimes as they viewed images of intimate partner violence. The results showed that male batterers had a different profile for brain functioning when viewing images with intimate partner violence content.

The fourth study included the evaluation of brain regions related to emotional processing at the structural level. In our results, male batterers compared to men convicted of other crimes, had lower cortical thickness in prefrontal (orbitofrontal) regions, in the midline (anterior and posterior cingulate) and limbic areas (insula, parahippocampal).

In addition, the thickness of the posterior dorsal cingulate cortex in the male batterer group was correlated with the total score on the Ekman emotional perception test.

Finally, the fifth study analyzed whether the differences in brain functioning of the previous studies were related to brain damage in male batterers that could explain functional and structural differences. Male batterers did not present structural cerebral alterations related to brain damage in comparison with other delinquents. Therefore, the differences found at a structural and functional level are not due to injuries caused by brain damage or the existence of abnormal regions in the brain.

Considering findings for a specific neuropsychological and cerebral functioning in men who commit crimes of intimate partner violence, a neuroscientific perspective is merited and must be taken into account together with the other variables when analyzing the behavior of male batterers. In Chapter 12, the general discussion, conclusions, and future perspectives are made. And finally, Chapter 13 is reserved to mention of the Thesis as an International Doctorate.

I. INTRODUCCIÓN

CAPÍTULO 1:

INTRODUCCIÓN AL CONCEPTO DE VIOLENCIA GENERAL Y DE VIOLENCIA DE GÉNERO

CAPÍTULO 1. Introducción al concepto de violencia de género y de violencia general

1.1 Violencia de género, violencia general, modelos explicativos y aplicaciones de los modelos en la violencia contra la pareja

La violencia de género (VG) se define en nuestro país como la "manifestación de la discriminación, la situación de desigualdad y las relaciones de poder de los hombres sobre las mujeres, que se ejerce sobre éstas por parte de quienes sean o hayan sido sus cónyuges o de quienes estén o hayan estado ligados a ellas por relaciones similares de afectividad, aun sin convivencia", y "comprende todo acto de violencia física y psicológica, incluidas las agresiones a la libertad sexual, las amenazas, las coacciones o la privación arbitraria de libertad" (Ley Orgánica 1/2004, de 28 de diciembre, de Medidas de Protección Integral contra la Violencia de Género).

El movimiento feminista en su constante lucha social, consiguió darle reconocimiento a la gravedad de este problema. Así, se estudió el patriarcado como modelo social dominante responsable de la violencia contra las mujeres. La visión del patriarcado a día de hoy sigue anclada en por gran parte de la sociedad, produciendo pensamientos y creencias erróneas sobre la superioridad masculina, provocando desigualdad entre hombres y mujeres, y dando lugar a que la violencia de género, siga presente en la actualidad (De Miguel, 2005). En este contexto, en los últimos años ha habido un creciente interés a nivel social, profesional y científico en relación a la violencia de género. Se ha convertido en un grave problema mundial, donde casi el 30 % de las mujeres de todo el mundo han sufrido violencia física o sexual a manos de sus parejas o exparejas (Devries et al., 2013; Organización Mundial de la Salud, 2013).

En los últimos 40 años de investigación sobre la VG, el estudio sobre las mujeres víctimas, y de manera novedosa las investigaciones con hombres maltratadores, se han combinado para producir un marco en la política actual, las leyes y las prácticas de respuesta en este campo (Sheehan et al., 2015). Un ejemplo en nuestro país es la creación en 2007 del Sistema de Seguimiento Integral en los casos de Violencia de Género (Sistema VioGén) de la Secretaría de Estado de Seguridad del Ministerio del Interior, utilizado para integrar información sobre el hombre maltratador e informar del nivel de riesgo de violencia.

A continuación nos aproximaremos a diferentes modelos explicativos de la violencia, y su aplicación a la citada violencia contra la pareja. Finalmente, nos centraremos en el perfil de los hombres maltratadores en materia de violencia basada en el género. Los comportamientos violentos del ser humano responden a cualquier acción de una persona contra otra, llevada a cabo con la intención de dañar al otro y conseguir un objetivo (Anderson y Bushman, 2002). Se ha descrito la violencia o agresión como "el uso intencional de la fuerza física o el poder, tanto si es real como una amenaza, contra otro individuo, que resulta o tiene alta probabilidad de terminar en lesiones, muerte, daño psicológico, alteraciones en el desarrollo o deprivación" (Krug et al., 2002). Los actos violentos contra otros han sido explicados por diferentes teorías como la teoría del aprendizaje social (e.g., Bandura, 1983 y Bandura, 2001), y la teoría de la frustración- agresión (Dollard et al., 1939) entre otras. Sin embargo, en los últimos años surgen varios modelos que ha conseguido unificar las teorías anteriormente propuestas, en un sólo concepto (Allen, Anderson y Bushman, 2018).

Entre ellos, cabe destacar en primer lugar el “Modelo General de Agresión” (Anderson y Bushman, 2002), el cual engloba factores cognitivos, sociales y de manera novedosa las variables biológicas (Anderson y Bushman, 2002; DeWall, Anderson y Bushman, 2011-2012). Este modelo se basa en la premisa de que los factores situacionales junto con las características personales, los diferentes constructos como el arousal (efectos fisiológicos) y los procesos afectivos y cognitivos, podrían conducir a la persona a realizar acciones reflexivas o acciones impulsivas, que darían lugar a cometer violencia y a repetirla, debido a las patrones cognitivos ya aprendidos (Gilbert y Daffern, 2011). Aunque se denomina modelo general de agresión, ha sido aplicado para comprender muchos contextos violentos específicos, como la violencia entre grupos o la violencia doméstica (Allen, Anderson y Bushman, 2018).

Otro modelo novedoso es el conocido como “I3 Model” (Finkel, 2007-2014; Slotter y Finkel, 2011). El modelo I3 pretende explicar, cómo una interacción “*normal”* puede convertirse en una interacción “*agresiva”*. Esta metateoría toma en cuenta los conceptos de instigación e impulso (factores que aumentarían la probabilidad de cometer violencia) junto con el concepto de inhibición, (que reduciría la ocurrencia de la misma) (Finkel y Hall, 2018). Recientemente los autores de esta metateoría, llevaron a cabo cuatro investigaciones aplicando el modelo I3 a la violencia contra la pareja analizando si los tres procesos descritos tenían relación con la agresividad disposicional (variable de diferenciación individual que engloba ira, hostilidad y comportamiento agresivo interpersonal) (Buss y Perry, 1992). Dichos estudios demostraron que la agresividad disposicional es un buen pronóstico de la violencia contra la pareja, por lo que los factores de este modelo pueden ayudar a clarificar los mecanismos envueltos en esta violencia específica (Finkel et al., 2012).

1.2 Tipologías de hombres maltratadores

En los últimos años ha habido un creciente interés a nivel social, profesional y científico en relación a la violencia de género y el estudio del comportamiento violento en los hombres condenados por estos delitos. Investigaciones previas han puesto de manifiesto que no todos los hombres maltratadores obedecen a un mismo perfil (Amor, Echeburúa y Loinaz, 2009; Loinaz, Echeburúa, Fernández y Torrubia, 2010). La tipología más mencionada y replicada a lo largo de la literatura científica, ha sido la propuesta por Holtzworth-Munroe y Stuart (1994) quienes formularon su clasificación en relación a las dimensiones de: funcionamiento psicológico, la extensión, y la gravedad de la violencia. A partir de estas variables propusieron tres tipologías:

1) Limitados al ámbito familiar. Este grupo representa el 50 % de los hombres maltratadores. Son fundamentalmente violentos contra sus parejas y sus hijos/as, y la severidad de su violencia es baja. Este grupo pudo haber sufrido niveles bajos o moderados de agresión en su familia de origen (Holtzworth-Munroe y Stuart, 1994).

2) Hombres maltratadores borderline o disfóricos (impulsivos). Este grupo representa alrededor del 25% de los hombres maltratadores (Holtzworth-Munroe y Stuart, 1994). Suelen ser violentos física, psicológica y sexualmente, y muestran una violencia de intensidad media o alta contra su pareja y otros miembros de la familia (Amor, Echeburúa, y Loinaz, 2009). Un estudio en 2008 afirmó que el diagnóstico de personalidad borderline, aumentaría la probabilidad de ser violentos con sus parejas (Costa y Babcock, 2008).

3) Hombres maltratadores violentos en general o antisociales (instrumentales). Este grupo supone el 25% de los hombres maltratadores (Holtzworth-Munroe y Stuart, 1994). Utilizan una violencia de tipo física y psicológica, que se manifiesta de forma generalizada (no limitada al hogar) como una estrategia de afrontamiento para conseguir lo deseado y superar las frustraciones (Fernández-Montalvo y Echeburúa, 1997; Holtzworth-Munroe y Stuart, 1994). Su violencia es premeditada y de mayor frecuencia e intensidad que la de los dos grupos anteriores, y es probable que consuman algún tipo de sustancia (Echeburúa et al., 2008). En un estudio posterior, se identificó un nuevo subtipo de agresor definido como “antisocial de bajo nivel”, el cual cometería menos actos violentos que el grupo anterior. (Amor et al., 2009).

Por otro lado, otros autores también citados, clasificaron a los hombres maltratadores como instrumentales e impulsivos (Tweed y Dutton, 1998). Los hombres maltratadores instrumentales ejercerían una violencia planificada, sin mostrar sentimiento de culpa y expresarían un grado profundo de insatisfacción en su relación. En cuanto a los hombres maltratadores de tipo impulsivo, tendrían dificultades para controlar los impulsos y la expresión de sus afectos, actuando con ira ante su pareja. (Tweed y Dutton, 1998).

Por ese motivo, se desprende que habría un perfil muy heterogéneo de hombres maltratadores, ya que sus formas de agresión estarían relacionadas con factores de personalidad, sus valores, el contexto sociocultural de él y su víctima, y las propias circunstancias del hecho (Lorente Acosta, 2004).

CAPÍTULO 2:

¿QUÉ PUEDE APORTAR LA NEUROCIENCIA AL ESTUDIO DE LOS HOMBRES MALTRATADORES?

Parte de este capítulo ha sido traducido y extraído de: Natalia Bueso-Izquierdo, Julia C. Daugherty, Natalia Hidalgo-Ruzzante y Miguel Pérez-García. *Libro: Violence Risk in Criminal Offender Populations*: *A Forensic Psychological and Neuropsychological Perspective. Capítulo: "Neuropsychological and neuroimaging research with male batterers and domestic violence perpetrators".*

Editorial: Wiley & Sons (2017). ***Under Review (Anexo 2)***

CAPÍTULO 2. ¿Qué puede aportar la neurociencia al estudio de los hombres maltratadores?

Resulta sorprendente que la neurociencia haya dedicado considerables esfuerzos a entender y estudiar el problema de la violencia y sin embargo, haya dedicado tan poco ahínco a investigar el grave problema de la violencia de género. Por eso, para facilitar la especificidad de las contribuciones que esta perspectiva puede aportar al campo de la VG, el objetivo de este capítulo es revisar de modo general las principales aportaciones que la neurociencia ha hecho al campo de la violencia en general y sus contribuciones específicas en la violencia de género.

2.1 Contribuciones específicas de la neurociencia al estudio de la violencia en general

Estableciendo las bases neurales sobre la violencia general, se han descrito varios modelos para intentar comprender y proporcionar, un enfoque que recoja las distintas variables que pueden dar lugar a estos comportamientos (Deb y Deb, 2016; Nelson y Trainor, 2007; Moya-Albiol, 2010). Una de las hipótesis está centrada en la alteración de la corteza prefrontal, ya que su daño o variación daría lugar a una mayor probabilidad de cometer actos violentos, disminuyendo la correcta toma de decisiones, y produciendo impulsividad e inflexibilidad del comportamiento (Deb y Deb, 2016; Moya-Albiol, 2004; Raine y Buchsbaum, 1996). La siguiente premisa está basada en el control de las emociones y formula que estructuras como la corteza prefrontal, la amígdala, el hipocampo, el hipotálamo, el córtex cingulado anterior y otras zonas conectadas entre sí, participan en los procesos de regulación (Moya-Albiol, 2014).

La conexión de estas estructuras, junto a ciertos cambios en neurotransmisores, hormonas y las variables genéticas que posteriormente describiremos, darían lugar a la comisión de violencia de tipo impulsiva (Davidson et al., 2000). Por último queremos señalar que también se ha estudiado como bajos niveles de serotonina, disminuirían el control del córtex prefrontal y llevarían a cometer agresión impulsiva, mientras que altos niveles del ratio testosterona-cortisol impactarían en la amígdala, incrementando la conexión de la sustancia gris periacueductal (PAG), aumentando la probabilidad de una respuesta violenta ante amenazas sociales (Montoya et al., 2012). En la siguiente imagen de Montoya et al. (2012) se puede observar de manera gráfica cómo se produce este mecanismo de acción:

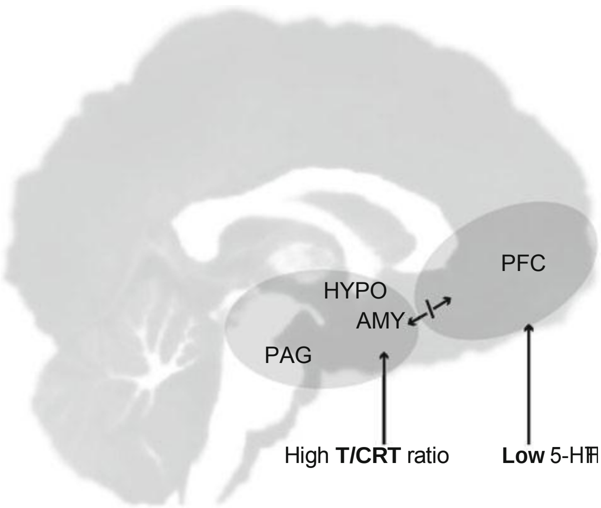


Imagen 1. Figura explicativa sobre la teoría dual hormonal serotoninérgica en la agresión humana impulsiva (Montoya et al., 2012)

Estas dos hormonas: los esteroides del cortisol y la testosterona forman parte del eje hipotalámico-adrenal-pituitario (HPA) y el eje hipotalámico-gonadal-pituitario (HPG).

2.2. Contribuciones específicas de la neurociencia al problema de la violencia de género

En el marco de estos estudios que analizan la violencia ejercida hacia otras personas, ha surgido en los últimos años, un gran interés neurocientífico en conocer las características concretas de los hombres que ejercen violencia contra su pareja o expareja (Corvo et al., 2015; Pinto et al., 2010). En un gran esfuerzo de seguir entendiendo mejor su perfil, se ha comenzado a enfatizar el papel de las variables biológicas (Chester y DeWall 2017; Pinto et al., 2010).

El estudio de la violencia de género desde la perspectiva neurocientífica contribuiría a diferentes aspectos de la comprensión de dicha violencia. En primer lugar, la neurociencia puede proporcionar una metodología objetiva que complementaría la evaluación que tradicionalmente se ha utilizado en las investigaciones con esta población, la cual se ha basado casi exclusivamente en el empleo de cuestionarios y medidas de autoinforme. En este caso, cuando los cuestionarios se administran a los hombres maltratadores, se ha comprobado cómo estas personas están fuertemente sujetas a sesgos de deseabilidad social (Eckardt et al., 2012; Helfritz et al., 2006).

Este tipo de evaluación, con instrumentos autoadministrados conexos con los rasgos de personalidad o los valores morales en relación a la violencia, puede provocar respuestas "deseables" que deberían considerarse con cautela. En este sentido, la neurociencia ofrecería una metodología objetiva, la cual es poco probable que se vea afectada por factores como la deseabilidad social. Además, aporta instrumentos que detectan el bajo esfuerzo o simulación añadiendo valor al estudio de la veracidad en las evaluaciones.

Una segunda justificación para el uso de esta perspectiva en el estudio de los hombres maltratadores, es la facilidad con la cual la neurociencia puede integrar diferentes niveles de conocimiento. La violencia general y específicamente la violencia de género, es un contexto de comportamiento complejo en el que se han propuesto la influencia de diferentes variables, como la genética y las hormonas (Romero-Martínez et al., 2013), el funcionamiento cerebral (Lee et al., 2009) y la cultura entre otras (Levinson, 1989). La integración de estos diferentes niveles en un modelo podría ser un problema, pero en el caso de la neurociencia estaría especialmente preparada para abordar esto, debido a su multidisciplinariedad.

Otra razón importante para incorporar esta perspectiva neurocientífica al estudio con hombres maltratadores, es la información que puede ofrecer sobre las variables cerebrales específicas relacionadas con su comportamiento violento, en concreto en lo que respecta a los antecedentes de lesión cerebral y consumo de drogas (Bueso-Izquierdo et al., 2012). Algunas investigaciones apuntan una mayor prevalencia de daño cerebral en estos hombres, en comparación con población general (Farrer, Frost y Hedges, 2012). Sin embargo, los estudios realizados sobre el funcionamiento cerebral en este grupo hasta la fecha, indican diferencias en la activación cerebral en comparación a grupos controles (Lee, Chan y Raine, 2009), no la presencia o ausencia de trauma cerebral. De hecho, la existencia de daño cerebral parece exacerbar los déficits que ya están presentes en los hombres maltratadores, pero no sería suficiente para explicarlos (Romero-Martínez y Moya-Albiol, 2013). Por lo tanto, debería ser esencial estudiar la estructura del cerebro y su funcionalidad en hombre condenados por VG, para arrojar luz sobre la influencia de estas variables como características específicas en este tipo de delitos.

Otra contribución importante es la influencia que las variables neuropsicológicas podrían tener en la predicción del riesgo de violencia. Se sabe que las variables actuariales y psicológicas combinadas en instrumentos utilizados por jueces expertos, como el aclamado instrumento de "Evaluación del Riesgo de Violencia de Pareja" "SARA" (Kropp y Hart, 2000), ha alcanzado niveles aceptables de predicción exitosa de la violencia (aproximadamente 80%). Sin embargo, los diferentes metanálisis publicados sobre la precisión de la predicción, han indicado que el 0,8 es el "techo de cristal" que no puede ser superado (Coid et al., 2011). En un intento por sobrepasar este límite, la inclusión de nuevas variables neurocientíficas que no se han considerado previamente en estos instrumentos, podría ser muy valiosa. Estas variables propuestas incluyen medidas relacionadas tanto con la conducta violenta, como el funcionamiento neuropsicológico (Coid et al., 2011). Estudios recientes apuntan la capacidad predictiva de las variables neuropsicológicas, lo que indica que pueden favorecer a una mejor predicción del comportamiento violento (Fox et al., 2016; Hanlon et al., 2013).

Por último, cabe señalar también que la neurociencia no sólo hace contribuciones críticas a la comprensión científica del comportamiento de los hombres maltratadores, sino que también realiza aportaciones sobre las secuelas neuropsicológicas que sufren las mujeres víctimas de violencia de género. Si bien son muy escasas las investigaciones realizadas en el ámbito neuropsicológico, resulta evidente que un número significativo de mujeres maltratadas sufren distintas alteraciones de memoria, atención y concentración causadas por golpes directos sufridos en la cabeza o ligadas al estrés mantenido, alteraciones emocionales y estrés postraumático a consecuencia de la relación violenta (Kwako et al., 2011; Torices et al., 2016; Valera y Kucyi, 2016). Una adecuada evaluación neuropsicológica podría objetivar y clarificar las posibles alteraciones cognitivas, emocionales o conductuales producidas por el daño cerebral (Pérez, Puente y Vilar-López, 2009).

Por todo lo mencionado anteriormente, consideramos que la investigación neurocientífica, concretamente el estudio del funcionamiento neuropsicológico y cerebral de los hombres maltratadores podría ayudar a 1) caracterizar mejor el perfil de este tipo de agresores que ejerce una violencia muy concreta hacia la pareja o expareja y 2) investigar si este tipo de funcionamiento neuropsicológico y cerebral, es específico de este tipo de violencia, o es similar al funcionamiento de las personas violentas que ejercen una violencia general (condenadas por otro tipo de delitos).

Todas estas aportaciones constituyen un nuevo programa de investigación ligado a esta Tesis Doctoral sobre la perspectiva neurocientífica en la violencia de género, que podría incluir al menos diferentes líneas de investigación, respondiendo a esta pregunta:

¿Cómo puede la neurociencia ayudar al problema de la violencia de género en hombres y mujeres?

HOMBRES MALTRATADORES	MUJERES VÍCTIMAS
Ayudando a conocer su naturaleza	Evaluación de secuelas neuropsicológicas
Ayudando en el manejo del problema: subtipos de hombres maltratadores	Rehabilitación de secuelas neuropsicológicas
Mejorando la comprensión de la mente del hombre maltratador	Apoyo en procesos forenses

CAPÍTULO 3:

Estudios sobre el funcionamiento neuropsicológico con hombres maltratadores

Parte de este capítulo ha sido extraído y traducido de Bueso-Izquierdo, N., Hart, S. D., Hidalgo-Ruzzante, N., Kropp, P. R., & Pérez-García, M. (2015). The mind of the male batterer: a neuroscience perspective. *Aggression and Violent Behavior, 25,* 243-251. *(Anexo 1).*

Otra parte de este capítulo ha sido extraído y traducido de Natalia Bueso-Izquierdo, Julia C. Daugherty, Natalia Hidalgo-Ruzzante y Miguel Pérez-García. *Libro: Violence Risk in Criminal Offender Populations: A Forensic Psychological and Neuropsychological Perspective*. Capítulo: *"Neuropsychological and neuroimaging research with male batterers and domestic violence perpetrators".* Editorial: Wiley & Sons (2017). *Under Review (Anexo 2).*

CAPÍTULO 3. Estudios sobre el funcionamiento neuropsicológico con hombres maltratadores

Desde el primer trabajo de Schafer y Fals-Stewart (1997), se han producido en los últimos quince años una progresión de trabajos publicados apuntando las características neuropsicológicas en hombres maltratadores (Cohen et al., 2003; Corvo et al., 2006; Easton et al., 2008; Marsh y Martinovich, 2006; Romero-Martínez y Moya-Albiol, 2013; Romero-Martínez et al., 2016; Teichner et al., 2001; Walling et al., 2012). Sin embargo, los hallazgos de dichos estudios han mostrado una importante variabilidad entre los resultados. Algunas investigaciones han hallado que presentan problemas de procesamiento verbal (Cohen et al., 1999), falta de atención (Marsh y Martinovich, 2006), falta de habilidades verbales (Cohen et al., 2003); mientras otros sugieren que esta población tiene problemas de impulsividad (Cohen et al., 2003), flexibilidad cognitiva (Becerra-García, 2015; Easton et al., 2008) y en general, peor rendimiento en función ejecutiva comparado con otras personas (Romero-Martínez y Moya-Albiol, 2013; Teichner et al., 2001).

Esta diferenciación de resultados podría deberse a la influencia de ciertas variables sociodemográficas como el estatus socioeconómico, el nivel educativo, y/o la etnia en el rendimiento de las pruebas neuropsicológicas. Además, el uso de diferentes medidas neuropsicológicas para evaluar diferentes constructos, podría explicar la inconsistencia en los resultados. Por último, cabe destacar otras variables relevantes y a veces poco controladas, como el consumo de drogas y el daño cerebral. Un extenso cuerpo de la literatura ha señalado que las personas que presentan abuso de drogas y/o daño cerebral, muestran varios déficits neuropsicológicos (para una revisión ver Fernández-Serrano et al., 2011; Schretlen y Shapiro, 2003).

Dichas variables, han sido relacionadas en la literatura científica con la comisión de delitos de violencia contra la pareja (Thomas, Bennet y Stoops, 2012; Walling et al., 2012). Los resultados de un reciente estudio apuntan que existió un porcentaje significativamente mayor de hombres maltratadores con antecedentes de daño cerebral, que habían tenido más incidentes de abuso de pareja en el periodo de seguimiento de su condena, comparado con hombres maltratadores sin antecedentes de daño cerebral (Akerele, Murphy y Williams, 2017).

En 1989, Rosenbaum y Hoge encontraron una alta prevalencia de abuso de alcohol y daño cerebral en hombres violentos comparados con población general. En este caso, las personas que sufren daño en el lóbulo frontal puede desarrollar alteraciones en su conducta como: impulsividad, comportamiento violento, falta de autocontrol o descontrol de las emociones (Cole et al., 2008; Farrer et al., 2012; Turkstra, Jones y Toler, 2003; Westby y Ferraro, 1999). En el caso de la violencia de género, varios estudios han señalado una alta prevalencia de antecedentes de daño cerebral en hombres maltratadores (Farrer et al., 2012). Las primeras investigaciones mostraron una prevalencia de historia de daño cerebral en esta población que oscilaba entre el 53 % y el 62 % (Rosenbaum y Hoge, 1989; Rosenbaum et al., 1994).

En el caso del consumo de drogas, se ha descrito que estar bajo la influencia de drogas puede incrementar la severidad de los actos violentos en contra de las mujeres (Corvo, 2014; Mcmurran y Gilchrist, 2007; Thomas et al., 2012).

Además se ha demostrado que los hombres con abuso/dependencia a sustancias, cometen más delitos de violencia contra la pareja y de forma más severa, que aquellos hombres sin abuso o dependencia (Feingold, Kerr y Capaldi, 2008; Kraanen et al., 2014). Específicamente, el alcohol ha sido la droga más estudiada en relación al comportamiento de esta población (Easton et al., 2008; Foran y O´Leary, 2008), considerada como un facilitador de la agresión (Murphy y Ting, 2010).

Recientemente, Romero-Martínez et al. (2016) evaluaron los cambios en las variables neuropsicológicas y su relación con el consumo de alcohol en 116 hombres condenados por VG: 55 con alto contenido de abuso de alcohol (HA) y 61 hombres con bajo consumo de alcohol (LA). Los resultados hallaron que los hombres maltratadores con alto consumo, fueron menos cognitivamente flexibles que aquellos con consumo de bajo grado antes de acudir a los grupos de terapia. Por otro lado, el grupo HA mostró un mayor riesgo de reincidencia de volver a cometer violencia de género, comparado con el grupo de hombres con bajo consumo de alcohol. Esta investigación apoyó la idea de que el consumo de alcohol se debe tomar en cuenta en los estudios con esta población. Por ello, consideramos que estos dos factores específicos influyen en mayor medida en los resultados, en cuanto al rendimiento neuropsicológico en hombres maltratadores y deben ser controlados en los estudios.

El objetivo de este capítulo es clarificar mejor lo descrito anteriormente e integrar los diferentes estudios en categorías. A continuación se presenta un resumen de las investigaciones encontradas sobre funcionamiento neuropsicológico en hombres maltratadores, diferenciando dichos estudios según el análisis realizado de dichas variables: abuso de drogas, daño cerebral y/o variables sociodemográficas.

3.1. Estudios neuropsicológicos que no consideraron abuso de drogas ni antecedentes de daño cerebral

Teichner et al. (2001) condujeron una investigación centrada en funcionamiento cognitivo a través de pruebas neuropsicológicas, comparando 50 hombres condenados por violencia contra la pareja y 23 hombres controles (principalmente universitarios, miembros de personal de la universidad y estudiantes de grado). Los investigadores encontraron que el 48% de los agresores sufrieron alteraciones neuropsicológicas, a diferencia de sólo el 4,3% de los controles (Teichner et al., 2001). El rendimiento significativamente más bajo se encontró en flexibilidad, memoria visual, inhibición de las respuestas verbales y atención centrada. Las conclusiones más relevantes que los autores extrajeron de estos resultados fueron la adecuación de considerar dicho patrón de desempeño neuropsicológico cuando sea necesario establecer grupos, y la importancia de este funcionamiento en el diseño de terapias específicas para este tipo de delitos.

Otro estudio enmarcado en este apartado, se realizó por Chan, Rain y Lee (2010). Su estudio se basó en analizar el sesgo atencional de los hombres maltratadores mediante una tarea de Stroop emocional. Los investigadores evaluaron 23 hombres maltratadores y 24 controles sanos. En sus resultados, los hombres violentos mostraron tiempos de reacción mayores cuando respondían a estímulos negativos que a estímulos neutros. Las conclusiones dejaban ver que los hombres maltratadores pueden ser menos competentes cuando inhiben los estímulos emocionales que los distraen, lo que podría dar lugar a no racionalizar adecuadamente los problemas que surgen en situaciones de conflicto (Chan et al., 2010).

3.2. Estudios neuropsicológicos que consideraron abuso de drogas pero no antecedentes de daño cerebral

En 2008, Easton y su equipo analizaron diferentes dominios neuropsicológicos en una muestra de 9 hombres dependientes al alcohol con un historial de violencia física contra su pareja (IPV+), 9 hombres dependientes al alcohol sin historial de violencia física contra su pareja (IPV-) y 7 hombres fumadores seleccionados como controles. En sus resultados, el grupo IPV+ mostró peor rendimiento en flexibilidad y tareas de concentración comparados con los controles. Además, el grupo IPV+ y el grupo IPV-demostraron ser más impulsivos que el grupo control. Aunque en este estudio la muestra era pequeña, esta investigación sirvió para fortalecer la idea de que las investigaciones neuropsicológicas deben controlar variables como el consumo de drogas, edad de inicio de consumo… ya que la interacción entre cometer actos violentos y consumir alcohol en grandes cantidades, daría lugar a un peor funcionamiento cognitivo (Easton et al., 2008).

Por último en 2017, un estudio evaluó el desempeño de las funciones ejecutivas en una muestra con 17 hombres maltratadores y 17 hombres no maltratadores. En sus resultados, los hombres maltratadores mostraron problemas en el cambio de estrategias, inhibición de las respuestas, atención sostenida y selectiva, planificación, resolución de conflictos y toma de decisiones. Los hallazgos de este estudio plantean la necesidad de perfiles neurocognitivos específicos para evaluar el riesgo de reincidencia, lo que podría beneficiar enormemente al campo legal forense (Cáceres Durán, Salas Picón y Gutiérrez de Piñeres, 2017).

3.3. Estudios neuropsicológicos que consideraron antecedentes de daño cerebral pero no abuso de drogas

Brenner (2017) analizó en su Tesis, la relación entre las medidas de flexibilidad y los autoinformes en una muestra de 92 hombres perpetradores de violencia doméstica. En sus resultados, los hombres que puntuaron más alto en flexibilidad cognitiva, fueron los que atendieron a un mayor número de sesiones de terapia. La importancia de incidir en el componente de la flexibilidad cognitiva, como parte de la función ejecutiva en los tratamientos con hombres maltratadores es fundamental.

3.4. Estudios neuropsicológicos que consideraron abuso de drogas y antecedentes de daño cerebral

Schafer y Fals-Stewart (1997) se convirtieron en pioneros de los estudios de funcionamiento neuropsicológico con hombres violentos. En este estudio, recogieron datos de una muestra de 31 parejas en las que los hombres no habían tenido antecedentes de daño cerebral ni abuso de drogas. Los resultados mostraron un bajo desempeño en flexibilidad, inhibición y vocabulario, los cuales se relacionaron con niveles más altos de violencia severa entre el marido y la mujer. Este estudio fue innovador por señalar un perfil específico para los hombres violentos controlando las variables mencionadas anteriormente, aunque hay que señalar que la muestra fue recogida a través de anuncios, por lo que no eran hombres condenados por violencia contra la pareja (VCP).

El siguiente estudio realizado en 1999 por Cohen y colaboradores, permitió un avance en el campo de la neuropsicología y la violencia contra la pareja. Estos autores centraron su investigación en el funcionamiento ejecutivo. Compararon 39 hombres que habían cometido VCP frente a 63 hombres controles no violentos (todos seleccionados a través de anuncios en periódicos) a través de una extensa batería neuropsicológica. El uso de drogas y el daño cerebral fueron cuidadosamente analizados, junto con una entrevista sobre variables sociodemográficas. Los resultados revelaron que el 46% de los hombres violentos informaron acerca de una historia de daño cerebral, en comparación con el 21% de los controles. Por otro lado, los hombres maltratadores tenían un nivel educativo más bajo que los controles y no se observaron diferencias en el consumo de drogas entre los dos grupos. En relación con el perfil neuropsicológico, se observó un peor rendimiento en aprendizaje, memoria, habilidades verbales y función ejecutiva en el grupo de hombres maltratadores (Cohen et al., 1999).

Unos años más tarde, Cohen y su equipo en 2003, se centraron en un dominio neuropsicológico específico: la impulsividad. Reclutaron 41 hombres que habían cometido violencia contra la pareja, comparado con 20 hombres no violentos. En esta investigación, se aseguraron de que no hubiese diferencias en variables sociodemográficas como la educación y la edad. En sus resultados, los hombres maltratadores presentaron mayor impulsividad y un peor desempeño habilidades verbales, en comparación con los controles. En resumen, estos autores sugirieron que los déficits en la función verbal y ejecutiva podrían tener un papel clave en la forma en que estos hombres resuelven los conflictos con sus parejas (Cohen et al., 2003).

Los siguientes dos estudios son novedosos por la comparación de diferentes grupos de hombres maltratadores, prestando especial atención a las diferencias de subtipos según el daño cerebral o el uso de drogas. En 2006, Marsh y Martinovich evaluaron 22 hombres violentos con sus parejas con lesión cerebral traumática (TBI) y 16 hombres violentos con sus parejas sin TBI en diferentes dominios neuropsicológicos.
Los investigadores controlaron el abuso de sustancias, al clasificarlo como criterio de exclusión. El objetivo de estos autores fue replicar estudios previos que habían señalado una alta prevalencia de antecedentes de daño cerebral, centrándose especialmente en el funcionamiento ejecutivo. Los resultados hallaron que los hombres violentos con TBI presentaron peor desempeño neuropsicológico que el grupo sin TBI.

Otro estudio publicado en el mismo año, fue realizado por Corvo, Halpern y Ferraro (2006), en el que se realizó un análisis secundario de los resultados presentados por Westby y Ferraro (1999) para analizar la relación entre el déficit de lóbulo frontal y el abuso de alcohol, relacionado con tareas neuropsicológicas. En este nuevo análisis, encontraron que el abuso de alcohol influye en las variables neuropsicológicas; y en el caso del lóbulo frontal, a menudo aparecían déficits en casos de violencia severa.

En cuanto al funcionamiento ejecutivo relacionado con los subtipos famosos propuestos por Holtzworth-Munroe y Stuart (1994), en 2012 Walling y su equipo, evaluaron a 102 hombres perpetradores de agresión contra la pareja íntima (IPA) y 62 hombres controles. Dividieron la muestra de IPA en los siguientes tres subtipos: violentos sólo para la familia (37 hombres), de bajo nivel antisocial (34 hombres) y en general, violentos-antisociales (31 hombres).

Los resultados mostraron que las bajas puntuaciones en habilidades verbales fueron significativas en el grupo de hombres que empleaban violencia física y que la inteligencia verbal fue la única medida que se correlacionaba con la frecuencia de la agresión psicológica de la pareja. En cuanto a los tipos de personalidad, el grupo anti-social, el borderline-disfórico y el grupo antisocial con antecedentes de daño cerebral, tuvieron puntuaciones más bajas en las pruebas neuropsicológicas para los tests de inteligencia verbal (Walling et al., 2012).

Becerra-García (2015) analizó el funcionamiento ejecutivo de hombres condenados por violencia contra la pareja en comparación con diferentes grupos de delincuentes. Este cambio en las características del grupo de control marca un avance importante, ya que los grupos control incluían previamente individuos sin delitos. La muestra consistió en 10 hombres condenados por violencia contra la pareja (ofensas de agresión física o psicológica contra sus parejas o ex parejas; 20 participantes condenados por delitos sexuales, 9 participantes condenados por delitos violentos (asalto, intento de homicidio, homicidio y robo a mano armada) y 8 hombres no violentos. Para el componente de flexibilidad, se usó el Trail Making Test (TMT). Los hombres maltratadores y los hombres delincuentes sexuales mostraron peor flexibilidad cognitiva, comparados con el grupo control. Este perfil de inflexibilidad podría explicar por qué algunos hombres maltratadores no modifican sus acciones o pensamientos según la situación, ejerciendo la violencia machista como medio de acción contra sus parejas (Becerra-García, 2015).

3.5. Variables sociodemográficas que deben ser consideradas en los estudios con funcionamiento neuropsicológico

Como previamente mencionamos factores como el nivel educativo, estatus socioeconómico y/ o la etnia, son normalmente considerados durante la evaluación neuropsicológica, ya que pueden dar lugar a variables confusoras que afecten a los resultados (Lezak, 2004). Sin embargo, sólo recientemente empezaron a ser variables de interés en investigación (Chiao, 2009; Noble et al., 2012).

Otro tipo de variables muy importantes a tomar en cuenta, son la procedencia de la muestra y la selección del grupo control. En el caso de los hombres maltratadores, hay estudios que seleccionan a sus grupos a través de anuncios de periódico (Schafer y Fals-Stewart, 1997), otros mediante condena (Becerra-García, 2015)… y a su vez, el grupo control de algunos estudios son reclutados de diferentes localizaciones y con diferentes niveles educativos…

Esta variabilidad puede afectar a los resultados ya que se ha comprobado que las circunstancias asociadas con el encarcelamiento o la prolongación de la vida en prisión pueden influir en el desempeño de las pruebas psicológicas a nivel cognitivo (Ruiz, 2007).

3.6. Conclusiones

En lo últimos años, ha habido un interés creciente en la investigación de los hombres maltratadores a través de la neuropsicología (Pinto et al., 2010). Frecuentemente los estudios han señalado que esta población presenta alteraciones en varios componentes de la función ejecutiva (Cohen et al., 1999; Marsh y Martinovich, 2006; Teichner et al., 2001) y en habilidades verbales o vocabulario (Cohen et al., 1999; Schafer y Fals-Stewart, 1997; Walling et al., 2012). Específicamente, los trabajos han indicado que los hombres maltratadores tienen problemas de impulsividad (Cohen et al., 2003; Schafer y Fals-Stewart, 1997), flexibilidad (Becerra-García, 2015; Easton et al., 2008), atención (Cohen et al., 2003; Easton et al., 2008; Teichner et al., 2001), memoria (Cohen et al., 1999; Teichner et al., 2001) e inhibición de respuesta (Easton et al., 2008). A pesar de todos estos hallazgos, no se ha encontrado un patrón neuropsicológico concreto.

Cuando analizamos las investigaciones que han considerado el abuso de drogas o los antecedentes de daño cerebral, los problemas en vocabulario o déficits en habilidades verbales son los problemas más señalados (Cohen et al., 1999; Cohen et al., 2003). Sin embargo, al no considerar esas variables, otros estudios hallaron problemas flexibilidad cognitiva (Teichner et al., 2001). Finalmente, la mayoría de los estudios neuropsicológicos con esta población han sido conducidos con participantes de etnia caucásica de alto nivel educativo y nivel medio socio-económico, lo que limitaría las conclusiones a un grupo específico de esta población; además de ser comparados con controles que no residen en centros penitenciarios o han sido condenados por algún delito. Por tanto, más investigación sería necesaria para entender la influencia de esas variables y generalizarlas a una muestra más amplia de hombres maltratadores.

CAPÍTULO 4:

Estudios sobre el sistema nervioso con hombres maltratadores

Parte de este capítulo ha sido extraído y traducido de Bueso-Izquierdo, N., Hart, S. D., Hidalgo-Ruzzante, N., Kropp, P. R., & Pérez-García, M. (2015). The mind of the male batterer: a neuroscience perspective. *Aggression and Violent Behavior, 25,* 243-251. *(Anexo 1).*

Otra parte de este capítulo ha sido extraído y traducido de Natalia Bueso-Izquierdo, Julia C. Daugherty, Natalia Hidalgo-Ruzzante y Miguel Pérez-García. *Libro: Violence Risk in Criminal Offender Populations: A Forensic Psychological and Neuropsychological Perspective*. *Capítulo: "Neuropsychological and neuroimaging research with male batterers and domestic violence perpetrators".* Editorial: Wiley & Sons (2017). *Under Review (Anexo 2).*

CAPÍTULO 4. Estudios sobre el sistema nervioso con hombres maltratadores

La neuroimagen puede servir como un método novedoso para entender los mecanismos cerebrales subyacentes relacionados a la agresión que ejercen los hombres maltratadores. Complementarias al enfoque neuropsicológico, estas técnicas pueden arrojar luz sobre las sutiles diferencias cerebrales estructurales y funcionales que modulan el comportamiento violento entre esta población (Lee et al., 2009). A lo largo de los años se han utilizado diversas metodologías, como la imagen de tensor de difusión (DTI) y la resonancia magnética estructural y funcional (MRI). Por un lado, la DTI reuniría información sobre las direcciones y la organización de las fibras axonales (Kubicki et al., 2007; Le Bihan et al., 2001), proporcionando evidencia de alteraciones en la conectividad entre regiones cerebrales (Mori y Zhang, 2006). Por otra parte, los estudios de resonancia magnética permitirían una comprensión más profunda de la morfología cerebral y de la conectividad funcional en respuesta a condiciones o estímulos manipulados. El objetivo de este capítulo es analizar los estudios encontrados con hombres maltratadores en relación al sistema nervioso.

4.1 Estudios centrados en el sistema nervioso central

George et al. (2004) utilizaron la tomografía por emisión de positrones (PET) para analizar la actividad del metabolismo de la glucosa y las estructuras responsables del seguimiento y la mediación de las respuestas condicionadas al miedo, asociadas con la violencia doméstica. Los autores seleccionaron a ocho hombres perpetradores de violencia con dependencia del alcohol, 11 hombres no agresores con dependencia alcohólica y 10 sujetos varones sanos.

Los resultados revelaron que los agresores con abuso de alcohol tenían menores tasas de captación de glucosa en el hipotálamo derecho en comparación con los otros dos grupos, lo que sugiere que habría una anormalidad en la actividad hipotalámica de estos hombres que podría predisponerlos a cometer violencia. Sin embargo hay que señalar que los participantes que fueron categorizados como perpetradores de violencia doméstica, fueron reclutados a partir de anuncios en los periódicos y no habían sido condenados por ningún delito de violencia contra la pareja.

Más tarde, Stanford et al. (2007) examinaron el funcionamiento ejecutivo y el componente P3 (una onda positiva que aparece aproximadamente 300 ms después de la presentación de un estímulo de baja probabilidad) de un potencial relacionado con el evento (ERP). El ERP es la respuesta cerebral medida durante el procesamiento cognitivo. Estas variables fueron evaluadas en una muestra de 18 hombres condenados por abuso conyugal y 18 varones controles no violentos. El P3 se obtuvo utilizando una tarea auditiva que se presentaba en un bloque de 200 ensayos. Los estímulos consistían en dos tonos aleatorios secuenciales: un tono frecuente de 1000 Hz y un tono extraño de 2000 Hz.

Los participantes tenían que cerrar los ojos y contar silenciosamente los tonos extraños de 2000 Hz. Los sujetos tenían que volver a la tarea si no informaban del recuento correcto (± 5 tonos); además realizaron pruebas de evaluación de función ejecutiva. Los resultados indicaron que los agresores mostraron más errores que el grupo de control en flexibilidad evaluada con la tarea Trail Making Test (Parte B). Por otro lado, obtuvieron más fallos en mantener el set en la prueba de clasificación de cartas Wisconsin Card Sorting Test (una tarea que evalúa planificación, estrategia y respuesta).

Estos hallazgos neuropsicológicos sugieren que habría deficiencias atencionales y problemas conductuales generales en los sujetos violentos (Stanford et al., 2007). La prueba de ERP reveló menores amplitudes de P3 en los agresores en comparación con los controles no violentos que tuvieron una topografía P3 normal (Anterior b Posterior). El comportamiento violento en la violencia contra la pareja podría ser explicado en parte, por los déficits en el procesamiento cognitivo de los agresores. La principal limitación de esta investigación fue la presencia de abuso de sustancias alcohólicas y los factores psicopatológicos, presentes en la muestra. Como señalan los autores, estos factores podrían ser variables de confusión en sus hallazgos (Stanford et al., 2007).

De los pocos estudios con resonancia magnética llevados a cabo con hombres maltratadores, se han encontrado discrepancias funcionales y estructurales entre grupos de hombres maltratadores y otras poblaciones (Lee, Chan y Raine, 2008; Lee et al., 2009). En nuestra revisión cronológica de la literatura sobre los estudios de neuroimagen en esta población, encontramos un estudio de resonancia magnética funcional (fMRI) realizado por Lee y colaboradores en 2008, que examinó la actividad cerebral en respuesta a estímulos visuales en un grupo de hombres violentos (n = 10) comparado con un grupo control (n = 13).

En comparación con los controles, los hombres maltratadores mostraron una mayor activación límbica y una menor activación de las áreas frontales en el cerebro. Los autores sugirieron que estos hallazgos indicarían una peor regulación de la activación emocional en el sistema límbico como la supresión de la emoción negativa, que se ha asociado con el control inhibitorio entre las regiones frontales y subcorticales del sistema límbico (Bush, Luu y Posner, 2000; Davidson, Putnam y Larson, 2000; Filley, 2011).

Del mismo modo, los mismos autores hallaron diferencias en el funcionamiento cerebral entre hombres maltratadores y controles, mientras observaban cuatro tipos diferentes de imágenes: neutras, de afecto positivo, imágenes relacionadas con la agresión y agresión específicamente contra las mujeres. En comparación con los controles, los hombres maltratadores tuvieron una mayor activación en respuesta a estímulos amenazantes en el hipocampo, giro fusiforme, giro cingulado posterior, tálamo y corteza occipital. Por otra parte, se produjo una activación en el precuneus bilateral en respuesta a las imágenes de violencia contra las mujeres. La hiperrespuesta a los estímulos amenazantes encontrados en estos estudios de fMRI, apuntaría hacia una disfunción subyacente en el procesamiento del afecto en hombres maltratadores (Lee et al., 2009).

Por último, una investigación en 2013 empleó técnicas de imagen estructural para examinar las alteraciones cerebrales en hombres violentos, pero cabe señalar que la mayoría de estas personas fueron reclutadas a través de anuncios de periódicos locales. Estos autores examinaron las diferencias volumétricas en la corteza prefrontal y seis estructuras subcorticales, usando resonancia magnética en una muestra de hombres violentos con dependencia al alcohol (n = 27), pacientes no violentos dependientes del alcohol (n = 14) y controles sanos (n = 13). Se encontró una reducción significativa de volumen en el grupo de agresores con dependencia de alcohol en la amígdala derecha. Este grupo también informó acerca de una edad más temprana de inicio de consumo de alcohol, una mayor comorbilidad con los clúster B y C de los trastornos de la personalidad según DSM-IV, y mayores niveles de neuroticismo. Teniendo en cuenta la comorbilidad común del abuso del alcohol y la perpetración de la VCP, los hallazgos de este estudio ofrecen una comprensión más profunda de las estructuras cerebrales implicadas (Zhang et al., 2013).

4.2 Estudios centrados en el sistema nervioso periférico

La literatura científica ha sugerido que los actos violentos o la criminalidad están asociados con la reactividad psicofisiológica (Patrick, 2008); por ejemplo, los niveles de conductancia cutánea aumentan cuando las personas ven imágenes agresivas (Choi et al., 2011). Varios investigadores han estudiado la excitación del sistema nervioso periférico en los agresores utilizando técnicas psicofisiológicas (Jacobson et al., 1994; Margolin, John y Gleberman, 1988). Los primeros estudios en este campo que midieron el arousal a través de autoinformes, encontraron que los hombres que abusaron físicamente de sus parejas informaron altos niveles de tristeza, miedo e ira. Estos hombres se sintieron agredidos y tenían niveles levemente más altos de excitación fisiológica, en comparación con un grupo que abusaba verbalmente (Margolin et al., 1988).

Jacobson et al. (1994) realizaron uno de los primeros estudios examinando el arousal del sistema nervioso autónomo durante las discusiones con las parejas. Los autores compararon 60 parejas que habían experimentado episodios de violencia doméstica con 32 parejas que no se habían involucrado en comportamientos violentos. Los participantes tenían que describir un episodio violento sucedido en el pasado. Esta información facilitó al entrevistador dos versiones de la pareja, proporcionando una narración más objetiva del incidente. Los resultados indicaron que sólo había diferencias en el arousal cardiovascular para el grupo de mujeres que habían sufrido violencia doméstica, ya que tenían amplitudes de pulso de dedo más largas y tiempos de tránsito de pulso más rápidos. No hubo diferencias entre los hombres violentos y no violentos a nivel fisiológico, como los autores esperaban.

Gottman et al. (1995) examinaron las respuestas observadas en la frecuencia cardíaca de hombres violentos con sus parejas durante una tarea en la que hablaban de sus problemas maritales. Los autores distinguieron dos categorías de agresores: Tipo 1 (baja tasa cardíaca en la interacción de pareja) y Tipo 2 (alta tasa cardíaca en la interacción de pareja). En sus resultados, los agresores de Tipo 1 mostraron más premeditación, fueron generalmente más violentos y tuvieron escalas elevadas de comportamiento antisocial y agresión sádica en comparación con los agresores de Tipo 2. Sin embargo, los agresores de Tipo 1 puntuaron más bajos en dependencia que los agresores de Tipo 2 (Gottman et al., 1995).

Meehan, Holtzworth-Munroe y Herron (2001) no pudieron replicar los hallazgos de Gottman et al. (1995). No encontraron diferencias significativas entre los hombres que abusaron físicamente versus los que cometían abuso psicológico. Sin embargo, los agresores Tipo 1 mostraron mayores niveles de malestar marital que los agresores Tipo 2. Otro estudio que intentó replicar los hallazgos de Gottman encontró resultados contradictorios porque el estudio original usó una alta línea de base de arousal (Babcock et al., 2004). Finalmente, Meehan et al. (2001), revisaron los tres estudios antes mencionados y concluyeron que los resultados no respaldaban totalmente las tipologías propuestas de agresores de Tipo 1 y Tipo 2, en relación a las medidas fisiológicas tales como la frecuencia cardíaca.

Babcock et al. (2005) examinaron el perfil psicofisiológico de hombres violentos usando una muestra de 35 hombres maltratadores severamente violentos, 37 hombres maltratadores con un bajo nivel de violencia y 21 controles no violentos.

Los autores analizaron los niveles de frecuencia cardíaca y de conductancia cutánea de los hombres, sus respuestas de conflicto durante los argumentos y sus respuestas durante una inducción estandarizada de la ira. Los hallazgos demostraron que la hiporreactividad autonómica puede ser un predictor de los factores de riesgo para la personalidad antisocial en hombres severamente violentos, mientras que la hiperreactividad podía ser común en hombres que muestran comportamientos violentos de bajo nivel.

Debido a los anteriores intentos fallidos para replicar las investigaciones de Gottman et al. (1995), recientemente ha habido autores interesados en estudiar la relación entre las características límite de la personalidad, las características de psicopatía del Factor 1 y la reactividad psicofisiológica. Esta idea surgió ya que en los anteriores estudios con hombres violentos no se han evidenciado perfiles psicofisiológicos basados sólo en las características de la personalidad. Los participantes fueron reclutados a través de anuncios en el periódico y las medidas psicofisiológicas usadas fueron los cambios en la conductancia de la piel y la tasa cardíaca, junto con la escala de empatía (IRI) y la escala borderline del Inventario de evaluación de personalidad (PAI).

Los resultados mostraron que la empatía actuó como variable moderadora en la tasa cardíaca y las variables de personalidad. Por otro lado y en concordancia a los estudios previos, no se pudo replicar las tipologías de Gottman et al. (1995) por lo que parece que no se pueden hallar perfiles psicofisiológicos de hombres violentos sólo en base a las características de la personalidad (Costa y Babcock, 2008).

Recientemente, Romero-Martínez y colaboradores encontraron que la impulsividad y los niveles de testosterona se asocian con mayores niveles de conductancia de la piel en hombres violentos contra su pareja, durante la realización de una tarea virtual de argumento (Romero-Martínez et al., 2013). Usando esta tarea encontraron que los agresores tenían índices cardíacos más altos y relaciones vagales más bajas que el grupo control y que la reactividad psicofisiológica estaba relacionada con la ansiedad y los niveles de ira, antes de la tarea estresante. Se observó además un patrón cardiovascular diferente de respuesta al estrés psicosocial, ofreciendo una mejor comprensión de los diferentes subtipos de agresores (Romero-Martínez et al., 2013).

4.3 Conclusiones

Revisando todos los estudios sobre el sistema nervioso, las investigaciones novedosas realizadas con neuroimagen permiten probar hipótesis sobre la activación diferenciada de las áreas cerebrales que ampliarían la investigación tradicional de la violencia de género hacia nuevos enfoques (Lee et al., 2009; Pinto et al., 2010). Los resultados preliminares han revelado que cuando los hombres maltratadores están expuestos a estímulos agresivos, sus circuitos prefrontales se ven alterados (Lee et al., 2008).

Sin embargo, estos resultados deben considerarse con cautela ya que sólo se han realizado dos estudios hasta ahora, los tamaños de las muestras para estos estudios eran pequeños, y en algunas de estas investigaciones, no se controlaron los antecedentes de daño cerebral o abuso de drogas.

Por otro lado, los hallazgos psicofisiológicos con respecto a los hombres maltratadores no son del todo concluyentes de momento (Pinto et al., 2010). Se ha intentado establecer una tipología a través de medidas como la frecuencia cardíaca (Gottman et al., 1995); sin embargo las réplicas de los estudios no han conducido a conclusiones sólidas con respecto a las medidas psicofisiológicas. La falta de validez ecológica en tareas de laboratorio podría dar lugar a resultados incongruentes, ya que es difícil replicar las reacciones psicofisiológicas de esta población en contextos reales en el laboratorio.

Por tanto, se necesita más investigación para investigar el funcionamiento del sistema nervioso periférico en hombres maltratadores para averiguar qué papel juegan estas variables.

CAPÍTULO 5:

Estudios sobre otras variables biológicas relacionadas con hombres maltratadores: genética y neurotransmisores

CAPÍTULO 5. Estudios sobre otras variables biológicas relacionadas con hombres maltratadores: genética y neurotransmisores

En los últimos años se ha producido un enorme adelanto en el estudio sobre cómo la genética puede ayudar a comprender mejor el funcionamiento del comportamiento violento de los seres humanos (Moya-Albiol, 2004). En relación al concepto de violencia general, se ha demostrado que ciertos factores genéticos, hormonales y los neurotransmisores están presentes en la comisión de actos violentos junto con el papel del ambiente (Alcázar-Córcoles et al., 2010; Moya-Albiol, 2010; Siever, 2008). En la actualidad, no se ha llegado a una interpretación clara y concisa sobre los correlatos biológicos específicos presentes en el comportamiento del hombre maltratador (Pinto et al., 2010). El objetivo de este capítulo es presentar un resumen de las investigaciones encontradas con hombres maltratadores en relación a estas variables biológicas.

5.1 Estudios sobre genética

En 2004 se realizó una investigación con 175 gemelos (134 gemelos monocigóticos y 41 gemelos dicigóticos del mismo sexo) que habían informado de relaciones violentas contra la pareja siendo adultos. Los análisis de ajuste del modelo señalaron que los genes compartidos explicaban el parecido familiar en la agresión psicológica y física contra la pareja; la varianza restante fue explicada por el entorno únicamente. Los resultados mostraron que los actos violentos físicos y psicológicos contra la pareja estaban influenciados por su genética, por lo que aunque las conclusiones deben ser cautas, este comportamiento podría verse influenciado por los genes y el medio ambiente (Hines y Saudino, 2004).

Uno de los genes más estudiados en el campo de la violencia general ha sido el gen MAOA (un gen del cromosoma X). En seres humanos, bajos niveles de este gen se han relacionado con impulsividad y alteración de la conducta (Lawson et al., 2003). Los polimorfismos o variantes genéticas (características visibles que una persona presenta) han sido los indicadores más importantes en el estudio de la expresión de los rasgos observables o fenotipos conductuales (Pinto et al., 2010). En el caso de la violencia contra la pareja, las variantes genéticas más analizadas han sido los polimorfismos del gen MAOA (una enzima encargada de metabolizar la serotonina, la norepinefrina y la dopamina en el cerebro), y su papel en la regulación de los comportamientos impulsivos, antisociales y violentos en el ser humano (Pinto et al., 2010).

Presenciar o vivir de manera directa violencia familiar en la infancia hace más probable que algunos de esos niños/as puedan desarrollar comportamientos violentos cuando son adultos, a diferencia de los/as que no presenciaron nunca ese tipo de violencia (Dixon, Browne y Hamilton-Giachritsis, 2005). Por todo ello, Stuart et al. (2014) fueron pioneros y hasta el momento los únicos, que se atrevieron a estudiar las contribuciones del medio ambiente y la genética.
Analizaron la puntuación genética acumulada en el gen A (MAOA) en una muestra de 97 hombres maltratadores con problemas de alcohol para investigar si la mezcla de ese gen y el gen transportador de serotonina humana unida al polimorfismo (5-HTTPLR) estaban relacionados con cometer violencia contra la pareja.

En sus resultados, los hombres con altas puntuaciones en el porcentaje acumulado genético (CGS) mostraron mayor probabilidad de cometer violencia física y psicológica contra la pareja (por encima de los efectos del alcohol). Estos resultados novedosos abrieron un debate acerca del papel de los factores genéticos en los actos violentos en hombres maltratadores y la necesidad de más investigación para beneficiar el desarrollo o mejora de las terapias, junto con nuevas estrategias de prevención (Stuart et al., 2014).

Sin embargo, la publicación de este estudio desató en la comunidad científica un debate acerca de que el CGS por sí mismo busca incrementar el poder estadístico en muestras pequeñas, además de asumir el mismo peso para ambos genes (DeWall y Baldwin, 2014). Otras críticas se enfocaron en el problema de la explicación de sólo una cantidad pequeña de varianza en un fenotipo (McGeary et al., 2012). Además como el propio Stuart et al. (2014) afirmaron en sus limitaciones, el tamaño de la muestra del estudio fue pequeña y sólo podría generalizarse a hombres maltratadores con problemas de abuso de alcohol. Críticas constructivas aparte, la mayor parte de los investigadores reconoció la valentía de este estudio y el reconocimiento científico por abrir camino desde la neurociencia al campo de la violencia contra la pareja.

5.2 Estudios sobre hormonas y neurotransmisores

A lo largo de la literatura se han identificado diversos neurotransmisores (NT) y hormonas relacionadas con la conducta violenta (Corvo y Dutton, 2015). El NT más relacionado con el comportamiento social ha sido la serotonina, jugando un papel fundamental en la regulación de las emociones y algunos componentes de la función ejecutiva (Enge et al., 2011).

En el terreno de la violencia, se ha estudiado la asociación de bajos niveles de serotonina y la comisión de comportamientos violentos (Caspi et al., 2002). Concretamente, la reducción de los niveles de serotonina (5HT) llevaría a los hombres violentos a desarrollar una mayor impulsividad, produciendo agresión de tipo impulsiva -no premeditada- (Terburg, Morgan y van Honk, 2009).

Una investigación de George et al. (2001) mostró diferencias entre hombres violentos alcohólicos y no alcohólicos, en las concentraciones de serotonina y testosterona. El grupo de hombres violentos tuvo una puntuación mayor en medidas relacionadas con la agresión, en comparación con los controles. Específicamente, el grupo de violentos no alcohólicos, tuvo mayor índice de agresión física y menor nivel de serotonina en comparación a los hombres violentos con problemas de alcohol y los controles.
Por último, los hombres violentos con problemas de alcohol obtuvieron mayores índices de testosterona en comparación con los otros dos grupos, y mayor puntuación en la escala de agresión física comparado con los controles. Todo ello muestra la importancia de controlar la variable de consumo de alcohol en hombres maltratadores, dado las diferencias halladas en sus mecanismos biológicos (George et al., 2001).

De todas las hormonas, específicamente la testosterona (T) y el cortisol (C) merecen especial atención en el problema de la violencia de género (Romero-Martínez, González-Bono y Moya-Albiol, 2013; Soler, Vinayak y Quadagno, 2000). Hasta ahora, la hipótesis más citada expone que la ratio de testosterona y cortisol (T/C) se relaciona con la predisposición de cometer agresión (Montoya et al., 2012).

En esta línea, un aumento de la ira que diera lugar a cometer violencia, alteraría el papel de las hormonas, dando como resultado un incremento en la ratio (T/C) (Romero-Martínez et al., 2013). Además, los niveles de testosterona impactarían en el eje HPG disminuyendo los niveles de cortisol.

Por separado, se conoce que altos niveles de testosterona facilitan el comportamiento violento produciendo mayor insensibilidad al castigo o a cometer comportamientos de riesgo (Moya-Albiol, 2010). Y por su parte, el cortisol ha sido también estudiado aunque en la dirección contraria, ya que altos niveles de esta hormona aumentarían la sensibilidad al castigo social, inhibiendo el comportamiento violento.

Partiendo de esta premisa Romero-Martínez et al. (2013) analizaron si los niveles de T/C eran mayores en hombres maltratadores comparados con personas no violentas, usando medidas de respuesta ante el estrés. Para llevar a cabo su objetivo, recogieron la saliva a 16 hombres condenados por VG y 21 hombres controles a través de un análisis hormonal con la tarea de escenario estresante: “Trier Social Stress Test (TSST)”. En sus resultados los hombres maltratadores tuvieron mayores niveles de ratio en T/C comparado con el grupo control. En el grupo de hombres maltratadores se encontraron altos niveles de testosterona en la fase de preparación de las post-tareas a diferencia de los controles. Asimismo, los autores señalaron que para poder explicar el comportamiento violento impulsivo de esta población junto a estos marcadores biológicos, se deben estudiar otros factores, como el funcionamiento neuropsicológico (Romero-Martínez et al., 2013).

Los mismos investigadores llevaron a cabo otro estudio centrado en el funcionamiento neuropsicológico de hombres maltratadores, los niveles de T/C y la medida 2D:4D (un ratio para medir la exposición prenatal a la testosterona) (Romero-Martínez et al., 2013). Este indicador 2D:4D se obtiene midiendo la longitud del dedo índice y el dedo anular (Manning y Bundred, 2000). Participaron 19 hombres maltratadores y 21 hombres controles. En sus resultados, los hombres maltratadores sufrieron un empeoramiento del estado de ánimo, una disminución en el nivel de testosterona y un aumento de cortisol tras la realización la tarea de (TSST). Además, los hombres maltratadores tuvieron una menor ratio 2D:4D, la cual se relacionó con un alto nivel de testosterona en respuesta al estrés. Por último en lo referente a las variables neuropsicológicas, se encontró un peor reconocimiento de emociones y un peor rendimiento en función ejecutiva en hombres maltratadores. (Romero-Martínez et al., 2013).

El último estudio pionero que queremos nombrar en este apartado, es el llevado a cabo por Romero-Martínez et al. (2015) quienes analizaron a 16 hombres condenados por violencia de género y 20 hombres controles con el objetivo de analizar el papel modulador de la ratio T/C en la expresión de la ira y los trastornos de personalidad. En sus resultados, los hombres maltratadores tuvieron mayores puntuaciones en los trastornos de personalidad antisocial, borderline y narcisista, además de una mayor expresión de ira, comparado con el grupo control. Sólo en el caso de los hombres maltratadores, se observó una relación positiva entre estas variables, siendo la ratio T/C moduladora en los trastornos de personalidad y la expresión de ira. Estos hallazgos realizaron una importante contribución en la línea de la comprensión del perfil neurocientífico de hombres maltratadores

5.3 Conclusiones

Analizar los factores biológicos juntos con otras variables debe ser una parte fundamental para profundizar más en el conocimiento del comportamiento del hombre maltratador. Esta perspectiva neurocientífica debe ser una pieza más de todo el puzzle de factores de estudio -psicosociales, culturales, personales, psicopatológicos…- que conforman la complejidad del análisis de la conducta violenta en esta población (Pinto et al., 2010).

Queremos dejar muy claro en este último capítulo que estamos de acuerdo con anteriores autores/as, que todos los hallazgos neurocientíficos encontrados, no pueden explicar por sí solos la comisión de actos violentos en hombres maltratadores. De manera que aunque la herencia genética, las hormonas y/o los neurotransmisores se relacionen con la severidad de los actos violentos, siempre deben ser analizadas junto a las variables psicológicas, sociales y ambientales que intervienen en este grave problema mundial (Moya-Albiol, 2004; Pinto et al., 2010).

II. JUSTIFICACIÓN, OBJETIVOS E HIPÓTESIS

CAPÍTULO 6:

Justificación, objetivos e hipótesis

CAPÍTULO 6. Justificación, objetivos e hipótesis

6.1 Justificación y objetivo general

Las investigaciones con hombres maltratadores han demostrado que existe un perfil heterogéneo entre ellos (Holtzworth-Munroe y Stuart, 1994; Loinaz, Echeburúa y Torrubia, 2010). Aunque muchos de los estudios se han centrado en usar cuestionarios, instrumentos de autoinforme y medidas subjetivas, los resultados podrían dar un sesgo de respuesta debido a la deseabilidad social por parte de esta población. En los últimos años, las posibilidades que ofrece la neurociencia en diversas áreas como las adicciones o la obesidad, ha demostrado que esta perspectiva puede ser muy útil en la caracterización del hombre maltratador (Chester y DeWall, 2018; Corvo y Dutton, 2015; Pinto et al., 2010).

La mayoría de las investigaciones neurocientíficas con hombres maltratadores se han centrado en el funcionamiento neuropsicológico, y de manera novedosa también, en el funcionamiento cerebral. Sin embargo, en algunos estudios existen variables confusoras o no controladas, como por ejemplo la elección del grupo control, ya que se ha estudiado que las circunstancias asociadas con la vida en prisión, pueden influir en el desempeño de las pruebas psicológicas a nivel cognitivo (Ruiz, 2007). Todas estas barreras hacen que se no se haya obtenido todavía un perfil específico en cuanto al funcionamiento neuropsicológico. Además, a nivel de funcionamiento cerebral, sólo hay hasta la fecha dos estudios de neuroimagen funcional con hombres maltratadores condenados por este delito, por lo que se deberían seguir realizando investigaciones a través de estas técnicas novedosas para profundizar más en la cuestión sobre si este funcionamiento es específico de este tipo de violencia, o es similar al funcionamiento de las personas violentas en general (otro tipo de delitos). Estos planteamientos podrían reducir la prevalencia de la violencia de género evitando que los hombres maltratadores reincidan con la misma pareja o una nueva y mejorar los tratamientos psicológicos que actualmente reciben los hombres maltratadores, produciendo un impacto social-científico.

Por tanto, en este contexto de investigación, donde la evidencia muestra que la neurociencia tiene un papel fundamental en la problemática de la violencia de género, **el objetivo general** de la presente Tesis Doctoral es estudiar el funcionamiento neuropsicológico y cerebral de los hombres maltratadores comparados con hombres condenados por otros delitos.

6.2. Objetivos específicos e Hipótesis

Del objetivo general, se derivan dos objetivos específicos que se corresponden con los cinco estudios empíricos de la tesis.

Objetivo 1. Analizar el funcionamiento neuropsicológico centrado en función ejecutiva y emoción en hombre maltratadores. Hipotetizamos que:

> **Hipótesis 1**: Los hombres maltratadores tendrán peor funcionamiento ejecutivo comparado con los hombres condenados por otro tipo de delitos. Para comprobar esta hipótesis se realizó el estudio 1 (ver capítulo 7) publicado en:

Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Daugherty, J. C., Burneo-Garcés, C., & Pérez-García, M. (2016). Differences in Executive Function Between Batterers and Other Criminals. *Journal of Forensic Psychology Practice, 16*(5), 321-335. https://doi.org/10.1080/15228932.2016.1219216

Hipótesis 2: Los hombres maltratadores mostrarán un peor procesamiento emocional comparado con el grupo de otros hombres condenados por otros delitos. Para comprobar esta hipótesis se realizó el estudio 2 (ver capítulo 8) publicado en:

Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Burneo-Garcés, C., & Pérez-García, M. (2015). Procesamiento emocional en maltratadores de género mediante el Test de Expresiones Faciales de Ekman y la Tarea Stroop Emocional. *Revista Latinoamericana de Psicología, 47* (2), 102-110. https://doi.org/10.1016/j.rlp.2015.02.001

Objetivo 2. Analizar el funcionamiento cerebral en términos funcionales, estructurales y la posible prevalencia y daño cerebral en hombres maltratadores. Hipotetizamos que:

Hipótesis 3: Los hombres maltratadores activarán zonas cerebrales diferentes a las de hombres condenados por otro tipo de delitos cuando observen imágenes de violencia de género y violencia general. Para comprobar esta hipótesis se realizó el estudio 3 (ver capítulo 9) publicado en:

Bueso-Izquierdo, N., Verdejo-Román, J., Contreras-Rodríguez, O., Carmona-Perera, M., Pérez-García, M., & Hidalgo-Ruzzante, N. (2016). Are batterers different from other criminals? An fMRI study. *Social cognitive and affective neuroscience*, *11* (5), 852-862. https://doi.org/10.1093/scan/nsw020

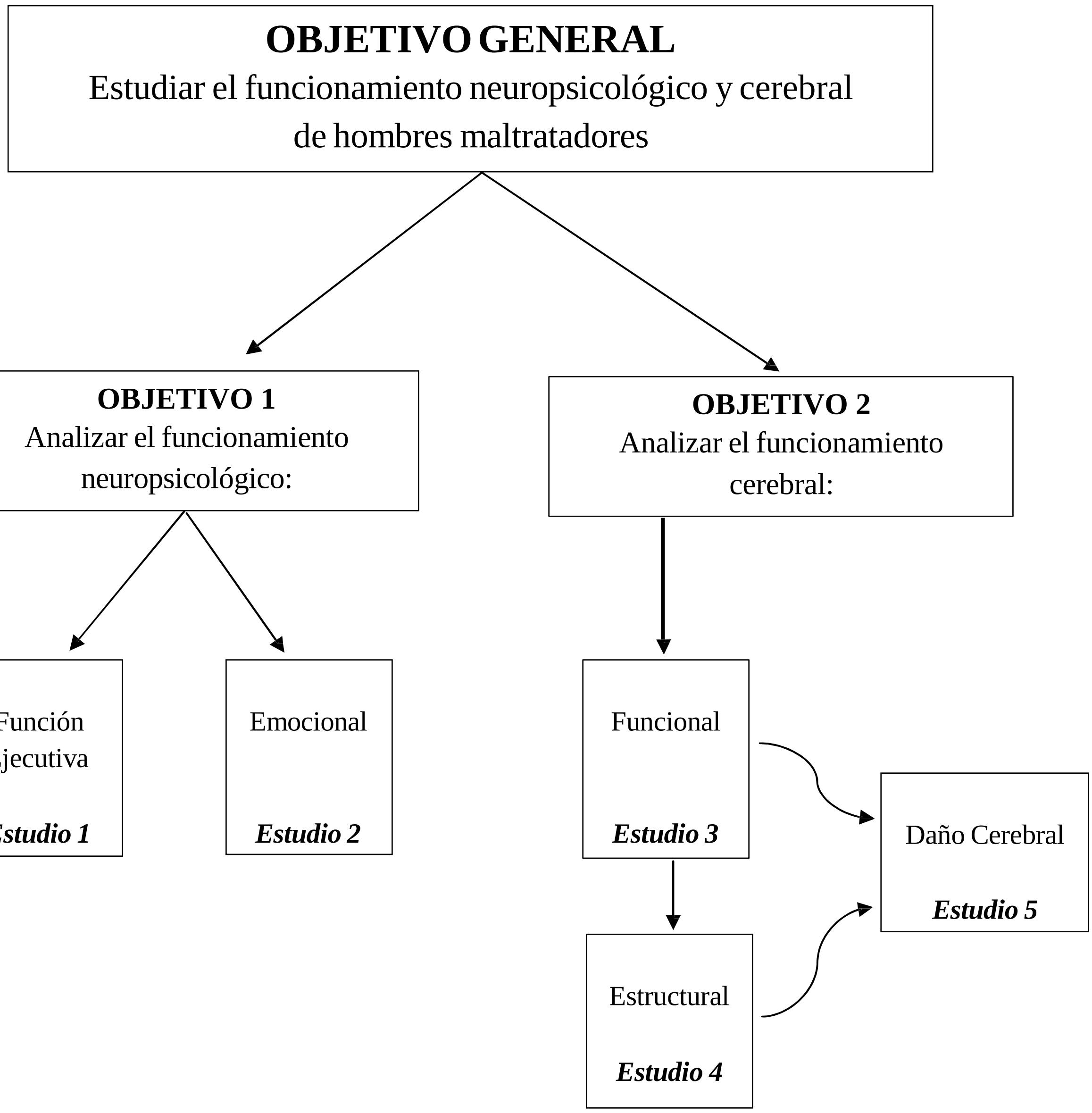
Hipótesis 4: Los hombres maltratadores mostrarán diferencias a nivel estructural en áreas relacionadas con procesamiento emocional, comparados con hombres condenados por otro tipo de delitos. Para comprobar esta hipótesis se realizó el estudio 4 (ver capítulo 10) que se encuentra *"Under Review"* en:

Verdejo-Román, J., Bueso-Izquierdo, N., Daugherty, J., Hidalgo-Ruzzante, N., & Pérez-García, M. (2017). Structural brain differences in emotional regulation areas between male batterers and others criminals: A preliminary study. *Social Neuroscience*.

Hipótesis 5: Los hombres maltratadores no tendrán daño cerebral que justifiquen las diferencias funcionales halladas en el estudio 3 publicado. Para comprobar esta hipótesis se realizó el estudio 5 (ver capítulo 11) que se encuentra en "*Major Revision"* en:

Bueso-Izquierdo, N., Verdejo-Román, J., Martínez-Barbero, J.P., Pérez-Rosillo, M.A., Pérez-García, M., Hidalgo-Ruzzante, N., & Hart, S. (2017). Prevalence and nature of structural brain abnormalities in batterers: A magnetic resonance imaging study. *International Journal of Forensic Mental Health*

De modo gráfico, la secuencia de objetivos se puede ver en la siguiente figura:



III. MEMORIA DE TRABAJOS

CAPÍTULO 7:

DIFFERENCES IN EXECUTIVE FUNCTION BETWEEN BATTERERS AND OTHER CRIMINALS

Este capítulo se encuentra publicado en:

Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Daugerthy, J. C., Burneo-Garcés, C., & Pérez-García, M. (2016). Differences in Executive Function Between Batterers and Other Criminals. *Journal of Forensic Psychology Practice, 16*(5), 321-335. *(Anexo III)*

1. Introduction

Intimate Partner Violence (IPV) is a complex and global phenomenon that requires an interdisciplinary approach. IPV should be considered from a multidimensional perspective that involves various factors, including biological (head injury, neuropsychological functioning, or neurotransmitters) (Corvo & Dutton, 2015; Pinto et al., 2010), psychopathological (sadistic, antisocial, borderline personality; Hart, Dutton, & Newlove, 1993), social learning and family system (childhood corporal punishment experiences and witnessing interparental physical violence; Wareham, Boots, & Chavez, 2009), and patriarchal factors (participation of women in social, economic, and political systems; Cunningham et al., 1998). Of these, biological factors are studied the least (Farrer, 2011) and studies about neuropsychological functioning of batterers are scarce (Corvo, 2014; Corvo & Johnson, 2013; Pinto et al., 2010).

In contrast, there is a growing body of evidence about the relationship between neuropsychological and frontal lobe dysfunction and violent or criminal behavior (Brower & Price, 2001; Hawkins & Trobst, 2000; Moya-Albiol, 2004). Neuropsychological studies about violence support the role of underlying neuropsychological factors in violent behavior, especially in measures of executive function and general intellectual abilities (Fishbein, 2000; Paschall & Fishbein, 2002; Seguin, Sylvers, & Lilienfeld, 2006; Stanford, Houston, & Baldridge, 2008; Verlinden et al., 2014; Villemarette et al., 2003). Literature provides evidence that performance on measures of executive function could correctly classify them as 73.1% of individuals with prior criminal convictions (Trausch, 2013).

For example, Bergvall et al. (2001) found that violent offenders are deficient in attentional setshifting, and that their ability to alter behavior in response to fluctuations in the emotional significance of stimuli is altered.

While there are many studies examining the role of neuropsychology in the execution of violent acts, few studies examine neuropsychological factors in IPV (Corvo, Halpern, & Ferraro, 2006; Easton et al., 2008; Marsch & Martinovich, 2006; Walling, Meehan, Marshall, & Holtzworth-Munroe, 2012). Research shows that men who were violent with their partners had a worse performance than the control group on measures of attention, memory, executive function, verbal intelligence, and verbal skills (Cohen et al., 1999; Holtzworth-Munroe & Taft, 2012; Teichner et al., 2001; Walling et al., 2012).

Furthermore, certain components of executive function, such as impulsivity or inflexibility (Cohen et al., 2003; Easton et al., 2008; Marsch & Martinovich, 2006) have been associated with violent behavior in batterers. Also, recent studies revealed that batterers could be less proficient in inhibiting distracting emotional stimuli (Chan, Raine, & Lee, 2010). These preliminary findings suggest the potential role of neuropsychological variables in helping to understand the behaviors of these batterers. However, some of these neuropsychological findings may be due to confounding variables such as brain damage or a history of drug abuse in the sample of male batterers (Bueso-Izquierdo et al., 2015). And, to our knowledge, no studies have compared the neuropsychological characteristics of batterers to that of other criminals, and very few studies have compared these populations considering other variables or the exclusion criteria as those mentioned above.

Moffitt et al. (2000) have shown that partner abuse and general crime represent different constructs that are moderately related considering personality and antisocial behaviors in both groups. In another study, Boyle et al. (2008) found that general violent offenders have more conduct disorder, delinquent behaviors, and lifetime antisocial behaviors, were more psychologically abusive, and showed more disinhibition than partner-only violent participants. Nevertheless, studying whether batterers are similar to other criminals from a neuropsychological point of view could contribute to knowledge on whether IPV and general crime are the same type of violence. Such knowledge would have implications for a better understanding of IPV behavior and for the development of new treatment perspectives (Simpler & Parmenter, 2011).

Thus, the main goal of the present study is to assess neuropsychological functioning, focusing on executive function measures in male batterers in comparison with other criminals. In accordance with the scarce literature, we hypothesize that batterers will show different executive functioning than the other criminal groups.

2. Method

Participants

All participants were recruited from two facilities of the prison in Granada, Spain: Main Prison and its associated Social Integration Center (CIS). The sample included 28 men from 21 to 56 years old (*M* = 36.39, *SD* = 9.735) who were sentenced for an intimate partner violence crime (IPVG), and an “other criminals” group (CG) of 35 men from 23 to 50 years old (*M* = 36.69, SD = 8.369) who were sentenced for a crime other than IPV (see Table 1).

The following inclusion criteria were used for the group of batterers: individuals 18 years old or older that had been convicted of a crime of physical, psychological, or sexual aggression against a partner or ex-partner (Spain Law 1/2004, Comprehensive Protection Law against Gender Violence, order 1/2004). This Spanish law aims to act on violence against women caused by men who have been a spouse or have been linked to a woman by a similar emotional relationship. According to this law, IPV includes any act of physical and psychological harm, including sexual assault, coercion, threats, or arbitrary deprivation of liberty. In addition, a batterer could be convicted for psychological, physical, or sexual abuse against his partner.

For the criminal group, additional exclusion criteria eliminated individuals who were sentenced for intimate partner violence since there was no clear manner to determine whether such violence had indeed occurred. Hence, an additional exclusion criterion was used that excluded participants who were not sentenced but who had been involved with IPV. To address this issue, the Conflict Tactile Scale (CTS 2; Straus, Hamby, Boney-McCoy, & Sugarman, 1996) was administered to the CG. Individuals with a CTS 2 score equal to or greater than 11 on the severity scale were excluded from the study according to Cohen et al. (2003) criteria. After applying all of these criteria, four participants were excluded.

Table 1. Demographic and crime characteristics of Intimate Partner Violence Groups (IPVG) and Criminal Groups (CG).

Variables	IPVG M SD	CG M SD	t /X^2	P
Age	36.29 (9.73)	36.69 (8.36)	−1.28	.898
Education level	2.39 (1.85)	3.14 (1.85)	−1.39	1.69
IQ	95.25 (9.84)	97.54 (13.95)	−7.63	.44
CTS2 (< 11)	2.15 (3.66)	.43 (1.33)	2.57	.013
Time of crime [%(n)]				
Misdemeanor	IPV-PV = 42.8 % (12)	SCF/DD = 39.8% (14)		
Felony	IPV-PPV = 53.5% (15)	GAR/VF =54.1% (20)		
Murder	IPV-Murder= 3.5 % (1)	Murder = 5.71 % (1)		

Note. SD = standard deviation; Education Level: (1–2: Primary Studies; 2–3: School Graduate; 3–4: Higher Education); IPV-Psychological Violence = PV; Scams or Crime of Forgery = SCF; DD = Dangerous Driving; IPV-PPV = IPV–Physical and Psychological Violence; GAR = Grave Assault/Robbery; VF = Violent Fight.

All participants in the criminal group had a score of 5 or less on the CTS 2, for which they were included in the subsequent data gathering. A score of 5 is considered a very low mark for violence against women. Criminal group participants had committed various crimes (see Table 1). While it is not possible to match severity of crime, the severity of crime was similar for both groups. For example, the number of batterers convicted for physical aggression was similar to the number of criminals convicted for personal assault. Moreover, there was one participant convicted for murder in each group. Additional exclusion criteria were history of brain injuries, including but not limited to head injury, seizures, anoxia, prenatal or perinatal complications, and stroke. Due to complications in the way that head injuries are reported in Spain, the common criterion used to determine head injury was a loss of consciousness for more than one hour (Cohen et al., 2003).

The Structured Clinical Interview from the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (SCID/DSM-IV; American Psychiatric Association, 1994) was administered to determine if the participants fulfilled the diagnostic criteria for abuse of or dependence on any substance, including alcohol.

The participants who met any drug abuse or dependence criteria were excluded from the study. Finally, illiterate participants were excluded using a socioeconomic and violence interview (Echeburúa, Montalvo, & De Corral, 2008). In summary, the three major exclusionary criteria were (a) brain injury, (b) drug abuse or dependence, and (c) illiteracy.

Instruments

Demographic and violence variables

The structured interview (Echeburúa et al., 2008) was used to determine the level of partner violence. This questionnaire measures the sociodemographic variables and education level of the aggressor and victim, relationship status of the couple (couple not living together, cohabitation, in the process of separating, separated, etc.), types of violence and profile of the aggressor (information about the formal complaint and perpetrator´s feelings in that moment).

The CTS 2 Spanish version (Loinaz, Echeburúa, Ortiz-Tallo, & Amor, 2012) of the original CTS 2 (Conflict Tactic Scales; Straus et al., 1996) was used to detect the existence of physical, psychological, and sexual violence on behalf of the perpetrator in the last year or over the course of the entire relationship. The CTS 2 measures the frequency and intensity of violence within a relationship.

Variables related to the use of drugs

The diagnostic subscale for substance use disorders (alcohol and drugs) of the Structured Clinical Interview of the DSM-IV (SCID; First, Spitzer, & Gibson, 1999) was used to address substance disorders.

Executive function battery

Four components of executive function were measured using the system outlined by Miyake et al. (2000) and Verdejo-García & Perez-García (2007): updating, monitoring, response inhibition, flexibility, and decision making.

Updating and monitoring

Working memory letter-number sequencing (Wechsler, 1997): participants were asked to listen to a sequence in which letters and numbers were combined, and were then asked to reproduce the sequence by initially placing the numbers in ascending order and the letters in alphabetical order followed by the letters in alphabetical order. The dependent variable from this test was the total number of correct hits.

Abstract reasoning was measured using the Kaufman Brief Intelligence Test´s (K-BIT) Matrix subtest (Kaufman, Cordero, & Calonge, 1997). This test consisted of the subject selecting the correct option when faced with elements that required comprehension of their nature and the logic that governed them.

Response inhibition

A GO/NO-GO Task using a computer-based task of 100 trials was used. In the first 50 trials (pre-switch), the participants were asked to press a key as quickly as possible whenever the GO stimulus was presented (the silhouette of either a bear or dolphin) and to inhibit a response when the NO-GO stimulus was presented. The stimuli to the GO and NO-GO conditions were counterbalanced across the subjects. In the second 50 trials (post-switch), the participant was asked to switch the response from the GO to the NO-GO stimulus (which became clear in the post-switch GO trial). Therefore, the participant was asked to respond to the NO-GO trial and not to the GO trial. The interstimulus interval (ISI) was established at 1,000 ms, and each stimulus was presented for 500 ms. Auditory feedback (one of two distinctive sounds) was provided after each response to indicate whether that response was right or correct. If the participant did not respond within the 1,000-ms response window, the same two sounds were used as positive and negative feedback for not responding.

The main dependent variable from this test was reaction time. These variables were analyzed across 10 blocks of 10 trials to explore the effects of learning and switching during the task.

The Delis-Kaplan Executive Function System’s (D-KEFS) Color-Word Interference Test (CWIT; Delis, Kaplan, & Kramer, 2001) was also used. This test is used as a means of evaluating verbal executive function. It includes a measure for the inhibition of more automatic verbal responses and cognitive flexibility. D-KEFS-CWIT consists of four different sections, each containing 50 items. Section 1 (color naming) presents patches of colors, and the participants had to name the colors as quickly and accurately as possible. Section 2 (reading) presented the words *red, blue,* and *green* printed in black ink, and the participants had to read these words aloud. Section 3 (inhibition) introduced the interference effect, in which the words *red, blue,* and *green* were printed in incongruent colors, and the participants had to name the text color and ignore the word itself. Section 4 (switching) contained similar items to section 3, but the participants had to switch their response between naming the color of the ink and reading the word.

Flexibility

The Delis-Kaplan Executive Function System’s (D-KEFS; Delis et al., 2001) Trail Making Test (TMT) consisted of a visual cancellation task and a series of connect-the-circle tasks. The primary executive-function task consisted of number-letter switching (condition 4), which was a method of assessing thinking flexibility in a visual-motor sequencing task.

Decision making

The Iowa Gambling Task (IGT) (Bechara, Damasio, Tranel, & Damasio, 2005): This computer task contained several aspects of decision making, including uncertainty, risk, and the evaluation of rewarding and punishing events. The IGT involved four decks of cards: decks A′, B′, C′, and D′. Each time a participant selected a card, a specified amount of play money was awarded. The global IGT net score was calculated by applying an identical formula to the 100 trials of the task.

Evaluation of intelligence

The K-BIT Test (Kaufman et al., 1997): The K-BIT measured cognitive functions using two tests: verbal (vocabulary, which was comprised of two tests) and nonverbal (matrices), which evaluated crystallized and fluid intelligence and obtained a compound IQ.

Procedure

After obtaining prior authorizations from the Institute of Prisons in Spain, participants were recruited for the study at the Albolote Prison Center (Granada) and the Center for Social Integration (Granada). The participants were invited to collaborate in the study on a voluntary and anonymous basis. The study was approved by the Research Ethics Committee of the University of Granada, Spain. All of the participants signed a written informed consent document, which explained the purpose of the investigation, risks and benefits of the participation, and confidentiality associated with the obtained results. Participants had the right to withdraw from the study at any time. Participants were evaluated in two individual sessions (duration of approximately two hours per session including breaks), as well as another group session (duration of one hour).

During the individual sessions, interview, CTS 2, and neuropsychological tests were administered. In the group sessions, personality tests were administered. Interviews and tests were completed by two trained and supervised psychology graduate students (one of whom is a neuropsychologist and professor of neuropsychology at the University of Granada). These research collaborators had experience in test administration and they received similar training to administer the neuropsychology battery used in this study. They followed the same administration protocol. The participants were given 20 euros in compensation for their time used to complete the entire evaluation.

Statistical analyses

Descriptive statistics, including an outlier analysis, were obtained for demographic information; IPV and neuropsychological variables, and also a chi-square test, were performed to assess between-groups differences in the frequency of clinical and demographic categorical measures.

Univariate *t*-tests were used to compare the performance of batterers and non-batterers on the neuropsychological measures in a between- groups design. For the IGT, a 2 (groups) x 5 (20 trial blocks) ANOVA was conducted using the IGT scores, and post-hoc *t*-tests were used to examine group differences in the five blocks. For the GO/NO-GO task, an additional 2 (groups) x 10 (10 trial blocks) ANOVA was conducted using the GO/NO-GO reaction times. Finally, Cohen's delta was obtained for all the group comparisons. An alpha level below .05 was established for statistical significance in all comparisons.

3. Results

Analysis of sociodemographic variables

The batterer and criminal group were statistically similar in age, education, and IQ. The groups differed on CTS 2 values (t [1, 1, 72] = 2.29; *p* = .029]), which was consistent with the selection criteria (see Table 1).

Differences in executive function components

For the *updating* component, the results showed that no statistical differences were found between batterers and criminals on any of the tests (see Table 2). For the *flexibility* component, batterers were significantly more inflexible than the criminal group on the TMT_4T task (t [1, 92.59] = 2.03, *p* = .045; see Table 2). On the other hand, for the component of *response inhibition* assessed by the Stroop Test, results showed that no statistical differences were found between batterers and criminals.

Nevertheless, for the *response inhibition component* measured by the GO/NO-GO task, the block main effect (*F* [9,495] = 11.51; *p* = .000) and the interaction of the variable group x blocks were significant (*F* [9,495] = 3.12; *p* = .001). The interaction analysis for the IPVG showed statistically significant differences among block 5, 6, and 7 (*F* [2, 56] = 3.35; *p* = .042) but no differences were obtained in the pair comparison between any block using the Bonferroni post-hoc analysis. For the CG, the analysis showed statistically significant differences among blocks 5, 6, and 7 (F [2, 68] = 6.62; p = .002) and the post-hoc Bonferroni analysis showed differences between blocks 5 and 6 (p = .021) and blocks 6 and 7 (p = .027).

Finally, for the decision-making component measured by the Iowa Gambling task, the main effect of block (F [4,252] = 6.18; p = .000) and the interaction of the variable group x blocks were significant (F [4,252] = 2.42; p = .049). Nevertheless results showed that no statistical differences were found between batterers and criminals on the IGT. The interaction analysis for the IPVG showed statistically significant differences among blocks 1, 2, 3, 4, and 5 (F [4,116] = 5.43; p = .000) and differences were obtained in the pair comparison between blocks 2 versus 4 (p = .001), 2 versus 5 (p = .017), 3 versus 4 (p = .040), and 4 versus 2 (p = .001) using Bonferroni post-hoc analysis (see Table 2). On the other hand, for the CG (see Figure 1), the analysis showed statistically significant differences among all the blocks (F [4,136] = 2.71; p = .033) and the post-hoc Bonferroni analysis only showed differences between blocks 1 and 3 (p = .006; see Table 2).

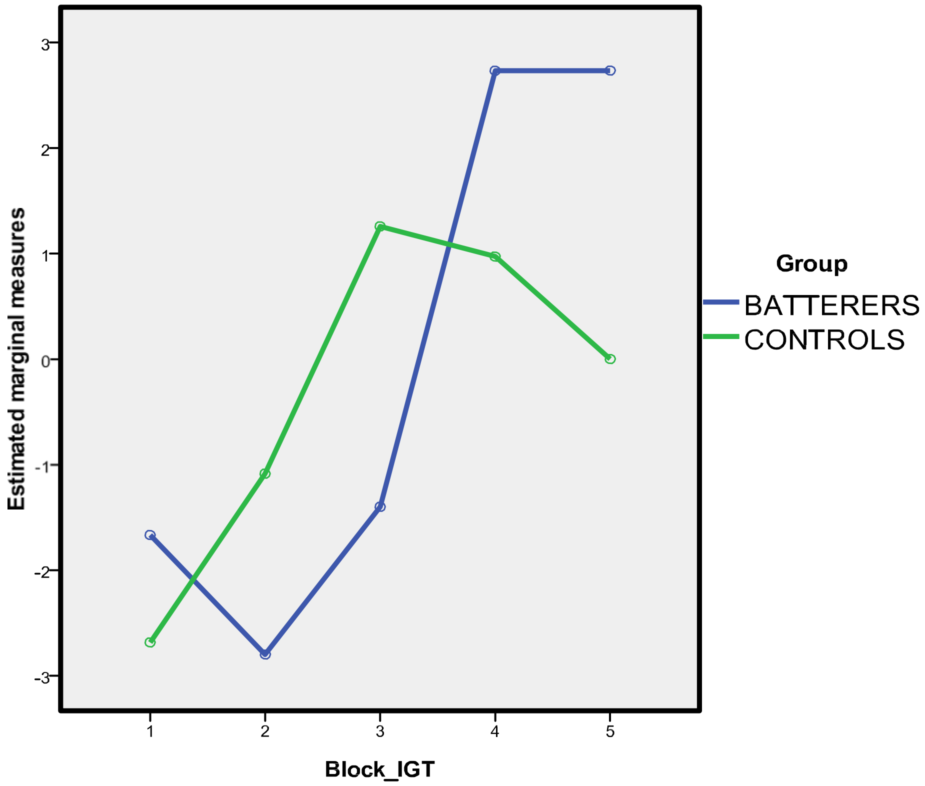
With respect to effect sizes, the Cohen deltas varied between small effect sizes for the updating component and the Stroop Test, and moderate effect sizes for flexibility (according to the criteria proposed by Cohen, 1988; see Table 2).

Table 2. Performances of IPVG and CG on Executive Function

Executive Function	*Measures*	*IPVG N=28 M SD*	*CG N=35 M SD*	*t/F*	*p*	*d*
Updating/ Monitor.	**Lns**	(9.31±2.46)	(10.03±2.60)	-1.09	2.79	0.28
	KBIT_MT	(32.00±.73)	(33.29±5.78)	-.61	5.41	0.24
	Stroop1T_Naming	(27.86±4.99)	(30.23±6.50)	1.59	.117	0.40
Stroop	**Stroop2T_Reading**	(21.00±3.52)	(21.34±4.29)	3.40	.735	0.08
	Stroop3T_Inhibi	(52.00±10.17)	(51.94±11.53)	.021	.984	0.004
	Stroop4T_Switch	(60.89±13.78)	(63.03±17.60)	5.25	.601	0.13
Flexibility	**TMT1_ VS.T**	(20.61±5.32)	(19.03±4.79)	1.23	.221	0.31
	TMT2_ NS.T	(43.68±15.45)	(34.86±11.83)	2.56	.013*	0.65
	TMT3_LS.T	(52.08±16.79)	(48.43±20.02)	.77	.443	0.19
	TMT4_NLS.T	(99.04±29.43)	(82.94±31.45)	2.03	.047*	0.52
	TMT5_ MS.T	(69.75±22.91)	(65.90±28.80)	.49	.624	0.12
Inhibition						
	Go-no-go TR5	(461.35±73.38)	(434.01±73.38)	Blocks=11.5	.000	0.40
	Go-no-go TR6	(494.54±90.59)	(485.79±100.9)	Inter=3.12	.001	0.09
	Go-no-go TR7	(453.29±83.37)	(434.74±67.27)	Blocks=6.18	.000	0.24
	IGT_1	-	-			
Decision-Making	**IGT_2**	-	-			
	IGT_3	(-1.40±8.30)	(1.26±5.90)	Interaction =2.42	.049	0.37
	IGT_4	(2.73±8.39)	(.97±8.03)			0.21
	IGT_5	(2.73±8.78)	(0±9.34)			0.30

Note. Lns: Letters and numbers; KBIT_MT: KBIT_ Matrix Subtest; Stroop1T: Naming; Stroop2T: Reading; Stroop 3T: Inhibition; Stroop4T:Switching; TMT1_VS.T= Trail Making Test Visual Scanning Time; TMT2_NS.T= Trail Making Test Number Sequencing Time; TMT3_LS.T= Trail Making Test Letter Sequencing Time; TMT4_NLS.T: Trail Making Test Number Letter Sequencing Time; TMT5_MS.T=Trail Making Test Motor Speed Time; Go-no-go TR= Go-no-go Reaction Time; IGT_1= Iowa Gambling Task Block 1, IGT_2= Iowa Gambling Task Block 2, IGT_3= Iowa Gambling Task Block 3, IGT_4= Iowa Gambling Task Block 4, IGT_5= Iowa Gambling Task Block 5.

Figure 1. Performances on the IOWA GAMBLING TASK (Block by group interaction)



4. Discussion

The main goal of this research was to compare the neuropsychological functioning of batterers to that of other criminals on executive function tests. Results in our study have shown that batterers were significantly less impulsive and more inflexible than other criminals. Moreover, batterers demonstrated better decision making on the learning curve. On the other hand, no differences were found in working memory. Our results have shown that batterers are more *inflexible* than other criminals. These findings are similar to prior studies that have found that batterers are more inflexible than the noncriminal control group (Teichner et al., 2001). This was also the case even when using similar tasks (TMT) or a different test (WCST). (Cohen et al., 2003; Easton et al., 2008).

In contrast, our results about *impulsivity and decision making* differ from previous literature. Prior studies have shown that batterers exhibited a poorer performance on measures of impulsivity (Cohen et al., 2003) and a better decision-making capacity (Easton et al., 2008) than criminals. The discrepancies between our results and previous literature may be explained by several factors. First, the use of different criminal groups (healthy vs. other criminals) may influence results. It might be the case that batterers are more impulsive and they make better decisions than healthy participants, but that they are better in these components only when compared to other criminals. Discrepancies may also be explained by a lack of control for a history of substance use and brain damage in batterers in previously published research. Earlier studies have shown that drug-dependent or TBI (traumatic brain injury) individuals exhibit alterations in impulsivity (Cohen et al., 1999; Easton et al., 2008) and decision making (Schafer & Fals-Stewart, 1997).

In addition, IPV has been associated with a history of substance use (Foran & O´Leary, 2008; Schafer & Fals-Stewart, 1997) and brain injury (Farrer, Frost, & Hedges, 2012). Thus, the impulsivity shown in batterers in other studies may be due to the coexistence of a history of brain injury or substance abuse in batterers. Nevertheless, it is important to note several limiting factors in the present study. Due to the fact that the definition for brain injury is not universal, it may be controversial to use the one-hour-or- less exclusion criteria. Nevertheless, this is the most commonly used measure in the Spanish health system. Even so, it is possible that some individuals with mild traumatic brain injury have inadvertently been included in the present sample.

Moreover, due to the restrictive exclusion criteria, the number and representativeness of the batterers in this sample may be reduced. However, this is the first step in studying batterers' differences in IPV, and strict exclusion criteria were needed in order to achieve the aim of this study. Addressing the previously listed limitations will increase the likelihood of more clearly pinpointing the major characteristics of batterers in terms of neuropsychological and not psychosocial factors. Two important strengths should be mentioned in this study. First, differences in the observed inflexibility cannot be attributed to a general cognitive deficit since batterers showed a normal IQ that was similar to that of the other criminal group. Second, many studies have compared batterers in prison with normal participants recruited from the community who were not in prison. The circumstances associated with imprisonment or prolonged life in prison can have an influence on performance on psychological tests at the cognitive level (Ruiz, 2007). Thus, previous psychological differences obtained from comparing batterers in prison with control groups outside of prison could be due to imprisonment or to the batterer condition. In our study, imprisonment was controlled for.

In summary, this study reveals differences in executive functioning between batterers and other criminals who had not committed violent crimes against their partners. IPV batterers were less impulsive, better decision makers, and more inflexible than other criminals. These results improve the understanding of abusers' behavior and provide the opportunity to understand the role of neuropsychology in explaining the behavior of these individuals. In addition, this information could help in developing an intervention program for batterers that is more adequately adjusted to their neuropsychological needs.

CAPÍTULO 8:

PROCESAMIENTO EMOCIONAL EN MALTRATADORES DE GÉNERO MEDIANTE TEST DE EXPRESIONES FACIALES DE EKMAN Y LA TAREA DE STROOP EMOCIONAL

Este capítulo se encuentra publicado en:

Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Burneo-Garcés, C., & Pérez-García, M. (2015). Procesamiento emocional en maltratadores de género mediante el Test de Expresiones Faciales de Ekman y la Tarea Stroop Emocional. *Revista Latinoamericana de Psicología*, *47*(2), 102-110. *(Anexo IV).*

1. Introducción

La violencia de género es un grave problema social y de salud pública que sufren mujeres de todo el mundo (Ramos Lira, Saltijeral & Caballero, 2013; World Health Organization, 2013). El intento de comprender la etiología de dicha violencia nos sitúa obligatoriamente ante la necesidad de realizar un análisis multicausal. Entre las distintas perspectivas que en la actualidad intentan explicar este complejo fenómeno (feminista, transgeneracional y psicosocial), los autores Corvo y Johnson (2013) resaltan que el estudio de las variables psicológicas y neuropsicológicas podría simplificar el trabajo conceptual y ampliar el poder estadístico.

En consonancia con ello, se ha comenzado a investigar las variables psicológicas propias del hombre maltratador (para una amplia revisión en castellano, véase, por ejemplo, Calvete, 2012; Echeburúa & Amor, 2010; Sarto & Esteban, 2010; para una revisión en literatura anglosajona, por ejemplo, Farrell, 2011) incluyendo sus características de personalidad y psicopatológicas (Amor, Echeburúa & Loinaz, 2009; Holtzworth- Munroe & Stuart, 1994; Fernández-Montalvo & Echeburúa, 2005; Loinaz, Echeburúa & Torrubia, 2010; Loinaz, Ortiz-Tallo, Sánchez & Ferragut, 2011), la influencia de variables como el consumo de sustancias (Thomas, Bennett & Stoops, 2012), su funcionamiento neuropsicológico (Bueso-Izquierdo et al., 2012; Corvo & Johnson, 2013; Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013; Walling et al., 2012) o su tipología (Capaldi & Kim, 2007; Cunha & Gonzálvez, 2013; Fernández-Montalbo & Echeburúa, 1997; Holtzworth-Munroe & Meehan, 2004).

Existen numerosas aproximaciones teóricas al estudio de la emoción, aunque recientemente se ha producido un intento integrador de los modelos tradicionales dimensionales (como el modelo de P. Lang) y categóricos (como el modelo de Ekman) (Izard, 2009). Sin embargo, desde un punto de vista neuropsicológico, la evaluación del estado emocional se centra en la evaluación de la capacidad para detectar estados emocionales en los demás y la capacidad de sentir estados emocionales propios (Carmona-Perera & Pérez-García, 2012). En este sentido, la prueba más utilizada para evaluar la habilidad para detectar la capacidad emocional en los demás es el test de reconocimiento de emociones de Ekman (Young, Perrett, Calder, Sprengelmeyer & Etcoff, 2002).

Por otro lado, la evaluación de la capacidad de sentir emociones se ha realizado a través de registros psicofisiológicos (Lang, 1985), tareas de interferencia emocional (Baños, Quero & Botella, 2005) o pruebas basadas en imágenes con contenido emocional (Aguilar de Arcos et al., 2008). Aunque existe una amplia literatura sobre los problemas de control emocional de los hombres maltratadores y cómo intervenir en ellos (Arce & Fariña, 2006), el número de trabajos que han evaluado el procesamiento emocional, tanto experiencia como reconocimiento de emociones, en esta población es muy escaso. En el caso concreto de la violencia contra la pareja, se ha encontrado que el reconocimiento de emociones faciales depende del tipo de hombre maltratador, y oscila entre un déficit en la identificación de emociones y una mayor exactitud en dicho reconocimiento, especialmente en expresiones faciales de asco, de miedo o neutras (Babcock, Green & Webb, 2008). Otras investigaciones proponen un reconocimiento diferente de las emociones en las caras de sus esposas —frente a la cara de otras mujeres u hombres no familiares—, mediados estos sesgos por la existencia de psicopatía (Marshall & Holtzworth-Munroe, 2010).

En el caso de estudios sobre la capacidad de los hombres maltratadores de sentir emociones, se ha realizado también un reducido número de trabajos utilizando registros psicofisiológicos (Gottman, Jacobson, Rushe & Shortt, 1995; Jacob- son et al., 1994) o la tarea *Stroop* Emocional (Chan, Raine & Lee, 2010).

Usando registros psicofisiológicos, se ha encontrado que algunos hombres maltratadores presentan una hiperreactividad cardíaca y de conductancia y otros, hiporreactividad cuando procesan imágenes de violencia de género (Gottman et al., 1995) y que la reactividad psicofisiológica predice la gravedad de la violencia (Babcock, Green, Webb & Yerington, 2005). Por otro lado, usando la tarea de *Stroop* Emocional, Chan et al. (2010) encontraron que los hombres maltratadores tienen un tiempo de reacción ante la tarea de nombrar el color en palabras con contenido afectivo agresivo mayor frente a las neutras (Chan et al., 2010). Actualmente, no existen estudios que hayan investigado en la misma muestra la capacidad de reconocer emociones y la capacidad de sentirlas. Además, los escasos estudios realizados siempre han comparado el funcionamiento emocional de los hombres maltratadores con sujetos controles no violentos, pero nunca se ha estudiado en comparación con otros violentos que no hayan cometido delitos de violencia de género. Esto podría ser de gran interés, ya que permitiría obtener una mejor caracterización del procesamiento emocional de los maltratadores, ya que se ha descrito que las personas violentas en general presentan problemas de procesamiento emocional (Chan et al., 2010). Por otro lado, la investigación del procesamiento emocional de los hombres maltratadores debe profundizarse comparando su respuesta ante estímulos relacionados con la violencia de género, ante otros estímulos emocionales negativos u otros estímulos emocionales relacionados con las relaciones de pareja.

La utilización del *Stroop Emocional* permite estudiar estos aspectos, ya que es posible añadir estímulos de distinta naturaleza en la tarea.

Por ello, el objetivo de este estudio preliminar es investigar, por un lado, la capacidad para reconocer emociones a partir de las fotografías estandarizadas (Young et al., 2002) y, por otro, la interferencia emocional de palabras con contenido emocional positivo, contenido negativo, relacionado con las relaciones de pareja (funcionales), y ante palabras relacionadas con la violencia de género, que ejercen en una tarea *Stroop Emocional* en comparación con otras personas violentas que no han cometido delitos de violencia de género. La ausencia de un cuerpo consistente de resultados previos en este campo no permite hipotetizar la dirección de las posibles diferencias con otro grupo de personas violentas en general.

2. Método

Participantes

En este estudio participaron 167 sujetos, divididos en dos grupos: uno de hombres condenados por delitos de violencia contra la pareja (n = 90) y otro de hombres condenados por otro tipo de delitos (n = 77). Se reclutó a los sujetos en el Centro Penitenciario de Albolote (Granada, España) y el Centro de Inserción Social Matilde Cantos Fernández (Granada, España), previa autorización formal de Instituciones Penitenciarias. Ambos grupos estaban igualados por edad y nivel educativo (tabla 1). Tampoco hubo diferencias entre los dos grupos (hombres maltratadores y hombres no maltratadores) en consumo de drogas (tabla 1). En consecuencia, no fue necesario el control de dichas variables en la comparación del procesamiento emocional de ambos grupos.

Los principales datos sociodemográficos y de consumo de sustancias de los participantes se muestran en la tabla 1. Los criterios de inclusión fueron ser mayor de 18 años y cumplir condena en uno de los dos centros penitenciarios anteriormente citados. Para el grupo de hombres maltratadores, también fue un criterio de inclusión haber sido condenado por algún delito de agresión física, psicológica y/o sexual contra su pareja o expareja.

Los criterios de exclusión propuestos fueron ser analfabetos o tener dificultades para completar las pruebas escritas y antecedentes de psicopatología grave y/o de daño cerebral (pérdida de conciencia de más de 1 hora (Cohen et al., 2003). Para los hombres no maltratadores, también fue un criterio de exclusión tener alguna condena por violencia de género u obtener una puntuación ≥ 11 en la escala de gravedad de violencia de la *Conflict Tactic Scale-2* (CTS-2) (Cohen et al., 2003). Esta escala normalmente se utiliza en los estudios como cribado de violencia.

La participación en el estudio fue completamente voluntaria. Los participantes fueron informados sobre los objetivos del estudio y se los recompensó con 20 euros por el tiempo que duró la evaluación completa. Este estudio fue aprobado por el Comité de Ética e Investigación Humana de la Universidad de Granada, España.

Tabla 1. Estadísticos descriptivos y análisis en hombres maltratadores y no maltratadores sobre las variables sociodemográficas y de consumo de drogas

Variables	Maltratadores (n = 90)	No maltratadores (n = 77)	p (t o χ^2)
Edad (años)	36.70 (7.815)	37.12 (7.786)	.726
Nivel educativo	1.39 (.624)	1.38 (.555)	.470
Estado civil, %			.711
Solteros	33	40	
Con pareja/casados	12.8	36.7	
Separados/divorciados	53.3	23.4	
CTS-2: gravedad < 11	2.58 (4.149)	.41(1.110)	< .001
Tipos de drogas (abuso/ dependencia), %			
Cannabis/marihuana	21.7	18.4	.457 / .323
Alcohol	40.2	26.4	.309
Heroína	16.3	13.2	.550
Cocaína	19.8	22.4	.871
Tranquilizantes (BZD)	1.1	1.3	.569
Estimulantes (MDMA)	3.3	0	.158

CTS-2: *Conflict Tactic Scale.2.* Salvo otra indicación, los valores expresan media (desviación típica).

Instrumentos

Variables demográficas y relacionadas con la violencia

Valoración de riesgo de violencia: entrevista de valoración de riesgo de violencia grave en la relación de pareja (Echeburúa, Fernández-Montalvo, de Corral & López-Goñi, 2008). Esta entrevista contiene 58 preguntas, mayoritariamente en formato sí/no, por ejemplo: "¿El agresor tiene un historial de conductas violentas con otras personas (amigos/ compañeros de trabajo, etc.)?". Recoge variables sociodemográficas del agresor y de la víctima, así como la situación de la relación de la pareja (pareja sin convivencia, convivencia en pareja, trámites de separación, separación, entre otros), el perfil del agresor (datos sociodemográficos, datos de la denuncia, pensamientos y sentimientos sobre su condena) y la vulnerabilidad de la víctima (apoyo familiar, autonomía económica, o consumo de drogas). El coeficiente alfa obtenido de la muestra total de participantes (agresores graves y no graves) fue .71. En cuanto a su validez, la escala diferencia adecuadamente entre agresores graves (.69) y no graves (.66) (Echeburúa y cols., 2008). En este estudio, se usaron para recoger información acerca del agresor: historial, características, pensamientos y conductas que realizó durante su relación de pareja.

Presencia de violencia en la pareja, frecuencia e intensidad *Revised Conflict Tactic Scale* (CTS2) (Straus et al., 1996) se utiliza para detectar si ha habido violencia física y/o psicológica en la pareja en el último año o a lo largo de toda la relación. Mide frecuencia e intensidad de la violencia en la relación de pareja.

Variables relacionadas con el consumo de drogas

Abuso/dependencia de drogas: entrevista clínica estructurada del DSM-IV SCID "I" (First, Spitzer, Williams & Smith- Benjamin, 1998), entrevista compuesta por tantos módulos diagnósticos como categorías diagnósticas tiene el DSM-IV. Se usó la subescala diagnóstica para el trastorno por abuso/ dependencia de sustancias psicoactivas (alcohol y drogas). Permite los diagnósticos de trastorno primario o inducido por sustancias de manera clara y precisa (Becoña et al., 2010).

Procesamiento emocional

El test de percepción emocional (test de expresiones faciales de Ekman) (Ekman & Friesen, 1975) es una prueba informatizada en la que se presentan caras de personas que muestran expresiones faciales correspondientes a seis emociones básicas: ira, asco, miedo, felicidad, tristeza y sorpresa (para los valores de fiabilidad y validez, véase Young et al., 2002). Se requiere que el participante identifique la emoción que expresa cada una de las caras. La principal variable dependiente es el número de aciertos en cada categoría emocional.

Tarea de *Stroop* Emocional computarizada sobre violencia contra la pareja

Basada en diferentes aplicaciones de estos trabajos (Baños et al., 2005; Eckhardt & Cohen, 1997), fue creada específicamente por el equipo de investigación para la evaluación en situaciones de violencia de género.

La tarea consiste en que el sujeto debe pulsar el color de la tinta con que aparecen impresas las palabras en la pantalla, ignorando su significado, lo más rápidamente posible. En concreto, esta prueba mide la capacidad de procesar emociones a través de la respuesta del sujeto a palabras con contenido emocional, las cuales aparecen en varios colores. Dichas palabras se organizaron según su pertenencia a determinada categoría emocional: palabras con contenido emocional negativo, contenido emocional positivo, contenido emocional vinculado con las relaciones de pareja funcionales, contenido de maltrato y contenido neutro. Para cada dimensión se puede obtener como variable dependiente el tiempo de reacción, los aciertos, los errores de omisión (no contestar cuando debía hacerlo) y los errores de comisión (contestar con el color incorrecto). Para el listado y la clasificación de las palabras utilizadas, se extrajo un conjunto amplio de palabras relacionadas con la violencia que se clasificaron mediante juicios de expertos.

De este modo, se seleccionaron 33 palabras en la categoría maltrato, que un mínimo del 75% de los expertos había puntuado con 8, 9 o 10, y 214 palabras en la categoría relaciones de pareja, que un mínimo del 80% de los expertos había puntuado con 8, 9 o 10. Las palabras correspondientes al bloque de palabras positivas, negativas y neutras se seleccionaron de la literatura en castellano (Baños et al., 2005, Calleja & Hernández-Pozo, 2009; Martínez & Belloch, 2004). Cada palabra perteneciente a cada uno de los cinco bloques fue igualada en díadas a partir de la longitud (entre 4 y 10 letras), para formar el listado definitivo con 12 palabras por bloque (tabla 2). Se utilizó un ordenador con una pantalla de 15 pulgadas para la presentación de las palabras (15 mm de tamaño en tipo Lucida Console), las cuales aparecen en los bloques referidos a una misma categoría emocional. La sucesión de los bloques se presenta aleatorizada. Los participantes tenían cuatro ensayos de práctica antes de comenzar la tarea.

Este formato computarizado consistió en un total de 240 ensayos distribuidos a lo largo de cinco bloques experimentales. Cada una de las 12 palabras de cada bloque aparecía aleatorizadamente cuatro veces en los diferentes colores: azul, rojo, verde y amarillo, sobre fondo negro. Por lo tanto, cada bloque estaba dividido en 48 presentaciones (12 palabras × 4 colores). En cada presentación, aparece en primer lugar una X en el centro de la pantalla (con una duración de 400 ms), para quedar luego la pantalla en blanco (100 ms). A continuación, durante 1000 ms se produce la exposición de la palabra. Finalmente se ofrece *feedback* (correcto o incorrecto) al participante (500 ms). El programa informático presentaba las palabras de cada bloque aleatoriamente, de modo que la misma palabra o el mismo color no podían aparecer de forma consecutiva, contrabalanceando las cinco condiciones. El programa informático introducía un periodo de descanso tras cada bloque.

Tabla 2. Categoría de palabras utilizadas en la Tarea *Stroop Emocional* computerizada sobre la violencia contra la pareja

BLOQUE 1 MALTRATO	BLOQUE 2 RELAC PAREJA	BLOQUE 3 POSITIVAS	BLOQUE 4 NEGATIVAS	BLOQUE 5 NEUTRAS
Agresión	Amor	Sincero	Tumor	Libreta
Bofetada	Apoyo	Honesto	Cáncer	Cartera
Golpes	Besos	Alegría	Operar	Compás
Zorra	Compartir	Amable	Enfermedad	Carpeta
Humillada	Cariño	Animada	Infectar	Goma
Indefensa	Confianza	Ánimo	Infarto	Agenda
Insulto	Convivir	Calma	Flemón	Papel
Intimidar	Diálogo	Relajada	Amputar	Papelera
Maltrato	Equilibrio	Contenta	Vicio	Borrador
Puta	Ilusión	Agradable	Vértigo	Sacapuntas
Moretón	Proyectos	Segura	Contamina	Bolígrafo
Perseguida	Respeto	Afortunada	Adicción	Tintero

Procedimiento

Una vez Instituciones Penitenciarias aprobó el inicio del estudio, se invitó a participar a los penados del Centro Penitenciario de Albolote (Granada) y el Centro de Inserción Social Matilde Cantos Fernández (Granada) que cumplían con los criterios de inclusión. Los participantes fueron evaluados entre junio de 2011 y junio de 2013. Este estudio formó parte de un proyecto más amplio en el que se evaluó a los sujetos en tres sesiones, dos de ellas individuales, con una duración aproximada de 2 h por sesión (incluidos los descansos), y otra grupal de 1 h, en la que procedían a rellenar los cuestionarios de autoinforme.

Los sujetos internos en la prisión fueron evaluados en salas habilitadas para su tratamiento o evaluación en las dependencias del Centro Penitenciario de Albolote (Granada). Los sujetos del Centro de Inserción Social fueron evaluados en salas habilitadas también para evaluación o tratamiento en las dependencias abiertas de dicho centro. Ambos espacios tenían las mismas características ambientales y eran sitios tranquilos y silenciosos. Antes de aplicarse cualquier instrumento de medida, todos los participantes fecharon y firmaron por duplicado un consentimiento informado, que también firmaron los investigadores. Los investigadores explicaron verbalmente al sujeto la voluntariedad en cuanto a la participación y la retirada del estudio cuando lo considerasen necesario, así como los objetivos y el procedimiento a seguir en la investigación. A su vez, el consentimiento incluyó información acerca de la confidencialidad de los datos obtenidos durante el proceso de la investigación, de acuerdo con lo establecido en la Ley Orgánica 15/1999, del 13 de diciembre, de Protección de Datos de Carácter Personal y en lo relativo al secreto profesional. Todos los examinadores eran Licenciados en Psicología, con formación y experiencia en el campo de la Neuropsicología, y fueron entrenados bajo una común instrucción en el manejo de las pruebas de evaluación. Los investigadores siguieron el mismo protocolo de administración y se determinó la elegibilidad de los participantes sobre la base de los criterios de inclusión y exclusión descritos previamente.

Análisis estadísticos

Para comprobar que los grupos estaban igualados en las principales variables sociodemográficas, se realizaron pruebas de la *t* de Student para la variable cuantitativa edad y de la $\chi 2$ para la variable cualitativa nivel educativo. Además, se compararon los porcentajes entre los dos grupos en consumo de drogas, a partir de la entrevista clínica estructurada del DSM-IV SCID (First et al., 1999). Para comprobar si se cumplía el supuesto de normalidad de las variables, se realizó la prueba de Kolmogorov-Smirnov. Dado que el supuesto de normalidad no se cumplía, se optó por realizar análisis no paramétricos mediante la prueba de la *U* de Mann-Whitney para dos muestras independientes para la comparación de las diferencias existentes entre los dos grupos de estudio (hombres maltratadores y hombres no maltratadores) en el procesamiento emocional en las diferentes medidas del test de percepción emocional y de la tarea de *Stroop* Emocional computarizada sobre violencia contra la pareja. El nivel de significación se estableció en $p = .05$.

3. Resultados

Los resultados de la prueba *(U)* para dos muestras independientes mostraron diferencias estadísticamente significativas en el reconocimiento de emociones faciales de ira $U = 2462.500$ ($z = –2.273$; $p = .023$) y sorpresa $U = 2503.000$ ($z = –2.125$; $p = .034$). En dichas dimensiones, la puntuación era mayor en el grupo de maltratadores, lo que denota un mejor reconocimiento de dichas emociones. Los tamaños del efecto de las diferencias estadísticamente significativas fueron bajos-moderados (tabla 3).

En el análisis de la tarea *Stroop* Emocional, se compararon los dos grupos en las cinco condiciones emocionales (palabras con contenido emocional negativo, contenido emocional positivo, contenido emocional vinculado con las relaciones de pareja funcionales, contenido de maltrato y contenido neutro) tanto en tiempo de reacción como en errores de omisión y comisión. Los resultados mostraron que no había diferencias estadísticamente significativas (tabla 3). Para el resto de las variables analizadas, los resultados no mostraron diferencias estadísticamente significativas entre ambos grupos.

Tabla 3. Procesamiento emocional entre hombres maltratadores y hombres no maltratadores

	No maltratadores (n = 77)	Maltratadores (n = 90)	*U*	*Z*	*p*	*d*
Test de Ekman						
Ira	7.43 (1.745)	7.98 (1.799)	2462.50	–2.2733	.023	.30
Asco	7.23 (2.072)	7.48 (1.984)	2937.50	–.774	.439	.12
Miedo	5.83 (2.123)	5.78 (2.411)	3123.00	–.092	.927	.01
Felicidad	9.82 (.661)	9.91 (.328)	3024.50	–.454	.650	.17
Tristeza	7.61 (1.751)	7.57 (1.768)	3070.50	–.122	.903	.02
Sorpresa	8.73 (1.179)	9.11 (1.011)	2503.00	–2.125	.034	.34
Stroop Emocional						
Bloque 1 Maltrato						
Aciertos	42.28 (6.159)	42.31 (5.281)	3330.50	–.434	.665	.05
Errores	.31 (2.345)	1.69 (2.848)	2919.50	–1.844	.065	.14
Omisiones	4.41 (5.953)	4.00 (4.371)	3336.50	–.416	.677	.07
Total respuesta	766.39 (65.756)	746.46 (76.648)	2787.00	–.1628	.103	.28

Bloque 2 Relaciones de pareja						
Aciertos	44.03 (5.177)	44.78 (3.651)	3151.50	–1.018	.309	.14
Errores	1.29 (1.915)	1.10 (1.465)	3452.00	–.045	.964	.01
Omisiones	2.68 (4.905)	2.12 (3.208)	3120.00	–1.139	.255	.15
Total respuesta	733.40 (73.515)	712.96 (80.759)	2945.00	–1.447	.148	.24
Bloque 3 Positivas						
Aciertos	44.10 (5.469)	44.78 (3.651)	3151.50	–1.018	.309	.14
Errores	1.11 (1.517)	1.10 (1.465)	3452.00	–.045	.964	.01
Omisiones	2.79 (5.337)	2.12 (3.208)	3120.00	–1.139	.255	.15
Total respuesta	732.11 (73.599)	712.96 (80.759)	2945.00	–1.447	.148	.24
Bloque 4 Negativas						
Aciertos	44.52 (4.674)	44.27 (3.999)	3180.50	–.924	.356	.05
Errores	1.23 (1.879)	1.06 (1.600)	3395.00	–.242	.809	.09
Omisiones	2.24 (4.257)	2.66 (3.351)	2966.00	–1.649	.099	.01
Total respuesta	721.27 (67.121)	718.00 (81.248)	3327.00	–.074	.941	.04
Bloque 5 Neutras						
Aciertos	43.96 (5.753)	44.75 (3.241)	3318.50	–.475	.635	.17
Errores	1.36 (2.240)	1.04 (1.526)	3247.00	–.763	.445	.16
Omisiones	2.69 (5.415)	2.21 (2.867)	3408.00	–.187	.852	.01
Total respuesta	725.44 (76.259)	711.99 (78.146)	3114.00	–1.012	.312	.02

4. Discusión

El objetivo del presente trabajo de investigación fue investigar el procesamiento emocional de maltratadores, examinando por un lado el reconocimiento de emociones faciales y, por otro, el efecto de interferencia ante palabras con contenido emocional, utilizando una tarea *Stroop* Emocional diseñada específicamente para evaluar el procesamiento emocional en situaciones de violencia contra la pareja o expareja.

Los resultados muestran que se produjo un mejor reconocimiento emocional en maltratadores ante las emociones faciales de ira y sorpresa. En cuanto al procesamiento de palabras con contenido emocional, los resultados muestran que no hubo diferencias entre ambos grupos. Estos resultados pueden considerarse una primera aproximación al estudio del procesamiento emocional en hombres maltratadores. Estudios previos muestran un reconocimiento de emociones faciales diferenciado en hombres maltratadores, especialmente ante las caras de sus parejas. En estos estudios se observan resultados que van desde un déficit (Babcock et al., 2008; Marshall & Holtzworth-Munroe, 2010) hasta una mejor ejecución (Babcock et al., 2008) para los grupos de hombres maltratadores. Nuestros resultados apoyan estos últimos trabajos. Si bien los resultados de este estudio son preliminares, se puede destacar la tendencia a un mejor reconocimiento emocional con menor afectación ante contenidos de violencia de género en hombres maltratadores.

Todo ello resulta interesante porque podría arrojar información útil en la explicación de los mecanismos utilizados por los hombres maltratadores en la manipulación emocional de sus parejas. Así, estudios previos exponen el papel de las emociones que se generan en las mujeres víctimas de violencia en el proceso de persuasión llevado a cabo por su marido como determinantes del mantenimiento de la relación con la pareja más allá de la violencia recibida (Redo et al., 2005). Así pues, el hombre maltratador puede generar miedo real en su pareja, de modo que ella no es capaz de abandonar dicha relación en la que está siendo violentada (Echeburúa, Pedro & De Corral, 2002). Un mejor reconocimiento emocional podría ser la herramienta utilizada por los hombres maltratadores para manipular los sentimientos de sus parejas o exparejas, y así conseguir el objetivo de perpetuar la relación violenta.

En efecto, podría existir un perfil de agresores que reporta mayor empatía en su vertiente cognitiva —percepción, reconocimiento, atribución emocional— y que se perciben a sí mismos como con alta capacidad de discernir cognitivamente los estados emocionales de los demás, mientras que tienen una dificultad considerable para hacer frente a dichos estados emocionales, especialmente cuando las emociones son negativas (Covell, Huss & Langhinrichsen-Rohling, 2007). Este perfil de empatía se ha relacionado con mayores índices de violencia en general.

Por otro lado, no se han encontrado diferencias entre los grupos en cuanto al procesamiento de palabras con contenido emocional. Nuestros resultados no coinciden con los evidenciados por el trabajo de Chan et al. (2010), quienes encontraron que los maltratadores tienen mayor tiempo de reacción ante la tarea de nombrar el color en palabras con contenido afectivo agresivo. Sin embargo, obtuvieron sus resultados utilizando una tarea de carácter general, y no una diseñada específicamente para evaluar el procesamiento emocional en situaciones de maltrato y comparando con sujetos no violentos. En la presente investigación, y con una tarea específica para evaluar esta población, no encontramos diferencias entre un grupo de hombres maltratadores y otro grupo de violentos en general. Además, en el trabajo de Chan (2010), se comparó con sujetos controles y no con otros violentos.

El presente estudio tiene ciertas limitaciones. Todos los sujetos tienen medida judicial, ya sea por delitos de violencia de género u otros delitos. Además, la utilización de un grupo control de hombres sin antecedentes penales y que no ejerzan violencia contra su pareja podría ser útil para determinar qué parte de los hallazgos aquí presentados se explicarían por las características específicas de la muestra del presente estudio.

Asimismo, conviene destacar que los participantes en este estudio provenían tanto del Centro Penitenciario de Albolote, internos en él, como del Centro de Inserción Social Matilde Cantos Fernández, establecimiento penitenciario destinado al cumplimiento de penas privativas de libertad en régimen abierto y al seguimiento de penas no privativas de libertad y de liberados condicionales, por lo que el perfil de dicha población no siempre es marginal y se puede acercar suficientemente (en el caso de los participantes en régimen abierto) a los sujetos sin medidas judiciales (por ejemplo, las penas por delitos contra la seguridad del tráfico podrían utilizar un sistema penitenciario en régimen abierto).

Por último, este estudio se ha centrado en el procesamiento de caras no familiares y no ha investigado el procesamiento de caras familiares, incluidas las de sus parejas, ni ha considerado otras medidas de la empatía. A pesar de estas limitaciones, los resultados preliminares de la presente investigación contribuyen a un mayor conocimiento del procesamiento emocional de los maltratadores. En efecto, un posible aporte sería crear una herramienta específica para la evaluación del procesamiento emocional en situaciones de violencia contra la pareja que se pueda utilizar para la evaluación de la empatía en hombres maltratadores. En la línea de la investigación de Covell et al. (2007), la tarea *Stroop Emocional* computarizada sobre violencia contra la pareja que se propone puede ser útil en futuras investigaciones para discernir un perfil de hombres maltratadores especialmente violentos y peligrosos, y estudiar las características particulares que muestran los hombres que reinciden una vez han pasado por programas de tratamiento, como el programa "Violencia de Género PRIA: Programa de Intervención para Agresores" (Ruiz et al., 2010).

Por último, cabe mencionar que conocer con mayor profundidad el comportamiento de los hombres maltratadores en el terreno emocional puede contribuir a comprender los mecanismos subyacentes a la relación de dominio y manipulación que caracteriza las relaciones violentas (Alcázar- Córcoles & Gómez-Jarabo, 2001; Chan et al., 2010). Futuras investigaciones podrían explorar dichos hallazgos, ampliando el ámbito de estudio a participantes sin medida judicial y atendiendo también a otras pautas empáticas más afectivas, como el remordimiento.

En vista de los resultados obtenidos, sería interesante contrastar en futuros estudios si la capacidad de procesar emociones a partir de las caras es un efecto general o se comporta de modo diferencial cuando son expresadas por su pareja. También sería útil investigar si el procesamiento emocional encontrado en nuestro trabajo facilita o dificulta de alguna manera la capacidad empática y la interacción social de los hombres maltratadores. En resumen, este trabajo preliminar permite conocer un poco más lo relacionado con el procesamiento emocional que otros delincuentes no maltratadores presentan en el reconocimiento de emociones. Una replicación de este estudio, controlando variables como los antecedentes penales (con y sin antecedentes), el tipo de violencia (física y psicológica o solo psicológica) y la generalidad de los actos violentos (solo con sus parejas o violentos en general) resultará imprescindible para conocer las implicaciones directas de estos resultados.

CAPÍTULO 9:

ARE BATTERERS DIFFERENT FROM THE OTHERS CRIMINALS? AN FMRI STUDY

Este capítulo se encuentra publicado en: Bueso-Izquierdo, N., Verdejo-Román, J., Contreras-Rodríguez, O., Carmona-Perera, M., Pérez-García, M., & Hidalgo-Ruzzante, N. (2016). Are batterers different from other criminals? An fMRI study. *Social cognitive and affective neuroscience*, *11*(5), 852-862. *(Anexo V)*

1. Introduction

Intimate partner violence (IPV) is a complex and global phenomenon that requires a multi-perspective analysis. According to the World Health Organization (WHO), IPV refers to any violent behavior within an intimate relationship. It includes physical aggression (e.g. slapping, hitting, kicking or beating), sexual force, psychological abuse (e.g. intimidation, constant belittling or humiliation) or any other controlling behavior by a current or former partner or spouse (Krug et al., 2002; World Health Organization, 2013). Many studies have pointed out that IPV is related to several factors including psychosocial, family, patriarchal or biological variables (Pinto et al., 2010; Corvo and Johnson, 2013), but the number of neuroscientific studies conducted on this issue are scarce as compared with the number of studies on other types of violence (Corvo, 2014).

A great number of neuroimaging studies on general violence (GV) have focused on the brain functioning of violent people. Furthermore, these results have been replicated in structural and functional studies using different techniques such as Computed tomography, positron emission tomography (PET), Single-photon emission computed tomograph, magnetic resonance imaging (MRI) and Event-related potential scans (Patrick, 2008; Schiltz et al., 2013). The prefrontal cortex, temporal cortex, insula, amygdala, hippocampus and cingulate gyrus have been key structures related to aggressive behavior (Blair, 2001; Siever, 2008; Blair and Lee, 2013). Nevertheless, brain structures are different according to the type of aggression. In reactive/impulsive aggression or aggression in response to a threating stimulus, activation in the amygdala, hypothalamus and periaqueductal gray (PAG) (Mobbs et al., 2007) has been consistently found.

The same structures have been found to be involved in cases of frustration (Blair, 2010). In instrumental/ goal directed aggression, the motor cortex and cerebellum are involved (White et al., 2015). In the last type of aggression, the amygdala and ventromedial prefrontal cortex have been related to moral decisions about harming another person (Blair, 2007; Harenski et al., 2010). In the case of offenders with psychiatric conditions, other brain areas have been found to be involved. In a study conducted on antisocial offenders, differentiated according to borderline personality disorder (BPD) or high psychopathic traits (HPT), Bertsch et al. (2013) found that antisocial offenders with BPD showed gray matter reduction in the orbitofrontal and ventromedial prefrontal cortices (involved in emotion regulation and reactive aggression) and in the temporal pole (involved in cognitive empathy). On the other hand, antisocial offenders with HPT showed gray matter reduction in cortical midline structures, such as the dorsomedial prefrontal cortex, the postcentral gyrus, posterior cingulate cortex (PCC), and dorsal anterior and posterior precuneus, which are principally involved in the default mode network (DMN).

To our knowledge few studies have assessed the brain function of abusers (George et al., 2004; Lee et al., 2009). George et al. (2004) used PET to analyze glucose metabolism activity in the structures responsible for monitoring and mediating conditioned responses to fear associated with domestic violence. Findings show that perpetrators with alcohol abuse, compared with non-perpetrators with alcohol abuse and control participants, had lower glucose uptake in the hypothalamus. Interestingly, using an fMRI picture-viewing paradigm, Lee et al. (2009) demonstrated that batterers had an over-activation in the hippocampus, the fusiform gyrus, the PCC, the thalamus and the occipital cortex in response to threatening stimuli compared with neutral stimuli.

On the other hand, specific higher activation was observed in batterers in the precuneus when they saw female aggression pictures versus neutral pictures. However, no direct neuroimaging studies comparing batterers with other criminals have been conducted, and few studies have compared both populations while considering other psychological variables.

For example, Moffitt et al. (2000) demonstrated that partner abuse and general crime represent different constructs that are moderately related but ‘not conceptually equivalent, even when performed by the same individual’, depending on his/her personality traits. General crime was related to high emotional negativity and low constraint, and IPV was also related to emotional negativity but not to low constraint. Boyle et al. (2008) found that general violent offenders showed more conduct disorder/delinquent behaviors, lifetime antisocial behaviors and disinhibition, and were more psychologically abusive than other violent participants. In this sense, comparing batterers’ brain functioning to that of other criminals could help in understanding the mechanism of IPV and its possible similarities with GV.

For these reasons, the main aim of this study is to compare the brain functioning of batterers with other criminals when they observe IPV or GV pictures to make progress from findings in previous studies (Lee et al., 2009). We also aimed to assess whether batterers have differences in brain functioning specific to IPV pictures that are not present to GV images. We hypothesized that batterers, relative to other criminals, will show a specific higher activation of the precuneus/PCC during the viewing of IPV pictures compared with neutral and GV pictures.

This hypothesis is in line with the over-activation of these regions in the only fMRI study that has assessed brain activation in response to IPV pictures in batterers relative to controls (Lee et al., 2009). We also hypothesized that batterers will show higher activation of the occipital, posterior parietal and temporal cortices during the viewing of GV images compared with neutral images. This hypothesis is also congruent with the study completed by Lee et al. (2009) showing over-activation of these brain regions in response to threatening *vs* neutral stimuli.

2. Method

Participants

Forty-one men convicted of crimes were recruited from the Center for Social Insertion (CSI) (Centro de Inserción Social, CIS) 'Matilde Cantos Fernández', in Granada (Spain). They were divided into two groups: (i) 21 batterers (batterers group, BG) convicted for a crime of violence against women and (ii) 20 men convicted of crimes other than IPV (other criminal group, OCG).

In Spain, IPV crimes are regulated by a specific law (Law 1/ 2004, 'Comprehensive Protection Law against Gender Violence'[Ley Orgánica 1/2004, de 28 de diciembre, de Medidas de Protección Integral contra la Violencia de Género]). This law states that a man may be convicted by a judge for several types of aggression including insults, threats, slaps or beatings, sexual abuse or murder. According to this law, first convictions for IPV without sexual or physical abuse are classified as a misdemeanor, which implies that the person is sent to an open facility (CSI) of the Ministry of Justice, but not to prison. In the CSI, batterers should attend IPV rehabilitation programs.

In case of sexual or physical abuse with any physical injury, batterers go to prison. Crime severity in Spaniard law is regulated by a Penal Code (article 33). According to this article, crimes sentences between 3 months and 5 years are classified as 'less serious'. Given that all participants were recruited in the CSI, we guaranteed that (i) it was the first time that participants of both groups were convicted; and (ii) they were convicted for the similar sanction ('less serious').

Table 1 shows the socio-demographic and severity of crime information. Groups did not differ significantly in age, education level and intelligence quotient (IQ). All were right-handed males with native fluency in Spanish. The selection of participants included the following inclusion criteria: individuals 18 years old or older; for the BG, being convicted of an IPV crime, for the OCG being convicted of a crime other than IPV. The exclusion criteria for the two groups included: illiteracy, a history of serious antecedents of psychological and personality problems (measured through the Millon Multiaxial Personality Test III; Millon, 1994, Spaniard adaptation; Cardenal et al., 2007), head injury, neurological illness, infectious disease, history of drug abuse or dependence (including alcohol) (SCID/ DSM-IV); American Psychiatric Association, 1994), systemic disease or any other diseases affecting the central nervous system (First et al., 1999), and the presence of significant abnormalities in MRI or any contraindications to MRI scanning (including claustrophobia or implanted ferromagnetic objects). Individuals in the OCG with a score greater than or equal to 11 on the severity scale of the CTS2 (Conflict Tactic Scales) (Straus et al., 1996) were excluded. This criterion was established in a previous study (Cohen et al., 2003) to rule out physical or psychological violence against partners. The study was approved by the Research Ethics Committee of the University of Granada, Spain.

The participants were invited to collaborate in the study on a voluntary and anonymous basis. The confidentiality of personal information was guaranteed in accordance with the Spanish legislation on personal data protection (Organic Law 15/1999, December 13). All of the participants signed a written informed consent document and they received 25 euros for participating the study.

Table 1. Demographic and crime characteristics of batterers (BG) and other criminal groups (CG).

Variables (Mean (SD))	BG	CG	P-value
Age	38.38 (8.70)	34.40 (8.66)	0.15
Years of education	9.62 (3.90)	9.45 (2.42)	0.87
IQ	99.83 (14.29)	92.85 (13.32)	0.13
Time of crime [%(n)]			
Misdemeanor	IPV-PV= 38 % (8)	SCF/DD= 50% (10)	0.44
Felony	IPV-PPV= 62%(13)	GAR/VF= 50% (10)	

SD= standard deviation; IPV-Psychological Violence= PV; Scams or Crime of Forgery= SCF; DD= Dangerous Driving; IPV-PPV= IPV- Physical and Psychological Violence; GAR= Grave assault/ robbery; VF= Violent fight

Materials

An interview evaluating socio-demographic information and the risk of serious couple violence was used (Echeburúa et al., 2008). This questionnaire measures the socio-demographic variables of the aggressor and victim, the relationship status of the couple (couple not living together, cohabitation, in the process of separating, separated, etc.), the types of violence, the profile of the aggressor (information about the formal complaint and emotions of the batterer in that moment), and vulnerability factors for the victim (i.e. substance use, economic dependence and lack of social support).

IPV Severity. The CTS 2 Spanish version (Loinaz et al., 2012) of the original CTS2 (Conflict Tactic Scales; Straus et al., 1996) was used to detect the existence of physical, psychological, and/ or sexual violence towards a partner in a relationship. It measures violence frequency and intensity in the relationship.

Intelligence Quotient. The K-BIT (Brief Intelligence Test) (Kaufman et al., 1997): The K-BIT measures cognitive functions through two tests: verbal (vocabulary, comprised of two tests), and non-verbal (matrix), which evaluates crystallized and fluid intelligence, and obtains a compound IQ.

fMRI task. The stimulus set comprised 72 pictures extracted from the International Affective Picture System (IAPS) database, divided equally into four categories: pleasant, unpleasant, general violence, and neutral. We also selected 18 pictures of intimate partner violence from Internet. For present study proposes, we focus on general and intimate partner violence images, using neutral images as the control condition.

General violence (GV) images included violent acts against humans and animals, such as fights, threats and injuries that lack women. Intimate partner violence (IPV) images, in turn, involved a female victim being attacked by a man, or injured women. Neutral (N) images included general objects that were not related to violence, such as chairs, baskets and spoons. Each picture was presented in blocks of 15 seconds, with an individual picture duration of 5 seconds (secs).

Picture blocks were presented pseudo-randomly. The task was performed with the Presentation software (Neurobehavioral System Inc., San Francisco, CA). The items were presented through magnetic resonance-compatible liquid crystal display goggles (Resonance Technology, Northridge, CA, U.S.A.) equipped with various corrective lenses.

Participants were instructed to sustain the emotion elicited by the pictures displayed during IPV, GV and N images. After the functional imaging session, participant involvement was confirmed by asking the participants to rate images on three emotional components using the Self-Assessment Manikins (SAM) scales, with valence: from happy (9) to unhappy (1), arousal: from excited (9) to calm (1), and dominance: from controlled (1) to in control (9).

Imaging data acquisition and preprocessing. The equipment used was a 3.0 Tesla clinical MRI scanner with an eight-channel phased-array head coil (Intera Achieva, Philips Medical Systems, Eindhoven, The Netherlands). During acquisition, a T2*-weighted echo-planar imaging (EPI) was obtained (Repetition time (TR) = 2000 msec, Echo time (TE) = 35 msec, Field of view (FOV) = 230 x 230 mm, 128 x 128 matrix, flip angle = 90°, 21 4-mm axial slices, 1-mm gap, 315 scans).

A sagittal three-dimensional T1-weighted turbo-gradient-echo sequence (3D-TFE) (160 slices, TR = 8.3 msec, TE = 3.8 msec, flip angle = 8°, FOV = 256 x 256, 1 mm3 voxels) was obtained in the same experimental session to check for gross anatomical abnormalities for each subject.

Brain images were analyzed using the Statistical Parametric Mapping (SPM8) software (Wellcome Department of Cognitive Neurology, Institute of Neurology, Queen Square, London, U.K.), running under Matlab R2009 (MathWorks, Natick, MA, U.S.A.). Preprocessing steps included slice timing correction, re-slicing to the first image of the time series, normalization (using affine and smoothly non-linear transformations) to an EPI template in the Montreal Neurological Institute (MNI) space, and spatial smoothing by convolution with a 3D Gaussian kernel (full width at half maximum (FWHM)= 8 mm).

Procedure

In session 1, the initial interview and behavioral tasks were administered in the CSI. All participants were assessed in an individual and quiet room for approximately one hour. In session 2, fMRI scans and image ratings were taken in the Centro Diagnóstico CEDISA (Granada, Spain) and each session lasted 1 hour.

Statistical analyses

Behavioral analyses. Behavioral data were analyzed using the Statistical Package for the Social Sciences, version 22 (SPSS; Chicago, IL, U.S.A.).

Independent-sample t-tests or cross-tabulation analyses (depending on the type of variable) were conducted to compare the two groups with regard to demographics and severity of crime variables. We also performed a mixed-design ANOVA (2 groups x 3 types of images) to analyze group differences on emotional responses by type of image as recorded by the SAM.

Neuroimaging analyses. The BOLD response at each voxel was convolved with the SPM8 canonical hemodynamic response function (using a 128-s high-pass filter). Conditions were modeled for the 15 seconds that each block appeared on the screen. To cover the study objectives, three contrasts of interest were defined at the first-level (single-subject): (1) “IPV vs. N images”, (2) “GV vs. N images” and (3) “IPV vs. GV images”. The resulting first-level contrast images were then used in the second-level random-effect analyses to assess for between-group differences. For the (1) “IPV vs. N images” and (2) “GV vs. N images” contrasts two-sample t-test models were used to compare group activations. For the (3) “IPV vs. GV” comparison, two approaches were used. First, a second-level paired t-test model, using contrast images from contrasts (1) and (2), was used to sensitively explore group effects to each type of violence. Moreover, a collapsed across groups second-level t-test analysis using the “IPV vs. GV” contrast images was performed to identify brain activations uniquely associated with IPV images. For both of these latter statistical approaches, the signal eigenvariate of the significant brain regions (peak maxima) were extracted and group*condition interaction analyses were conducted in SPSS.

Threshold criteria. Significance in ANOVA models were established at a threshold of $p<0.05$. For the imaging analyses, the spatial extent threshold was determined by 1,000 Monte Carlo simulations using AlphaSim as implemented in the SPM REST toolbox (Song et al., 2011; Ward, 2013). For one-sample t-tests, input parameters included a whole-brain brain mask of 283,654 voxels (2 mm x 2 mm x 2 mm), an individual voxel threshold probability of 0.005, a cluster connection radius of 5 mm, and the actual smoothness of the data.

A minimum cluster extent (KE) of 173 voxels (1384 mm^3) was estimated to satisfy a P_{FWE} < 0.05. Significance in two-sample and paired t-tests was assessed using the same input parameters, masking results on the basis of activation and deactivation maps derived from the corresponding one-sample t-test contrasts for both study groups. Therefore, for contrasts 1 and 2, a minimum cluster extent (KE) of 91 and 94 voxels (within masks of 38491 and 61538) were estimated to satisfy a $P_{FWE} < 0.05$, respectively. For the paired t-test analyses, a KE of 99 voxels (within a mask of 69.598) were estimated.

3. Results

Differences between batterers and criminals in behavioral responses

Analyses showed no significant main effect for the group factor (batterers vs. general crime), nor an interaction effect (group by type of imagine) in emotional ratings. These findings suggested that valence, arousal and dominance ratings were the same for batterers and criminals overall and across the type of image displayed in the fMRI task. As expected according to the selection criteria for images, a significant main effect for type of images (i.e. IPV, GV, N images) was observed for valence [$F(2,74)= 222.61$; $p=.000$], arousal [$F(2,74)= 40.26$; $p=.000$], and dominance [$F(2,74)= 14.60$; $p=.000$].

For both groups, IPV images showed less valence, higher arousal, and less dominance than GV images, and GV images showed less valence, higher arousal and less dominance than N images (see table 2).

Table 2. Descriptive scores and mixed-design ANOVA results for the valence, arousal, and dominance affective dimensions.

	BG			CG			Main effect		Interaction
Variables Mean (SD)	IPVI	GVI	NI	IPVI	GVI	NI	Group P-value	TI P-value	Group*TI P-value
Valence	1.44 (0.53)	2.22 (0.91)	5.76 (1.23)	1.59 (0.64)	2.54 (0.90)	5.58 (1.05)	0.57	0.000	0.67
Arousal	7.48 (1.80)	6.53 (1.74)	4.41 (1.39)	7.08 (2.01)	6.42 (1.60)	4.48 (0.87)	0.68	0.000	0.63
Dominance	5.14 (2.87)	5.88 (2.20)	6.51 (1.81)	4.10 (2.50)	5.16 (2.20)	7.03 (1.48)	0.45	0.000	0.33

SD= standard deviation; BG= Batterers Groups; CG= Other Criminals Group; IPVI= Intimate Partner Violence Images; GVI= General Violence Images; NI= Neutral Images; TI= Type of Imagen

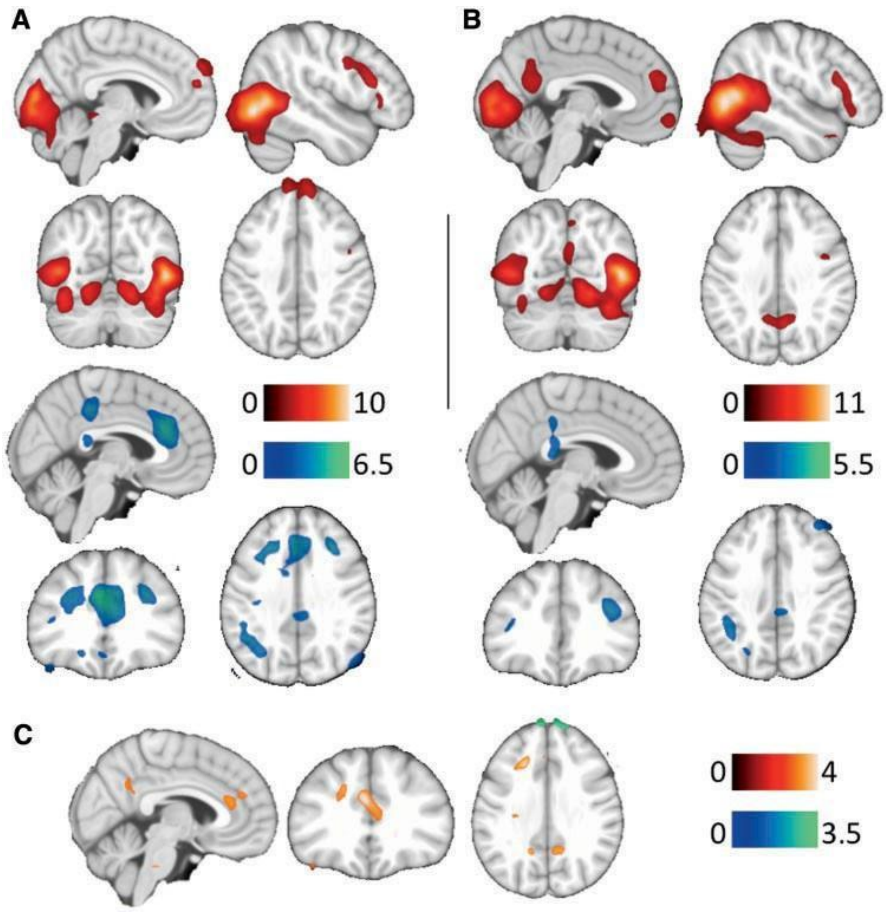
Neuroimaging results

Intimate partner violence vs. Neutral images (IPV>N)

Group activations: Brain activation and deactivations for the IPV>N contrast in both groups are reported in Table 3. Criminals showed activation in the superior frontal gyrus. Batterers, on the other hand, showed additional activation in the orbitofrontal cortex and the posterior cingulate cortex, and significant deactivation in the anterior cingulate cortex and the insula.

Between-group differences: Batterers, relative to criminals, demonstrated significantly higher activation of the middle prefrontal cortex, and the anterior and posterior cingulate cortex (Figure 1, Table 4). Criminals showed higher activation of the superior prefrontal cortex compared to batterers (Table 4).

Fig. 1. Main group activations (red) and deactivations (blue) to IPV>N in criminals (A) and batterers (B). Between-group differences (C) show increased (red) and decreased (blue) brain activity in batterers.



The right hemisphere corresponds to the right side of the axial and coronal views. Sagittal images show the right hemi- sphere in B and C views, and the left hemisphere in A view. The color bar indicates *t*-values.

General violence vs. Neutral images (GV>N)

Group activations: Brain activation and deactivations for the GV>N contrast in both groups are reported in Table 3.

Criminals showed activation in the superior frontal gyrus, and significant deactivation in the anterior cingulate cortex, middle frontal gyrus, insula, middle posterior cingulate cortex and temporal cortex, which was not identified in batterers. Batterers, on the other hand, showed additional activation in the orbitofrontal cortex, the thalamus, the precuneus and the superior parietal.

Table 3. Brain activations and deactivations observed during IPV > N and GV > N contrasts in within-group (one-sample) whole brain analyses

Brain region	Batterers			Other Criminals		
	x, y, z	kE	t value	x,y,z	kE	t value
	IPV > N					
Activations						
Superior PFC			ns	8, 64, 30	973*	4.7
Inferior PFC	42, 16, 20	484	4.2	60, 28, 34	706	3.9
Medial PFC	4, 50, 14	616	3.1	-4, 54, 18	973*	4.3
OFC	4, 62, -14	287	4.9			ns
PCC	4, -58, 30	1392	5.1			ns
Temporal	52, -68, 2	20891*	11.0	50, -72, -4	20266*	10.0
	-42, -76, -2	20891*	10.7	-42, -76, -2	20266*	9.9
PAG			ns	2,- 34, -8	238	3.7
Occipital	-4, -90, 4	20891*	7.2	8, -88, 4	20266*	8.1
Deactivations						
ACC			ns	-2, 32, 28	2147*	6.4
Middle PFC	38, 38, 18	784	5.2	32, 26, 34	452	5.4
	-32, 38, 10	199	3.9	-26, 28, 32	2147*	4.8
OFC	30, 62, -6	294	4.2	-14, 22, -16	181	3.7
	-38, 54, 2	202	3.5			ns

Fusiform gyrus	30, -54, 0	1055*	4.4	32, -44, -6	177	3.8
	-34, -52, -6	379	3.6	-20, -46, 2	530	3.4
Middle PCC	6, -34, 40	1055*	3.6	-2, -36, 44	465	4.8
Insula			ns	48, -24 12	892	4.3
Angular gyrus			ns	54, -44, 66	942	3.8
	-44, -42, 38	228	4.0	-46, -54, 36	351	4.4

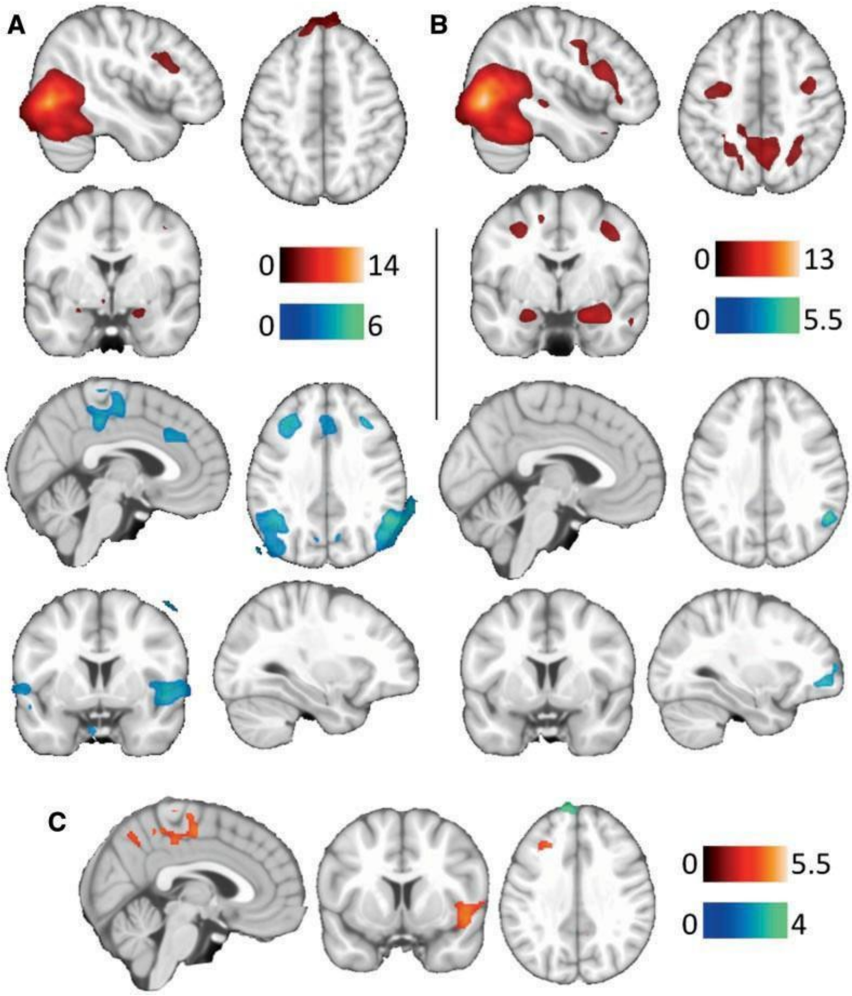
	GV > N					
Activations						
Superior PFC			ns	-10, 62, 36	1379	4.9
Inferior PFC	46, 16, 18	1044*	4.3	50, 10, 32	1262	4.4
OFC	6, 70, -18	388	3.9			ns
Precentral gyrus	40, -2, 46	1044*	4.2			ns
	-32, -12, 42	348	3.8			ns
Amygdala-HPC	20, -4, -20	36259*	5.1	32, -16, -18	320	3.8
	-22, -8, -20	36259*	3.8			ns
Thalamus	14, -26, -2	36259*	5.5			ns
	-10, -24, -6	36259*	4.1			ns
Fusiform gyrus	38, -56, -20	36259*	6.9	38, -56, -16	27576*	5.1
	-40, -44, -20	36259*	5.1	-49, -52, -22	27576*	7.9
Precuneus	6, -56, 44	36259*	4.3			ns
Superior Parietal	26, -60, 48	36259*	4.1			ns
	-26, -54, 46	207	3.4			ns
Temporal	50, -72, 0	36259*	12.6	50, -72, -2	27576*	11.7
	-44, -76, -2	36259*	10.5	-42, -74, -2	27576*	9.8
Occipital	16, -88, 6	36259*	11.4	8, -86, -8	27576*	13.8
Deactivations						

ACC			ns	6, 34, 14	2198*	4.3
Orbitofrontal	-26, 58, 6	366	3.7	-34, 54, 2	2198*	4.0
Middle PFC			ns	34, 28, 36	399	4.4
			ns	-34, 12, 44	862	4.6
SMA			ns	30, -16, 58	528	5.2
Insula			ns	48, 8, -6	2323*	4.9
			ns	-44, 18, -6	258	3.8
Middle PCC			ns	-2, -18, 66	829	4.2
Angular	50, -54, 36	636	5.2	48, -50, 40	3303	5.8
			ns	-44, -58, 38	3117	4.5
Temporal			ns	64, -22, -10	2323*	3.5
				-64, -30, -6	859	4.2

x,y,z= MNI peak coordinates; kE= Cluster extent in voxels; IPV= Intimate Partner Violence; GV= General Violence; N= Neutral; ns= nonsignificant; * part of a larger cluster; PFC= Prefrontal Cortex; OFC= Orbitofrontal Cortex; PCC= Posterior Cingulate Cortex; PAG= Periaqueductal Gray; ACC= Anterior Cingulate Cortex; HPC= Hippocampus; SMA= Supplementary Motor Area.

Between-group differences: Relative to criminals, batterers demonstrated significantly higher activation of the middle prefrontal cortex, the SMA-Precuneus and the insula (Figure 2, Table 4). Criminals showed higher activation of the superior prefrontal cortex compared to batterers (Table 4).

Fig. 2. Main group activations (red) and deactivations (blue) to GV>N in criminals (A) and batterers (B). Between-group differences (C) show increased (red) and decreased (blue) brain activity in batterers.



The right hemisphere corresponds to the right side of the axial and coronal views, and sagittal images show the right hemi- sphere in all views. The color bar indicates *t*-values.

Table 4. Brain regions showing significantly differences between groups during IPV > N and GV > N contrasts

Brain region	x, y, z	kE	t value
IPV > N			
Other Criminals > Batterers			
Superior PFC	10, 60, 40	156	3.4
Batterers>Other Criminals			
Middle PFC	-20 26, 34	130	3.9
ACC	-2, 30, 26	252	4.0
PCC - Precuneus	14, -52, 34	98	3.5
GV> N			
Other Criminals>Batterers			
Superior PFC	-8, 62, 34	145	3.7
Batterers>Other Criminals			
Precentral	28, -16, 62	360	5.1
SMA-Precuneus	6, -12, 52	696	4.0
Middle PFC	-24, 28, 30	131	3.4
Insula	48, 8, -6	958	3.8
	-54, -8, 10	316	3.6

x,*y*,*z*¼ MNI peak coordinates; kE, cluster extent in voxels; IPV, intimate partner violence; GV, general violence; N, neutral; PFC, prefrontal cortex; ACC, anterior cingulate cortex; PCC, posterior cingulate cortex

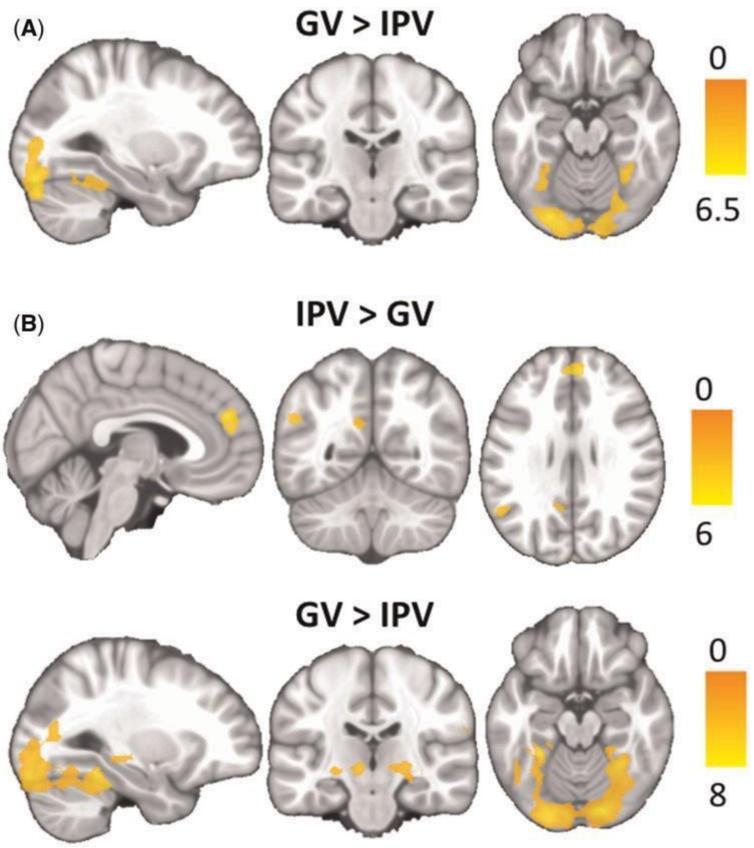
Intimate partner violence vs. General violence (IPV > GV)

Group effects (Paired t-test analysis): Brain activation and deactivations for the IPV vs. GV contrast in both groups are reported in Table 5. To IPV images, batterers showed activation in the medial prefrontal cortex, the posterior cingulate cortex, and the left angular gyrus, which was not identified in the OCG (Figure S1). Criminals showed no significant activations to IPV images. To GV images, both groups showed activation in the fusiform gyrus and the occipital cortex.

Batterers showed additional activation in the thalamus, hippocampus and supramarginal gyrus not identified in the criminal group (Figure 3, Table 5). A group*condition interaction with the extracted signal eigenvariate of these brain regions did not yield significant findings (all ps > 0.05).

This was also the case for the PCC that was initially hypothesized to show an increased activation to IPV compared to GV images in batterers relative to criminals.

Fig. 3. Brain regions showing significant differences in the comparison between GV and IPV conditions in criminals (A) and batterers (B). The right hemisphere corresponds to the right side of the axial and coronal views.



Sagittal images show the right hemisphere in B ‘IPV>GV’ view, and the left hemisphere in the other sagittal views. The color bar indicates *t*-values.

IPV processing across groups (collapsed analysis): The angular gyrus was the only region significantly associated with the processing of IPV images (MNI coordinates, x= -50, y= -60, z= 28, kE= 649, t= 3.4, $p<0.005$) across the study groups. A group*condition interaction with the extracted signal eigenvariate of the angular gyrus did not yield significant findings (F (1,39)=0.138, $p=0.713$).

Table 5. Brain regions showing significantly differences within groups (paired *t*-test) between IPV and GV images

Brain region	Batterers			Brain region	Other Criminals		
	x, y, z	kE	t value		x, y, z	kE	t value
IPV>GV							
Medial PFC	2, 48, 26	328	5.9				
PCC	-4, -62, 24	111	3.3				
Angular	-56, -56, 28	216	3.9				
GV>IPV				*GV>IPV*			
Fusiform gyrus	30, -40, -20	8528*	6.1	Fusiform gyrus	30, -60, 10	4635*	4.8
	-28, -42, -22	8528*	6.5		-32, -60, -18	4635*	4.5
Occipital	-20, -88, -20	8528*	8.0	Occipital	-28, -86, -20	4635*	6.3
Thalamus	24, -20, -2	178	4.6				
	-10, -20, -4	289*	5.4				
HPC	24, -24, -6	178	3.2				
	-24, -24, -6	289*	4.2				
Supramarginal	64, -24, 26	103	4.3				

x,y,z= MNI peak coordinates; kE= Cluster extent in voxels; IPV= Intimate Partner Violence; GV= General Violence; * part of a larger cluster; PFC= Prefrontal Cortex; PCC= Posterior Cingulate Cortex; HPC= Hippocampus.

4. Discussion

The main aim of this study is to compare the brain functioning of batterers with that of other criminals when they observe IPV or general violence pictures. Results reveal that batterers, as compared to other criminals, show higher activation in the anterior and posterior cingulate cortex to IPV images compared to neutral images. In addition, batterers demonstrate higher activation in the insula and parietal regions to GV images compared with neutral images. They also show a higher activation in the middle prefrontal cortex and a decreased activation in the superior prefrontal cortex to both IPV and GV images compared to neutral images. Nevertheless, batterers do not show the hypothesized higher activation of the PCC-precuneus during the viewing of IPV pictures compared to GV images when compared with the criminal group, although the PCC-precuneus is more activated in response to the IPV images in the batterers only. Therefore, our hypotheses were partially confirmed. This distinct brain functioning is observed regardless of differences in the subjective emotional responses between the study groups.

The finding of a higher activation in the PCC extending to the precuneus in response to IPV vs neutral images in batterers is consistent with our hypothesis and the study of Lee and colleagues (2009). In this study, the authors similarly found that batterers show an increased activation in the precuneus to aggressive-female vs neutral images, when compared to a sample of controls non-criminals. Our approach of comparing the batterers' brain functioning to that of other criminals extends these findings, demonstrating that the activation of the PCC-precuneus specifically characterize the brain functioning of batterers, above those of other criminals, while processing IPV images. The PCC is key in episodic memory retrieval and emotional reasoning (Rekkas et al., 2007). For example, PCC activation has been reported following moral judgment of harmful actions and increased negative attitudes towards others (Greene et al., 2001; Bruneau et al., 2010).

Furthermore, batterers also show a higher activation in the ACC to the IPV vs neutral images. At a functional level, the ACC has been involved in self-referential aspects of thinking, emotional contagion and affective perspective taking (Harrison, 2008; Raichle, 2001; Raine, 2006), and its activation during the observation of pain have been predicted by individual differences in neuroticism (Cheetham et al., 2009). This observation may be directly related to findings showing that lower perspective taking abilities and higher levels of personal distress in reaction to the emotions of others are related to violence perpetration in batterers (Covell et al., 2007).

Overall, increased activation in the PCC and ACC in batterers to intimate partner images may underlie the increased negative feelings of emotional distance that raise fears of abandonment from the significant other. This may in turn lead batterers to have maladaptive coping and regulation of affect in the form of obsessions about his/her partner and stalking, as documented by George and colleagues (George et al., 2006).

The significant higher activation of the insula and the SMA-precuneus in the parietal cortex in batterers to the GV images, relative to other criminals, is also consistent with the brain over-activation to threatening situations found by Lee et al., (2009) in these individuals, and interpreted as a hyper-response to threatening stimuli. Hyperactivation of these brain regions is one of the most common neuroimaging findings across fear conditioning studies (Fullana et al., 2015; Etkin and Wager, 2007).

Previous clinical and scientific work showing that batterers experience fear, autonomic activation and bias towards the processing of negative stimuli (George et al., 2000; Bitler et al., 1994; George et al., 1989; Chang et al., 2010) may be consistent with this neural over- activation to the GV images in batterers. Interestingly, the anterior insula has recently been associated particularly with perceived anxiety sensations independent from anxiety traits (Harrison et al., 2015). This finding may be consistent with the sudden affective instability in the form of increased anxiety, fearful mood states, anger or rage described by batterers when challenged by his/her partner (George et al., 2006). Furthermore, the decreased activation of the superior frontal and the increased activation of the middle frontal gyri to both IPV and GV images may also contribute to the affective instability and bias towards the processing of negative information in batterers (Gross 2014; Kensinger and Schacter, 2006). This is consistent with the deficient top-down regulatory control over excessive limbic activation already suggested by previous studies with batterers (Lee et al., 2009; George et al., 2004) and the preferential activation of the middle frontal gyrus to negative valence information (Kensinger and Schacter, 2006).

However not all hypotheses were supported in this study. Specifically, the PCC was not preferentially activated in response to IPV images relative to the GV situations in batterers vs criminals. This was also the case for the angular gyrus, a region that shows a preferential activation in all participants during the viewing of IPV images and was only activated in batterers for the paired t-test. The angular gyrus is considered an important cerebral hub (Timoty and Volkow, 2011), consistently involved in semantic processing, attentional shifting, spatial cognition, episodic and autobiographical memory retrieval, DMN, conflict resolution, and theory of Mind (Seghier, 2013).

Therefore, the activation of the angular gyrus in the batterer group when they viewed IPV compared to GV images in paired analyses could be explained by the fact that IPV images activated autobiographical and episodic memory of past IPV events in batterers. Further studies with larger samples may be interested in investigating whether impairment of the angular gyrus in batterers is associated with their capacity to judge attempted harms as morally right or wrong.

Despite differences in brain functioning, there are a lack of differences between batterers and other criminals in the emotional behavioral responses. The absence of such differences may be related to the batterers' response bias for social desirability. Social desirability has not been previously reported in emotional tasks, but it has been measured in personality questionnaires (Gibbons et al., 2011).

This important concern, referred to as explicit subjective measures in batterers, has motivated the development of new implicit tasks to measure attitudes in batterers. Its inclusion may likely benefit further studies with batterer samples (Eckhardt et al., 2012). Nevertheless, the generalization of our results are limited for several reasons. First, the sample size is relatively small, which may have made it difficult to reach statistical significance in some comparisons. Even so, our results are similar to other published articles that use smaller samples, and the sample size of the present study is the largest to date. Second, categorizing types of crime is difficult due to the complex characteristics of each case. Another limitation was related to the representativeness of the IPV group. In order to reduce the influence of confounders in the MRI analyses, participants with a history of substance abuse or personality disorder were excluded.

Third, we do not have objective evidence that the stimuli were attended to equally by both groups, although there were no differences between groups in the activation of the occipital cortex in the comparison between task conditions (Vuilleumier, 2005). Lastly, our research has been conducted in "first episode" batterers with low severity of violence. Despite this limitation, the findings from the present study indicate that even batterers who are not imprisoned show brain differences.

In sum, our results have shown that batterers have different brain functioning, as compared to other criminals, when they observe both intimate partner violence and general violence images as compared to neutral images. Future studies should replicate our results in batterers who have committed more severe offenses.

CAPÍTULO 10:

STRUCTURAL BRAIN DIFFERENCES IN EMOTIONAL REGULATION AREAS BETWEEN MALE BATTERERS AND OTHER CRIMINALS: A PRELIMINARY STUDY

Este capítulo se encuentra bajo revisión (Under review) en *Social Neuroscience.* Verdejo-Román, J . , Bueso-Izquierdo, N., Daugherty, J., Pérez-García, M., & Hidalgo-Ruzzante, N. (2017). Structural brain differences in emotional regulation areas between male batterers and other criminals: A preliminary study. *(Anexo VI)*

1. Introduction

Difficulties in resolving conflicts or communicating effectively with partners or ex-partners constitute key features of the male batterer's (MB) psychological profile (Holtzworth-Munroe & Stuart, 1994). MBs often choose violent strategies, using verbal violence, control, or even physical strength as a method of domination over their partners (Arce & Fariña, 2006; Echeburúa & Amor, 2016). Another relevant characteristic among this population is their difficulties in communicating emotions to their partners, which can lead to a continuum of violent psychological and physical episodes (Castillo et al., 2005). Emotion regulation is a key aspect of normative behavior among human beings in social situations (Ekman, Friesen & Ellsworth, 1972; Gross, 1999). The concept of emotion regulation has been defined as: "the ability of the human being to experience strong emotions, whether positive or negative, with the ability to handle them in personal or conflict situations" (Walden & Smith, 1997). Having difficulties in processing or regulating emotions may explain why there are MBs who do not resolve conflicts adequately, using violent tactics to control the situation instead (Harper et al., 2005).

In 2008, Babcock et al. explored this lack of emotional processing according to the typology of batterers suggested by Holtzworth-Munroe and Stuart (1994). This study utilized the Ekman's Emotional Recognition Test to measures one's ability to detect emotional capacity in others (Young, Perrett, Calder, Sprengelmeyer & Etcoff, 2002). In their results, generally violent or antisocial men showed problems in recognizing emotions (Babcock, Green & Webb, 2008).

These findings suggest that poor emotional performance, among other variables, may be an important risk factor in violence against partners (Chase, O'Leary & Heyman, 2001; Harper et al., 2005; Mc Nulty & Hellmuth, 2008). Nevertheless, Bueso-Izquierdo et al. (2015) demonstrated that MBs have better emotional recognition of anger and surprise than other criminals. Despite the importance of emotional processing and regulation, these variables cannot explain the IPV phenomenon on their own.

Recent studies have pointed out the importance of a more comprehensive approach to the male batterers' behaviour which includes patriarchy, psycho-social, personality, neuropsychological and biological variables (Bueso-Izquierdo et al, 2015; Chester et al., 2018; Corvo & Johnson, 2013; Pinto et al., 2010). This approach comprises novel neuroscientific studies that are beginning to use techniques such as neuroimaging to advance knowledge on partner violence. From this neuroscientific perspective on intimate partner violence, few studies have used neuroimaging techniques to study the brain structure and functioning of batterers. Of this limited research, a structural MRI study suggests reduced volume in the right amygdala of male perpetrators of violence, when compared to healthy controls and non-violent alcohol dependent men (Zhang, 2011). However, this study has some limitations due to the fact that it was conducted on men who were not convicted for IPV. As a result, these findings could be linked to other criminal behavior and not specifically to intimate partner violence.

To date, only three neuroimaging studies have explored the specific brain functioning of batterers while they viewed pictures with emotional content. These studies have shown increased limbic and decreased frontal activation in response to aggressive stimuli with men (Lee et al., 2008) and increased frontal, anterior and posterior cingulate, and precuneus activations while viewing images of violence against women, when compared with controls or other criminals (Bueso-Izquierdo et al., 2016; Lee et al., 2009). These authors suggest that hyperactivation in these areas may underlie their maladaptive coping and lack of emotional regulatory control.

To the best our knowledge, no studies have specifically analyzed whether differences in brain structure are related to emotion processing and regulation in male batterers. Furthermore, no study has examined the brain areas that could be related to problems in resolving couple disputes and or that may be specific to male batterers. In this sense, comparing batterers' brain structure to that of other criminals could help to better understand the mechanisms of IPV and the how the minds of male batterers work (Bueso-Izquierdo et al., 2015). Recent studies have linked cortical grey matter thickness to emotion regulation (Vijayakumar et al. 2014) and impulsive behaviour (Hoptman et al., 2014).

Therefore, the purpose of the present study is to compare the cortical grey matter thickness of male batterers to that of other criminals in the brain areas related to emotional processing and regulation. We also aim to establish whether those differences correlate with behavioral measures of emotional perception.

We hypothesize that batterers, relative to other criminals, will show reduced cortical thickness in brain areas involved in emotion processes. If male batterers show a decreased cortical thickness, these differences should also be related to scores on the Ekman emotional perception face task.

2. Method

Participants

Forty-one men convicted of crimes were recruited from the Center for Social Insertion (CSI) “Matilde Cantos Fernández”, in Granada (Spain). They were divided into two groups: 1) twenty-one batterers (batterers group, BG) convicted for a crime of violence against women, and 2) twenty men convicted of crimes other than IPV (other criminal group, OCG). One participant from the OCG was excluded due his excessive movement during the MRI acquisition. Details of inclusion and exclusion criteria, as well as further information about the Spanish IPV law and the crime severity of participants, are described completely elsewhere (Bueso-Izquierdo et al., 2016). In short, participants from both groups were convicted for the first time and had similar sanctions.

Table 1 shows the socio-demographic and severity of crime information. Groups did not differ significantly in age, education level, and intelligence quotient (IQ). Individuals in the OCG with a score greater than or equal to 11 on the severity scale of the CTS2 (Conflict Tactic Scales) (Straus, Hamby, Boney-McCoy & Sugarman, 1996) were excluded. This criterion was established in a previous study (Cohen et al., 2003) to rule out physical or psychological violence against partners.

Table 1. Socio-demographic and severity of crime information

Variable mean (SD)	BG	OCG	p-value
Age	38.38 (8.70)	34.74 (8.76)	0.195
Years of education	9.62 (3.90)	9.53 (2.46)	0.928
IQ	99.83 (14.29)	93.32 (13.52)	0.163
Type of crime [%(n)]			0.369
Misdemeanor	IPV/PV = 38% (8)	SCF/DD = 53% (10)	
Felony	IPV/PPV = 62% (13)	GAR/VF = 47% (9)	

Note: SD, standard deviation; IPV, intimate partner violence; PV, psychological violence; SCF, scams or crime of forgery; DD, dangerous driving; IPV-PPV, IPV- physical and psychological violence; GAR, grave assault/ robbery; VF, violent fight.

The study was approved by the Research Ethics Committee of the University of Granada, Spain. Participants were invited to collaborate in the study on a voluntary and anonymous basis. The confidentiality of personal information was guaranteed in accordance with the Spanish legislation protection of personal data (Organic Law 15/1999, December 13). All of the participants signed a written informed consent document and received 25 euros for participating in the study.

Materials

An interview evaluating socio-demographic information and the risk of serious couple violence was used (Echeburúa et al., 2008).

IPV Severity. The CTS2 Spanish version (Loinaz et al., 2012) of the original CTS2 (Conflict Tactic Scales; Straus et al., 1996) was used to detect the existence of physical, psychological, and/ or sexual violence towards a partner in a relationship.

Intelligence Quotient. The K-BIT (Brief Intelligence Test) (Kaufman et al., 1997): The K-BIT obtains a compound IQ by measuring cognitive functions through two tests: verbal (vocabulary, comprised of two tests) and non-verbal (matrix), which evaluates crystallized and fluid intelligence.

Emotional Perception. Ekman's Emotional Perception test (Ekman & Friesen, 1975) is a computerized test that presents faces of people displaying facial expressions corresponding to six basic emotions: anger, disgust, fear, happiness, sadness, and surprise (for reliability and validity values, see Young et al., 2002). The participant is required to identify the emotion expressed by each face. The main dependent variable is the number of hits in each emotional category.

Magnetic Resonance Imaging. Participants were scanned using a 3.0 T clinical MRI scanner equipped with a eight-channel phased-array head coil (Intera Achieva, Philips Medical Systems, Eindhoven, The Netherlands). A high resolution sagittal three-dimensional T1-weighted turbo-gradient-echo sequence was obtained with the following parameters: 160 slices, Repetition time (TR) = 8.3 ms, Echo time (TE) = 3.8 ms, Field of view (FOV) = 256 x 256 mm, flip angle = 8º, voxel resolution: 1 mm isotropic. Foam positioners were used to minimize head motion. All images were manually inspected for major artifacts and realigned to the AC-PC line.

Image processing was performed using the automated processing pipeline in FreeSurfer (version 5.1.0), involving intensity normalization, registration to Talairach space, skull stripping, segmentation of WM, tessellation of the WM boundary, and automatic correction of topological defects. Cortical thickness was generated by combining adjacent labels from the Destrieux atlas (Destrieux et al., 2010) using weighted averaging, based on the number of vertices in each label. Complete technical details are described extensively elsewhere (Fischl et al., 2000).

Procedure

In session 1, the initial interview and behavioral tasks were administered in the CSI. All participants were assessed in an individual and quiet room for approximately one hour. In session 2, MRI acquisition was taken in the Centro Diagnóstico CEDISA (Granada, Spain).

Regions of interest

Following the aims of this research, we constricted the neuroimaging analyses to brain regions indicated by the automated meta-analysis of emotion processing and regulation that included 1,340 previous studies, provided by www.neurosynth.org (Yarkoni, 2011).

These areas, included in the anatomical parcellation of Destrieux (2010), comprised frontal areas (inferior, middle, superior and orbital cortices), the cingulate gyrus (anterior and posterior), the insulas, the precuneus, the inferior and intra-parietal cortices, the superior temporal gyrus, and the middle and superior occipital gyrus.

Statistical analyses

Demographic, behavioral, and cortical thickness data were analyzed with SPSS 19 (Chicago, IL, USA). We conducted independent t-tests (two-tailed) to compare the two groups. We also examined whether cortical thickness of the region of interest differed between groups using independent t-tests. To discard the differences that could be driven by the different age distribution, we conducted additional analyses of group comparisons using age as a covariate.

Finally, we performed a pearson correlation analysis to estimate the relationship between the Ekman face performance and the cortical thickness of the selected areas in the batterers group.

3. Results

BG showed thinner cortex in the left dorsal posterior cingulate cortex and parahippocampal gyrus, the right anterior cingulate cortex, the central sulcus of the insula, and bilaterally in the medial orbital sulcus (See table 2 and Figure 1).

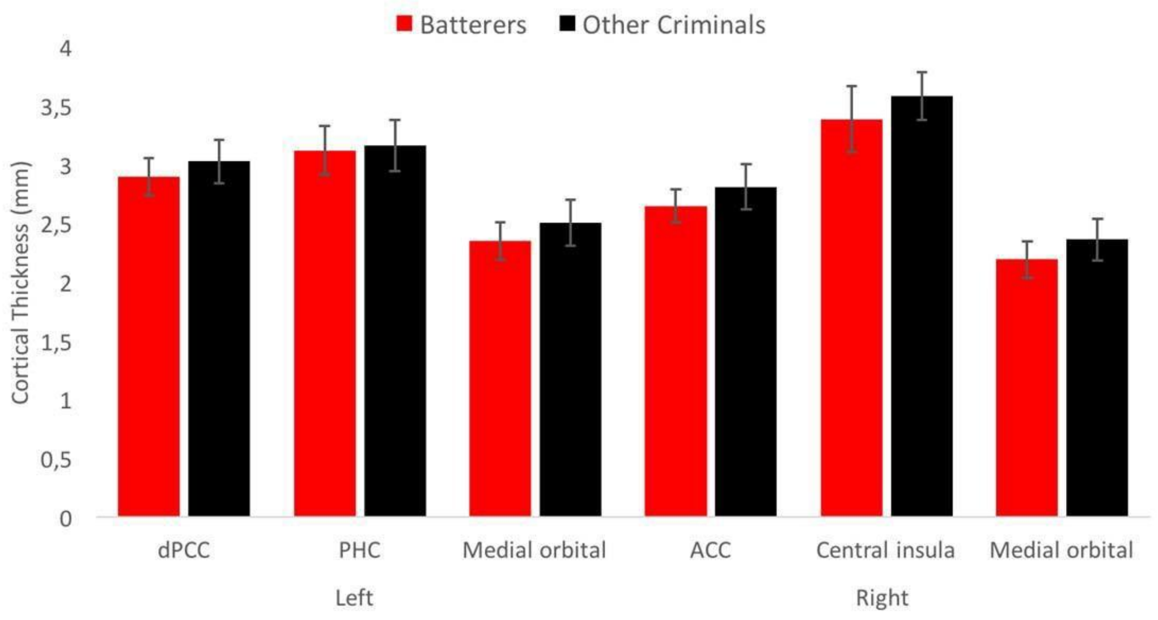
Correlation analyses showed that the dPCC cortical thickness positively correlated with the total Ekman score in the BG (r = 0.53, p = 0.029). No other correlation reached statistical significance.

Table 2. Mean cortical thickness and correlation with Ekman scores in the batterers group, of brain regions showing statistical differences between groups

Region	Side	BG	OCG	p-value	p-value (age-adjust)	Correlation with Ekman scores (only BG)
Dorsal Posterior cingulate cortex (dPCC)	Left	2.895 (0.156)	3.026 (0.183)	0.019	0.039	r=0.530 p=0.029
Parahippocampal gyrus	Left	3.119 (0.206)	3.259 (0.218)	0.043	0.040	r=0.225 p=0.384
Medial orbital sulcus	Left	2.350 (0.161)	2.504 (0.195)	0.010	0.007	r=-0.326 p=0.202
Anterior Cingulate Cortex (ACC)	Right	2.648 (0.139)	2.810 (0.192)	0.004	0.010	r=0.353 p=0.165
Central sulcus of the insula	Right	3.385 (0.279)	3.580 (0.202)	0.017	0.043	r=0.036 p=0.891
Medial orbital sulcus	Right	2.191 (0.157)	2.363 (0.178)	0.002	0.005	r=0.091 p=0.729

Note: BG,batterer group; OCG, other criminal group.

Figure 1. Mean group cortical thickness of brain areas showing significant differences between groups.



Note: dPCC: dorsal Posterior Cingulate Cortex; PHC: Parahippocampal gyrus; ACC: Anterior Cingulate Cortex.

4. Discussion

The main aim of this study was to examine cortical thickness of brain regions involved in emotional processing in a group of male batterers compared to other criminals. We found that batterers have thinner cortices in prefrontal, midline, and limbic brain regions. Further, the thickness of the dorsal posterior cingulate cortex in the batterer group correlated with scores on the Ekman's Emotional Perception test.

Our results are in line with the findings of Zhang et al., (2011), who provided the first evidence in male perpetrators of violence of reduced amygdala volume, a key region involved in emotional processing. Our study expands on these findings to include several additional cortical brain areas that have been previously related to emotion processing and regulation. In our results, cortical thickness is reduced in male batterers in the posterior cingulate cortex (PCC), which is correlated with the Ekman emotional perception scores.

To the best of our knowledge, this is the first study to provide empirical evidence for the relationship between emotional impairment and differential brain structure in male batterers. The involvement of this brain region in IPV is consistent with previous functional neuroimaging studies that demonstrate a higher activation of the PCC in batterers while viewing images of violence against women (Bueso-Izquierdo et al., 2016; Lee et al., 2009). Other studies have also similarly shown activation in the PCC in relation to moral judgement in harmful actions and elevated negative attitudes toward others (Bruneau et al., 2010; Greene et al., 2001). Nevertheless, the preliminary results of the present study should be considered with caution considering a correlation was found in only one cerebral region of those that were examined.

Previous studies in healthy controls have likewise demonstrated involvement of the ACC in modulating emotional reactions (Bush et al., 2000; Etkin et al., 2011; Luu & Posner, 2003) and interpersonal emotion regulation (Hallam et al. 2014). For example, some studies have found a higher activation in the ACC in response to IPV vs neutral images in male batterers (Bueso-Izquierdo et al., 2016).

The ACC has also been found to be involved in self-referential aspects of thinking, emotional contagion and affective perspective taking (Harrison, 2008; Raichle et al., 2001; Raine & Yang, 2006).

Two recent meta-analyses help to explain the role of emotion processing in the remaining brain areas found to have reduced cortical thickness in batterers. The first demonstrates that the medial orbitofrontal, insular and anterior cingulate cortices are part of a common network that integrates interoception, emotion, and social cognition (Adolfi et al., 2017). Finally, the second meta-analysis which explores up- and down-regulation processes found that the parahippocampal gyrus decreases its activation during emotion downregulation (Frank et al., 2014).

Today, a consensus has still not been reached on the specific causes of violence against women and what leads these men to attack, since their forms of aggression are related to a multitude of factors such as personality, values, the patriarchal and sociocultural context of the couple, circumstances of the event, and neurobiological factors (Lorente Acosta, 2004). Considering this complexity, the present study seeks to makes a closer approximation by involving several of these integral factors and investigating the role of emotions from a neuroscientific perspective. Neuroscience can offer a better understanding of how brain activity is related to the behavior of this population. Including neuroscientific studies within the psychological study of intimate partner violence may help to explain why male batterers tend to behave in a defiant and cruel manner, without fearing the criminal consequences of their behavior, or assuming responsibility for their maltreatment of the victim (Echeburúa and Corral, 2008).

Poor management of emotions may trigger severe aggravation and frustration, especially when accompanied by feelings of abandonment and betrayal. All this, perceived as an injustice, seems to feed the desire to assault women or even to re-offend once they have served their sentence (Fernández-Montalvo & Echeburúa, 1997). In sum, this preliminary study expands our knowledge on the specific brain structures of batterers and their relation to emotional processing and regulation. It offers a better understanding of the role of the emotions behind abusive relationships with intimate partners.

Research Limitations

This study has the following limitations. First, the sample size is small due to the fact that not all participants could perform the magnetic resonance session as a result of incompatibilities with the machine. Furthermore, various individuals were unable to participate due to difficulties in receiving permissions of leave from the penitentiary. Second, this study only analyzes batterers who committed their 'first episode'. Despite this limitation, the findings from this study indicate that even batterers who are not imprisoned show brain differences. Future research should increase the sample size and improve the pioneering studies that have been carried out thus far. As such, it may be useful to study emotional processing and brain structure in terms of the batterer's typology as illustrated by Babcock et al. (2008).

Research Implications

These preliminary findings on neuroimaging research in men give light to a new perspective with two goals in mind. First, these results deepen our understanding about the brain structures involved in the behaviors behind violent acts in order to better understand their role. Additionally, it is critical to emphasize that future neuroscientific studies on IPV should never be used to justify violent acts or to exonerate batterers from the responsibility of their actions (Gondolf, 2007). Instead, they should serve to indicate what brain areas may be related to violent behaviors in male batterers (Bueso-Izquierdo et al., 2016).

Clinical and Policy Implications

Interventions in emotion regulation in intimate partners has been shown to decrease conflict between partners (Finkel, 2013). Further research is needed to better understand emotion processing specific to male batterers and whether improvement in this area could prevent violent conflict in relationships. These results offer useful information to professionals who work with male batterers. Furthermore, this preliminary study could serve to improve therapy with this population, bringing attention to the evaluation of emotion recognition. In turn, results from these assessments could lead to different prognoses in rehabilitation programs, serving as an impetus for evaluating emotion management before and after abusive men receive therapy. This approach has previously been recommended by Romero-Martínez et al. (2016), who suggests focusing on empathy skills after the therapy. All these improvements following therapy could potentially lead to non-recidivism in male batterers of intimate partner violence.

CAPÍTULO 11:

PREVALENCE AND NATURE OF STRUCTURAL BRAIN ABNORMALITIES IN BATTERERS: A MAGNETIC RESONANCE IMAGING STUDY

Este capítulo se encuentra en *Major Revision* en la revista: *International Journal of Forensic Mental Health*. Bueso-Izquierdo, N., Verdejo-Román, J., Martínez-Barbero, J.P., Pérez-Rosillo, M.A., Pérez-García, M., Hidalgo- Ruzzante, N., & Hart, S. (2017). Prevalence and Nature of Structural Brain Abnormalities in Batterers: A Magnetic Resonance Imaging. *(Anexo VII)*

1. Introduction

Intimate partner violence (IPV) is a serious social problem, and one that appears to reflect the influence of causal factors from biological, psychological, interpersonal, and social domains (e.g., Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002). In recent years, there has been increased focus on biological factors in IPV, and especially on neurocognitive factors (e.g., Bueso-Izquierdo et al., 2015; Chester et al., 2018; Corvo & Johnson, 2013; Pinto et al., 2010), due in part to the advances in neuroimaging technologies and techniques. In addition to its potential for improving our theoretical understanding of the causes of violence generally and IPV more specifically, neuroscientific research may have important clinical implications for risk assessment and treatment, as well as for legal decisions about criminal responsibility or culpability (Eastman & Campbell, 2006; Gazzaniga, 2008; Goodenough & Tucker, 2010; Knabb et al., 2009; Vincent, 2013; but cf. Gondolf, 2007, 2011).

There have been many neuroimaging studies of generally violent offenders (Choudhury, Nagel, & Slaby, 2009) but, as far as we know, there are only three published studies looking specifically with IPV offenders (Bueso-Izquierdo et al., 2016; Lee et al., 2008; Lee et al., 2009), a group commonly referred to as batterers. All three studies examined brain function, that is, brain activation after exposure to various stimuli as assessed by functional Magnetic Resonance Imaging or fMRI. In the first study, Lee et al. (2008) found that male batterers had increased limbic activation and decreased frontal activation in response to aggressive stimuli. In the second and third studies, Lee et al. (2009) and Bueso-Izquierdo et al. (2016) found increased activation of the frontal, anterior and posterior cingulate, and precuneus regions while viewing images of IPV in batterers, as compared with other groups.

At least on the surface, these findings of differences in the brain *function* of batterers (versus other offenders) appear to be consistent with suggestions that there may be a high rate of abnormal brain *structure* in batterers (see, for example, Becerra-García, 2015; Farrer, Frost, & Hedges, 2012; Romero-Martínez & Moya-Albiol, 2013). But there are several reasons why one should be cautious drawing conclusions about structural abnormality on the basis of functional differences. First, functional differences may reflect normal processes or individual differences such as attitudes, personality traits, trauma, or coping mechanisms rather than some congenital, idiopathic, or other pathological process (George et al., 2006). Second, functional differences may be context-specific rather than generalized, evident only when exposed to certain stimuli or while performing certain tasks. Third, it is not safe to assume that functional differences observed at the group level are found in all or even most members of a group.

Current Study

In this study, we investigated the prevalence and nature of structural brain abnormalities in 21 batterers versus 20 other offenders from Bueso-Izquierdo et al. 2016, as well as a new group of 21 healthy controls. Two neuroradiologists independently diagnosed structural brain abnormalities based on MRI scans taken as part of the original fMRI studies in which the men had participated. If general or specific structural abnormalities are common in batterers who have exhibited functional differences—and especially of the structural abnormalities are more common in batterers than in other offenders or healthy controls—it is plausible that structural abnormalities may account for the functional differences.

2. Method

Participants

As noted previously, the 21 batterers and 20 other offenders were the same participants studied by Bueso-Izquierdo et al. (2016). A detailed description of the recruitment and selection criteria of that study, as well as the demographic and criminal history characteristics batterers and other offenders, can be found in the original article. Briefly, all the offenders were adult males, aged 18 years or older, and serving custodial sentences. They had been invited and volunteered to take part in a fMRI study. Those who received a more detailed explanation of the study and gave informed consent to participate underwent a screening assessment. Offenders were excluded from participation if they met any of the following criteria: lack of basic literacy skills; unable to attend the research facilities due to security restrictions; lifetime diagnosis of serious mental illness; lifetime diagnosis of substance use according to SCID/DSM-IV criteria (American Psychiatric Association, 1994; First et al., 1999); a history of head injury with loss of consciousness of any duration asked during the initial interview; a history of neurological, systemic, or other disease affecting the central nervous system; or the presence of any contraindication for undergoing neuroimaging in the opinion of the fMRI technicians (e.g., claustrophobia, implanted ferromagnetic objects, or evidence of gross brain damage in the initial fMRI scans).[1]

Offenders were classified as batterers if they were serving a sentence for IPV-related crimes, and as other offenders if they were not serving a sentence for IPV-related crimes and did not self-report a history of serious IPV according to the revised Conflict Tactics Scale (Straus et al., 1996; i.e., CTS2 severity score $\leq$ 11, following Cohen et al., 2003) to rule out physical or psychological violence against partners.

The 21 health controls were also adult males, aged 18 and older. They were selected from a larger group of healthy controls who volunteered to participate in another fMRI study of substance abusers (Moreno-López et al., 2013) to match the batters and other offenders with respect to age. All had passed screening to ensure that they did not meet any of the exclusion criteria used to screen the batterers and other offenders. In addition, none reported a history of conviction for IPV-related or other criminal offenses; however, as the healthy controls did not complete the CTS2, we were unable to confirm that they did not have a self-reported history of serious IPV that did not result in conviction.

The final sample, then, comprised 21 batterers, 20 other offenders, and 21 healthy controls. The average age of men in each was as follows: batterers, $M = 38.38$ yrs, $SD = 8.70$ yrs; other offenders, $M = 34.40$ yrs, $SD = 8.66$ yrs; and healthy controls, $M = 34.33$ yrs, $SD = 4.22$ yrs. The groups did not differ significantly in terms of age, $F\ (2, 61) = 2.00$, $p = 0.144$.

The study was approved by the Research Ethics Committee of University of Granada, Spain. Participants were invited to collaborate on a voluntary and anonymous basis. The confidentiality of personal information was guaranteed in accordance with the Spanish legislation on personal data protection (Organic Law 15/1999, December 13). All the participants signed a written informed consent document and received economic compensation for participating in the study.

Procedure

Magnetic Resonance Imaging. Participants were scanned using a 3.0 T clinical MRI scanner equipped with a eight-channel phased-array head coil (Intera Achieva, Philips Medical Systems, Eindhoven, The Netherlands).

A high resolution sagittal three-dimensional T1-weighted turbo-gradient-echo sequence was obtained with the following parameters: 160 slices, Repetition time (TR) = 8.3 ms, Echo time (TE) = 3.8 ms, Field of view (FOV) = 256 x 256 mm, flip angle = 8º, voxel resolution: 1 mm isotropic. A T2 single-shot TSE sequence was also obtained: 19 slices, TR = 15 s, TE = 90 ms, FOV = 230 x 230 mm, flip angle = 90º, voxel resolution: 0.5 x 0.5 x 4 mm. Foam positioners were used to minimize head motion. The acquisition of MRI was taken in a private imaging center under a research agreement with the University of Granada, Spain.

Radiologist Procedure

All images were evaluated for findings by two experienced neuroradiologists with 10 and 5 years of experience, respectively, in reading brain MRIs. They diagnosed all brain images independently and group-blinded, then reached consensus in case of discrepancy between them. The neuroimaging studies were classified in three categories according to their findings: normal findings, findings of minor abnormalities, and findings of major abnormalities. Normal studies were those without any intracranial abnormality. Extracranial findings, such as sinus pathology, were not taken under consideration as they were not related with the purpose of our study. Isolated enlarged perivascular Virchow-Robin spaces without mass effect were also not considered abnormal findings.

Findings of minor abnormalities were those considered not clinically relevant. They included congenital abnormalities such as developmental venous anomalies or DVAs (Töoper et al.,1999); normal variations such as ventricular asymmetry; nonspecific white matter lesions; and cystic lesions with no mass effect, such as small pineal or arachnoid cysts. Findings such as these are frequent in young healthy volunteers and do not require clinical evaluation or follow up (Evans, 2017; Vernooij, 2007).

Findings of major abnormalities were those with clinical relevance, including those that require further study, follow up, or treatment (Katzman, 1999; Bos et al., 2016; Sempere et al., 2005). According to literature, major findings typically include: intracranial solid tumours, intracranial cysts with mass effect or bigger than 10 millimeter, ischaemic lesions (lacunary or major infarctions), intracranial haemorrhage, post traumatic injuries, severe brain atrophy, hypertensive hydrocephalus, vascular malformations, and congenital abnormalities with clinical impairment such as neuronal migration and cortical organization disorders. White matter acquired pathologies such as multiple sclerosis or severe small vessel ischemic disease may also be considered as major findings (Osborn, 2015). It is important to emphasize, however, that categorization of imaging findings may differ among investigators as some may classify normal anatomical variants as minor abnormalities whereas others may not. In addition, the consideration of an imaging abnormality as major may also vary according to the clinical experience of the reader and the symptoms of the patient. White matter punctuated lesions were first evaluated according to MAGNIMS criteria, to rule out a potential origin (Filippi et al., 2016). If lesions did not meet those diagnostic criteria, they were evaluated according to the Age-Related White Matter Changes or ARWMC scale (Wahlund et al., 2001).

This is the reference scale to measure quantitatively white matter lesions secondary to small vessel disease. Brain atrophy was evaluated using the global cortical atrophy scale (Harper et al., 2015). Agreement between the findings of the two independent neuroradiologists was indexed using Cohen's kappa or χ_2 (McHugh, 2012). Overall agreement was excellent, χ_2=0.84.

3. Results

Major Abnormalities

The prevalence of major abnormalities is summarized in Table 1. Only 1 participant, a batter, was deemed to have major abnormality. It was an enlarged pineal cystic lesion, maximum diameter of 16mm that caused no mass effect and was judged to be not clinically relevant.

Table 1. ***Prevalence (Number, %) of Major Structural Brain Abnormalities, Overall and in Batterers, Other Offenders, and Healthy Controls***

Major Abnormalities	**Overall (*N* = 62)**	**Batterers (*N* = 21)**	**Other Offenders (*N* = 20)**	**Healthy Controls (*N* = 21)**
Solid tumors	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ischemic lesions	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Demyelinating disease	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Intracranial cyst (> 10 mm)	1 (2%)	1 (5%)	0 (0%)	0 (0%)

Intracranial haemorrhage	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Post traumatic injuries	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Severe brain atrophy	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Hypertensive hydrocephalus	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vascular malformations	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Any Major Abnormality	**1 (2%)**	**1 (5%)**	**0 (0%)**	**0 (0%)**

Minor Abnormalities

The prevalence of minor abnormalities is summarized in Table 2.

Table 2. ***Prevalence (Number, %) of Minor Structural Brain Abnormalities, Overall and in Batterers, Other Offenders, and Healthy Controls***

Minor Abnormalities	**Overall (*N* = 62)**	**Batterers (*N* = 21)**	**Other Offenders (*N* = 20)**	**Healthy Controls (*N* = 21)**
Leukoaraiosis	11 (18%)	6 (29%)	2 (10%)	3 (14%)
Brain atrophy	4 (6%)	3 (14%)	1 (5%)	0 (0%)
Pineal cyst	3 (5%)	2 (10%)	1 (5%)	0 (0%)
Developmental venous anomaly	2 (3%)	1 (5%)	0 (0%)	1 (5%)
Arachnoid cyst	1 (2%)	0 (0%)	0 (0%)	1 (5%)

Non-hypertensive ventriculomegaly	1 (2%)	1 (5%)	0 (0%)	1 (5%)
Any Minor Abnormality	**18 (29%)**	**10 (48%)**	**3 (15%)**	**5 (25%)**

[1] One important goal of the exclusion criteria was to control via selection for potential confounding factors, including brain damage secondary to neurological insult or injury. Although it is generally recognized that brain damage increase the risk for general violence, there is no reason to believe that it is specifically related to risk for IPV; our focus was on structural brain abnormalities that might be specifically related to risk for IPV.

A total of 18 participants were deemed to have minor abnormalities: 10 batterers, 3 other offenders, and 5 healthy controls. Of these, 4 participants presented multiple abnormalities: 1 was the batter with a major abnormality, who also had leukoaraiosis; and the other 3 had brain atrophy plus leukoaraiosis.

White matter lesions consistent with leukoaraiosis were observed in 11 participants: 6 batterers, 2 other offenders, and 3 healthy controls. White matter punctuate lesions are a common finding in neuroimaging studies, and they are commonly cataloged as “nonspecific” in radiology reports. In young patients, the most important task for the radiologist is to rule out multiple sclerosis as the underlying cause; as noted previously, MAGNIMS criteria were used to rule out multiple sclerosis in our subjects.

White matter punctuate lesions may be also related to normal ageing, cardiovascular risk factors, or migraine (Osborn, Alder, & Mitchell, 1991). We categorized white matter lesions were according to ARWMC classification, which is based on number and location of lesions, cognitive decline, and cardiovascular risk factors.

In 10 of the 11 cases, participants had very few and isolated lesions, consistent with Grade 1 of the ARWMC classification. Grade 1 may be a normal finding in healthy people; it is usually subclinical and does not need to be included in radiology reports. Only 1 participants had a higher number of lesions, consistent with Grade 2 of ARWMC. As this participant was a healthy control, the lesions were judged not to be clinically relevant.

Brain atrophy, or loss of brain volume, was observed in 4 participants: 3 batterers and 1 other offender. Brain atrophy was mild in all 4 cases, who were between 34 and 49 years old. As the results of intellectual assessment using the K-bit (Kaufman et al., 1997) revealed no evidence of deficits, with IQs ranging from 93 to 128, the brain atrophy was considered not clinically relevant.

Small pineal cystic lesions were observed in 3 participants: 2 batterers group and 1 other offender. In two cases, the cysts measured one centimeter; and in the other case, the cyst measured 16 x 13 mm. Pineal cyst are common findings in neuroimaging studies, and their clinical relevance is usually related to their mass effect, as they may cause hydrocephalus (Berhouma et al., 2015). However, the lesion found in our study did not produce relevant mass effect over the *lamina cuadrigemina*, and the supratentorial ventricular system was normal in size and shape (Májovský, Netuka, & Beneš, 2016).

Pineal cystic lesions have also been related in certain patients to increased risk of migraine and to sleep disorders (Seifert et al., 2008). Nevertheless, to our knowledge, they have never been related to behavioral disorders, violence or any other psychological alteration allied to the purpose of our study. Images highly suspicious of developmental venous anomalies (DVAs, also known as *caput medusae*) were observed in 2 participants: 1 batterer and 1 healthy control.

As intravenous contrast media was not administered, the diagnosis could not be confirmed. In one case, the suspected DVA was located at the inferior frontal gyrus, and in the other it was located in the left temporal lobe.

DVAs are congenital abnormalities of venous drainage that typically do not cause other symptoms and are without clinical significance (Töpper et al., 1999); in these cases, there was no suspicion of complications, as no oedema or bleeding was seen surrounding the suspected DVAs.

An arachnoid cyst was observed in 1 participant, a healthy control. Arachnoid cysts are a common finding in neuroimaging studies, and may be found in both asymptomatic patients and healthy subjects (Vernooij et al., 2007). In the affected participant, the arachnoid cyst was located in the right middle cranial fossa. It did not cause mass effect over the ventricular system, and no edema was found in the underlying temporal pole parenchyma. Thus, it was considered an incidental finding with no clinical relevance, as further studies or follow up were not indicated (Ros López, Martín Gallego, & Iglesias Moroño, 2016). Non-hypertensive ventriculomegaly was observed in 1 participant, a batterer. Ventriculomegaly is a condition that occurs when the ventricular system grows in volume but intraventricular pressure is not increased and there are not obstructive lesions. It is usually a long-term condition with onset in childhood (Osborn, 2011).

Overall Prevalence and Group Differences

Overall, then, 18 of 62 participants (29%) had at least one structural abnormality: 1 had a major plus a minor abnormality, and 17 had one or two minor abnormalities.

The prevalence of abnormalities was highest in batterers, with 10 of 21 participants (48%) having at least one; lower in healthy controls, with 5 of 21 (25%) having at least one; and lowest in other offenders, with 3 of 20 (15%) having at least one.

We indexed the between-group differences in the prevalence of structural abnormalities using odds ratios (ORs). The overall test of the homogeneity approached statistical significance, χ^2 (2) = 5.62, p = .060, indicating substantial heterogeneity among the ORs. This was due to a statistically significant difference between batterers and other offenders, OR = .19, χ^2 (1) = 4.91, p = .027. There was, however, no statistically significant difference between batterers and healthy controls, OR = .34, χ^2 (1) = 2.53, p = .112; or between other offenders and healthy controls, OR = 1.77, χ^2 (1) = 0.49, p = .482.

4. Discussion

We compared the prevalence of structural brain abnormalities, assessed by neuroradiologists based on MRI scans, in batterers versus other offenders and healthy controls. All participants were carefully screened to control for potential confounding factors, including brain damage secondary to neurological injury or insult. Only one participant, a batterer, was found to have both a major and minor structural abnormality, and 17 had only minor structural abnormalities. Most of the abnormalities were judged to be not clinically relevant.

Overall, just under half of batterers had structural brain abnormalities, and although the prevalence of structural brain abnormalities in batterers was significantly higher than in other offenders, it was not significantly higher than in healthy controls.

In addition, all SBAs were unrelated to brain damage or TBI and it has also been observed that they were not clinically implicated.

Limitations

Our study, like most brain imaging studies, had a small sample. This limited our ability to make precise estimates of the prevalence of structural brain abnormalities, and also limited our power to detect between-group differences in prevalence.

We doubt that most research groups will be able to locate the resources necessary to conduct large-sample brain imaging studies with offenders; however, if enough small-sample studies are conducted, it should be possible to aggregate findings using meta-analytic methods. We therefore encourage attempts to replicate and extend our findings.

We also had difficulty forming “pure” groups in our study. Ideally, in future research, all participants would undergo a review of official records to confirm the presence or absence of arrest, charge, or conviction for IPV-related offenses (as was done in this study), but, in addition, all participants would complete self-reports of IPV perpetration and their intimate partners would complete self-reports of IPV victimization by the participants. Another limitation was that our control group was not assessed for IPV with the CTS2. This was because we only used the CTS2 to discard intimate partner violence for the criminal group.

We controlled for confounding factors, including brain damage secondary to neurological injury or insult, by selection. The major limitation of this strategy is that confounded factors are a fact of life.

Most people’s problems in living are complex, and so focusing solely on a minority of people with relatively simple problems may led to results that are not representative of or generalizable to the majority. Finally, the MRI protocol that we used was not optimal for analyzing the clinical significance of the findings. Specifically, acquisition parameters were adjusted according to the research aims or the original studies and did not include all the specific sequences used in routine clinical practice.

Implications for Theory

Our findings suggest that structural brain abnormalities, not linked to TBI, are not strongly or specifically associated with IPV. As a consequence, it is unlikely that structural abnormalities are responsible for the differences in brain functioning between batterers and other offenders observed in past research (e.g., Lee et al., 2008; Lee et al., 2009; Bueso-Izquierdo et al., 2016)—at least, unlikely they are responsible for *all* the observed functional differences. We speculate that structural brain abnormalities (as well as other neurocognitive problems) may have an adverse influence on human decision making regarding whether or not to commit violence, both IPV and general violence. Specifically, they may play a general disinhibiting or destabilizing causal role. Once people have a motivation (thought, urge, impulse) to engage in violence, structural brain abnormalities may adversely affect the care with which they evaluate the potential negative consequences of perpetrating violence or consider and evaluate the potential positive consequences of alternatives to violence.

Implications for Forensic Mental Health

We plan to continue researching biological factors related to IPV, and we encourage others to do so. Even if these factors are related to violence generally rather than IPV specifically, understanding the nature and extent of their causal influence may assist and improve risk assessment, treatment, and even assessment of criminal culpability.

But in the course of our work, we will continue to heed the warnings of those who are skeptical about the relevance of neuroscience research for the practice of forensic mental health, and in particular Gondolf's comments about neuroscience research on batterers (Gondolf, 2007, 2011). We believe that neuroscience research need not—indeed, *should* not—take a reductionist stance. If one accepts the general utility of an ecological or multi-level approach to understanding violence, then it would be as foolish to over-focus on biological factors as it would be to disregard them.

Neurocognitive factors such as structural abnormalities, then, may be risk factors for violence that play a limited and contributory causal role, but are clearly neither necessary nor sufficient causes. This speculation is consistent with the many rational choice theories of violence, such as situated action theory (Wikström & Treiber, 2009), decision theory (Hart & Logan, 2011), and I^3 theory (Slotter & Finkel, 2011).

It may be inconsistent with the view that there are unique biological, sociobiological, or evolutionary mechanisms underlying IPV vis-à-vis general violence. Rational choice theories have been the dominant models of human action in Western thought (including philosophy, law, economics, neuroscience, psychology, and criminology) for the past 2,300 years.

They do not assume that people are rational in the sense of acting on the basis of (correct) reason or logic correct, but instead rational in the sense of acting in a reasoned manner, moving from goal to intent to action. With respect to violence, they assume that many factors impinge on or influence a person's decisions, including decisions about whether or how to commit violence, often resulting in bad choices (i.e., those with non-optimal outcomes) or choices made badly (i.e., in a disorganized or incoherent manner) (Hart, Douglas, & Guy, 2016). Researchers and practitioners alike should keep in mind that biological factors are only one out of many families of factors that influence people's decisions about violence, and they do not trump psychological, interpersonal, and social factors. The (potential) existence and influence of biological factors does not rob people of their capacity and responsibility to make better decisions; nor does it rob forensic mental health professionals of the capacity or responsibility to help their patients make better decisions.

IV. DISCUSIÓN GENERAL, CONCLUSIONES Y PERSPECTIVAS FUTURAS

CAPÍTULO 12:

DISCUSIÓN GENERAL, CONCLUSIONES Y PERSPECTIVAS FUTURAS

CAPÍTULO 12. Discusión general, conclusiones y perspectivas futuras

12.1 Discusión General

El objetivo principal de esta Tesis Doctoral fue analizar el funcionamiento neuropsicológico y cerebral de los hombres maltratadores, comparados con otros hombres condenados por otros delitos. El programa de investigación sobre neurociencia y violencia de género creado hace varios años por nuestro grupo de investigación "Neuropsicología y Psiconeuroinmunología aplicadas a la infancia, adultos y mayores", ha permitido a través de los estudios recogidos en esta Tesis, abordar este objetivo general. Nuestros resultados muestran la existencia de un patrón de funcionamiento neuropsicológico y cerebral específico en hombres maltratadores condenados por delitos de violencia de género.

De modo específico, los resultados del primer estudio mostraron un perfil de funcionamiento ejecutivo propio de hombres maltratadores, caracterizado por ser más inflexibles y menos impulsivos, comparados con otros criminales. Esta inflexibilidad cognitiva ha sido encontrada en estudios anteriores (Becerra-García, 2015; Schafer y Fals-Stewart, 1997) y probablemente sirva para entender por qué los hombres maltratadores son a menudo incapaces de modificar sus planes de acción o aceptar situaciones o conflictos que surgen en pareja. Hay que señalar que esta inflexibilidad podría ser mostrada sólo con su pareja. La influencia de la sociedad patriarcal podría ser la variable que estaría explicando por qué esa inflexibilidad surge al interaccionar sólo con su pareja o expareja, culminando con el consecuente *aleccionamiento* hacia la mujer víctima.

Con respecto al procesamiento emocional, el segundo estudio halló diferencias en el procesamiento de ira y sorpresa en hombres maltratadores comparado con otros delincuentes. Nuestros resultados no coinciden con los señalados por Chan et al. (2010), donde los hombres maltratadores tuvieron mayor tiempo de reacción ante la tarea de nombrar el color en palabras con contenido afectivo agresivo. Sin embargo, obtuvieron sus resultados utilizando una tarea de carácter general, y no fue una tarea diseñada específicamente para evaluar el procesamiento emocional en situaciones de maltrato ni comparando con hombres condenados por otros delitos. Aunque los resultados de nuestro estudio son muy modestos y preliminares, los hallazgos contribuyen a conocer mejor las diferencias en procesamiento emocional específico de los hombres maltratadores. Un mejor reconocimiento emocional podría ser la herramienta utilizada por estos hombres para manipular los sentimientos de sus parejas o exparejas, y así conseguir el objetivo de perpetuar la relación violenta.

Respecto a los estudios de neuroimagen incluidos en esta Tesis, los resultados han mostrado que el funcionamiento cerebral de los hombres maltratadores es diferente al de otros hombres condenados por otros delitos. El estudio de neuroimagen funcional (tercer estudio) realizado, mostró que los hombres maltratadores tienen un perfil de funcionamiento cerebral diferente al visualizar imágenes con contenido relacionado con la violencia de género. En concreto, los hombres maltratadores en comparación con otros delincuentes mostraron una mayor activación en la corteza cingular anterior y posterior y en la corteza prefrontal medial, y una menor activación en la corteza prefrontal superior, ante imágenes de violencia de género con respecto a imágenes neutras.

El conocimiento de la activación cerebral en hombres maltratadores arroja explicaciones útiles. La posible relación de estas áreas y sentimientos negativos como el miedo, podrían conducir al hombre maltratador a tomar una distancia emocional, la cual haría aumentar -posiblemente- los temores a ser abandonados por parte de su pareja. Como consecuencia, los hombres maltratadores tendrían un afrontamiento desadaptativo y una desregulación del afecto en forma de obsesiones sobre su pareja, tal como como lo documenta George et al. (2006).

Por otro lado, el estudio de neuroimagen estructural (cuarto estudio) incluyó la evaluación de las regiones cerebrales relacionadas con el procesamiento emocional a nivel estructural. En nuestros resultados los hombres maltratadores, comparados con hombres condenados por otros delitos, tuvieron menor grosor cortical en regiones prefrontales (orbitofrontal), en la línea media (cíngulo anterior y posterior) y áreas límbicas (ínsula, parahipocampal). Además, el grosor de la corteza cingulada posterior dorsal en el grupo de hombres maltratadores se correlacionó con la puntuación total en la prueba de percepción emocional de Ekman. En anteriores investigaciones se ha descubierto que el ACC está involucrado en aspectos autorreferenciales del pensamiento, el contagio emocional y la toma de perspectiva afectiva (Harrison, 2008; Raichle et al., 2001; Raine y Yang, 2006). Nuestros resultados están en línea con de Zhang et al. (2011), quienes proporcionaron la primera evidencia de volumen reducido de amígdala en hombres que perpetraron actos de violencia. La amígdala es una región clave involucrada en el procesamiento emocional, por lo tanto nuestro estudio amplía estos hallazgos para incluir varias áreas adicionales del cerebro cortical que se han relacionado previamente con el procesamiento y la regulación de las emociones en hombres maltratadores.

Estos datos preliminares ofrecen una mejor comprensión del papel de las emociones detrás de las relaciones abusivas con parejas íntimas y puede ser útil en el tratamiento con esta población, ya que se ha demostrado que las intervenciones en la regulación de las emociones en las relaciones de parejas, puede ayudar a disminuir el conflicto (Finkel, 2013).

Por último se realizó el último estudio que compone esta Tesis Doctoral para avalar los resultados de neuroimagen encontrados en las anteriores investigaciones. Los resultados mostraron una mayor prevalencia de hallazgos menores en el grupo de hombres maltratadores, pero tras el estudio de cada uno de los casos, no se observó que tuvieran relevancia clínica significativa ni relacionada con el desarrollo de comportamientos violentos. Estos hallazgos sugieren que las anormalidades cerebrales estructurales existentes, no están asociadas con las diferencias encontradas en nuestra anterior investigación (Bueso-Izquierdo et al., 2016) siendo poco probable que sean las responsables de todas las diferencias funcionales observadas. Se ha observado que la prevalencia de daño cerebral en hombres maltratadores oscila entre un 40%-60% en comparación a población general (Pinto et al., 2010), sin embargo, también hay hombres maltratadores sin estos antecedentes. Los factores neurocognitivos, como las anormalidades estructurales pueden ser factores de riesgo de violencia que desempeñarían un papel importante, pero claramente no son ni necesarias ni suficientes para explicar este tipo de delitos.

Todos los resultados de las investigaciones que componen esta Tesis Doctoral deben entenderse en el contexto realizado, que trae como consecuencia varias limitaciones. Hemos de señalar que la generalización de los resultados es limitada debido a varias razones: en primer lugar el tamaño de la muestra es pequeña debido a la dificultad de la selección de participantes, lo que puede haber obstaculizado el alcance de la significación estadística en algunas comparaciones. En segundo lugar, igualar la severidad de los delitos entre hombres maltratadores y otros delincuentes es complicado debido a la dificultad de equiparar los delitos de violencia de género con otro tipo de delitos. Por último, debido a los criterios de exclusión para someterse a las pruebas de neuroimagen, la representatividad de la muestra no pueda ser generalizada a todo tipo de hombres maltratadores.

En cuanto a las fortalezas de esta Tesis Doctoral, uno de los principales puntos fuertes es que las diferencias en funcionamiento neuropsicológico y cerebral, no pueden ser atribuidas a variables como abuso o dependencia de drogas y antecedentes de daño cerebral, puesto que fueron controladas en todos los estudios realizados. Este control de variables es muy importante, ya que se ha comprobado cómo estos dos factores influyen en el rendimiento neuropsicológico y contaminarían a su vez, los resultados a nivel cerebral (para una revisión más extensa, ver (Fernández- Serrano et al., 2011; Schretlen y Shapiro, 2003). En segundo lugar, la elección de un grupo control con unas características tan concretas -hombres condenados por otros delitos no relacionados con violencia de género- hace que existan menos variables confusoras que puedan estar influyendo en los resultados, ya que se ha visto que el medio penitenciario o las circunstancias de haber sido condenado por algún tipo de delito afectan al rendimiento psicológico de las pruebas (Ruiz, 2007).

Por último, aunque reconocemos que nuestros estudios realizados con neuroimagen pueden y deben mejorar en muchos aspectos, resulta imprescindible resaltar que son investigaciones pioneras, siendo el primer estudio a nivel nacional (Bueso-Izquierdo et al., 2016) y el tercero internacional publicado con hombres maltratadores condenados por violencia de género.

Después de analizar y discutir todos los resultados, creemos que esta Tesis es el inicio de una línea de investigación a desarrollar sobre el perfil neurocientífico del hombre maltratador. Estos estudios permiten seguir investigando los factores biológicos relacionados con la violencia de género, y alentamos a otros investigadores/as a hacerlo y a colaborar en nuestra línea. Entender la naturaleza del problema de la violencia de género y el alcance de su influencia en la sociedad, puede ayudar a mejorar la evaluación de predicción de riesgo en hombres maltratadores, el tratamiento e incluso la evaluación de la responsabilidad criminal. Hemos de señalar que en el curso de nuestro trabajo, quizás hemos leído o hemos continuado escuchando las advertencias de aquellos que son escépticos sobre la relevancia de la investigación neurocientífica, para la práctica de la salud mental forense o la investigación de la neurociencia con hombres maltratadores (Gondolf, 2007; Gondolf, 2011).

En nuestra opinión, aceptar la utilidad general de un enfoque ecológico o multinivel para comprender la violencia, sería incongruente si este se centrara sólo en los factores biológicos, al igual que si los ignorara. Creemos que la investigación en neurociencia al no adoptar una postura reduccionista en sus planteamientos, contribuye muchísimo en varios problemas presentes en la sociedad (obesidad, adicciones...), y en particular puede contribuir en el estudio de la mente del hombre maltratador.

12.1.1 Implicaciones teóricas

Con respecto a la violencia, hay muchos factores que influyen en la toma de decisiones de una persona, incluidas las decisiones sobre si cometer violencia contra la pareja o de qué manera cometerla. En el caso de los hombres maltratadores, a menudo sus decisiones resultan en malas elecciones (ejerciendo violencia psicológicas, física… contra su pareja o ex pareja) (Hart, Douglas y Guy, 2016). Los investigadores/as y los profesionales deben tener en cuenta que los factores biológicos son sólo una de las variables que influyen en las decisiones de las personas sobre la violencia y que no prevalecen sobre los factores psicológicos, interpersonales y/ o sociales. Además, estos datos sirven para teorizar que la "potencial" influencia de los factores biológicos, no priva a las personas de su capacidad y responsabilidad para tomar mejores decisiones sobre sus actos; ni le quita a los profesionales forenses de salud mental, la capacidad de ayudar y hacer reconocer a sus pacientes la responsabilidad de sus actos.

Por último, los resultados encontrados en esta Tesis Doctoral permiten especular sobre cómo las variables neuropsicológicas encajarían en la teoría I3 (Slotter y Finkel, 2011). En el caso de los hombres maltratadores que se sienten provocados por sus parejas ("instigación"), reaccionan con agresividad ("impulso") y les caracteriza una baja flexibilidad cognitiva ("inhibición de factores disposicionales"), llevarían a estas personas a incrementar la probabilidad de reaccionar con más violencia. Aunque no podemos saber con seguridad si una variable determinada ejerce sus efectos sobre la agresión a través de un proceso, si podemos y debemos ir introduciendo en los futuros resultados empíricos, las teorías surgidas.

12.1.2 Implicaciones prácticas

Nuestros datos muestran que la perspectiva neurocientífica es necesaria en la caracterización del perfil del hombre maltratador. La neuropsicología puede contribuir significativamente al conocimiento de la conducta del hombre maltratador y a ayudar a esclarecer los diferentes subtipos de hombres maltratadores.

Además, dado que nuestros resultados arrojan información sobre un perfil de funcionamiento neuropsicológico, emocional y cerebral propio de esta población y diferente a otros delincuentes, esta caracterización nos sitúa ante la realidad de un tipo de violencia diferente, la cual necesitará inevitablemente una intervención específica. Esta aportación podría verse aplicada en las terapias de tratamiento psicológico que actualmente reciben los hombres maltratadores condenados por violencia de género (Programa de intervención con el agresor: PRIA). Este programa trabaja contenidos muy importantes como: identificación y expresión de emociones, las distorsiones cognitivas, la asunción de la responsabilidad o la empatía de la víctima (Castillo et al., 2005).

Para complementar los módulos ya creados en el tratamiento psicológico con hombres maltratadores, creemos que gracias a la perspectiva neurocientífica y los resultados derivados de esta Tesis se podría incluir por ejemplo, un contenido específico destinado a trabajar la flexibilidad cognitiva, ya que “es una habilidad mental importante para facilitar el aprendizaje y la reestructuración cognitiva, aumentando el funcionamiento adaptativo y la capacidad para los cambios y circunstancias de la vida”. (Johnco, Wuthrich y Rapee, 2014).

12.2 Conclusiones

Tras los resultados obtenidos en los diferentes estudios de esta Tesis, se derivan las siguientes conclusiones:

1. Los hombres maltratadores muestran un funcionamiento neuropsicológico específico, siendo más inflexibles y menos impulsivos comparados con hombres condenados por otros delitos.

2. Los hombres maltratadores muestran diferencias en el procesamiento emocional, procesando mejor las emociones de ira y sorpresa, comparado con hombres condenados por otro tipo de delitos.

3. Los hombres maltratadores condenados por violencia de género en comparación con hombres condenados por otros delitos, muestran una mayor activación en la corteza cingular anterior y posterior y en la corteza prefrontal medial, y una menor activación en la corteza prefrontal superior ante imágenes de violencia de género con respecto a imágenes de contenido neutro.

4. Los hombres maltratadores comparados con hombres condenados por otros delitos muestran menor grosor cortical en las regiones del córtex prefrontal orbitofrontal, línea media (cíngulo anterior y posterior) y áreas límbicas (ínsula, parahipocampal).

5. Los hombres maltratadores no presentan alteraciones cerebrales estructurales relacionadas con daño cerebral en comparación con otros delincuentes.

Por tanto, las diferencias encontradas a nivel estructural y funcional, no se deben a lesiones provocadas por daño cerebral o a la existencia de regiones anormales en el cerebro.

12.3 Perspectivas futuras

Los resultados y conclusiones derivadas de esta Tesis Doctoral nos permiten generar nuevas cuestiones y planteamientos de investigación que, a nuestro juicio, sería interesante e importante abordar en estudios futuros. Entre todas ellas, queremos destacar:

1. Evaluar los diferentes subtipos de hombres maltratadores en función de su condena y severidad de la violencia, a través de evaluaciones neuropsicológicas. Por tanto, queremos ampliar la muestra en los siguientes estudios y replicar investigaciones anteriores.

2. Investigar el papel de las hormonas y genética en hombres maltratadores, replicando lo encontrado en otros estudios anteriores en violentos no maltratadores de sus parejas, y a su vez relacionándolo con variables neuropsicológicas.

3. Desarrollar una batería neuropsicológica específica para hombres maltratadores que sirva como screening y se pueda aplicar cuando los hombres maltratadores son condenados por primera vez. Esta batería junto con las demás variables psicológicas, podría predecir con mayor exactitud qué hombres tienen más probabilidad de reincidir y cuáles no.

Las variables neuropsicológicas podrían ayudar a aportar objetividad en el proceso de evaluación, evitando los sesgos de deseabilidad social que se encuentran al aplicar pruebas subjetivas (cuestionarios o medidas de autoinforme).

4. Explorar la significación psicológica de las activaciones cerebrales encontradas en nuestros estudios. En futuros trabajos replicaremos las investigaciones realizadas pero además se recogerán variables relacionadas con el funcionamiento neuropsicológico y la violencia ejercida por los hombres maltratadores.

5. Utilizaremos la metodología de la neuroimagen para explorar nuevos aspectos de la violencia ejercida por los hombres maltratadores como sus valores morales o su capacidad de regular las emociones.

V. INTERNATIONAL DOCTORATE

CAPÍTULO 13:

GENERAL DISCUSSION, CONCLUSIONS AND FUTURE PERSPECTIVES

13.1 General Discussion

The main objective of this Doctoral Thesis was to analyze the neuropsychological and cerebral functioning of male batterers, compared to men convicted of other crimes. The neuroscience and intimate partner violence research program created several years ago by our research group "Neuropsychology and psychoneuroimmunology applied to children, adults and seniors", has addressed this general objective through the studies included in this Thesis. Our results showed the existence of a specific neuropsychological and cerebral functioning pattern in battering men condemned for crimes of intimate partner of violence.

Specifically, the results of the first study showed an executive functioning profile of male batterers, characterized by being more inflexible and less impulsive when compared with other criminals. This cognitive inflexibility has been found in previous studies (Becerra-García, 2015, Schafer & Fals-Stewart, 1997) and may help in understanding why these men are often unable to modify their action plans or accept situations or conflicts that arise in intimate partner relationships. It should be noted that this inflexibility was only shown with intimate partners. The influence of patriarchal society may explain why this inflexibility arises only in the context of interacting with partners or ex-partners, culminating in the consequent *"lecturing"* to the victim woman.

With respect to emotional processing, the second study found differences in the processing of anger and surprise in male batterers compared to other offenders. Our results do not coincide with those reported by Chan et al. (2010), where male abusers performed with more reaction time in the task of naming the color of words with aggressive affective content. However, the results of this study were obtained using a general task that was not specifically designed to evaluate emotional processing in situations of abuse or in comparison with men convicted of other crimes. Although the results of our study are very modest and preliminary, they contribute to a better understanding of the differences in the specific emotional processing of male batterers. Male batterers may be using their a better emotional recognition to manipulate the feelings of their partners or ex-partners, thus achieving the objective of perpetuating the violent relationship.

Regarding the neuroimaging studies included in this thesis, the results have shown that the brain functioning of male batterers is different from that of men convicted for other crimes.In the third study on functional neuroimaging), male batterers were found to have a different brain functioning profile when viewing images with content related to intimate partner violence. Specifically, male batterers compared to other offenders showed greater activation in the anterior and posterior cingulate cortex and in the medial prefrontal cortex, and a lower activation in the superior prefrontal cortex when viewing images of intimate partner violence as compared to neutral images. The knowledge of brain activation in male abusers offers useful explanations. The possible relationship of these areas to negative feelings such as fear could lead male batterers to be emotionally distant, which could potentially increase the fear of being abandoned by the partner. As a consequence, male abusers may have maladaptive coping and deregulation of affect in the form of obsessions about their partner, as documented by George et al. (2006).

On the other hand, in the fourth study on structural neuroimaging, brain regions related to emotional processing were included the evaluation at the structural level. In our results, male batterers, compared to men convicted of other crimes, had lower cortical thickness in prefrontal (orbitofrontal) regions, in the midline (anterior and posterior cingulate) and limbic areas (insula, parahipocampal). In addition, the thickness of the posterior dorsal cingulate cortex in the male batterer group was correlated with the total score on the Ekman emotional perception test. Previous research has found that ACC is involved in self-referential aspects of thinking, emotional contagion and affective perspective taking (Harrison, 2008, Raichle et al., 2001, Raine & Yang, 2006).

Our results are in line with that of Zhang et al. (2011), who provided the first evidence of reduced amygdala volume in men who perpetrated acts of violence. Our study extends findings of emotional processing in the amygdala to include several additional areas of the cortical brain that have been previously related to the processing and regulation of emotions in male abusers. These preliminary data offer a better understanding of the role of emotions behind abusive relationships with intimate partners and may be useful in the treatment of this population, since it has been shown that interventions in emotion regulation with couple relationships can help reduce conflict (Finkel, 2013).

Finally, the last study composed in this Doctoral Thesis was carried out to support the neuroimaging results found in previous investigations. The results showed minor differences among the group of male batterers, but after studying each case, they did not have significant clinical relevance or were not related to the development of violent behaviors.

These findings suggest that the existing structural brain abnormalities are not associated with the differences found in our previous investigation (Bueso-Izquierdo et al., 2016), making it unlikely that they are responsible for all the observed functional differences.
The literature suggests that the rate of head injury among male abusers is approximately 40-60% higher (Pinto et al., 2010). Nevertheless, there are also male batterers without this background. Neurocognitive factors, such as structural abnormalities, may be risk factors for violence that would play an important role, but clearly they are neither necessary nor sufficient to explain this type of crime.

All results of the research that make up this Doctoral Thesis should be understood in the context in which they were carried out, It is critical to point out that the generalization of results is limited due to several reasons: first, the sample size is small due to difficulties of participant selection, which may standardizing limited results from reaching statistical significance in some comparisons. Second, equalizing the severity of other types of crimes for other offenders to those of intimate partner violence for the male abusers is complicated. Finally, due to the exclusion criteria of neuroimaging tests, the representativeness of the sample can not be generalized to all types of male batterers.

Regarding the strengths of this Doctoral Thesis, one of the main strengths is that the differences in neuropsychological and cerebral functioning cannot be attributed to variables such as drug abuse or dependence and brain damage history, since they were controlled in all the studies carried out. The control of these variables is very important, since it has been proven how these two factors influence neuropsychological performance and would in turn contaminate the results at the cerebral level (for a more extensive review, see (Fernández-Serrano et al., 2011; Schretlen & Shapiro, 2003) Second, the choice of a control group with such specific characteristics (men condemned for other crimes not related to intimate partner violence) means that there are fewer confounding variables that may be influencing the results. This is due to the fact that the penitentiary environment or the circumstances of having been convicted for some type of crime affect psychological performance on tests (Ruiz, 2007). Finally, although we recognize that our neuroimaging studies can and should improve in many aspects, it is essential to highlight that they are pioneering research, including the first study to be published at the national level (Bueso-Izquierdo et al., 2016) and the third internationally with male batterers convicted for IPV.

We believe that this Thesis is just the beginning of a line of research that will be developed on the neuroscientific profile of the male batterer. These studies allow us to continue investigating the biological factors related to intimate partner violence, and we encourage other researchers to do so and to collaborate in our line of research. Understanding the nature of the problem of IPV and the extent of its influence on society can help to improve the assessment of risk prediction in male batterers, the treatment and even the evaluation of criminal culpability. We must point out that in the course of our work, we have read or continued to hear the warnings of those who are skeptical about the relevance of neuroscientific research in the practice of forensic mental health with male batterers (Gondolf, 2007; Gondolf, 2011). In our opinion, to accept the general utility of an ecological or multilevel approach to understanding violence, it is too simple to focus solely on biological factors such as ignoring them.

We believe that research in neuroscience, when a reductionist position is not adopted, contributes greatly to various problems present within society (obesity, addictions, etc.), and in particular to the study of the mind of male batterer.

13.1.1 Theoretical Implications

With regard to violence, there are many factors that influence a person's decision-making, including decisions about whether to commit violence against a partner or how to commit it. In the case of male batterers, their decisions often result in bad choices (exercising psychological and physical violence against their partner or ex-partner) (Hart, Douglas & Guy, 2016). Researchers and professionals should bear in mind that biological factors are only one of the variables that influence people's decisions about violence and that they do not prevail over psychological, interpersonal and / or social factors. In addition, these data serve to theorize that the "potential" influence of biological factors does not deprive people of their ability and responsibility to make better decisions about their actions; nor does it deprive forensic mental health professionals of the ability to help and make their patients recognize the responsibility for their actions.

Finally, the results found in this Doctoral Thesis allow us to speculate on how neuropsychological variables would fit in the I3 theory (Slotter and Finkel, 2011). In the case of male batterers, being provoked by their partners ("instigation"), their aggressive reactions ("impulse"), and low cognitive flexibility ("inhibition of dispositional factors") increase the probability of reacting with more violence. Although we cannot know with certainty whether certain variables affect aggression through these processes, we can and should introduce these developing theories in future empirical studies.

13.1.2 Practical Implications

Our data show that the neuroscientific perspective is necessary in characterizing the male batterer profile. Neuropsychology can contribute significantly to the knowledge of these men's behavior and help to clarify the different subtypes of batterers. In addition, given findings of a profile of neuropsychological, emotional and cerebral functioning specific to this population and different from other offenders, this characterization presents us with a different type of violence, which will inevitably needs a specific intervention. Knowledge of these characteristics could be applied in the psychological treatment therapies currently received by men convicted for IPV ("Intervention program with the aggressor: PRIA"). This program works on very important contents such as: identification and expression of emotions, cognitive distortions, the assumption of responsibility, and empathy for the victim (Castillo et al., 2005).

We believe that the neuroscientific perspective and the results derived from this Thesis could complement modules that have already been created in the psychological treatment of male batterers. For example, specific content aimed at working with cognitive flexibility could be helpful, since "it is a skill important mental to facilitate learning and cognitive restructuring, increasing adaptive functioning and capacity for changes and circumstances of life." (Johnco, Wuthrich & Rapee, 2014)

13.2 Conclusions

After the results obtained in the different studies of this Thesis, the following conclusions are derived:

1. Male batterers show a specific neuropsychological functioning, being more inflexible and less impulsive compared to men convicted for other crimes.

2. Male batterers show differences in emotional processing with a better processing of anger and surprise, compared to men convicted of other types of crimes.

3. Male batterers, in comparison to men convicted of other crimes, show greater activation in the anterior and posterior cingulate cortex and in the medial prefrontal cortex, and less activation in the superior prefrontal cortex when they view images of intimate partner violence with respect to images of neutral content.

4. Male batterers compared to men convicted of other crimes show less thickness in the regions of the prefrontal orbitofrontal cortex, midline (anterior and posterior cingulate) and limbic areas (insula, parahippocampal).

5. Male batterers do not present structural brain alterations related to brain damage compared to other criminals. Therefore, the differences found at a structural and functional level are not due to injuries caused by brain damage or the existence of abnormal regions in the brain.

13.3 Future perspectives

The results and conclusions derived from this doctoral thesis allow us to generate new questions and research approaches that, in our opinion, would be interesting and important to address in future studies. Among all of them, we want to highlight:

1. Evaluate the different subtypes of male batterers based on their sentence and severity of violence through neuropsychological evaluations. Therefore, we want to expand the sample in the following studies and replicate previous research.

2. Investigate the role of hormones and genetics in male batterers, replicating what was found in previous studies on violent men who do not abuse their partners, and in turn relating it to neuropsychological variables.

3. Develop a specific neuropsychological battery for male batterers that serves as a screening and can be applied when male batterers are convicted for the first time. This battery, along with the other psychological variables, could more accurately predict which men are more likely to reoffend and which are not.

The neuropsychological variables could help to provide objectivity in the evaluation process, avoiding the biases of social desirability found when applying subjective tests (questionnaires or self-report measures).

4. Explore the psychological significance of the brain activations found in our studies.In addition to replicating research that has already been carried out, we will include variables related to neuropsychological functioning and violence exercised by male batterers in future studies.

5. We will use a neuroimaging methodology to explore new aspects of violence exerted by male batterers, such as their moral values or their capacity to regulate emotions.

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ANEXOS ARTÍCULOS

PUBLICADOS Y EN REVISIÓN

ANEXO I

THE MIND OF MALE BATTERER: A NEUROSCIENCE PERSPECTIVE

Bueso-Izquierdo, N., Hart, S. D., Hidalgo-Ruzzante, N., Kropp, P. R., & Pérez-García, M. (2015). The mind of the male batterer: a neuroscience perspective. *Aggression and violent behavior*, *25*, 243-251. https://doi.org/10.1016/j.avb.2015.09.009

Aggression and Violent Behavior 25 (2015) 243–251

Contents lists available at ScienceDirect

Aggression and Violent Behavior

The mind of the male batterer: A neuroscience perspective☆

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article info

Article history:
Received 13 August 2014
Received in revised form 2 September 2015
Accepted 23 September 2015
Available online 3 October 2015

Keywords:
Intimate partner violence
Batterers
Neuropsychology
Neuroimaging and psychophysiology

abstract

This review analyzes neuropsychology, psychophysiology, and neuroimaging studies that examine the neuropsychological functioning and the nervous system (central and peripheral) of male batterers. Previous research has attempted to establish a neuropsychological profile for batterers. Yet factors such as brain injury, drug abuse antecedents, and other methodological concerns (e.g., sample size, control group selection, education level, socio-economic status, ethnicity, variability of the specific neuropsychological measures, and constructs assessed) may have led to inconsistent results. Neuropsychological studies reveal that poor performance on tests of executive functioning, verbal skills, and vocabulary is the most frequently reported characteristic for these men. With regard to research on the central and peripheral nervous system, these results should be considered with caution due to the small number of studies conducted on this topic. Therefore, the neuroscientific approach may be utilized in future studies to provide a better account of batterer typologies, the individualization of therapeutic approaches, and the prediction of recidivism. In summary, advancing our understanding of the mind and brain functioning of male batterers may aid in the prediction and reduction of violence against women in the future.

Contents

☆ Funding: This work has been funded by grants grant by the Ministry of Science and Innovation, Spain (MICINN) (Project: PSI 2009-13585), Ministry of Economy and Competitiveness (Project: PSI2013-42792-R), and Regional Ministry of Economy, Innovation and Science from Andalusian Government (Project: P2012-SEJ1723). The authors declare no conflicts of interest.

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http://dx.doi.org/10.1016/j.avb.2015.09.009
1359-1789/

1. Introduction

Intimate partner violence (IPV) is a major public health problem given its high impact in terms of morbidity and mortality (Claramunt, 1999; Merino, 2009; World Health Organization, 2013). In a multi-country study conducted by the World Health Organization, 15–71% of women between the ages of 15 and 49 reported having experienced physical and/or sexual violence by an intimate partner at some point in their lives (World Health Organization, 2013).

The relevance and severity of this problem justify the number of theories that have been proposed to explain IPV and batterers' behavior (Corvo & Johnson, 2013). From the psychosocial perspective, variables such as personality, types of violence, and psychopathology have been studied extensively (Bell & Naugle, 2008; Holtzworth-Munroe & Stuart, 1994; Loinaz, Echeburúa, & Torrubia, 2010, with results leading to the development of different profiles for batterers. Numerous typologies represented in the previous literature, the profile proposed by Holtzworth-Munroe and Stuart (1994) is the most well-known and cited. This profile classifies batterers into three subtypes: family-only (FO), borderline-dysphoric (BD), and generally violent-antisocial (GVA). These profiles are used to design therapeutic programs (Gondolf, 1997) and to define predictor variables for the severity and recidivism of violence (Gondolf, 1988; Kingsnorth, 2006).

Although biological variables have been extensively considered in violent acts (Fabian, 2010; Siever, 2008), little attention has been paid to these variables with regard to IPV (Corvo & Johnson, 2013; Pinto et al., 2010). Recently, there has been an increase in the number of reviews and empirical studies that emphasize the role of biological variables, such as hormonal, neuropsychological, and psychophysiological factors involved in IPV (Corvo & Dutton, 2015; Corvo & Johnson, 2013; Pinto et al., 2010; Walling, Meehan, Marshall, & Holtzworth-Munroe, 2012). Pinto et al. (2010) reviewed the biological correlates of IPV with a focus on the following areas: head injury and neuropsychology; psychophysiology; neurochemistry, metabolism and endocrinology; and genetics. Evidence indicates that all of these factors have a fundamental role in understanding how the mind of a batterer functions. These biological components should also be considered alongside social, psychological, and contextual factors, as the combination of these variables should better explain violent acts (Pinto et al., 2010). Recently, Corvo and Dutton (2015) have examined the role of neurotransmitters (such as dopamine, serotonin, and GABA) and neurohormones (such as testosterone and cortisol) in IPV. Nevertheless, empirical evidence about the relationship between biological factors and violence against women has not been well established, substantiating the need for more research examining this subject (Corvo & Dutton, 2015).

From a theoretical standpoint, a neuroscientific approach may play an important role in understanding the behavior of male batterers (Pinto et al., 2010). First, neuropsychological functioning mediates the interpretation of contexts, which may increase or decrease the probability of a violent act occurring (Cohen, Brumm, Zawacki, & Rosenbaum, 2003). Second, impairment of the brain or consequent neuropsychological problems could result in an increased probability of violent behavior (Cohen, Rosenbaum, Kane, Warnken, & Benjamin, 1999; Corvo, Halpern, & Ferraro, 2006). Third, specific neuropsychological characteristics, such as impulsivity and inflexibility, have been associated with violent behavior (Cohen et al., 2003; , Easton, Sacco, Neavins, Wupperman, & George, 2008; Marsh & Martinovich, 2006; Villemarette-Pittman, Stanford, & Greve, 2003). Finally, brain and neuropsychological variables may be systems through which genetic or molecular variables influence violent behavior (Pinto et al., 2010). Despite the potential influence of neuronal and neuropsychological variables on IPV, neuroscientific studies examining this issue are scarce (Corvo, 2014). Previous research examining the relevance of the brain and neuropsychological aspects in IPV has primarily been conducted via neuropsychological studies with batterers (Corvo & Dutton, 2015; Cohen et al., 2003; Easton et al., 2008; Walling et al., 2012), although a few studies have focused on neuroanatomical correlates (Lee, Chan, & Raine, 2009). Furthermore, there are a limited number of studies exploring the role of confounding variables, such as antecedents of brain injury or drug abuse (Cohen et al., 1999; Cohen et al., 2003; Corvo et al., 2006; Marsh & Martinovich, 2006; Westby & Ferraro, 1999), leading to contradictory results. Other confounders that influence brain or neuropsychological performance, such as education level, socioeconomic status (SES), or ethnicity, are usually considered during neuropsychological assessment (Lezak, 2004; Noble, McCandliss, & Farah, 2007; Puente, Pérez-García, López, Hidalgo-Ruzzante, & Fasfous, 2013). Nevertheless, they have not been studied in the neuroscientific literature related to IPV.

The purpose of the current paper is to review the neuroscientific literature regarding IPV batterers with a focus on the methodological concerns influencing the incongruence of neuropsychological and nervous system (central and autonomic) results. This review has been organized into two main sections: 1) neuropsychological studies; and 2) peripheral nervous system (PNS) and central nervous system (CNS) studies. In this review, we are not going to consider neuroscientific work examining general offenders, as our goal is to review the literature that focuses on batterers (for a review of neuroscientific literature related to violence, see Blair & Lee, 2013; Fabian, 2010; Siever, 2008)..

PubMed, Medline, Google Scholar, and PsycINFO were utilized to identify the articles that were related to our objective. The search included the following terms: batterers or perpetrators and intimate partner violence, in conjunction with neuropsychology, executive functioning, impulsivity, neuroimaging, psychophysiological reactivity and the nervous system, brain or head injury and drug abuse or dependence. The search included all articles published since 1970 to allow for an adequate review of the literature. All articles were published in English.

2. Neuropsychological functioning of IPV batterers

Since the publication of Cohen et al.'s (1999) seminal work, a number of papers have been published (Cohen et al., 2003; Teichner, Golden, Van Hasselt, & Peterson, 2001) regarding the neuropsychological characteristics of IPV batterers, with an accelerated progression in the past five years (Corvo et al., 2006; Easton et al., 2008; Marsh & Martinovich, 2006; Walling et al., 2012)..

In general, there is an important variability among findings. Some papers have found that batterers have problems with verbal processing (Cohen et al., 1999) or that they lack verbal skills (Cohen et al., 2003), whereas others suggest that they have issues with impulsivity (Cohen et al., 2003), cognitive flexibility (Easton et al., 2008) and executive functioning (Teichner et al., 2001) (see Table 1).

Table 1
Type, cognitive process examined and results of neuroscientific articles related to batterers.

Type of article	Authors	Cognitive process examined	Results
Neuropsychological studies that did not consider drug abuse and brain injury antecedents	Teichner et al. (2001)	Cognitive flexibility Impulsivity Immediate nonverbal memory Attention, motor speed and visual scanning	48% of male batterers vs. controls showed: worse performance measures in attention, memory, and executive functions.
	Chan et al. (2010)	Cognitive bias to negative affect stimuli	Batterers vs. controls: longer reaction times in mentioning the color of negative affect aggressive words than in saying affectively neutral words.
Neuropsychological studies that considered drug abuse but not brain injury antecedents	Easton et al. (2008)	Spatial and working memory Processing speed and response inhibition Sustained attention, concentration and impulsivity Visual motor sequencing Cognitive flexibility Verbal learning and memory IQ	IPV+ group: more impairment in IQ, visual motor tracking, cognitive shifting, and impulsivity as compared to controls. IPV+ and IPV− groups: more impairments than controls on the IGT.
Neuropsychological studies that considered brain injury but not drug abuse antecedents	Walling et al. (2012)	Planning Flexibility, inhibitory control, visual attention, and motor sequencing Speed processing and working memory Intellectual functioning	The verbal intelligence score was the only measure that correlated with psychological intimate partner aggression.
Neuropsychological studies that considered both brain injury and drug abuse antecedents	Schafer and Fals-Stewart (1997)	Intellectual functioning cognitive flexibility inhibition	Batterers vs. controls: poorer performance by the batterers on inhibition, flexibility, and vocabulary.
	Cohen et al. (1999)	Learning memory, attention, executive control General intelligence and verbal ability Sustained attention Verbal learning and recall Visual learning, verbal & visual recognition memory	Batterers vs. controls: poorer execution in learning and memory and verbal ability. Both groups differed in reported incidence of head injury (batterers showed 46% versus 21% in controls.
	Cohen et al. (2003)	Impulsivity Verbal functions Motor response control Planning Focused attention and sustained attention Motor speed Intellectual functioning	Batterers: more impulsivity, more verbal deficits, and lower attention. 45% of batterers reported a history of brain injury.
	Marsh and Martinovich (2006)	Intellectual functioning Response initiation and response suppression	TBI group: Lower average score in IQ. Batterers with TBI: worst performance on the Hayling and the Brixton Test.
Central nervous system	Corvo et al. (2006)	Visual speed, mental flexibility, sequential processing, and motor functioning. Cognitive control and inhibition.	The effects of frontal lobe deficits were most pronounced in cases of severe violence.
3) Peripheral nervous system	George et al. (2004)	Differences in neural structures and/or controlling the expression of fear-induced aggression	Perpetrators with alcohol abuse vs. the other two groups: lower glucose uptake in the hypothalamus.
	Stanford et al. (2007)	Speed of attention, mental flexibility, motor sequencing, and visual scanning	Batterers vs. controls: Lower P3 amplitude. More errors in TMT Part B. More failures to maintain set in WCST.
	Lee et al. (2008)	Cognitive and emotional Stroop tasks	Responses to aggressive words, batterers vs. controls: less activation of the left middle frontal gyrus, right anterior cingulate gyrus, left calcarine fissure, left lingual gyrus, left fusiform, and left middle and inferior temporal gyrus.
	Lee et al. (2009)	Evocation of a neutral, positive, or a negative emotional state	1) Positive images viewed during the neutral condition: batterers had a greater activation than controls in the right inferior orbitofrontal gyrus, the right anterior cingulate gyrus, and the right inferior parietal lobe. 2) Aggressive vs. neutral condition pictures: (batterers showed more activity than controls in the parietal cortex, temporal cortex, occipital cortex, left posterior cingulate gyrus and right thalamus. 3) Aggressive female pictures vs. neutral images: (control showed more activation than batterers in the frontal cortex, the parietal cortex, the temporal cortex and the occipital cortex
	Jacobson et al. (1994)	Affect, psychophysiology, and verbal content	There was no difference in psychological level among violent husbands and nonviolent husbands.
	Babcock et al. (2005)	Heart rate Skin conductance	Batterers vs. controls: Hyperreactivity is characteristic in men with low-level violence.
	Romero Martínez et al., (2013), Romero-Martínez et al., 2014	Heart rate Skin conductance	Batterers vs. controls: Batterers showed higher heart rates and lower vagal ratios, and this psychophysiological reactivity was related to anxiety and anger levels prior to the stressful task.

This variability in the results may be due to the influence of certain measures such as socioeconomic status, education level, and/or ethnicity. In addition, the use of various test measures or the examination of different constructs may explain inconsistencies in results. However, in our opinion, there are two specific influential factors; drug abuse and brain injury antecedents. An extensive body of literature has shown that drug abuse and traumatic brain injury patients show various neuropsychological deficits (for a review, see Fernández-Serrano, Pérez-García, & Verdejo-García, 2011; Schretlen & Shapiro, 2003; for instance). Therefore, the presence of all these factors in IPV batterers may influence their neuropsychological functioning.

Both drug abuse and brain injury are related to acts of IPV. Drug consumption may increase the severity of violent acts committed against women (Cohen et al., 1999; Corvo, 2014; Mcmurran & Gilchrist, 2007; Thomas, Bennett, & Stoops, 2012). Specifically, alcohol has been the most studied drug with regard to violent behavior in male batterers (Easton et al., 2008; Foran & O'Leary, 2008), as it is considered a facilitator of aggression (Murphy & Ting, 2010). Brain damage is also related to violence (Westby & Ferraro, 1999). For instance, people suffering from frontal lobe injury develop specific behavioral impairments, such as impulsivity, violent behavior, loss of self-control, and uncontrolled emotions (Cole et al., 2008; Farrer, Frost, & Hedges, 2012; Turkstra, Jones,& Toler,2003).

In the IPV literature, several studies have indicated that there is a higher prevalence and a greater severity of brain injury antecedents in batterers (Farrer et al., 2012; Turkstra et al., 2003). Initial research on braininjury in batterers showed that 53% and 62% of batterers had a history of brain injury (Rosenbaum & Hoge, 1989; Rosenbaum et al., 1994). To shed light on the neuropsychological functioning of batterers, the following section summarizes studies that did and did not consider drug abuse, brain injury antecedents, and socio-demographic confounders.

2.1. Neuropsychological studies that did not consider drug abuse and brain injury antecedents

Teichner et al. (2001) conducted preliminary studies examining neuropsychological functioning. They compared 50 men convicted of spousal violence to 23 male controls, who were primarily university staff members and undergraduate students. Participants who scored below the impaired cutoff point on two or more tests scored were classified as neuropsychologically impaired. The investigators found that 48% of male batterers were neuropsychologically impaired, compared to only 4% of controls (Teichner et al., 2001). Brain injury antecedents were recorded in this study but were not analyzed in relation to neuropsychological performance. Authors concluded that it is necessary to take into account neuropsychological factors in therapy for batterers to better understand its functioning.

Recently, a study investigated attentional bias based on the emotional Stroop tasks (Chan, Raine, & Lee, 2010). The researchers assessed 23 male batterers and 24 healthy controls who were recruited from the community. Compared to the controls, the batterers showed relatively slower reaction times when responding to negative stimuli than to neutral stimuli. In general, batterers were slower than the controls across all conditions. The researchers concluded that batterers may be less proficient when inhibiting distracting emotional stimuli, which could result in not properly rationalizing problems and instead employing more negative and violent behaviors during conflict situations (Chan et al., 2010).

2.2. Neuropsychological studies that considered drug abuse but not brain injury antecedents

To our knowledge, there is only one neuropsychological study that has considered drug abuse antecedents and not brain injury. Easton et al. (2008) examined the following three groups of people who were all recruited from a Mental Health Center: nine alcohol-dependent men convicted of intimate partner violence with physical violence (IPV+), nine alcohol-dependent men not convicted of physical violence (IPV-), and seven male smokers as controls. Participants were assessed using an executive functioning battery (see Table 1). Researchers found that IPV− men performed worse than controls on flexibility and concentration tasks, whereas the IPV− and IPV+ groups did not differ. Compared with controls, the IPV+ group had lower general intelligence and showed significant impairments in attention, cognitive flexibility, and impulsive control (Easton et al., 2008). The authors concluded that the interaction between committing violence and alcohol consumption may result in poorer cognitive performance. Therefore, it is necessary for future studies to better control variables (quantity, age of first use, type alcohol, etc.) in alcohol dependent men involved in intimate partner violence (Easton et al., 2008).

2.3. Neuropsychological studies that considered brain injury but not drug abuse antecedents

Recently, Walling et al. (2012) assessed 102 males who had committed intimate partner aggression (IPA) and 62 male controls (Non-IPA). A cluster analysis using the subtypes discussed by Holtzworth-Munroe, Meehan, Herron, Rehman, and Stuart (2000) categorized the IPA sample into the following three subtypes: family-only (37 men), low-level antisocial (34 men), and generally violent-antisocial (31 men). The authors also conducted a bivariate analysis for the IPA group with regard to physical and psychological aggression. All participants were evaluated with the Head Injury Questionnaire (Rosenbaum & Hoge, 1989) and an executive functioning battery (see Table 1). Verbal intelligence was the only measure that correlated with psychological intimate partner aggression. Impulsivity, planning, and lowlanguage skills were evident in the group of men who employed physical IPA (Walling et al., 2012). The borderline-dysphoric and generally violent-antisocial group with head injury antecedents had lower mean scores on the neuropsychological test for verbal intelligence. The authors indicated that it is important for future studies to contemplate neuropsychological variables, social factors, and individual differences (e.g., head injury) to advance our understanding of intimate partner violence (Walling et al., 2012).

2.4. Neuropsychological studies that considered both brain injury and drug abuse antecedents

Schafer and Fals-Stewart (1997) were the first to consider substance abuse and brain injury in batterers. The authors analyzed 31 couples in which the men were abstinent drug abusers who did not have neurological disorders or head injury antecedents. This group of men had the lowest levels of performance on inhibition, flexibility, and vocabulary(Schafer& Fals-Stewart, 1997). Although drug abuse and braininjury antecedents were considered, they were not analyzed in relation to neuropsychological performance. In conclusion, the authors demonstrated the importance of considering brain damage and drug abuse in all investigations, as it is strongly correlated with committing violent acts.

The preliminary studies conducted on neuropsychological assessment primarily focused on executive functions. Cohen et al. (1999) hypothesized that batterers would perform with lower scores on executive functioning and impulse control as compared to controls. They compared 39 males who had committed domestic violence to 63 nonviolent controls (recruited through a newspaper ad). Participants completed a questionnaire about drug abuse, a comprehensive neuropsychology battery, and an interview about general health, head injury, and learning disabilities (see Table 1). Results revealed that the groups differed in their reported incidences of head injury (i.e., 46% of batterers had acquired head injuries compared to 21% of the controls). In contrast, the two groups did not differ in the amount of illicit drugs taken. Moreover, batterers committed more violent acts with alcohol intoxication (67%) compared to controls. With regard to neuropsychological performance, batterers had lower performances on learning, memory, verbal ability, and executive functioning. These scores were considerably lower than those of the control group, suggesting that these deficits may pose a significant problem for these individuals (Cohen et al., 1999).

In a follow-up study on neuropsychological performance, Cohen et al. (2003) focused on impulsivity tasks. The authors compared a sample of 41 men who had committed domestic violence to a control group of 20 non-violent men. All participants were assessed with the Conflict Tactic Scale 2, and men who had a score above 11 were excluded. The results demonstrated that there was no difference in the consumption of illegal drugs between the two groups. However, there were differences in alcohol consumption, with 40% of batterers reporting a problem with alcohol and 68% admitting to having used violence when under the influence of alcohol. Additionally, 45% of batterers and 15% of the control group reported a history of head injury. With regard to verbal skills, the results indicated that batterers had greater verbal deficits than the control group. At the neuropsychological level, batterers were more impulsive than the controls. Furthermore, batterers had lower scores in attention/executive functioning compared to controls (Cohen et al., 2003). Drug abuse and brain injury antecedents were considered but not analyzed in relation to neuropsychological performance. The authors concluded that verbal deficits could be blocking the use of verbal expression to resolve conflicts (Corvo, 2014; Cohen et al., 2003).

Some studies have attempted to examine whether the executive functioning of batterers is affected by traumatic brain injury (TBI). Marsh and Martinovich (2006) evaluated 22 batterers with TBI and 16 batterers without brain injury on psychological measures. Although the authors collected participants' medical histories and substance abuse analyses, this information was not considered as an exclusion criterion (see Table 1). The results revealed that the batterers with TBI performed worse than the non-head-injury group on the Hayling and Brixton Tests, which measure of executive functioning linked to frontal lobe damage (Odhuba, Broek, & Johns, 2005). As in previous studies, the authors concluded that it is important to administer neuropsychological tests to batterers and implement interventions to treat deficits (Marsh & Martinovich, 2006).

Corvo et al. (2006) reviewed the work of Westby and Ferraro (1999) and explored the association between frontal lobe deficits and alcohol abuse when predicting domestic violence in 35 batterers (see Table 1). The results indicated that severe frontal lobe deficits were registered in cases of serious violence in men who were convicted of violence against women. Thus, the authors concluded that brain damage and alcohol abuse correlated with increased violence.

2.5. Neuropsychological studies that considered or did not consider education level, socio-economic status (SES), and ethnicity

As previously mentioned, education level, SES, and ethnicity are normally considered during the neuropsychological assessment (Lezak, 2004). These variables are considered confounders and taken into account during the neuropsychological assessment. Nevertheless, not until recently have SES and ethnicity arisen as variables of interest in research (Chiao, 2009; Noble, Houston, Kan, & Sowell, 2012).

Regarding education level, only two studies from Table 1 had comparable samples in education level for both groups. Furthermore, only two studies found differences between groups for this variable (Cohen et al., 1999) or who had a high level of education (Schafer & Fals-Stewart). Regarding SES, only three studies (Cohen et al., 2003; Marsh & Martinovich, 2006; Walling et al., 2012) mentioned the importance of this factor for its impact on neuropsychological performance. With regard to ethnicity, the majority of participants were Caucasian. In only one study conducted by Chan et al. (2010), the ethnic origin of participants was not provided, although all participants were recruited from a local facility in Hong Kong.

2.6. Summary of neuropsychological studies

In recent years, there has been an increasing interest in neuropsychological research on batterers. Studies frequently report that batterers perform poorly on a number of components of executive functioning (Cohen et al., 1999; Marsh & Martinovich, 2006; Teichner et al., 2001) and verbal skills or vocabulary (Cohen et al., 1999; Marsh & Martinovich, 2006; Schafer & Fals-Stewart, 1997; Walling et al., 2012). Additionally, studies have indicated that batterers have problems with impulsivity (Cohen et al., 2003; Schafer & Fals-Stewart, 1997), flexibility (Easton et al., 2008; Schafer & Fals-Stewart, 1997), attention (Cohen et al., 2003; Easton et al., 2008; Teichner et al., 2001), memory (Teichner et al., 2001; Cohen et al., 1999) and response inhibition (Easton et al., 2008). (See Table 1.)

Despite these findings, a specific neuropsychological pattern has not been found. When focusing on the studies that have considered drug abuse or brain injury antecedents, vocabulary or verbal skill deficits are the most frequently reported problems (Cohen et al., 1999; Cohen et al., 2003; Schafer & Fals-Stewart, 1997). Yet, other neuropsychological deficits have been found, including issues with memory (Cohen et al., 1999), impulsivity (Cohen et al., 2003), and cognitive flexibility (Schafer & Fals-Stewart, 1997). However, there is no definitive conclusion given the scarce number of studies.

Finally, most of the neuropsychological studies on batterers have been conducted on highly-educated Caucasian participants of a medium-SES, limiting conclusions to this type of batterer. More research is needed to understand the influence of these variables and to generalize conclusions to other batterers.

3. Nervous system functioning of IPV batterers

3.1. Studies examining the brain of IPV batterers

Neuroimaging is the most utilized technique for investigating aspects of brain functioning, and for examining the relationship between activity in certain brain areas and specific mental functions. Several studies have reported altered functioning of the amygdala, cingulate gyrus, and parietal and prefrontal cortices in violent people (Lee et al., 2009; Zhang et al., 2013). However, we only found four studies utilizing neuroimaging with male batterers that analyze these relations. Only one of these studies controlled for drug abuse (George et al., 2004), whereas none controlled for TBI antecedents.

George et al. (2004) used positron emission tomography (PET) to analyze the glucose metabolism activity and the structures responsible for the monitoring and mediating of conditioned responses to fear that are associated with domestic violence. The authors selected eight male perpetrators with alcohol dependence, 11 male non-batterers with alcohol dependence, and 10 healthy male subjects. Results revealed that perpetrators with alcohol abuse had lower rates of glucose uptake in the hypothalamus compared to the other two groups, suggesting that there is an abnormality in the perpetrators' hypothalamic activity that may predispose them to commit violent acts (George et al., 2004). However, the participants who were categorized as perpetrators of domestic violence were recruited from newspaper ads and had not been convicted of any IPV offenses.

Stanford, Conklin, Helfritz, and Kockler (2007) examined executive functioning and the P3 component (a positive wave that appears approximately 300 ms after the presentation of a low probability stimulus) of an event-related potential (ERP). ERP is the measured brain response during cognitive processing. These variables were assessed in a sample of 18 men convicted of spousal/partner abuse and 18 male controls. P3 was elicited using an auditory oddball task which was presented in a block of 200 trials. The stimuli consisted of two sequential random tones: a frequent 1000 Hz tone and a rare 2000 Hz tone. Participants had to close their eyes and silently count the rare 2000 Hz tones. They had to return to the task if they did not report the correct count

(±5 tones) (Stanford et al., 2007). In addition they conducted tests of executive function (see Table 1). The results indicated that the batterers showed more errors than the control group on the Trail Making Test Part B (flexibility) and had more failures to maintain a set in the Wisconsin Card Sorting Test WCST (a task that assesses planning, strategizing, and responding). These neuropsychological findings suggest that there are attentional deficits and general behavioral problems in abusers' relationships (Stanford et al., 2007). The ERP results revealed lower P3 amplitudes in the batterers compared to the non-violent controls who had a normal P3 topography (Anterior b Posterior). These findings suggest that aggressive behavior in intimate partner violence may be explained in part by deficits in the cognitive processing of batterers. The main limitation of this research was the presence of alcohol substance abuse in the batterer group, and psychopathology (i.e., personality disorders) in the sample. As the authors note, these factors could be confounding variables in their results (Stanford et al., 2007).

With a similar sample of 10 male batterers and 13 male controls (all without any significant medical illness or drug consumption antecedents), Lee et al. (2009) examined which brain areas were activated while the batterers observed aggressive-female and aggressive-threat pictures in comparison to neutral pictures. The images were presented in the 3 T Philips Achieva Scanner and were selected from the IAPS (International Affective Picture Systems) (see Table 1). In response to threat stimulus, results revealed an increased activation in the batterer group's brain structures such as the parietal cortex, temporal cortex, occipital cortex, left posterior cingulate gyrus, and right thalamus.

Additionally, the precuneus (the area in the superior parietal lobule in front of the occipital lobe) showed greater activation in batterers when they were viewing aggressive-female versus neutral pictures. The authors concluded that the precuneus could be related to evoking autobiographical memories of the abuse that they exerted on their partner (Lee et al., 2009).

3.2. Summary of the central nervous system

Neuroimaging studies make it possible to test hypotheses regarding differing activation of brain areas, which extend the traditional IPV research into new approaches (Lee et al., 2009; Pinto et al., 2010). Preliminary results reveal that when batterers are exposed to aggressive stimuli, they are impaired in tasks that rely on prefrontal circuitry (Lee, Chan, & Raine, 2008). Nevertheless, these results should be considered with caution as the sample sizes for the studies were small, there are a limited amount of studies, and most of them did not control for brain injury or drug abuse antecedents.

3.3. Peripheral nervous system functioning in IPV batterers

Previous literature suggests that violent acts or criminality are associated with psychophysiological reactivity (Patrick, 2008). For example, skin conductance levels increase when people view aggressive images (Choi et al., 2011).

A number of investigators have studied peripheral nervous system arousal in batterers using psychophysiological techniques (Jacobson et al., 1994; Margolin, John, & Gleberman, 1988). Early studies in this field that measured self-reports of arousal showed that physically abusive husbands reported high levels of sadness, fear, and anger. These men felt attacked and reported having slightly higher levels of physiological arousal compared to a verbally abusive group (Margolin et al., 1988).

Jacobson et al. (1994) conducted one of the first studies examining autonomic nervous system arousal during arguments with couples. The authors compared 60 couples who had experienced episodes of domestic violence with 32 couples who did not engage in violent behaviors. Table 1 describes the psychophysiological measures that were used during the "arguments in the laboratory." Participants had to describe a violent episode of the past. This provided the interviewer with two versions of the couple, providing a more objective narrative of the incident. Results indicated that there were only differences in cardiovascular arousal for the group of wives who had suffered from domestic violence, as they had longer finger pulse amplitudes and faster finger pulse transit times. There were no differences between the violent and non-violent husbands on a psychological level, as the authors had expected.

Gottman, Jacobson, Rushe, and Shortt (1995) examined the observed heart rate responses of battering couples during a task in which they talked about their marital problems. They distinguished between the following two categories of batterers: *Type 1* (low heart rate interaction partner) and *Type 2* (high heart rate interaction partner). Their findings suggested that *Type 1* batterers showed more premeditation, were generally more violent, and had elevated scales of antisocial behavior and sadistic aggression compared to *Type 2* batterers. However, *Type 1* batterers scored lower than *Type 2* batterers on dependency (Gottman et al., 1995).

Meehan, Holtzworth-Munroe, and Herron (2001) were unable to replicate the findings of Gottman et al. (1995). Meehan et al. found no significant differences between men who used physical abuse versus those who used psychological abuse. Nevertheless, *Type 1* batterers showed higher levels of marital distress than *Type 2* batterers. Another study that attempted to replicate Gottman's findings concluded that it found contradictory results because the original study used a high arousal baseline (Babcock, Green, Webb, & Graham, 2004). Finally, Meehan et al. (2001) reviewed the three aforementioned studies and concluded that the results did not fully support the proposed typologies of *Type 1* and *Type 2* batterers in terms of physiological measures, such as heart rate.

Babcock, Green, Webb, and Yerington (2005) examined the psychophysiological profile of violent men using a sample of 35 severely violent batterers, 37 batterers with a low level of violence, and 21 non-violent controls. The authors analyzed the men's heart rate and skin conductance levels, their conflict responses during arguments, and their responses during a standardized anger induction. The findings demonstrated that autonomic hyporeactivity may be an accurate predictor of risk factors for an antisocial personality in severely violent men, whereas hyperreactivity may be common in men who show low level violent behaviors.

Recently, Moya-Albiol and colleagues found that impulsivity and testosterone levels were associated with higher skin conductance levels in IPV men during a virtual argument task (Romero-Martínez, Lila, Williams, González-Bono, & Moya-Albiol, 2013). Using this task, they found that batterers had higher heart rates and lower vagal ratios than did controls, and that psychophysiological reactivity was related to anxiety and anger levels prior to the stressful task. The authors concluded that IPV perpetrators had a different cardiovascular pattern of response to psychosocial stress, offering a better understanding of the different batterer subtypes (Romero-Martínez, Nunes-Costa, Lila, González-Bono, & Moya-Albiol, 2014).

3.4. Summary of the peripheral nervous system

Overall, psychophysiological findings regarding IPV batterers are inconclusive. There have been attempts to establish a typology via measures such as heart rate (Gottman et al., 1995). Yet, replications have not led to strong conclusions regarding psychophysiological measures. Three studies have addressed the psychophysiological reactivity of batterers during arguments and have found contradictory results such as: hyporeactivity as a good predictor of severity of violence (Babcock et al., 2005) and hyperreactivity as a characteristic of IPV batterers (Romero-Martínez et al., 2013; Romero-Martínez et al., 2014). The lack of ecological validity in laboratory tasks may explain incongruent results, as it is difficult to replicate the psychophysiological reactions of batterers from real contexts in the lab setting. Nevertheless, more research is needed to investigate the functioning of the peripheral nervous system in batterers by measuring the psychophysiological variablesthatinfluenceIPV.

4. Additionalmethodological considerations

This review provides a detailed analysis of the influence of drug abuse, brain injury antecedents, and sociodemographic characteristics using findings in currently available neuropsychological studies. Nevertheless, additional methodological concerns could have influenced the incongruence of results in the aforementioned neuropsychological and cerebral studies. A number of problems have already been discussed in other papers (Corvo, 2014; Pinto et al., 2010).

First, the sampling strategies used to recruit IPV batterers, including newspaper ads (George et al., 2004; Schafer & Fals-Stewart, 1997; Walling et al., 2012), self-reports of violent history (Cohen et al., 1999), and criminal conviction (Cohen et al., 2003; Chan et al., 2010; Easton et al., 2008; Marsh & Martinovich, 2006; Teichner et al., 2001), may lead to variability in results. These differences could favor a sampling bias regarding the type or severity of the perpetrator's violence.

A similar issue may be relevant for the control groups, as they are recruited through newspaper advertisements (Cohen et al., 2003; Stanford et al., 2007), on the street (Easton et al., 2008), in therapeutic communities (Lee et al., 2009), and in university contexts (Teichner et al., 2001).

An additional issue is the sample sizes for the studies. Most studies have been conducted using small samples (Corvo, Halpern & Ferraro, 2008; Easton et al., 2008; Lee et al., 2008; Lee et al., 2009), which may bias the designs toward non-significant results. This problem is related to the lack of information regarding the effect sizes for neuropsychological studies with IPV batterers. To know the effect sizes of the reviewed studies, we have obtained the Cohen's delta when possible (i.e., studies should at least provide the means and standard deviations of the neuropsychological tests used for all groups) (Cohen et al., 1999; Cohen et al., 2003; Easton et al., 2008; Marsh & Martinovich, 2006; Teichner et al., 2001). With the given the neuropsychological domains, high effect sizes (deltas N 0.8) have been found for verbal skills, attention/working memory, verbal/visual memory, flexibility, inhibition, and decision-making (see Table 2). The small number of studies does not permit an analysis of the influence of sociodemographic characteristics, drug abuse, or brain injury antecedents on this effect size. Future studies should address this concern.

Another variable that influences neuropsychological heterogeneity is variability in the specific neuropsychological measures being used and the specificity of the constructs being assessed. For example, to assess impulsivity, Easton et al. (2008) administered the IGT, whereas Cohen et al. (2003) used the Stroop test. This variability in measurements complicates the comparison of these studies' results.

In summary, sample recruitment and size, sociodemographic factors (SES, ethnicity, or education level), selection of instruments, and definitions of neuropsychological constructs may influence the heterogeneity of the neuropsychological and cerebral findings in studies conducted with batterers. These issues are exacerbated by the lack of studies on this topic.

5. Conclusions, recommendations, and future directions

The mind of the male batterer should be studied from an integrative perspective that considers personality factors, culture, gender role differentiation, social perspectives, and neuroscientific factors. Given the critical findings and the methodological concerns regarding neuropsychology, psychophysiology and neuroimaging (see Table 1) presented in this review, we can conclude that batterers have some neuropsychological and neuroanatomical characteristics that differ from non-batterers. Furthermore, we conclude that no consistent and specific characteristics have been identified.

Table 2
Cohen's deltas by neuropsychological domain and tests included in each domain.

Domains	Cohen's delta	Tests
Processing speed	0.78	Digit symbol WAIS-R PASAT
Attention/working memory	0.87	Backward digit span PASAT ARCPT-d
Memory	1.39	Delayed figural memory (Luria-Nebraska battery) NVSRT: LTR RMT-words (Z-scores) RMT-faces (Z-scores)
Reasoning	0.53	WCST categories completed Porteus maze test Brixton test total
Inhibition	1.06	Stroop interference ARCPT-d Hayling test total
Flexibility	1.11	TMT-B WCST % errors WCST % perseverative errors WCST-total errors TMT errors
Decision-making	2.94	IGT
Verbal skills	0.77	VIQ Shipley raw score
Globalverbal	1.03	Any former tests using verbalstimulus[1]
Global non-verbal	0.90	Any former tests using 00visual stimulus[2]
IQ (intelligence quotient)	0.75	IQ Shipley VIQ Full scale IQ Shipley raw score

Note[1]: Results with Cohen's delta from studies that provide means and standard deviations: (Cohen et al., 1999; Cohen et al., 2003; Easton et al., 2008; Marsh & Martinovich, 2006; Teichner et al., 2001).
Note[2]: PASAT (paced auditory serial addition task), ARCPT-d (adaptive rate continuous performance test, detection accuracy), NVSRT:LTR (nonverbal selective reminding test-long-term recall), RMT (recognition memory test), TMT-B (trail making test part B), TMT-E (trail making test errors), WCST (Wisconsin Card sorting test), IGT (Iowa gambling task), and VIQ (Shipley Institute of Living Scale).
Note[3]: [1]Any former tests using verbal stimulus[1] [2]Any former tests using visual stimulus.

At the neuropsychological level, batterers showed differences in executive functioning, verbal skills, and attention (Cohen et al., 2003; Cohen et al., 1999; Corvo et al., 2006; Schafer & Fals-Stewart, 1997). However, it is still not clear which components are most important for the executive functioning of batterers or, for instance, which components could be used to differentiate neuropsychological subtypes. Various factors may explain the inconsistencies in results. First, the diversity of neuropsychological characteristics may be due to important variables, such as drug abuse or brain injury antecedents, that have not been considered. Second, the selection of control groups compared to batterers has led to inconsistencies across studies. The inclusion of a non-batterer drug abuse control group may help clarify which neuropsychological characteristics are specific to batterers and which are associated with their drug abuse condition or brain injury antecedents. Additionally, criminal convictions or incarcerations may lead to psychological reactions that are generated by continuous emotional stress (Echeverri-Vera, 2010). Therefore, the inclusion of samples of men who have been convicted of other crimes and live in detention centers may be appropriate when examining convicted IPV perpetrators.

It seems relevant to distinguish between the neuropsychological performances of batterers with and without histories of drug abuse or brain injury antecedents. Knowing the medical history (e.g., brain injury antecedents, general health, and relevant diseases) and drug consumption patterns is of vital importance to understanding the behavior of batterers. To further understand the neuropsychological performance of each group, future research should examine subgroups such as drug abuse batterers, batterers without a drug consumption history, and batterers with and without histories of brain injury. These classifications could shed light on the neuropsychology typology of each group and improve or customize the interventions available for each group. Thus, neuropsychology could provide a deeper understanding of batterers' violent behaviors by contributing objectivity to the research process and avoiding biases that occur in subjective tests.

Considering the central and peripheral nervous system functioning of batterers, results should be considered with caution. Only three studies have been conducted examining brain functioning and they have used small samples and shown inconsistent results. Typologies for batterers at the psychophysiological level cannot be established considering the inconsistent results with regard to the peripheral nervous system. Additionally, the few psychophysiological studies that have been conducted and reached similar conclusions have had small and heterogeneous samples, and some inconsistent results. More studies are needed to better understand the neurobiology of batterers.

The neuroscientific approach of studying the neurobiological factors involved in IPV may provide insight to the IPV problem. First, this approach sheds light on the brain and neuropsychological mechanisms involved in batterer behavior. Neuroimaging studies reveals what brain structures are involved in batterers' thoughts, beliefs, and behaviors. Furthermore, using this approach may reveal whether batterers differ from other offenders. Additionally, neuroscientific studies may be able to clarify whether there are different types of IPV offenders (Holtzworth-Munroe & Stuart, 1994) or whether they share neuropsychological characteristics. Neuropsychological characteristics could also help distinguish different types of batterers. Thus, more neuroscientific research, including neuroimaging and neuropsychological studies, are merited.

Second, neuroscience provides an excellent framework for integrating information from different levels of knowledge regarding the IPV problem. Neuroscience integrates evidence from cultural (Chiao, 2009), moral (Moll, Zahn, de Oliveira-Souza, Krueger, & Grafman, 2005), social (Cacioppo, Berntson, Sheridan, & McClintock, 2000), neuroanatomical (FitzGerald, Gruener, & Mtui, 2011), and genetic (Green et al., 2008) variables to provide an explanation of human behavior. Research integrating all or parts of these variables offers a better understanding of the IPV problem.

Finally, future neuroscientific research examining IPV should transcend from theory to practice. Recently, Sieguel (2013) proposed adapting batterer treatment programs to new evidence from emotional neuroscience suggesting that methods of emotional control could be useful, given that emotional control may play an important role in batterer behavior. It could be beneficial to explore the inclusion of other neuropsychological treatment procedures related to impulsivity, flexibility, and decision-making.

In conclusion, addressing IPV from a multidisciplinary perspective would amplify our knowledge regarding how the mind of the batterer works. IPV is a phenomenon that must be investigated further to reduce and ultimately eliminate this universal problem. It is, therefore, time to include the neuroscientific approach in our research.

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ANEXO II

NEUROPSYCHOLOGICAL AND NEUROIMAGING RESEARCH WITH MALE BATTERERS AND DOMESTIC VIOLENCE PERPETRATORS

Bueso-Izquierdo, N., Daugherty, J.C., Hidalgo-Ruzzante, N & Pérez-García, M.

Violence Risk in Criminal Offender Populations: *A Forensic Psychological and Neuropsychological Perspective. Capítulo de libro: "Neuropsychological and neuroimaging research with male batterers and domestic violence perpetrators".*

Editorial: Wiley & Sons (2017).

7841 words

"Neuropsychological and neuroimaging research with male batterers and domestic violence perpetrators"

Authors: Natalia Bueso-Izquierdo, Natalia Hidalgo-Ruzzante, Julia C. Daugherty & Miguel Pérez-García

Abstract

Neuroscientific research is currently having a critical impact on the understanding of the mind and brain functioning of male perpetrators of intimate partner violence (IPV). Since 1990, various investigations have tried to classify and study batterer typologies in terms of neuropsychology and neuroimaging, while taking into account social variables and personality types. This approach allows for an analysis of the brain to be conducted in terms of factors that characterize this population. Attending to the implications of this research will allow legal and health professionals to reach a higher level of impact when working with these men. This chapter is an overview, one that can serve to orient interested readers and direct them to further references. First, neuropsychological and neuroimaging studies about male perpetrators of intimate partner violence will be synthesized and chronologically reviewed. Finally, future directions about these findings will be discussed.

Keywords: Intimate partner violence, Executive function, Magnetic Resonance, Neuroscience, Forensics.

CONTENTS

1. How can neuroscience contribute to the study of male batterers?

In recent years, there has been a burgeoning of social and professional awareness concerning the pervasiveness and severity of intimate partner violence (IPV). It is a problem on a global scale, where nearly a third (30%) of women in the world have suffered physical or sexual violence at the hands of their intimate partner (Devries et al. 2013). Furthermore, the percentage of fatal victims due to this type of crime is alarming; intimate partners are responsible for 38.6% of female murders (Stöckl et al. 2013).

In the past 40 years of research on IPV, relevant information about female victims and male batterers have combined to produce a framework for current-day politics, laws and response practices in this field (Sheehan et al. 2015). Nevertheless, the number of cases of female victims due to this type of violence is not diminishing. On this front, the study of male batterer behavior has gained special attention (Corvo and Johnson 2013). It is known that not all batterers match the same profile (Echeburúa et al. 2008). Nevertheless, various studies identify an association between psychopathology (Grann and Wedin 2002), alcohol abuse (Fals-Stewart 2003), and violent behavior in men who have exercised violence against an intimate partner, even though this association remains unclear (Boyle et al. 2008). It appears that the male batterer is characterized by inflexible and less impulsive behavior compared to other criminals (Bueso-Izquierdo et al. 2016). Furthermore, other attributes such as emotions of anger and surprise are notable (Bueso-Izquierdo et al. 2015).

In a heightened interest to understand characteristics of male batterers, there has been a recent growth in the number of revisions that emphasize the role of biological variables, from hormonal and psychophysiological to a specific neuropsychological profile (Corvo and Dutton 2015; Corvo and Johnson 2013; Pinto et al. 2010; Walling et al. 2012). In this line of research, neuroscience can provide scientific evidence for specific characteristics in perpetrators of IPV, as has been done with other violent populations (for a revision, see Fabian 2010). This perspective also contribute to different aspects of understanding the male batterer profile. First, neuroscience can provide an objective methodology that can supplement questionnaires that have traditionally been used in this line of research. When questionnaires are administered to batterers, they are heavily subject to biases of social desirability (Eckardt et al 2012; Helfritz et al 2006). As such, when self-administered instruments related to personality traits or moral values in relation to violence are assessed, answers should be considered with caution. In this sense, neuroscience offers a methodology that is unlikely to be affected by factors such as social desirability. For example, impulsivity in batterers can be assessed using a variety of questionnaires, but using objective neuropsychological tasks such as the Go-No-Go or the Stroop may be more fruitful (Bueso-Izquierdo et al 2016). Another interesting example can be found in Bueso-Izquierdo et al.

(2016), where differences are not found in the subjective assessment of images of violence against women between batterers and other delinquents, but are instead detected in the activation of the brain regions used to process them.

A second justification for the use of neuroscience in the study of batterers is the ease with which neuroscience can be integrated into different levels of knowledge. General violence and specifically intimate partner violence is a complex behavioral context in which the influence of different variables have been proposed, such as genetics and hormones (Romero-Martínez et al 2013), brain functioning (Bueso-Izquierdo et al 2016), and culture (Levinson, 1989). Integrating these levels of knowledge into one model is a highly complex problem, for which neuroscience is especially prepared.

Another important reason for incorporating neuroscience into the study of male batterer behavior is the information it can offer regarding particular brain variables related to batterer behavior, especially in terms of antecedents for brain injury and drug consumption (Bueso-Izquierdo et al. 2015). Some studies point to the higher prevalence of traumatic brain injury in perpetrators of IPV as compared to the general population (Farrer, Frost, and Hedges 2012). Nevertheless, the scientific studies conducted on brain functioning in perpetrators of IPV to this date indicate differences in brain activation, not the presence or absence of brain trauma. Furthermore, the existence of traumatic brain injury appears to exacerbate the deficits that are already present in batterers, but is not sufficient to explain them (Romero-Martínez and Moya-Albiol 2013). On the other hand, the results of some studies indicate differential brain activation in batterers as compared to other populations (Bueso-Izquierdo et al. 2016; Lee, Chan, and Raine 2009). Neuroscience can be at the forefront of resolving this controversy.

Furthermore, the relationship between drug consumption and intimate partner violence is more than evident (Catalá-Miñana, Lila and Oliver 2013), and the effects that drugs have on the brain must be considered (Fernández-Serrano, Pérez-García and Verdejo-García 2011). It is, therefore, essential to study brain structure as well as neuropsychological and brain functioning in male batterers to shed light on the influence of these variables on characteristics specific to this population.

Another important contribution is the influence that neuropsychological variables can have on violence risk prediction. It is known that both actuarial and psychological variables combined in instruments used by expert judges such as the acclaimed instrument, Spousal Assault Risk Assessment (SARA: Kropp and Hart 2000) have reached acceptable levels of successful prediction of violence (approximately 0.8). Nevertheless, the different meta analyses published concerning the precision of prediction have indicated that 0.8 is the "glass ceiling" that can not be exceeded (Coid et al 2011). In an attempt to surmount this cap, the inclusion of new variables that have not previously been considered in these instruments is suggested. These proposed variables include measures related to violent conduct, such as neuropsychological functioning (Coid et al. 2011). Recent studies are now pointing to the predictive capacity of neuropsychological variables, indicating that they may contribute to an improved prediction of violent behavior (Fox et al. 2016; Hanlon et al. 2013).

Finally, it is important to note that neuroscience not only makes critical contributions to the scientific understanding of batterer behavior, but also in understanding the neuropsychological sequelae in female IPV victims resulting from the violent relationship (Kwako et al. 2011; Valera and Kucyi 2016). Furthermore, it helps to explain how these consequences interfere with their independence and decision making (Marin Torices et al.

2016). All growth in the understanding of sequelae related to IPV leads to improved care for victims, and a more objective perspective on cognitive deficits in forensic contexts.

2. A narrative of topics through clear examples from the neuroscientific literature

Neuroscientific research focused on the characterization of the male perpetrator profile has increased over the last few years, with a growing and special interest in neuropsychology and neuroimaging studies (Bueso-Izquierdo et al. 2015; Chester and DeWall 2017; Corvo and Johnson 2013; Pinto et al. 2010). For a better understanding of how research has progressed since 1990, we have arranged studies centered on these two disciplines in chronological order. Before reviewing the most influential studies, it should be emphasized that differences between discrepant findings found at the neuropsychological and neuroimaging level may be due to variables such as: drug abuse/dependence, history of brain damage, and/or others variables that will be described later on.

Drug consumption is often reported among domestic violence perpetrators, with alcohol being the most commonly reported type (Murphy and Ting 2010). Throughout the literature, it has been shown that drug abuse or dependence can increase the likelihood of committing violent acts (Easton et al. 2008, Thomas, Bennet and Stoops 2012). Furthermore, there is a higher prevalence of brain injury in this population than in the general population (Farrer, Frost and Hedges 2012). The consequences of antecedents for brain damage can lead to alterations in executive function such as: impulsivity, loss of self-control, or violent behavior (Cole et al. 2008). Others variables that could be affecting neuropsychological results are: sample size, sociodemographic factors (ethnicity, educational level, nationality), type of sentence (if they are convicted of IPV and other types of crime), recidivism, the selection of tasks or tests in each study, and definitions of neuropsychological constructs (Bueso-Izquierdo et al. 2015).

In this part of the chapter, authors have summarized neuropsychological studies focusing on male batterers and male perpetrators of intimate partner violence that have occurred over the years. This review of the literature aims to serve as a useful tool for professionals in the various fields psychology, criminal justice and forensics, social work, and health care. Furthermore, it may serve as a reference for researchers and scholars of different levels (undergraduates, graduates students, PhD).

2. 1 Neuropsychology: A chronological and critical revision with a vision for future research

In 1989, Rosenbaum and Hoge found a higher prevalence of alcohol abuse and brain damage in violent men against their partners compared to the general population. With this idea in mind, Schafer and Fals-Stewart (1997) became pioneers in neuropsychological functioning studies of violent men, analyzing the profile of 31 couples. In this study, they gathered data from a sample of men with a violent history but without any antecedents of brain damage and drug abuse. Results demonstrated low performances in flexibility, inhibition, and vocabulary, which were related to higher levels of husband-to-wife severe violence. This study was innovative for having pointed out a specific profile for violent men.

Nevertheless, it should be noted that the sample was collected through advertisements, and did not assess men who had been sentenced for IPV.

Variables such as evaluating men who have been sentenced in the penitentiary system to those who have not, as well as educational level, ethnicity or socioeconomic status, can influence results and should be taken into account (Bueso-Izquierdo et al. 2015).

Following the chronological progression, we find Cohen's study of 1999 that allowed for an advance in the field of neuropsychology and intimate partner violence. These authors focused their research on executive functioning. They compared 39 men who had committed domestic violence to 63 nonviolent controls (all selected through newspaper ads) on an extensive neuropsychological battery. Drug use and brain damage were carefully analyzed along with an interview on sociodemographic variables. The results revealed that 46% of violent men reported a history of brain damage compared to 21% of controls. On the other hand, batterers had a lower educational level than non batterers and no differences were observed in drug use between the two groups. In relation to the neuropsychological profile, a poor performance was observed in learning, memory, verbal skills, and executive function in violent men (Cohen et al. 1999).

In the previous decade, we can observe a small increase in the number of studies related to neuropsychological functioning and the behavior of the male perpetrators of IPV. In 2001, Teichner et al. conducted a brief communication focused on cognitive functioning through neuropsychological tasks with 50 men convicted of spousal violence and 23 male controls. The results demonstrated that about 48% of the male abusers group had more severe deterioration in neuropsychological domains. The most significantly low performance was found in flexibility, visual memory, inhibition in verbal responses, and focused attention. The most relevant of their conclusions were the implications that they inducted through evaluating male batterers with neuropsychological batteries to: 1) establish different groups according to their performance and 2) the importance the neuropsychological functioning when professionals are designing therapies for this population (Teichner et al. 2001).

A few years later after his 1999 study with violent men, Cohen et al. (2003) focused on a particular neuropsychological domain: impulsivity. They compared 41 men who had committed domestic violence versus 20 nonviolent men. In this study, they ensured that there was no difference in sociodemographic characteristics such as education and age. In their results, violent men had poorer performance on attention, executive function and verbal skills compared to controls. In summary, these authors suggested that verbal and executive function deficits could play a role in the way these men resolve conflicts with their partners.

The following three studies are novel in their comparison of different groups of male perpetrators of IPV, paying special attention to subtype differences according to brain damage or drug use. In 2006, Marsh and Martinovich assessed 22 male batterers with traumatic brain injury (TBI) and 16 male batterers without TBI on neuropsychological measures. They controlled substance abuse by designating it as an exclusion criterion. The aim of these authors was to replicate previous studies that had pointed out a high prevalence of brain damage antecedents, while focusing particularly on executive functioning. Results showed that male batterers with TBI had worse neuropsychological performance than the non-TBI group. These findings allow us to reinforce the idea that assessing neuropsychological domains in male perpetrators of intimate partner violence is important in improving their interventions.

Another study published in the same year was conducted by Corvo, Halpern and Ferraro (2006), in which a secondary analysis of the results presented by Westby and Ferraro (1999) was conducted in order to analyze the relationship between frontal lobe deficits and alcohol abuse related to neuropsychological tasks in domestic violence. In this new analysis, they found that alcohol abuse could mediate neuropsychological variables. In the case of the frontal lobe, deficits often show up in cases of severe violence.

A subsequent study in 2008 focused on the consumption of alcohol. They assessed different neuropsychological domains in 9 alcohol-dependent individuals convicted of IPV with physical violence (IPV+), 9 alcohol-dependent men not convicted of physical IPV (IPV-), and 7 male smokers of tobacco as controls. In their results, IPV+ men showed worse performance on flexibility and concentration tasks compared to controls. Furthermore, the IPV+ group and IPV- group were more impulsive than the control group. Although the sample in this study was small, it serves to strengthen the idea that future studies should control variables such as quantity of drug consumption, age of first use, and type of alcohol in male batterers with alcohol dependence (Easton et al. 2008).

In 2010, Chan, Raine and Lee analyzed cognitive biases toward negative stimuli using the Stroop task. The sample consisted of 23 male batterers and 24 controls. In their results, violent men were slower responding to negative stimuli than to neutral ones. The researchers discussed the idea that men who commit violence against intimate partners may be less competent in inhibiting emotional stimuli, which would in turn result in not being able to adequately rationalize problems, using violence as a form of conflict resolution.

Regarding the executive functioning related to famous subtypes proposed by Holtzworth-Munroe et al. 1994, Walling et al. (2012) assessed 102 male perpetrators of intimate partner aggression (IPA) and 62 male controls. They divided the IPA sample into the following three subtypes: family-only (37 men), low-level antisocial (34 men), and generally violent-antisocial (31 men). Results showed that low language skills were significant in the group of men who employed physical IPA, and that verbal intelligence was the only measure that correlated with psychological intimate partner aggression. In terms of personality types, the borderline-dysphoric and generally violent-antisocial group with head injury antecedents had lower mean scores on the neuropsychological test for verbal intelligence.

In 2013, Romero-Martínez and Moya-Albiol took a great step in analyzing the neuropsychological functioning of IPV perpetrators in relation to the role of hormones. In the literature, it has been verified that high levels of various hormones (e.g. androgens, testosterone) could increase violent behavior in men and the response to a threatening stimulus (George et al. 2001; Moya-Albiol 2010). The study sample consisted of 19 IPV perpetrators and 21 controls. In their results, IPV men had lower emotional recognition and executive performance compared to controls. Authors concluded that neuropsychological variables and hormonal factors may be critical in understanding neuropsychological variables and hormonal factors (Romero-Martínez and Moya-Albiol 2013).

In 2015, Becerra-García analyzed the executive functioning of domestic violence perpetrators compared with different groups of offenders. This change in control group characteristics marks an important advancement, as control groups previously included individuals without convictions. The sample consisted of 10 adult prisoners convicted of domestic violence (i.e. offenses of physical or psychological aggression against intimate partners); 20 participants convicted of sexual contact offenses, 9 participants convicted of violent crimes (i.e. assault, wounding, attempted homicide, homicide and armed robbery), and 8 non-violent offenders The Trail Making Test (TMT) was used to measure processing speed and cognitive flexibility. Their results showed that domestic violence and sex offenders had poorer cognitive flexibility. This profile of cognitive inflexibility could explain why some domestic violence offenders do not modify their actions or thoughts according to the situation, exerting violence as means of action instead.

A year later and in the same line of research, Bueso et al. 2016 compared the neuropsychological functioning of male batterers to other criminals. This time the sample consisted of 28 men sentenced for intimate partner violence (IPV), and 35 criminals sentenced for other crimes to which they were given an extensive neuropsychological battery. In contrast to previous studies, the two groups had no antecedents of brain injury or drug abuse, as the purpose was to study their executive function without premorbid alterations. Results demonstrated that batterers were less impulsive but more inflexible than other criminals. These results provide a preliminary understanding of executive functioning in IPV batterers and help in the development of an intervention program for batterers that is more adequately adjusted to their neuropsychological needs.

In 2016, Romero-Martínez et al. assessed changes in neuropsychological variables and their relationship to alcohol consumption in 116 male IPV perpetrators: 55 with high alcohol (HA) and 61 men with low alcohol consumption (LA). Results showed IPV perpetrators with HA consumption were less cognitively flexible than those with LA consumption before the IPV therapy. On the other hand, the HA group showed smaller improvements in these skills and a higher risk for IPV recidivism than the LA group, demonstrating efficacy in the intervention program.

In 2017, another study evaluated the performance of executive functions in a sample that consisted of 17 male batterers and 17 males that were not batterers. In their results, male batterers showed problems in changing strategies, inhibiting responses, sustained and selective attention, planning, conflict resolution, and decision making. The findings of this study raise the need for neurocognitive profiles to assess the risk of recidivism, which could greatly benefit the forensic-legal field (Salas Picón and Cáceres Durán 2017).

Last to date, Brenner (2017) studied the relationship between flexibility measures and self reports in a sample of 92 male perpetrators of domestic violence. In their results, the men who scored the highest in cognitive flexibility were those who had attended a greater number of therapy sessions. Cognitive flexibility was not related to self-reports of having perpetrated violence in the past year, and no differences were found based on the typology of the batterer (family only violent versus generally violent).

After reviewing all studies to date, we can conclude that there are similar results in some studies but also an important variability among others. Some papers have found that perpetrators of intimate partner violence have problems with verbal processing (Cohen et al., 1999) and that they lack verbal skills or vocabulary (Cohen et al., 2003; Schafer and Fals-Stewart 1997). Other authors suggest that they have issues with impulsivity (Cohen et al., 2003; Schafer and Fals-Stewart 1997), whereas some demonstrate more premeditated behavior (Bueso-Izquierdo et al. 2016), inflexibility (Becerra-García 2015; Bueso-Izquierdo et al. 2016; Easton et al. 2008; Schafer and Fals-Stewart 1997), and problems in executive functioning (Romero-Martínez and Moya-Albiol 2013, Teichner et al. 2001; Walling et al.

2012). In conclusion, it is clear that it is necessary to evaluate neuropsychological functioning in male batterers while considering all the mediating and confounding variables that allow for variation in results. All these advancements from the field of neuropsychology lend themselves to an improved understanding of the batterer's behavior. Furthermore, they may potentially lead to the development of a more adequate intervention program for batterers tailored to their neuropsychological needs (Bueso-Izquierdo et al. 2016).

2.2 Neuroimaging: A chronological and critical review with a vision for future research

Neuroimaging serves as an alternative method to understanding the underlying brain mechanisms behind aggression in male batterers. Complementary to the neuropsychological approach, neuroimaging techniques can shed light on the subtle structural and functional brain differences that modulate violent behavior among male batterers. Various methodologies can been used, such as diffusion tensor imaging (DTI) and structural and functional magnetic resonance imaging (MRI). On one hand, DTI gathers information about axonal fiber tract directions and organization (Kubicki et al. 2007; Le Bihan et al. 2001), providing evidence for alterations in connectivity between brain regions (Mori and Zhang 2006). MRI studies, on the other hand, allow for a deeper understanding of brain morphology and functional connectivity in response to manipulated conditions or stimuli.

Of the few neuroimaging studies conducted on male batterers, functional and structural discrepancies have been found between these men and other populations (Lee, Chan, and Raine 2008; Lee, Chan, and Raine 2009). However, before reviewing the literature, it is important to note important gaps of information among these studies. Due to a lack of brain-imaging studies on male batterers, some research has resorted to applying findings from studies conducted on individuals who have suffered childhood trauma to male batterers (Siegel 2013). Of those that directly examine male batterers, many fail to differentiate between batterers who have experienced childhood trauma, head injuries or who have a history of substance abuse, all variables that have been found to prompt or exacerbate violent behavior and poor impulse control (Corvo 2014; Siegel 2013). Furthermore, in criminal samples, only one study has distinguished between men convicted of IPV and men convicted of other crimes (Bueso-Izquierdo et al. 2016), while other studies combine violent offenders in the same sample (Raine et al. 2001). Lastly, the small sample sizes characteristic of neuroimaging studies precludes the generalizability of findings.

Considering evidence for a specific neuropsychological profile for male batterers (Bueso-Izquierdo et al. 2016), only studies that have directly examined this population will be included in this review. In our chronological revision of the literature regarding neuroimaging studies on male batterers, we begin with an fMRI study conducted by Lee et al. (2008) that examined brain activity in response to visual stimuli of aggression in abusers (n=10) and a control group of males (n=13). As compared to controls, male batterers demonstrated a greater limbic activation and lower activation of frontal areas in the brain. Authors suggest these findings indicate a poor top-down regulation of excessive emotional activation in the limbic system, as the suppression of negative emotion has been associated with inhibitory control between the frontal and the subcortical regions of the limbic system (Bush, Luu, and Posner 2000; Davidson, Putnam, and Larson 2000; Filley 2011).

Similarly, the same authors found differences in brain functioning between male batterers and control participants while viewing four different types of images that were either neutral, of positive affect, related to aggression, or aggression specifically against women (Lee et al. 2009). As compared to controls, batterers had a significantly higher activation in response to threat stimuli in the hippocampus, fusiform gyrus, posterior cingulate gyrus, thalamus and occipital cortex. Furthermore, they had increased activation in the precuneus bilaterally in response to the images of violence against women. The hyperresponse to threatening stimuli found in these fMRI studies points toward an underlying dysfunction in affect-processing in male batterers.

Other studies have employed structural imaging techniques to examine brain alterations in male perpetrators of IPV, but it should be noted that the majority of these groups were recruited through local newspaper ads. Zhang et al. (2013) examined volumetric differences using magnetic resonance imaging (MRI) among perpetrators with alcohol dependence (n=27), non-violent alcohol dependent patients (n=14), and healthy controls (n=13) in the prefrontal cortex and six subcortical structures. Significant volume reduction was found in the perpetrator group with alcohol dependence in the right amygdala. This group also reported an earlier age-onset of alcohol use, a higher comorbidity with DSM-IV cluster B and C personality disorders, and higher levels of neuroticism. Considering the common comorbidity of alcohol abuse and IPV perpetration, the findings of this study offer a deeper understanding of the brain structures implicated in this significant sub-group of violent men (Zhang et al. 2013).

Finally, another fMRI study was conducted to examine differences in brain functioning between male batterers (n=21) and individuals convicted of other crimes (n=20) when viewing images of IPV, general violence, and neutral content (Bueso-Izquierdo et al. 2016). Results revealed that batterers demonstrated a higher activation in the anterior and posterior cingulate cortex and the prefrontal cortex, and a decreased activation in the superior prefrontal cortex when viewing images related to IPV compared to the neutral images. When comparing engagement during general violence to IPV images, batterers demonstrated a higher activation in the insula and parietal cortex. In addition, activation was found only in the batterer group in the medial prefrontal cortex, the posterior cingulate and the left angular cortices when viewing IPV-related images. These results not only reinstate findings by Lee et al. (2009) by demonstrating an involvement of the precuneus region, but also extend to a more specific understanding of brain functioning in male batterers as this study did not find the same activation in other criminals. Differences in activation and connectivity in terms of type of violence further supports the need for research specific to male batterers. Finally, these findings highlight differences in brain regions that may help to explain behavioral patterns among this population, such as poor affect regulation, lower perspective taking abilities, and maladaptive coping (Covell et al 2007; George et al. 2006).

The emerging body of knowledge provided by these pioneering studies on brain functioning in male batterers have paved the way for a more specific understanding of the brain mechanisms involved in IPV perpetration. These findings may help to explain the underlying mechanisms behind batterer typologies suggested by the extensive literature on neuropsychological functioning of male batterers. This research should not be used to exculpate IPV perpetrators for their violent behavior (Gondolf 2007), but should rather help to develop a more comprehensive understanding of violent behavior among this population.

3. Suggestions for future developments

Neuropsychological risk factors for violent behavior among male batterers are substantial, with numerous studies pointing specifically to differential performance in executive functioning (Bueso et al. 2016; Becerra-García 2015; Cohen et al. 1999; Marsh and Martinovich 2006; Romero-Martínez and Moya-Albiol 2013; Teichner et al, 2001; Walling et al. 2012). Executive functions (EF) are a high-level cognitive domain that serves to carry out effective, creative, and socially accepted behavior. EF are also involved in planning, initiation, regulation, and management of behavior (Miyake et al 2000). Research points to evidence that performance on measures of executive function could correctly classify 73.1% of individuals with prior criminal convictions (Trausch 2013). Therefore, investigating neuropsychological functioning in perpetrators of intimate partner violence is necessary to understand the violent behavior of this population. Such knowledge could lead to improved prevention strategies for recidivism.

With regard to future studies on neuropsychological functioning, there should be more focus on male batterers who have specifically been convicted of IPV. Recruiting men from penitentiary centers ensures this specific type of violent behavior, and allows for a better replication under a similar context. Additionally, different profiles of male batterers and types of sentences should be examined. There is extensive literature on batterer typology, most notably the Holtzworth-Munroe et al. 1994, which can guide future research in understanding neuropsychological functioning particular to different sub-groups. As always, these studies should compare functioning to groups of men who have not been involved in IPV, both in prison and outside of the prison setting. Finally, biological measures are beginning to have important implications in research on violent behavior (Pinto et al. 2010). The inclusion of variables such as hormones and neurotransmitters could buttress neuropsychological findings and help to understand the underlying mechanisms behind discrepancies between groups (Romero-Martínez et al. 2013).

With regard to neuroimaging, findings highlight important structural and functional differences, most notably in areas related to top-down regulation and the limbic region (Bueso-Izquierdo et al. 2016; Lee et al. 2008, Lee et al. 2009, Zhang et al. 2013). These findings inform the more expanded literature on executive functioning, indicating the specific brain regions that may be involved in a poor regulation of excessive emotional responses (Filley 2011). Nevertheless, neuroimaging studies among male batterers are scarce and there remain important gaps of information in the literature using this methodology. Future research should consider examining brain functioning specifically among male batterers and longitudinally, to understand brain areas that are involved in recidivism and repeat offenses. Furthermore, additional research is needed with regard to the potential sources for brain alterations such as alcohol use (Foran and O'Leary 2008) and head injury (Farrer, Frost & Hedges 2012; Marsh and Martinovich 2006; Warnken et al. 1994). The sample size used for male perpetrators in previous studies ranges between 10 (Lee et al. 2008, Lee et al. 2009) and 27 (Zhang et al. 2013). Augmenting this sample size in subsequent studies will lead to more generalizable and significant findings.

Thanks to these neuroscientific advances in our understanding of IPV perpetrator behavior, it may be possible in the future to improve treatments for these men by adding neuropsychological components to pre- and post- assessments. In addition, developing neuropsychological instruments or batteries that are supplemented by risk predictors such as B-SAFER (Kropp, Hart and Belfrage, 2005) or SARA (Kropp and Hart 2000) may help improve the prediction of risk of recidivism in male abusers of partner violence.

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ANEXO III

DIFFERENCES IN EXECUTIVE FUNCTION BETWEEN BATTERERS AND OTHER CRIMINALS

Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Daugherty, J. C., Burneo-Garcés, C., & Pérez-García, M. (2016). Differences in Executive Function Between Batterers and Other Criminals. *Journal of Forensic Psychology Practice*, *16*(5), 321-335. http://dx.doi.org/10.1080/15228932.2016.1219216

Journal of Forensic Psychology Practice

ISSN: 1522-8932 (Print) 1522-9092 (Online) Journal homepage: http://www.tandfonline.com/loi/wfpp20

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JOURNAL OF FORENSIC PSYCHOLOGY PRACTICE
2016, VOL. 16, NO. 5, 321–335
http://dx.doi.org/10.1080/15228932.2016.1219216

Routledge
Taylor & Francis Group

Differences in Executive Function Between Batterers and Other Criminals

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ABSTRACT
While the neuropsychological profile of criminals has been studied extensively, there is little neuropsychological research on batterers, and there is no study that compares both groups. The main objective of the present study was to examine executive function- ing of male batterers, in comparison with other criminals, using a comprehensive executive functioning battery. Data were obtained from a sample of 28 men sentenced for intimate partner violence (IPV), and 35 criminals sentenced for other crimes. Results showed that batterers were more inflexible, but less impulsive than other criminals. These results provide a preliminary understanding of executive functioning in IPV batterers.

KEYWORDS
Impulsivity; inflexibility; intimate partner violence; neuropsychology

Intimate Partner Violence (IPV) is a complex and global phenomenon that requires an interdisciplinary approach. IPV should be considered from a multidimensional perspective that involves various factors, including biological (head injury, neuropsychological functioning, or neurotransmitters) (Corvo & Dutton, 2015; Pinto et al., 2010), psychopathological (sadistic, antisocial, borderline personality; Hart, Dutton, & Newlove, 1993), social learning and family system (childhood corporal punishment experiences and witnessing interparental physical violence; Wareham, Boots, & Chavez, 2009), and patri- archal factors (participation of women in social, economic, and political systems; Cunningham et al., 1998). Of these, biological factors are studied the least (Farrer, 2011) and studies about neuropsychological functioning of batterers are scarce (Corvo, 2014; Corvo & Johnson, 2013; Pinto et al., 2010).

In contrast, there is a growing body of evidence about the relationship between neuropsychological and frontal lobe dysfunction and violent or crim- inal behavior (Brower & Price, 2001; Hawkins & Trobst, 2000; Moya-Albiol, 2004). Neuropsychological studies about violence support the role of

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underlying neuropsychological factors in violent behavior, especially in mea- sures of executive function and general intellectual abilities (Fishbein, 2000; Paschall & Fishbein, 2002; Seguin, Sylvers, & Lilienfeld, 2006; Stanford, Houston, & Baldridge, 2008; Verlinden et al., 2014; Villemarette et al., 2003). Literature provides evidence that performance on measures of executive func- tion could correctly classify them as 73.1% of individuals with prior criminal convictions (Trausch, 2013). For example, Bergvall, Wessely, Forsman, and Hansen (2001) found that violent offenders are deficient in attentional set- shifting, and that their ability to alter behavior in response to fluctuations in the emotional significance of stimuli is altered.

While there are many studies examining the role of neuropsychology in the execution of violent acts, few studies examine neuropsychological factors in IPV (Corvo, Halpern, & Ferraro, 2006; Easton, Sacco, Neavins, Wupperman, & George, 2008; Marsch & Martinovich, 2006; Walling, Meehan, Marshall, & Holtzworth- Munroe, 2012). Research shows that men who were violent with their partners had a worse performance than the control group on measures of attention, memory, executive function, verbal intelligence, and verbal skills (Cohen, Rosenbaum, Kane, Warnken, & Benjamin, 1999; Holtzworth-Munroe & Taft, 2012; Teichner, Golden, Van Hasselt, & Peterson, 2001; Walling et al., 2012). Furthermore, certain compo- nents of executive function, such as impulsivity or inflexibility (Cohen et al., 2003; Easton et al., 2008; Marsch & Martinovich, 2006) have been associated with violent behavior in batterers. Also, recent studies revealed that batterers could be less proficient in inhibiting distracting emotional stimuli (Chan, Raine, & Lee, 2010). These preliminary findings suggest the potential role of neuropsychological vari- ables in helping to understand the behaviors of these batterers. However, some of these neuropsychological findings may be due to confounding variables such as brain damage or a history of drug abuse in the sample of male batterers (Bueso-Izquierdo, Hart, Hidalgo-Ruzzante, Kropp, & Pérez-García, 2015). And, to our knowledge, no studies have compared the neuropsychological characteristics of batterers to that of other criminals, and very few studies have compared these populations considering other variables or the exclusion criteria as those men-tioned above.

Moffitt et al. (2000) have shown that partner abuse and general crime represent different constructs that are moderately related considering personality and anti-social behaviors in both groups. In another study, Boyle et al. (2008) found that general violent offenders have more conduct disorder, delinquent behaviors, and lifetime antisocial behaviors, were more psychologically abusive, and showed more disinhibition than partner-only violent participants. Nevertheless, studying whether batterers are similar to other criminals from a neuropsychological point of view could contribute to knowledge on whether IPV and general crime are the same type of violence. Such knowledge would have implications for a better understanding of IPV behavior and for the development of new treatment perspectives (Simpler & Parmenter, 2011).

Thus, the main goal of the present study is to assess neuropsychological functioning, focusing on executive function measures in male batterers in comparison with other criminals. In accordance with the scarce literature, we hypothesize that batterers will show different executive functioning than the other criminal groups.

Method

Participants

All participants were recruited from two facilities of the prison in Granada, Spain: Main Prison and its associated Social Integration Center (CIS). The sample included 28 men from 21 to 56 years old (*M* = 36.39, *SD* = 9.735) who were sentenced for an intimate partner violence crime (IPVG), and an "other criminals" group (CG) of 35 men from 23 to 50 years old (*M* = 36.69, *SD* = 8.369) who were sentenced for a crime other than IPV (see Table 1).

The following inclusion criteria were used for the group of batterers: individuals 18 years old or older that had been convicted of a crime of physical, psychological, or sexual aggression against a partner or ex-partner (Spain Law 1/2004, Comprehensive Protection Law against Gender Violence, order 1/2004). This Spanish law aims to act on violence against women caused by men who have been a spouse or have been linked to a woman by a similar emotional relationship. According to this law, IPV includes any act of physical and psychological harm, including sexual assault, coercion, threats, or arbitrary deprivation of liberty. In addition, a batterer could be convicted for psychological, physical, or sexual abuse against his partner.

For the criminal group, additional exclusion criteria eliminated individuals who were sentenced for intimate partner violence since there was no clear manner to determine whether such violence had indeed occurred. Hence, an additional exclusion criterion was used that excluded participants who were not sentenced but who had been involved with IPV. To address this issue, the

Table 1. Demographic and crime characteristics of Intimate Partner Violence Groups (IPVG) and Criminal Groups (CG).

Variables	IPVG M SD	CG M SD	t /X^2	P
Age	36.29 (9.73)	36.69 (8.36)	−1.28	.898
Education level	2.39 (1.85)	3.14 (1.85)	−1.39	1.69
IQ	95.25 (9.84)	97.54 (13.95)	−7.63	.44
CTS2 (< 11)	2.15 (3.66)	.43 (1.33)	2.57	.013
Time of crime [%(n)]				
Misdemeanor	IPV-PV = 42.8 % (12)	SCF/DD = 39.8% (14)		
Felony	IPV-PPV = 53.5% (15)	GAR/VF = 54.1% (20)		
Murder	IPV-Murder = 3.5 % (1)	Murder = 5.71 % (1)		

Note. SD = standard deviation; Education Level: (1–2: Primary Studies; 2–3: School Graduate; 3–4: Higher Education); IPV-Psychological Violence = PV; Scams or Crime of Forgery = SCF; DD = Dangerous Driving; IPV-PPV = IPV–Physical and Psychological Violence; GAR = Grave Assault/Robbery; VF = Violent Fight.

Conflict Tactile Scale (CTS 2; Straus, Hamby, Boney-McCoy, & Sugarman, 1996) was administered to the CG. Individuals with a CTS 2 score equal to or greater than 11 on the severity scale were excluded from the study according to Cohen et al. (2003) criteria. After applying all of these criteria, four participants were excluded. All participants in the criminal group had a score of 5 or less on the CTS 2, for which they were included in the subsequent data gathering. A score of 5 is considered a very low mark for violence against women.

Criminal group participants had committed various crimes (see Table 1). While it is not possible to match severity of crime, the severity of crime was similar for both groups. For example, the number of batterers convicted for physical aggression was similar to the number of criminals convicted for personal assault. Moreover, there was one participant convicted for murder in each group.

Additional exclusion criteria were history of brain injuries, including but not limited to head injury, seizures, anoxia, prenatal or perinatal complications, and stroke. Due to complications in the way that head injuries are reported in Spain, the common criterion used to determine head injury was a loss of consciousness for more than one hour (Cohen et al., 2003).

The Structured Clinical Interview from the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (SCID/DSM-IV; American Psychiatric Association, 1994) was administered to determine if the participants fulfilled the diagnostic criteria for abuse of or dependence on any substance, including alcohol. The participants who met any drug abuse or dependence criteria were excluded from the study.

Finally, illiterate participants were excluded using a socioeconomic and violence interview (Echeburúa, Montalvo, & De Corral, 2008). In summary, the three major exclusionary criteria were (a) brain injury, (b) drug abuse or dependence, and (c) illiteracy.

Instruments

Demographic and violence variables

The structured interview (Echeburúa et al., 2008) was used to determine the level of partner violence. This questionnaire measures the sociodemographic variables and education level of the aggressor and victim, relationship status of the couple (couple not living together, cohabitation, in the process of separating, separated, etc.), types of violence, profile of the aggressor (infor- mation about the formal complaint and perpetrator´s feelings in that moment), and vulnerability factors for the victim (substance use, economic dependence, and lack of social support).

The CTS 2 Spanish version (Loinaz, Echeburúa, Ortiz-Tallo, & Amor, 2012) of the original CTS 2 (Conflict Tactic Scales; Straus et al., 1996) was used to detect the existence of physical, psychological, and sexual violence on behalf of the perpetrator in the last year or over the course of the entire relationship. The CTS 2 measures the frequency and intensity of violence within a relationship.

Variables related to the use of drugs

The diagnostic subscale for substance use disorders (alcohol and drugs) of the Structured Clinical Interview of the DSM-IV (SCID; First, Spitzer, & Gibson, 1999) was used to address substance disorders.

Executive function battery

Four components of executive function were measured using the system outlined by Miyake et al. (2000) and Verdejo-García & Perez-Garcia (2007): updating, monitoring, response inhibition, flexibility, and decision making.

Updating and monitoring

Working memory letter-number sequencing (Wechsler, 1997): participants were asked to listen to a sequence in which letters and numbers were combined, and were then asked to reproduce the sequence by initially placing the numbers in ascending order and the letters in alphabetical order followed by the letters in alphabetical order. The dependent variable from this test was the total number of correct hits.

Abstract reasoning was measured using the Kaufman Brief Intelligence Test´s (K-BIT) Matrix subtest (Kaufman, Cordero, & Calonge, 1997). This test consisted of the subject selecting the correct option when faced with elements that required comprehension of their nature and the logic that governed them.

Response inhibition

A GO/NO-GO Task using a computer-based task of 100 trials was used. In the first 50 trials (pre-switch), the participants were asked to press a key as quickly as possible whenever the GO stimulus was presented (the silhouette of either a bear or dolphin) and to inhibit a response when the NO-GO stimulus was presented. The stimuli to the GO and NO-GO conditions were counterba- lanced across the subjects. In the second 50 trials (post-switch), the participant was asked to switch the response from the GO to the NO-GO stimulus (which became clear in the post-switch GO trial). Therefore, the participant was asked to respond to the NO-GO trial and not to the GO trial. The interstimulus interval (ISI) was established at 1,000 ms, and each stimulus was presented for

500 ms. Auditory feedback (one of two distinctive sounds) was provided after each response to indicate whether that response was right or correct. If the participant did not respond within the 1,000-ms response window, the same two sounds were used as positive and negative feedback for not responding.

The main dependent variable from this test was reaction time. These variables were analyzed across 10 blocks of 10 trials to explore the effects of learning and switching during the task.

The Delis-Kaplan Executive Function System's (D-KEFS) Color-Word Interference Test (CWIT; Delis, Kaplan, & Kramer, 2001) was also used. This test is used as a means of evaluating verbal executive function. It includes a measure for the inhibition of more automatic verbal responses and cognitive flexibility. D-KEFS-CWIT consists of four different sections, each containing 50 items. Section 1 (color naming) presents patches of colors, and the partici- pants had to name the colors as quickly and accurately as possible. Section 2 (reading) presented the words *red, blue,* and *green* printed in black ink, and the participants had to read these words aloud. Section 3 (inhibition) introduced the interference effect, in which the words *red, blue,* and *green* were printed in incongruent colors, and the participants had to name the text color and ignore the word itself. Section 4 (switching) contained similar items to section 3, but the participants had to switch their response between naming the color of the ink and reading the word. This procedure was only performed for a minority of items that were framed by a box. The main dependent variables derived from this test were the composite time measures of inhibition versus color naming (time section 3–time section 1) and switching versus inhibition (time section 4–time section 3), and the number of errors committed in sections 3 (inhibition errors) and 4 (switching errors).

Flexibility

The Delis-Kaplan Executive Function System's (D-KEFS; Delis et al., 2001) Trail Making Test (TMT) consisted of a visual cancellation task and a series of connect-the-circle tasks. The primary executive-function task consisted of number-letter switching (condition 4), which was a method of assessing thinking flexibility in a visual-motor sequencing task. The other four conditions of this test allowed the examiner to quantify and derive normative data for the several key component processes necessary for performing the switching task, including visual scanning, number sequencing, letter sequencing, and motor speed.

Decision making

The Iowa Gambling Task (IGT) (Bechara, Damasio, Tranel, & Damasio, 2005): This computer task contained several aspects of decision making, including uncertainty, risk, and the evaluation of rewarding and punishing events. The IGT involved four decks of cards: decks A′, B′, C′, and D′. Each time a participant selected a card, a specified amount of play money was awarded. Moreover, there were probabilistic punishments (monetary losses of different amounts) inter- spersed among these rewards. Two of the card decks (A′ and B′) produced high immediate gains. In the long run, however, these two decks would lose more money than they had won and were therefore considered to be the disadvanta- geous decks. The remaining two decks (C′ and D′) were considered advantageous because they resulted in small, immediate gains but would yield more money than they would detract in the long run. The main dependent variable from this task was the net score for each block of the task (5 blocks of 20 trials).

We calculated the net scores by subtracting the number of disadvantageous choices (decks A′ and B′) from the number of advantageous choices (decks C′ and D′) for each block. The global IGT net score was calculated by applying an identical formula to the 100 trials of the task.

Evaluation of intelligence

The K-BIT Test (Kaufman et al., 1997): The K-BIT measured cognitive functions using two tests: verbal (vocabulary, which was comprised of two tests) and nonverbal (matrices), which evaluated crystallized and fluid intelligence and obtained a compound IQ.

Procedure

After obtaining prior authorizations from the Institute of Prisons in Spain, participants were recruited for the study at the Albolote Prison Center (Granada) and the Center for Social Integration (Granada). The participants were invited to collaborate in the study on a voluntary and anonymous basis. The study was approved by the Research Ethics Committee of the University of Granada, Spain. All of the participants signed a written informed consent document, which explained the purpose of the investigation, risks and benefits of the participation, and confidentiality associated with the obtained results. Participants had the right to withdraw from the study at any time.

Participants were evaluated in two individual sessions (duration of approximately two hours per session including breaks), as well as another group session (duration of one hour). During the individual sessions, interview, CTS 2, and neuropsychological tests were administered. In the group sessions, personality tests were administered. Interviews and tests were completed by two trained and supervised psychology graduate students (one of whom is a neuropsychologist and professor of neuropsychology at the University of Granada). These research collaborators had experience in test administration and they received similar training to administer the neuropsychology battery used in this study. They followed the same administration protocol. The participants were given 20 euros in compensation for their time used to complete the entire evaluation.

Statistical analyses

Descriptive statistics, including an outlier analysis, were obtained for demographic information; IPV and neuropsychological variables, and also a chi-square test, were performed to assess between-groups differences in the frequency of clinical and demographic categorical measures.

Univariate *t*-tests were used to compare the performance of batterers and nonbatterers on the neuropsychological measures in a between-groups design. For the IGT, a 2 (groups) x 5 (20 trial blocks) ANOVA was conducted using the IGT scores, and post-hoc *t*-tests were used to examine group differences in the five blocks. For the GO/NO-GO task, an additional 2 (groups) x 10 (10 trial blocks) ANOVA was conducted using the GO/NO-GO reaction times.

Finally, Cohen's delta was obtained for all the group comparisons. An alpha level below .05 was established for statistical significance in all comparisons.

Results

Analysis of sociodemographic variables

The batterer and criminal group were statistically similar in age, education, and IQ. The groups differed on CTS 2 values (t [1, 1, 72] = 2.29; *p* = .029]), which was consistent with the selection criteria (see Table 1).

Differences in executive function components

For the *updating* component, the results showed that no statistical differences were found between batterers and criminals on any of the tests (see Table 2). For the *flexibility* component, batterers were significantly more inflexible than the criminal group on the TMT_4T task (t [1, 92.59] = 2.03, *p* = .045; see Table 2). On the other hand, for the component of *response inhibition* assessed by the Stroop Test, results showed that no statistical differences were found between batterers and criminals. Nevertheless, for the *response inhibition component* measured by the GO/NO-GO task, the block main effect (*F* [9,495] = 11.51; *p* = .000) and the interaction of the variable group x blocks were significant (*F* [9,495] = 3.12; *p* = .001). The interaction analysis for the IPVG showed statistically significant differences among block 5, 6, and 7 (*F* [2, 56] = 3.35; *p* = .042) but no differences were obtained in the pair comparison between any block using the Bonferroni post-hoc analysis.

Table 2. Performances of IPVG and CG on Executive Function.

Executive Function	Measures	IPVG N = 28 M SD	CG N = 35 M SD	t/F	p	d
Updating and monitoring	Lns	(9.31 ± 2.46)	(10.03 ± 2.60)	−1.09	2.79	0.28
	KBIT_MT	(32.00 ± .73)	(33.29 ± 5.78)	–.61	5.41	0.24
Stroop	Stroop1 T_Naming	(27.86 ± 4.99)	(30.23 ± 6.50)	1.59	.117	0.40
	Stroop2 T_Reading	(21.00 ± 3.52)	(21.34 ± 4.29)	3.40	.735	0.08
	Stroop3 T_Inhibition	(52.00 ± 10.17)	(51.94 ± 11.53)	.021	.984	0.004
	Stroop4 T_Switching	(60.89 ± 13.78)	(63.03 ± 17.60)	5.25	.601	0.13
Flexibility	TMT1_VS.T	(20.61 ± 5.32)	(19.03 ± 4.79)	1.23	.221	0.31
	TMT2_NS.T	(43.68 ± 15.45)	(34.86 ± 11.83)	2.56	.013*	0.65
	TMT3_LS.T	(52.08 ± 16.79)	(48.43 ± 20.02)	.77	.443	0.19
	TMT4_NLS.T	(99.04 ± 29.43)	(82.94 ± 31.45)	2.03	.047*	0.52
	TMT5_MS.T	(69.75 ± 22.91)	(65.90 ± 28.80)	.49	.624	0.12
Inhibition	GO-NO-GO TR5	(461.35 ± 73.38)	(434.01 ± 73.38)	Blocks = 11.51	.000	0.40
	GO-NO-GO TR6	(494.54 ± 90.59)	(485.79 ± 100.9)	Interaction = 3.12	.001	0.09
	GO-NO-GO TR7	(453.29 ± 83.37)	(434.74 ± 67.27)	Blocks = 6.18	.000	0.24
Decision making	IGT_1	–	–			
	IGT_2	–	–			
	IGT_3	(−1.40 ± 8.30)	(1.26 ± 5.90)	Interaction = 2.42	.049	0.37
	IGT_4	(2.73 ± 8.39)	(.97 ± 8.03)			0.21
	IGT_5	(2.73 ± 8.78)	(0 ± 9.34)			0.30

Note. Lns: Letters and numbers; KBIT_MT: KBIT_ Matrix Subtest; Stroop1 T: Naming; Stroop2 T: Reading; Stroop 3 T: Inhibition; Stroop4 T: Switching; TMT1_VS.T = Trail Making Test Visual Scanning Time; TMT2_NS.T = Trail Making Test Number Sequencing Time; TMT3_LS.T = Trail Making Test Letter Sequencing Time; TMT4_NLS.T: Trail Making Test Number Letter Sequencing Time; TMT5_MS.T = Trail Making Test Motor Speed Time; GO–NO-GO TR = GO–NO-GO Reaction Time; IGT_1 = Iowa Gambling Task Block 1, IGT_2 = Iowa Gambling Task Block 2, IGT_3 = Iowa Gambling Task Block 3, IGT_4 = Iowa Gambling Task Block 4, IGT_5 = Iowa Gambling Task Block 5.

For the CG, the analysis showed statistically significant differences among blocks 5, 6, and 7 (F [2, 68] = 6.62; p = .002) and the post-hoc Bonferroni analysis showed differences between blocks 5 and 6 (p = .021) and blocks 6 and 7 (p = .027).

Finally, for the *decision-making* component measured by the Iowa Gambling task, the main effect of block (F[4,252] = 6.18; p = .000) and the interaction of the variable group x blocks were significant (F[4,252] = 2.42; p = .049). Nevertheless results showed that no statistical differences were found between batterers and criminals on the IGT. The interaction analysis for the IPVG showed statistically significant differences among blocks 1, 2, 3, 4, and 5 (F[4,116] = 5.43; p = .000) and differences were obtained in the pair comparison between blocks 2 versus 4 (p = .001), 2 versus 5 (p = .017), 3 versus 4 (p = .040), and 4 versus 2 (p = .001) using Bonferroni post-hoc analysis (see Table 2). On the other hand, for the CG (see Figure 1), the analysis showed statistically significant differences among all the blocks (F[4,136] = 2.71; p = .033) and the post-hoc Bonferroni analysis only showed differences between blocks 1 and 3 (p = .006; see Table 2).With respect to effect sizes, the Cohen deltas varied between small effect sizes for the updating component and the Stroop Test, and moderate effect sizes for flexibility (according to the criteria proposed by Cohen, 1988; see Table 2).

Discussion

The main goal of this research was to compare the neuropsychological functioning of batterers to that of other criminals on executive function tests. Results in our study have shown that batterers were significantly less

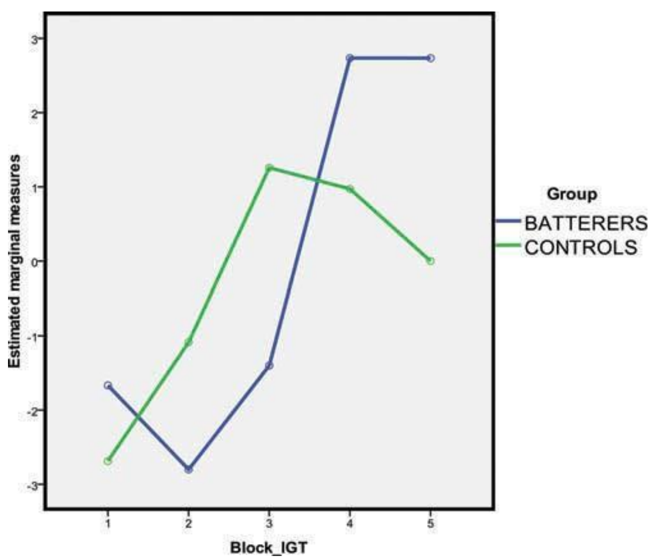

Figure 1. Performances on the Iowa Gambling Task (Block by Group Interaction).

impulsive and more inflexible than other criminals. Moreover, batterers demonstrated better decision making on the learning curve. On the other hand, no differences were found in working memory.

Our results have shown that batterers are more *inflexible* than other criminals. These findings are similar to prior studies that have found that batterers are more inflexible than the noncriminal control group (Teichner et al., 2001). This was also the case even when using similar tasks (TMT) or a different test (WCST; Cohen et al., 2003; Easton et al., 2008).

In contrast, our results about *impulsivity and decision making* differ from previous literature. Prior studies have shown that batterers exhibited a poorer performance on measures of impulsivity (Cohen et al., 2003) and a better decision-making capacity (Easton et al., 2008) than criminals. The discrepancies between our results and previous literature may be explained by several factors. First, the use of different criminal groups (healthy vs. other criminals) may influence results. It might be the case that batterers are more impulsive and they make better decisions than healthy participants, but that they are better in these components only when compared to other criminals. Discrepancies may also be explained by a lack of control for a history of substance use and brain damage in batterers in previously published research. Earlier studies have shown that drug-dependent or TBI (traumatic brain injury) individuals exhibit alterations in impulsivity (Cohen et al., 1999; Easton et al., 2008) and decision making (Schafer & Fals-Stewart, 1997). In addition, IPV has been associated with a history of substance use (Foran & O´Leary, 2008; Schafer & Fals-Stewart, 1997) and brain injury (Farrer, Frost, & Hedges, 2012). Thus, the impulsivity shown in batterers in other studies may be due to the coexistence of a history of brain injury or substance abuse in batterers. Nevertheless, it is important to note several limiting factors in the present study. Due to the fact that the definition for brain injury is not universal, it may be controversial to use the one-hour-or- less exclusion criteria. Nevertheless, this is the most commonly used measure in the Spanish health system. Even so, it is possible that some individuals with mild traumatic brain injury have inadvertently been included in the present sample. Moreover, due to the restrictive exclusion criteria, the number and representativeness of the batterers in this sample may be reduced. However, this is the first step in studying batterers' differences in IPV, and strict exclusion criteria were needed in order to achieve the aim of this study. Addressing the previously listed limitations will increase the likelihood of more clearly pinpointing the major characteristics of batterers in terms of neuropsychological and not psychosocial factors.

Two important strengths should be mentioned in this study. First, differences in the observed inflexibility cannot be attributed to a general cognitive deficit since batterers showed a normal IQ that was similar to that of the other criminal group. Second, many studies have compared batterers in prison with normal participants recruited from the community who were not in prison. The circumstances associated with imprisonment or prolonged life in prison can have an influence on performance on psychological tests at the cognitive level (Ruiz, 2007). Thus, previous psychological differences obtained from comparing batterers in prison with control groups outside of prison could be due to imprisonment or to the batterer condition. In our study, imprisonment was controlled for.

In summary, this study reveals differences in executive functioning between batterers and other criminals who had not committed violent crimes against their partners. IPV batterers were less impulsive, better decision makers, and more inflexible than other criminals. These results improve the understanding of abusers' behavior and provide the opportunity to understand the role of neuropsychology in explaining the behavior of these individuals. In addition, this information could help in developing an intervention program for batterers that is more adequately adjusted to their neuropsychological needs.

Acknowledgment

We acknowledge the support of the General Secretary of Penitentiary Institutions, Ministry of the Interior, Spain.

Funding

The research described in this study was financed by the Ministry of Science and Innovation, Spain (Project: PSI 2009-13585), Ministry of Economy and Competitiveness (Project: PSI2013-42792-R), and Regional Ministry of Economy, Innovation, and Science from the Andalusian Government (Project: P2012-SEJ1723).

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ANEXO IV

PROCESAMIENTO EMOCIONAL EN MALTRATADORES DE GÉNERO MEDIANTE TEST DE EXPRESIONES FACIALES DE EKMAN Y LA TAREA DE STROOP EMOCIONAL

Bueso-Izquierdo, N., Hidalgo-Ruzzante, N., Burneo-Garcés, C., & Pérez-García, M. (2015). Procesamiento emocional en maltratadores de género mediante el Test de Expresiones Faciales de Ekman y la Tarea Stroop Emocional. *Revista Latinoamericana de Psicología*, *47*(2), 102-110. https://doi.org/10.1016/j.rlp.2015.02.001

Rev Latinoam Psicol. 2015;47(2):102-110

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ORIGINAL

Procesamiento emocional en maltratadores de género mediante el Test de Expresiones Faciales de Ekman y la Tarea *Stroop* Emocional

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Recibido el 25 de febrero de 2015; aceptado el 27 de febrero de 2015

PALABRAS CLAVE
Violencia contra la pareja;
Emoción;
Maltratadores;
Atención

Resumen
La investigación actual en el campo de la violencia de pareja es escasa en lo que se refiere al papel del procesamiento emocional de los maltratadores. Sin embargo, ningún estudio ha investigado en la misma muestra la capacidad de reconocer las emociones y la influencia de las emociones en los aspectos atencionales. El objetivo de este estudio es investigar en una muestra de maltratadores la capacidad de reconocer las emociones de fotografías estandarizadas y analizar la interferencia de las palabras con contenido emocional en una tarea atencional. La muestra consistió en 90 hombres condenados por violencia de pareja y 77 hombres condenados por otros delitos. Se evaluaron las características sociodemográficas asociadas a nuestra muestra y el procesamiento emocional de las expresiones faciales con la prueba de Ekman y la Tarea *Stroop* Emocional, diseñada específicamente para evaluar el procesamiento emocional en situaciones de violencia contra la pareja. Los resultados mostraron un mejor reconocimiento emocional de los maltratadores en las emociones faciales de enfado y sorpresa. Para el procesamiento de palabras con contenido emocional, las diferencias no fueron estadísticamente significativas.

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KEYWORDS
Intimate partner violence;
Emotion;
Abusers;
Attention

Emotional processing in batterers as assessed by Test Ekman Facial Expressions and Emotional Stroop Task in intimate partner violence situations

Abstract
Current research in the field of intimate partner violence has been scarce as regards the role of emotional processing in abusers. Nevertheless, no study has investigated the ability to recognize emotions and the influence of emotions on attention-related aspects among the same sample. The aim of this study is to investigate the ability to recognize emotions in standardized photographs, and to analyze the interference that words with emotional content exert on an attention task in a sample of abusers. The sample consisted of 90 men convicted of intimate partner violence and 77 men convicted of other crimes. Demographic characteristics associated to the sample were evaluated, as were emotional processing of facial expressions with the Ekman Test and the Emotional Stroop task, specifically designed to assess emotional processing in situations of intimate partner violence. The results showed better emotional recognition among abusers in the recognition of facial emotions of anger and surprise. As for the processing of words with emotional content, differences were not statistically significant.

La violencia de género es un grave problema social y de salud pública que sufren mujeres de todo el mundo (Ramos Lira, Saltijeral & Caballero, 2013; World Health Organization, 2013). El intento de comprender la etiología de dicha violencia nos sitúa obligatoriamente ante la necesidad de realizar un análisis multicausal. Entre las distintas perspectivas que en la actualidad intentan explicar este complejo fenómeno (feminista, transgeneracional y psicosocial), los autores Corvo y Johnson (2013) resaltan que el estudio de las variables psicológicas y neuropsicológicas podría simplificar el trabajo conceptual y ampliar el poder estadístico.

En consonancia con ello, se ha comenzado a investigar las variables psicológicas propias del maltratador (para una amplia revisión en castellano, véase, por ejemplo, Calvete, 2012; Echeburúa & Amor, 2010; Sarto & Esteban, 2010; para una revisión en literatura anglosajona, por ejemplo, Farrell, 2011) incluyendo sus características de personalidad y psicopatológicas (Amor, Echeburúa & Loinaz, 2009; Holtzworth-Munroe & Stuart, 1994; Fernández-Montalvo & Echeburúa, 2005; Loinaz, Echeburúa & Torrubia, 2010; Loinaz, Ortiz-Tallo, Sánchez & Ferragut, 2011), la influencia de variables como el consumo de sustancias (Thomas, Bennett & Stoops, 2012), su funcionamiento neuropsicológico (Bueso-Izquierdo et al., 2012; Corvo & Johnson, 2013; Pinto et al., 2010; Romero-Martínez & Moya-Albiol, 2013; Walling et al., 2012) o su tipología (Capaldi & Kim, 2007; Cunha & Gonçalvez, 2013; Fernández-Montalbo & Echeburúa, 1997; Holtzworth-Munroe & Meehan, 2004). Sin embargo, apenas se han realizado trabajos sobre el procesamiento emocional de los maltratadores, definido en general como la capacidad para percibir estados emocionales en los demás y sentir estados emocionales propios (Carmona-Perera & Pérez-García, 2012).

Existen numerosas aproximaciones teóricas al estudio de la emoción, aunque recientemente se ha producido un intento integrador de los modelos tradicionales dimensionales (como el modelo de P. Lang) y categóricos (como el modelo de Ekman) (Izard, 2009). Sin embargo, desde un punto de vista neuropsicológico, la evaluación del estado emocional se centra en la evaluación de la capacidad para detectar estados emocionales en los demás y la capacidad de sentir estados emocionales propios (Carmona-Perera & Pérez-García, 2012).

En este sentido, la prueba más utilizada para evaluar la habilidad para detectar la capacidad emocional en los demás es el test de reconocimiento de emociones de Ekman (Young, Perrett, Calder, Sprengelmeyer & Etcoff, 2002). Por otro lado, la evaluación de la capacidad de sentir emociones se ha realizado a través de registros psicofisiológicos (Lang, 1985), tareas de interferencia emocional (Baños, Quero & Botella, 2005) o pruebas basadas en imágenes con contenido emocional (Aguilar de Arcos et al., 2008).

Aunque existe una amplia literatura sobre los problemas de control emocional de los maltratadores y cómo intervenir en ellos (Arce & Fariña, 2006), el número de trabajos que han evaluado el procesamiento emocional, tanto experiencia como reconocimiento de emociones, en maltratadores es muy escaso. En el caso concreto de la violencia contra la pareja, se ha encontrado que el reconocimiento de emociones faciales depende del tipo de maltratador, y oscila entre un déficit en la identificación de emociones y una mayor exactitud en dicho reconocimiento, especialmente en expresiones faciales de asco, de miedo o neutras (Babcock, Green & Webb, 2008). Otras investigaciones proponen un reconocimiento diferente de las emociones en las caras de sus esposas —frente a la cara de otras mujeres u hombres no familiares—, mediados estos sesgos por la existencia de psicopatía (Marshall & Holtzworth-Munroe, 2010).

En el caso de estudios sobre la capacidad de los maltratadores de sentir emociones, se ha realizado también un reducido número de trabajos utilizando registros psicofisiológicos (Gottman, Jacobson, Rushe & Shortt, 1995; Jacobson et al., 1994) o la tarea *Stroop* Emocional (Chan, Raine & Lee, 2010).

Usando registros psicofisiológicos, se ha encontrado que algunos maltratadores presentan una hiperreactividad cardiaca y de conductancia y otros, hiporreactividad cuando procesan imágenes de violencia de género (Gottman et al., 1995) y que la reactividad psicofisiológica predice la gravedad de la violencia (Babcock, Green, Webb & Yerington, 2005). Por otro lado, usando la tarea de *Stroop* Emocional, Chan et al. (2010) encontraron que los maltratadores tienen un tiempo de reacción ante la tarea de nombrar el color en palabras con contenido afectivo agresivo mayor que frente a las neutras (Chan et al., 2010).

Actualmente, no existen estudios que hayan investigado en la misma muestra la capacidad de reconocer emociones y la capacidad de sentirlas. Además, los escasos estudios realizados siempre han comparado el funcionamiento emocional de los maltratadores con sujetos controles no violentos, pero nunca se ha estudiado en comparación con otros violentos que no hayan cometido delitos de violencia de género.

Esto podría ser de gran interés, ya que permitiría obtener una mejor caracterización del procesamiento emocional de los maltratadores, ya que se ha descrito que las personas violentas en general presentan problemas de procesamiento emocional (Chan et al., 2010). Por otro lado, la investigación del procesamiento emocional de los maltratadores debe profundizarse comparando su respuesta ante estímulos relacionados con la violencia de género, ante otros estímulos emocionales negativos u otros estímulos emocionales relacionados con las relaciones de pareja. La utilización del *Stroop* Emocional permite estudiar estos aspectos, ya que es posible añadir estímulos de distinta naturaleza en la tarea.

Por ello, el objetivo de este estudio preliminar es investigar, por un lado, la capacidad para reconocer emociones a partir de las fotografías estandarizadas (Young et al., 2002) y, por otro, la interferencia emocional de palabras con contenido emocional positivo, contenido negativo, relacionado con las relaciones de pareja (funcionales), y ante palabras relacionadas con la violencia de género, que ejercen en una tarea *Stroop* Emocional en comparación con otras personas violentas que no han cometido delitos de violencia de género. La ausencia de un cuerpo consistente de resultados previos en este campo no permite hipotetizar la dirección de las posibles diferencias con otro grupo de personas violentas en general.

Método

Participantes

En este estudio participaron 167 sujetos, divididos en dos grupos: uno de hombres condenados por delitos de violencia contra la pareja (*n* = 90) y otro de hombres condenados por otro tipo de delitos (*n* = 77). Se reclutó a los sujetos en el Centro Penitenciario de Albolote (Granada, España) y el Centro de Inserción Social Matilde Cantos Fernández (Granada, España), previa autorización formal de Instituciones Penitenciarias.

Ambos grupos estaban igualados por edad y nivel educativo (tabla 1). Tampoco hubo diferencias entre los dos grupos (maltratadores y no maltratadores) en consumo de drogas (tabla 1). En consecuencia, no fue necesario el control de dichas variables en la comparación del procesamiento emocional de ambos grupos.

Con respecto al consumo de sustancias, dado que en el caso de la violencia contra la pareja el abuso/dependencia

Tabla 1 Estadísticos descriptivos y análisis en hombres maltratadores y no maltratadores sobre las variables sociodemográficas y de consumo de drogas

Variables	Maltratadores (*n* = 90)	No maltratadores (*n* = 77)	*p* (*t* o x^2)
Edad (años)	36.70 (7.815)	37.12 (7.786)	.726
Nivel educativo	1.39 (.624)	1.38 (.555)	.470
Estado civil, %			.711
Solteros	33	40	
Con pareja/casados	12.8	36.7	
Separados/divorciados	53.3	23.4	
CTS-2: gravedad < 11	2.58 (4.149)	.41 (1.110)	< .001
Tipos de drogas (abuso/ dependencia), %			
Cannabis/marihuana	21.7	18.4	.457 / .323
Alcohol	40.2	26.4	.309
Heroína	16.3	13.2	.550
Cocaína	19.8	22.4	.871
Tranquilizantes (BZD)	1.1	1.3	.569
Estimulantes (MDMA)	3.3	0	.158

CTS: *Conflict Tactic Scale*.
Salvo otra indicación, los valores expresan media (desviación típica).

de drogas puede aumentar la gravedad de los actos violentos cometidos, también se controló dicha variable, y ambos grupos estaban igualados. Los principales datos sociodemográficos y de consumo de sustancias de los participantes se muestran en la tabla 1.

Los criterios de inclusión fueron ser mayor de 18 años y cumplir condena en uno de los dos centros penitenciaros anteriormente citados. Para el grupo de maltratadores, también fue un criterio de inclusión haber sido condenado por algún delito de agresión física, psicológica y/o sexual contra su pareja o expareja.

Los criterios de exclusión propuestos fueron ser analfabetos o tener dificultades para completar las pruebas escritas y antecedentes de psicopatología grave y/o de daño cerebral (pérdida de conciencia de más de 1 h) (Cohen et al., 2003). Para los no maltratadores, también fue un criterio de exclusión tener alguna condena por violencia de género u obtener una puntuación ≥ 11 en la escala de gravedad de violencia de la *Conflict Tactic Scale-2* (CTS-2) (Cohen et al., 2003). Esta escala normalmente se utiliza en los estudios como cribado de violencia.

La participación en el estudio fue completamente voluntaria. Los participantes fueron informados sobre los objetivos del estudio y se los recompensó con 20 euros por el tiempo que duró la evaluación completa. Este estudio fue aprobado por el Comité de Ética e Investigación Humana de la Universidad de Granada, España.

Instrumentos

Variables demográficas y relacionadas con la violencia

Valoración de riesgo de violencia: entrevista de valoración de riesgo de violencia grave en la relación de pareja (Echeburúa, Fernández-Montalvo, de Corral & López-Goñi, 2008). Esta entrevista contiene 58 preguntas, mayoritariamente en formato sí/no, por ejemplo: "¿El agresor tiene un historial de conductas violentas con otras personas (amigos/compañeros de trabajo, etc.)?". Recoge variables sociodemográficas del agresor y de la víctima, así como la situación de la relación de la pareja (pareja sin convivencia, convivencia en pareja, trámites de separación, separación, entre otros), el perfil del agresor (datos sociodemográficos, datos de la denuncia, pensamientos y sentimientos sobre su condena) y la vulnerabilidad de la víctima (apoyo familiar, autonomía económica, o consumo de drogas). El coeficiente alfa obtenido de la muestra total de participantes (agresores graves y no graves) fue .71. En cuanto a su validez, la escala diferencia adecuadamente entre agresores graves (.69) y no graves (.66) (Echeburúa et al., 2008). En este estudio, se usaron para recoger información acerca del agresor: historial, características, pensamientos y conductas que realizó durante su relación de pareja.

Presencia de violencia en la pareja, frecuencia e intensidad

La *Revised Conflict Tactic Scale* (CTS2) (Straus et al., 1996) se utiliza para detectar si ha habido violencia física y/o psicológica en la pareja en el último año o a lo largo de toda la relación. Mide frecuencia e intensidad de la violencia en la relación de pareja. Para el estudio, se usó la versión que contiene la escala adaptada al español (para que el lector pueda acceder directamente a la fuente original: Loinaz, Echeburúa, Ortiz-Tallo & Amor, 2012). En cuanto a su fiabilidad, en los 39 ítems del agresor obtuvo $\alpha = .88$ (Loinaz et al., 2012).

Variables relacionadas con el consumo de drogas

Abuso/dependencia de drogas: entrevista clínica estructurada del DSM-IV SCID "I" (First, Spitzer, Williams & Smith-Benjamin, 1998), entrevista compuesta por tantos módulos diagnósticos como categorías diagnósticas tiene el DSM-IV. Se usó la subescala diagnóstica para el trastorno por abuso/dependencia de sustancias psicoactivas (alcohol y drogas). Permite los diagnósticos de trastorno primario o inducido por sustancias de manera clara y precisa (Becoña, Nogueiras, Flórez, Álvarez & Vázquez, 2010).

Procesamiento emocional

El test de percepción emocional (test de expresiones faciales de Ekman) (Ekman & Friesen, 1975) es una prueba informatizada en la que se presentan caras de personas que muestran expresiones faciales correspondientes a seis emociones básicas: ira, asco, miedo, felicidad, tristeza y sorpresa (para los valores de fiabilidad y validez, véase Young et al., 2002). Se requiere que el participante identifique la emoción que expresa cada una de las caras. La principal variable dependiente es el número de aciertos en cada categoría emocional.

Tarea de *Stroop* Emocional computarizada sobre violencia contra la pareja

Basada en diferentes aplicaciones de estos trabajos (Baños et al., 2005; Eckhardt & Cohen, 1997), fue creada específicamente por el equipo de investigación para la evaluación en situaciones de violencia de género. La tarea consiste en que el sujeto debe pulsar el color de la tinta con que aparecen impresas las palabras en la pantalla, ignorando su significado, lo más rápidamente posible. En concreto, esta prueba mide la capacidad de procesar emociones a través de la repuesta del sujeto a palabras con contenido emocional, las cuales aparecen en varios colores. Dichas palabras se organizaron según su pertenencia a determinada categoría emocional: palabras con contenido emocional negativo, contenido emocional positivo, contenido emocional vinculado con las relaciones de pareja funcionales, contenido de maltrato y contenido neutro. Para cada dimensión se puede obtener como variable dependiente el tiempo de reacción, los aciertos, los errores de omisión (no contestar cuando debía hacerlo) y los errores de comisión (contestar con el color incorrecto).

Para el listado y la clasificación de las palabras utilizadas, se extrajo un conjunto amplio de palabras relacionadas con la violencia que se clasificaron mediante juicios de expertos.

De este modo, se seleccionaron 33 palabras en la categoría maltrato, que un mínimo del 75% de los expertos había puntuado con 8, 9 o 10, y 214 palabras en la categoría relaciones de pareja, que un mínimo del 80% de los expertos había puntuado con 8, 9 o 10. Las palabras correspondientes al bloque de palabras positivas, negativas y neutras se seleccionaron de la literatura en castellano (Baños et al., 2005, Calleja & Hernández-Pozo, 2009; Martínez & Belloch, 2004). Cada palabra perteneciente a cada uno de los cinco bloques fue igualada en díadas a partir de la longitud (entre

Tabla 2 Categorías de palabras utilizadas en la tarea *Stroop* Emocional computarizada sobre violencia contra la pareja

Bloque 1 Maltrato	Bloque 2 Relaciones de pareja	Bloque 3 Positivas	Bloque 4 Negativas	Bloque 5 Neutras
Agresión	Amor	Sincero	Tumor	Libreta
Bofetada	Apoyo	Honesto	Cáncer	Cartera
Golpes	Besos	Alegría	Operar	Compás
Zorra	Compartir	Amable	Enfermedad	Carpeta
Humillada	Cariño	Animada	Infectar	Goma
Indefensa	Confianza	Ánimo	Infarto	Agenda
Insulto	Convivir	Calma	Flemón	Papel
Intimidar	Diálogo	Relajada	Amputar	Papelera
Maltrato	Equilibrio	Contenta	Vicio	Borrador
Puta	Ilusión	Agradable	Vértigo	Sacapuntas
Moretón	Proyectos	Segura	Contamina	Bolígrafo
Perseguida	Respeto	Afortunada	Adicción	Tintero

4 y 10 letras), para formar el listado definitivo con 12 palabras por bloque (tabla 2).

Se utilizó un ordenador con una pantalla de 15 pulgadas para la presentación de las palabras (15 mm de tamaño en tipo Lucida Console), las cuales aparecen en los bloques referidos a una misma categoría emocional. La sucesión de los bloques se presenta aleatorizada. Los participantes tenían cuatro ensayos de práctica antes de comenzar la tarea.

Este formato computarizado consistió en un total de 240 ensayos distribuidos a lo largo de cinco bloques experimentales. Cada una de las 12 palabras de cada bloque aparecía aleatorizadamente cuatro veces en los diferentes colores: azul, rojo, verde y amarillo, sobre fondo negro. Por lo tanto, cada bloque estaba dividido en 48 presentaciones (12 palabras × 4 colores). En cada presentación, aparece en primer lugar una X en el centro de la pantalla (con una duración de 400 ms), para quedar luego la pantalla en blanco (100 ms). A continuación, durante 1000 ms se produce la exposición de la palabra. Finalmente se ofrece *feedback* (correcto o incorrecto) al participante (500 ms). El programa informático presentaba las palabras de cada bloque aleatoriamente, de modo que la misma palabra o el mismo color no podían aparecer de forma consecutiva, contrabalanceando las cinco condiciones. El programa informático introducía un periodo de descanso tras cada bloque.

Procedimiento

Una vez Instituciones Penitenciarias aprobó el inicio del estudio, se invitó a participar a los penados del Centro Penitenciario de Albolote (Granada) y el Centro de Inserción Social Matilde Cantos Fernández (Granada) que cumplían con los criterios de inclusión.

Los participantes fueron evaluados entre junio de 2011 y junio de 2013. Este estudio formó parte de un proyecto más amplio en el que se evaluó a los sujetos en tres sesiones, dos de ellas individuales, con una duración aproximada de 2 h por sesión (incluidos los descansos), y otra grupal de 1 h, en la que procedían a rellenar los cuestionarios de autoinforme.

Los sujetos internos en la prisión fueron evaluados en salas habilitadas para su tratamiento o evaluación en las dependencias del Centro Penitenciario de Albolote (Granada). Los sujetos del Centro de Inserción Social fueron evaluados en salas habilitadas también para evaluación o tratamiento en las dependencias abiertas de dicho centro. Ambos espacios tenían las mismas características ambientales y eran sitios tranquilos y silenciosos.

Antes de aplicarse cualquier instrumento de medida, todos los participantes fecharon y firmaron por duplicado un consentimiento informado, que también firmaron los investigadores. Los investigadores explicaron verbalmente al sujeto la voluntariedad en cuanto a la participación y la retirada del estudio cuando lo considerasen necesario, así como los objetivos y el procedimiento a seguir en la investigación. A su vez, el consentimiento incluyó información acerca de la confidencialidad de los datos obtenidos durante el proceso de la investigación, de acuerdo con lo establecido en la Ley Orgánica 15/1999, del 13 de diciembre, de Protección de Datos de Carácter Personal y en lo relativo al secreto profesional.

Todos los examinadores eran Licenciados en Psicología, con formación y experiencia en el campo de la Neuropsicología, y fueron entrenados bajo una común instrucción en el manejo de las pruebas de evaluación. Los investigadores siguieron el mismo protocolo de administración y se determinó la elegibilidad de los participantes sobre la base de los criterios de inclusión y exclusión descritos previamente.

Análisis estadísticos

Para comprobar que los grupos estaban igualados en las principales variables sociodemográficas, se realizaron pruebas de la t de Student para la variable cuantitativa edad y de la x^2 para la variable cualitativa nivel educativo. Además, se compararon los porcentajes entre los dos grupos (maltratadores y no maltratadores) en consumo de drogas, a partir de la entrevista clínica estructurada del DSM-IV SCID (First et al., 1999).

Para comprobar si se cumplía el supuesto de normalidad de las variables, se realizó la prueba de Kolmogorov-Smirnov. Dado que el supuesto de normalidad no se cumplía, se optó por realizar análisis no paramétricos mediante la prueba de la *U* de Mann-Whitney para dos muestras independientes para la comparación de las diferencias existentes entre los dos grupos de estudio (maltratadores y no maltratadores) en el procesamiento emocional en las diferentes medidas del test de percepción emocional y de la tarea de *Stroop* Emocional computarizada sobre violencia contra la pareja. El nivel de significación se estableció en $p = .05$.

Resultados

Los resultados de la prueba *(U)* para dos muestras independientes mostraron diferencias estadísticamente significativas en el reconocimiento de emociones faciales de ira $U = 2462.500$ ($z = -2.273$; $p = .023$) y sorpresa $U = 2503.000$ ($z = -2.125$; $p = .034$). En dichas dimensiones, la puntuación era mayor en el grupo de maltratadores, lo que denota un mejor reconocimiento de dichas emociones. Los tamaños del efecto de las diferencias estadísticamente significativas fueron bajos-moderados (tabla 3).

En el análisis de la tarea *Stroop* Emocional, se compararon los dos grupos en las cinco condiciones emocionales (palabras con contenido emocional negativo, contenido emocional positivo, contenido emocional vinculado con las relaciones de pareja funcionales, contenido de maltrato y contenido neutro) tanto en tiempo de reacción como en errores de omisión y comisión. Los resultados mostraron que no había diferencias estadísticamente significativas (tabla 3).

Para el resto de las variables analizadas, los resultados no mostraron diferencias estadísticamente significativas entre ambos grupos.

Tabla 3 Procesamiento emocional en maltratadores y no maltratadores

	No maltratadores ($n = 77$)	Maltratadores ($n = 90$)	*U*	*Z*	*p*	*d*
Test de Ekman						
Ira	7.43 (1.745)	7.98 (1.799)	2462.50	-2.2733	.023	.30
Asco	7.23 (2.072)	7.48 (1.984)	2937.50	-.774	.439	.12
Miedo	5.83 (2.123)	5.78 (2.411)	3123.00	-.092	.927	.01
Felicidad	9.82 (.661)	9.91 (.328)	3024.50	-.454	.650	.17
Tristeza	7.61 (1.751)	7.57 (1.768)	3070.50	-.122	.903	.02
Sorpresa	8.73 (1.179)	9.11 (1.011)	2503.00	-2.125	.034	.34
Stroop Emocional						
Bloque 1 Maltrato						
Aciertos	42.28 (6.159)	42.31 (5.281)	3330.50	-.434	.665	.05
Errores	.31 (2.345)	1.69 (2.848)	2919.50	-1.844	.065	.14
Omisiones	4.41 (5.953)	4.00 (4.371)	3336.50	-.416	.677	.07
Total respuesta	766.39 (65.756)	746.46 (76.648)	2787.00	-.1628	.103	.28
Bloque 2 Relaciones de pareja						
Aciertos	44.03 (5.177)	44.78 (3.651)	3151.50	-1.018	.309	.14
Errores	1.29 (1.915)	1.10 (1.465)	3452.00	-.045	.964	.01
Omisiones	2.68 (4.905)	2.12 (3.208)	3120.00	-1.139	.255	.15
Total respuesta	733.40 (73.515)	712.96 (80.759)	2945.00	-1.447	.148	.24
Bloque 3 Positivas						
Aciertos	44.10 (5.469)	44.78 (3.651)	3151.50	-1.018	.309	.14
Errores	1.11 (1.517)	1.10 (1.465)	3452.00	-.045	.964	.01
Omisiones	2.79 (5.337)	2.12 (3.208)	3120.00	-1.139	.255	.15
Total respuesta	732.11 (73.599)	712.96 (80.759)	2945.00	-1.447	.148	.24
Bloque 4 Negativas						
Aciertos	44.52 (4.674)	44.27 (3.999)	3180.50	-.924	.356	.05
Errores	1.23 (1.879)	1.06 (1.600)	3395.00	-.242	.809	.09
Omisiones	2.24 (4.257)	2.66 (3.351)	2966.00	-1.649	.099	.01
Total respuesta	721.27 (67.121)	718.00 (81.248)	3327.00	-.074	.941	.04
Bloque 5 Neutras						
Aciertos	43.96 (5.753)	44.75 (3.241)	3318.50	-.475	.635	.17
Errores	1.36 (2.240)	1.04 (1.526)	3247.00	-.763	.445	.16
Omisiones	2.69 (5.415)	2.21 (2.867)	3408.00	-.187	.852	.01
Total respuesta	725.44 (76.259)	711.99 (78.146)	3114.00	-1.012	.312	.02

Discusión

El objetivo del presente trabajo de investigación es investigar el procesamiento emocional de maltratadores, examinando por un lado el reconocimiento de emociones faciales y, por otro, el efecto de interferencia ante palabras con contenido emocional, utilizando una tarea *Stroop* Emocional diseñada específicamente para evaluar el procesamiento emocional en situaciones de violencia contra la pareja o expareja.

Los resultados muestran que se produjo un mejor reconocimiento emocional en maltratadores ante las emociones faciales de ira y sorpresa. En cuanto al procesamiento de palabras con contenido emocional, los resultados muestran que no había diferencias entre ambos grupos. Estos resultados pueden considerarse una primera aproximación al estudio del procesamiento emocional en maltratadores.

Estudios previos muestran un reconocimiento de emociones faciales diferenciado en maltratadores, especialmente ante las caras de sus parejas. En estos estudios se observan resultados que van desde un déficit (Babcock et al., 2008; Marshall & Holtzworth-Munroe, 2010) hasta una mejor ejecución (Babcock et al., 2008) para los grupos de maltratadores. Nuestros resultados apoyan estos últimos trabajos.

Si bien los resultados de este estudio son preliminares, se puede destacar la tendencia a un mejor reconocimiento emocional con menor afectación ante contenidos de violencia de género en maltratadores. Todo ello resulta interesante porque podría arrojar información útil en la explicación de los mecanismos utilizados por los maltratadores en la manipulación emocional de sus parejas. Así, estudios previos exponen el papel de las emociones que se generan en las mujeres víctimas de violencia en el proceso de persuasión llevado a cabo por su marido como determinantes del mantenimiento de la relación con la pareja más allá de la violencia recibida (Redo, Usaola, Nafs & Gironés, 2005). Así pues, el hombre maltratador puede generar miedo real en su pareja, de modo que ella no es capaz de abandonar dicha relación en la que está siendo violentada (Echeburúa, Pedro & De Corral, 2002). Un mejor reconocimiento emocional podría ser la herramienta utilizada por los maltratadores para manipular los sentimientos de sus parejas o exparejas, y así conseguir el objetivo de perpetuar la relación violenta.

En efecto, podría existir un perfil de agresores que reporta mayor empatía en su vertiente cognitiva —percepción, reconocimiento, atribución emocional— y que se perciben a sí mismos como con alta capacidad de discernir cognitivamente los estados emocionales de los demás, mientras que tienen una dificultad considerable para hacer frente a dichos estados emocionales, especialmente cuando las emociones son negativas (Covell, Huss & Langhinrichsen-Rohling, 2007). Este perfil de empatía se ha relacionado con mayores índices de violencia en general.

Por otro lado, no se han encontrado diferencias entre los grupos en cuanto al procesamiento de palabras con contenido emocional. Nuestros resultados no coinciden con los evidenciados por el trabajo de Chan et al. (2010), quienes encontraron que los maltratadores tienen mayor tiempo de reacción ante la tarea de nombrar el color en palabras con contenido afectivo agresivo. Sin embargo, obtuvieron sus resultados utilizando una tarea de carácter general, y no una diseñada específicamente para evaluar el procesamiento emocional en situaciones de maltrato y comparando con sujetos no violentos. En la presente investigación, y con una tarea específica para evaluar esta población, no encontramos diferencias entre un grupo de maltratadores y otro grupo de violentos en general. Además, en el trabajo de Chan (2010), se comparó con sujetos controles y no con otros violentos.

El presente estudio tiene ciertas limitaciones. Todos los sujetos tienen medida judicial, ya sea por delitos de violencia de género u otros delitos. Además, la utilización de un grupo control de hombres sin antecedentes penales y que no ejerzan violencia contra su pareja podría ser útil para determinar qué parte de los hallazgos aquí presentados se explicarían por las características específicas de la muestra del presente estudio (convictos).

Asimismo, conviene destacar que los participantes en este estudio provenían tanto del Centro Penitenciario de Albolote, internos en él, como del Centro de Inserción Social Matilde Cantos Fernández, establecimiento penitenciario destinado al cumplimiento de penas privativas de libertad en régimen abierto y al seguimiento de penas no privativas de libertad y de liberados condicionales, por lo que el perfil de dicha población no siempre es marginal y se puede acercar suficientemente (en el caso de los participantes en régimen abierto) a los sujetos sin medidas judiciales (por ejemplo, las penas por delitos contra la seguridad del tráfico podrían utilizar un sistema penitenciario en régimen abierto).

Por último, este estudio se ha centrado en el procesamiento de caras no familiares y no ha investigado el procesamiento de caras familiares, incluidas las de sus parejas, ni ha considerado otras medidas de la empatía. A pesar de estas limitaciones, los resultados preliminares de la presente investigación contribuyen a un mayor conocimiento del procesamiento emocional de los maltratadores. En efecto, un posible aporte sería crear una herramienta específica para la evaluación del procesamiento emocional en situaciones de violencia contra la pareja que se pueda utilizar para la evaluación de la empatía en maltratadores.

En la línea de la investigación de Covell et al. (2007), la tarea *Stroop* Emocional computarizada sobre violencia contra la pareja que se propone puede ser útil en futuras investigaciones para discernir un perfil de hombres maltratadores especialmente violentos y peligrosos, y estudiar las características particulares que muestran los hombres que reinciden una vez han pasado por programas de tratamiento, como el programa “Violencia de Género PRIA: Programa de Intervención para Agresores” (Ruiz et al., 2010).

Por último, cabe mencionar que conocer con mayor profundidad el comportamiento de los hombres maltratadores en el terreno emocional puede contribuir a comprender los mecanismos subyacentes a la relación de dominio y manipulación que caracteriza las relaciones violentas (Alcázar-Córcoles & Gómez-Jarabo, 2001; Chan et al., 2010). Futuras investigaciones podrían explorar dichos hallazgos, ampliando el ámbito de estudio a participantes sin medida judicial y atendiendo también a otras pautas empáticas más afectivas, como el remordimiento.

En vista de los resultados obtenidos, sería interesante contrastar en futuros estudios si la capacidad de procesar emociones a partir de las caras es un efecto general o se comporta de modo diferencial cuando son expresadas por su pareja. También sería útil investigar si el procesamiento emocional encontrado en nuestro trabajo facilita o dificulta de alguna manera la capacidad empática y la interacción social de los maltratadores. En resumen, este trabajo preliminar permite conocer un poco más lo relacionado con el procesamiento emocional que otros delincuentes no maltratadores presentan en el reconocimiento de emociones.

Una replicación de este estudio, controlando variables como los antecedentes penales (con y sin antecedentes), el tipo de violencia (física y psicológica o solo psicológica) y la generalidad de los actos violentos (solo con sus parejas o violentos en general) resultará imprescindible para conocer las implicaciones directas de estos resultados.

Financiación

Este trabajo ha sido financiado con los proyectos: "Caracterización y tipología neuropsicológica del maltratador" PSI 2009-13585, "Funcionamiento neuropsicológico y cerebral de maltratadores de género" concedido por la Dirección General de Investigación Científica y Técnica del Ministerio de Economía y Competitividad y el proyecto "Predicción de la reincidencia de los maltratadores en Andalucía: Variables neuropsicológicas, de personalidad, forenses y del contexto" de la Dirección General de Universidad de la Junta de Andalucía.

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ANEXO V

ARE BATTERERS DIFFERENT FROM THE OTHERS CRIMINALS? AND FMRI STUDY

Bueso-Izquierdo, N., Verdejo-Román, J., Contreras-Rodríguez, O., Carmona-Perera, M., Pérez-García, M., & Hidalgo-Ruzzante, N. (2016). Are batterers different from other criminals? An fMRI study. *Social cognitive and affective neuroscience*, *11*(5), 852-862. https://doi.org/10.1093/scan/nsw020

Social Cognitive and Affective Neuroscience, 2016, 852–862

doi: 10.1093/scan/nsw020
Advance Access Publication Date: 16 February 2016
Original article

Are batterers different from other criminals? An fMRI study

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Abstract

Intimate partner violence (IPV) is a complex and global phenomenon that requires a multi-perspective analysis. Nevertheless, the number of neuroscientific studies conducted on this issue is scarce as compared with studies of other types of violence, and no neuroimaging studies comparing batterers to other criminals have been conducted. Thus, the main aim of this study was to compare the brain functioning of batterers to that of other criminals when they are exposed to IPV or general violence pictures. An fMRI study was conducted in 21 batterers and 20 other criminals while they observed IPV images (IPVI), general violence images (GVI) and neutral images (NI). Results demonstrated that batterers, compared with other criminals, exhibited a higher activation in the anterior and posterior cingulate cortex and in the middle prefrontal cortex and a decreased activation in the superior prefrontal cortex to IPVI compared to NI. The paired *t-test* comparison between IPVI and GVI for each group showed engagement of the medial prefrontal cortex, the posterior cingulate and the left angular cortices to IPVI in the batterer group only. These results could have important implications for a better understanding of the IPV phenomenon.

Key words: intimate partner violence; neuroimaging; batterers

Introduction

Intimate partner violence (IPV) is a complex and global phenomenon that requires a multi-perspective analysis. According to the World Health Organization (WHO), IPV refers to any violent behavior within an intimate relationship. It includes physical aggression (e.g. slapping, hitting, kicking or beating), sexual force, psychological abuse (e.g. intimidation, constant belittling or humiliation) or any other controlling behavior by a current or former partner or spouse (Krug *et al.*, 2002; World Health Organization, 2013). Many studies have pointed out that IPV is related to several factors including psychosocial, family, patriarchal or biological variables (Pinto *et al.*, 2010; Corvo and Johnson, 2013), but the number of neuroscientific studies conducted on this issue are scarce as compared with the number of studies on other types of violence (Corvo, 2014).

A great number of neuroimaging studies on general violence (GV) have focused on the brain functioning of violent people. Furthermore, these results have been replicated in structural

Received: 10 February 2015; Revised: 22 January 2016; Accepted: 11 February 2016

and functional studies using different techniques such as Computed tomography, positron emission tomography (PET), Single-photon emission computed tomograph, magnetic resonance imaging (MRI) and Event-related potential scans (Patrick, 2008; Schiltz *et al.*, 2013). The prefrontal cortex, temporal cortex, insula, amygdala, hippocampus and cingulate gyrus have been key structures related to aggressive behavior (Blair, 2001; Siever, 2008; Blair and Lee, 2013). Nevertheless, brain structures are different according to the type of aggression. In reactive/impulsive aggression or aggression in response to a threating stimulus, activation in the amygdala, hypothalamus and periaqueductal gray (PAG) (Mobbs *et al.*, 2007) has been consistently found. The same structures have been found to be involved in cases of frustration (Blair, 2010). In instrumental/ goal directed aggression, the motor cortex and cerebellum are involved (White *et al.*, 2015). In the last type of aggression, the amygdala and ventromedial prefrontal cortex have been related to moral decisions about harming another person (Blair, 2007; Harenski *et al.*, 2010). In the case of offenders with psychiatric conditions, other brain areas have been found to be involved. In a study conducted on antisocial offenders, differentiated according to borderline personality disorder (BPD) or high psychopathic traits (HPT), Bertsch *et al.* (2013) found that antisocial offenders with BPD showed gray matter reduction in the orbitofrontal and ventromedial prefrontal cortices (involved in emotion regulation and reactive aggression) and in the temporal pole (involved in cognitive empathy). On the other hand, antisocial offenders with HPT showed gray matter reduction in cortical midline structures, such as the dorsomedial prefrontal cortex, the postcentral gyrus, posterior cingulate cortex (PCC), and dorsal anterior and posterior precuneus, which are principally involved in the default mode network (DMN).

To our knowledge few studies have assessed the brain function of abusers (George *et al.*, 2004; Lee *et al.*, 2009). George *et al.* (2004) used PET to analyze glucose metabolism activity in the structures responsible for monitoring and mediating conditioned responses to fear associated with domestic violence. Findings show that perpetrators with alcohol abuse, compared with non-perpetrators with alcohol abuse and control participants, had lower glucose uptake in the hypothalamus. Interestingly, using an fMRI picture-viewing paradigm, Lee *et al.* (2009) demonstrated that batterers had an over-activation in the hippocampus, the fusiform gyrus, the PCC, the thalamus and the occipital cortex in response to threatening stimuli compared with neutral stimuli. On the other hand, specific higher activation was observed in batterers in the precuneus when they saw female aggression pictures versus neutral pictures.

However, no direct neuroimaging studies comparing batterers with other criminals have been conducted, and few studies have compared both populations while considering other psychological variables. For example, Moffitt *et al.* (2000) demonstrated that partner abuse and general crime represent different constructs that are moderately related but 'not conceptually equivalent, even when performed by the same individual', depending on his/her personality traits. General crime was related to high emotional negativity and low constraint, and IPV was also related to emotional negativity but not to low constraint. Boyle *et al.* (2008) found that general violent offenders showed more conduct disorder/delinquent behaviors, lifetime antisocial behaviors and disinhibition, and were more psychologically abusive than other violent participants. In this sense, comparing batterers' brain functioning to that of other criminals could help in understanding the mechanism of IPV and its possible similarities with GV.

For these reasons, the main aim of this study is to compare the brain functioning of batterers with other criminals when they observe IPV or GV pictures to make progress from findings in previous studies (Lee *et al.*, 2009). We also aimed to assess whether batterers have differences in brain functioning specific to IPV pictures that are not present to GV images. We hypothesized that batterers, relative to other criminals, will show a specific higher activation of the precuneus/PCC during the viewing of IPV pictures compared with neutral and GV pictures. This hypothesis is in line with the over-activation of these regions in the only fMRI study that has assessed brain activation in response to IPV pictures in batterers relative to controls (Lee *et al.*, 2009). We also hypothesized that batterers will show higher activation of the occipital, posterior parietal and temporal cortices during the viewing of GV images compared with neutral images. This hypothesis is also congruent with the study completed by Lee *et al.* (2009) showing over-activation of these brain regions in response to threatening *vs* neutral stimuli.

Materials and methods

Participants

Forty-one men convicted of crimes were recruited from the Center for Social Insertion (CSI) (Centro de Inserción Social, CIS) 'Matilde Cantos Fernández', in Granada (Spain). They were divided into two groups: (i) 21 batterers (batterers group, BG) convicted for a crime of violence against women and (ii) 20 men convicted of crimes other than IPV (other criminal group, OCG).

In Spain, IPV crimes are regulated by a specific law (Law 1/2004, 'Comprehensive Protection Law against Gender Violence'[Ley Orgánica 1/2004, de 28 de diciembre, de Medidas de Protección Integral contra la Violencia de Género]). This law states that a man may be convicted by a judge for several types of aggression including insults, threats, slaps or beatings, sexual abuse or murder. According to this law, first convictions for IPV without sexual or physical abuse are classified as a misdemeanor, which implies that the person is sent to an open facility (CSI) of the Ministry of Justice, but not to prison. In the CSI, batterers should attend IPV rehabilitation programs. In case of sexual or physical abuse with any physical injury, batterers go to prison.

Crime severity in Spaniard law is regulated by a Penal Code (article 33). According to this article, crimes sentences between 3 months and 5 years are classified as 'less serious'. Given that all participants were recruited in the CSI, we guaranteed that (i) it was the first time that participants of both groups were convicted; and (ii) they were convicted for the similar sanction ('less serious').

Table 1 shows the socio-demographic and severity of crime information. Groups did not differ significantly in age, education level and intelligence quotient (IQ). All were right-handed males with native fluency in Spanish. The selection of participants included the following inclusion criteria: individuals 18 years old or older; for the BG, being convicted of an IPV crime, for the OCG being convicted of a crime other than IPV. The exclusion criteria for the two groups included: illiteracy, a history of serious antecedents of psychological and personality problems (measured through the Millon Multiaxial Personality Test III; Millon, 1994, Spaniard adaptation; Cardenal *et al.*, 2007), head injury, neurological illness, infectious disease, history of drug abuse or dependence (including alcohol) (SCID/DSM-IV); American Psychiatric Association, 1994), systemic disease or any other diseases affecting the central nervous

Table 1. Demographic and crime characteristics of batterers (BG) and other criminal groups (OCG)

Variables (Mean (SD))	BG	CG	P-value
Age	38.38 (8.70)	34.40 (8.66)	0.15
Years of education	9.62 (3.90)	9.45 (2.42)	0.87
IQ	99.83 (14.29)	92.85 (13.32)	0.13
Time of crime[%(n)]			
Misdemeanor	IPV-PV¼38 % (8)	SCF/DD¼50% (10)	0.44
Felony	IPV-PPV¼62%(13)	GAR/VF¼50% (10)	

SD, standard deviation; IPV, intimate partner violence; PV, psychological violence; SCF, scams or crime of forgery; DD, dangerous driving; IPV-PPV, IPV- physical and psychological violence; GAR, grave assault/robbery; VF, violent fight.

system (First *et al.*, 1999), and the presence of significant abnormalities in MRI or any contraindications to MRI scanning (including claustrophobia or implanted ferromagnetic objects). Individuals in the OCG with a score greater than or equal to 11 on the severity scale of the CTS2 (Conflict Tactic Scales) (Straus *et al.*, 1996) were excluded. This criterion was established in a previous study (Cohen *et al.*, 2003) to rule out physical or psychological violence against partners.

The study was approved by the Research Ethics Committee of the University of Granada, Spain. The participants were invited to collaborate in the study on a voluntary and anonymous basis. The confidentiality of personal information was guaranteed in accordance with the Spanish legislation on personal data protection (Organic Law 15/1999, December 13). All of the participants signed a written informed consent document and they received 25 euros for participating the study.

Materials

An interview evaluating socio-demographic information and the risk of serious couple violence was used (Echeburúa *et al.*, 2008). This questionnaire measures the socio-demographic variables of the aggressor and victim, the relationship status of the couple (couple not living together, cohabitation, in the process of separating, separated, etc.), the types of violence, the profile of the aggressor (information about the formal complaint and emotions of the batterer in that moment) and vulnerability factors for the victim (i.e. substance use, economic dependence and lack of social support).

IPV severity. The CTS 2 Spanish version (Loinaz *et al.*, 2012) of the original CTS2 Scales (Straus *et al.*, 1996) was used to detect the existence of physical, psychological and/or sexual violence toward a partner in a relationship. It measures violence frequency and intensity in the relationship.

Intelligence quotient. The K-BIT (Brief Intelligence Test) (Kaufman *et al.*, 1997): The K-BIT measures cognitive functions through two tests: verbal (vocabulary, composed of two tests), and non-verbal (matrix), which evaluates crystallized and fluid intelligence, and obtains a compound IQ.

fMRI task. The stimulus set comprised 72 pictures extracted from the International Affective Picture System database, divided equally into four categories: pleasant, unpleasant, GV and neutral. We also selected 18 pictures of IPV from Internet. For this study proposes, we focus on general and IPV images, using neutral images as the control condition. GV images included violent acts against humans and animals, such as fights, threats and injuries that lack women. IPV) images, in turn, involved a female victim being attacked by a man, or injured women. Neutral (N) images included general objects that were not related to violence, such as chairs, baskets and spoons. Each picture was presented in blocks of 15 s, with an individual picture duration of 5 s. Picture blocks were presented pseudo-randomly. The task was performed with the Presentation software (Neurobehavioral System Inc., San Francisco, CA). The items were presented through magnetic resonance-compatible liquid crystal display goggles (Resonance Technology, Northridge, CA.) equipped with various corrective lenses.

Participants were instructed to sustain the emotion elicited by the pictures displayed during IPV, GV and N images. After the functional imaging session, participant involvement was confirmed by asking the participants to rate images on three emotional components using the Self-Assessment Manikins (SAM) scales, with valence: from happy (9) to unhappy (1), arousal: from excited (9) to calm (1), and dominance: from controlled (1) to in control (9).

Imaging data acquisition and preprocessing. The equipment used was a 3.0 T clinical MRI scanner with an eight-channel phased-array head coil (Intera Achieva, Philips Medical Systems, Eindhoven, The Netherlands). During acquisition, a T2*-weighted echo-planar imaging (EPI) was obtained (Repetition time (TR) ¼ 2000 ms, Echo time (TE) ¼ 35 ms, Field of view (FOV) ¼ 230 x 230 mm, 128 x 128 matrix, flip angle ¼ 90^0, twenty-one 4-mm axial slices, 1-mm gap, 315 scans). A sagittal three-dimensional T1-weighted turbo-gradient-echo sequence (160 slices, TR ¼ 8.3 ms, TE ¼ 3.8 ms, flip angle ¼ 8^0, FOV ¼ 256 x 256, 1 mm^3 voxels) was obtained in the same experimental session to check for gross anatomical abnormalities for each subject.

Brain images were analyzed using the Statistical Parametric Mapping (SPM8) software (Wellcome Department of Cognitive Neurology, Institute of Neurology, Queen Square, London, UK), running under Matlab R2009 (MathWorks, Natick, MA). Preprocessing steps included slice timing correction, re-slicing to the first image of the time series, normalization (using affine and smoothly non-linear transformations) to an EPI template in the Montreal Neurological Institute (MNI) space, and spatial smoothing by convolution with a 3D Gaussian kernel (full width at half maximum (FWHM) ¼ 8 mm).

Procedure

In session 1, the initial interview and behavioral tasks were administered in the CSI. All participants were assessed in an individual and quiet room for approximately 1 h. In session 2, fMRI scans and image ratings were taken in the Centro Diagnóstico CEDISA (Granada, Spain) and each session lasted 1 h.

Statistical analyses

Behavioral analyses. Behavioral data were analyzed using the Statistical Package for the Social Sciences, version 22 (SPSS; Chicago, IL). Independent-sample *t*-tests or cross-tabulation analyses (depending on the type of variable) were conducted to compare the two groups with regard to demographics and severity of crime variables. We also performed a mixed-design ANOVA (2 groups x3 types of images) to analyze group differences on emotional responses by type of image as recorded by the SAM.

Table 2. Descriptive scores and mixed-design ANOVA results for the valence, arousal and dominance affective dimensions

Variables Mean (SD)	BG			CG			Main effect		Interaction
	IPVI	GVI	NI	IPVI	GVI	NI	Group *P*-value	TI *P*-value	Group*TI *P*-value
Valence	1.44 (0.53)	2.22 (0.91)	5.76 (1.23)	1.59 (0.64)	2.54 (0.90)	5.58 (1.05)	0.57	0.000	0.67
Arousal	7.48 (1.80)	6.53 (1.74)	4.41 (1.39)	7.08 (2.01)	6.42 (1.60)	4.48 (0.87)	0.68	0.000	0.63
Dominance	5.14 (2.87)	5.88 (2.20)	6.51 (1.81)	4.10 (2.50)	5.16 (2.20)	7.03 (1.48)	0.45	0.000	0.33

SD, standard deviation; BG, batterers groups; CG, other criminals group; IPVI, intimate partner violence images; GVI, general violence images; NI, neutral images; TI, type of images.

Neuroimaging analyses. The BOLD response at each voxel was convolved with the SPM8 canonical hemodynamic response function (using a 128-s high-pass filter). Conditions were modeled for 15 s that each block appeared on the screen. To cover the study objectives, three contrasts of interest were defined at the first-level (single-subject): (i) 'IPV *vs* N images', (ii) 'GV *vs* N images' and (iii) 'IPV *vs* GV images'. The resulting first-level contrast images were then used in the second-level random-effect analyses to assess for between-group differences. For the (i) 'IPV *vs* N images' and (ii) 'GV *vs* N images' contrasts two-sample *t*-test models were used to compare group activations. For the (iii) 'IPV *vs* GV' comparison, two approaches were used. First, a second-level paired *t*-test model, using contrast images from contrasts (i) and (ii), was used to sensitively explore group effects to each type of violence. Moreover, a collapsed across groups second-level t-test analysis using the 'IPV *vs* GV' contrast images was performed to identify brain activations uniquely associated with IPV images. For both of these latter statistical approaches, the signal eigenvariate of the significant brain regions (peak maxima) were extracted and group*condition interaction analyses were conducted in SPSS.

Threshold criteria. Significance in ANOVA models were established at a threshold of $P<0.05$. For the imaging analyses, the spatial extent threshold was determined by 1000 Monte Carlo simulations using AlphaSim as implemented in the SPM REST toolbox (Song *et al.*, 2011; Ward, 2013). For one-sample *t*-tests, input parameters included a whole-brain brain mask of 283 654 voxels (2 mm x 2 mm x 2 mm), an individual voxel threshold probability of 0.005, a cluster connection radius of 5 mm, and the actual smoothness of the data. A minimum cluster extent (KE) of 173 voxels (1384 mm^3) was estimated to satisfy a $P_{FWE} < 0.05$. Significance in two-sample and paired *t*-tests was assessed using the same input parameters, masking results on the basis of activation and deactivation maps derived from the corresponding one-sample *t*-test contrasts for both study groups. Therefore, for contrasts 1 and 2, a minimum KE of 91 and 94 voxels (within masks of 38491 and 61538) were estimated to satisfy a $P_{FWE} < 0.05$, respectively. For the paired *t*-test analyses, a KE of 99 voxels (within a mask of 69.598) were estimated.

Results

Differences between batterers and criminals in behavioral responses

Analyses showed no significant main effect for the group factor (batterers *vs* general crime), nor an interaction effect (group by type of imagine) in emotional ratings. These findings suggested that valence, arousal and dominance ratings were the same for batterers and criminals overall and across the type of image displayed in the fMRI task. As expected according to the selection criteria for images, a significant main effect for type of images (i.e. IPV, GV, N images) was observed for valence [$F(2,74)$ ¼222.61; P ¼ 0.000], arousal [$F(2,74)$ ¼ 40.26; P ¼ 0.000], and dominance [$F(2,74)$ ¼ 14.60; P ¼ 0.000]. For both groups, IPV images showed less valence, higher arousal and less dominance than GV images, and GV images showed less valence, higher arousal and less dominance than N images (see Table 2).

Neuroimaging results

Intimate partner violence vs neutral images (IPV>N). ***Group activations.*** Brain activation and deactivations for the IPV>N contrast in both groups are reported in Table 3. Criminals showed activation in the superior frontal gyrus. Batterers, on the other hand, showed additional activation in the orbitofrontal cortex and the PCC, and significant deactivation in the anterior cingulate cortex and the insula.

Between-group differences. Batterers, relative to criminals, demonstrated significantly higher activation of the middle prefrontal cortex, and the anterior and PCC (Figure 1, Table 4). Criminals showed higher activation of the superior prefrontal cortex compared to batterers (Table 4).

General violence vs neutral images (GV>N). ***Group activations.*** Brain activation and deactivations for the GV>N contrast in both groups are reported in Table 3. Criminals showed activation in the superior frontal gyrus, and significant deactivation in the anterior cingulate cortex, middle frontal gyrus, insula, middle PCC and temporal cortex, which was not identified in batterers. Batterers, on the other hand, showed additional activation in the orbitofrontal cortex, the thalamus, the precuneus and the superior parietal.

Between-group differences. Relative to criminals, batterers demonstrated significantly higher activation of the middle prefrontal cortex, the SMA-Precuneus and the insula (Figure 2, Table 4). Criminals showed higher activation of the superior prefrontal cortex compared to batterers (Table 4).

Intimate partner violence vs general violence (IPV > GV). ***Group effects (paired t-test analysis).*** Brain activation and deactivations for the IPV *vs* GV contrast in both groups are reported in Table 5. To IPV images, batterers showed activation in the medial prefrontal cortex, the PCC, and the left angular gyrus, which was not iden- tified in the OCG (Supplementary Figure S1). Criminals showed no significant activations to IPV images. To GV images, both groups showed activation in the fusiform gyrus and the occipi- tal cortex. Batterers showed additional activation in the thal- amus, hippocampus and supramarginal gyrus not identified in

Table 3. Brain activations and deactivations observed during IPV > N and GV > N contrasts in within-group (one-sample) whole brain analyses

Brain region	Batterers			Other Criminals		
	x, *y*, *z*	kE	*t* value	*x*,*y*,*z*	kE	*t* value
	IPV > N					
Activations						
Superior PFC			ns	8, 64, 30	973*	4.7
Inferior PFC	42, 16, 20	484	4.2	60, 28, 34	706	3.9
Medial PFC	4, 50, 14	616	3.1	-4, 54, 18	973*	4.3
OFC	4, 62, -14	287	4.9			ns
PCC	4, -58, 30	1392	5.1			ns
Temporal	52, -68, 2	20891*	11.0	50, -72, -4	20266*	10.0
	-42, -76, -2	20891*	10.7	-42, -76, -2	20266*	9.9
PAG			ns	2,- 34, -8	238	3.7
Occipital	-4, -90, 4	20891*	7.2	8, -88, 4	20266*	8.1
Deactivations						
ACC			ns	-2, 32, 28	2147*	6.4
Middle PFC	38, 38, 18	784	5.2	32, 26, 34	452	5.4
	-32, 38, 10	199	3.9	-26, 28, 32	2147*	4.8
OFC	30, 62, -6	294	4.2	-14, 22, -16	181	3.7
	-38, 54, 2	202	3.5			ns
Fusiform gyrus	30, -54, 0	1055*	4.4	32, -44, -6	177	3.8
	-34, -52, -6	379	3.6	-20, -46, 2	530	3.4
Middle PCC	6, -34, 40	1055*	3.6	-2, -36, 44	465	4.8
Insula			ns	48, -24 12	892	4.3
Angular gyrus			ns	54, -44, 66	942	3.8
	-44, -42, 38	228	4.0	-46, -54, 36	351	4.4
	GV > N					
Activations						
Superior PFC			ns	-10, 62, 36	1379	4.9
Inferior PFC	46, 16, 18	1044*	4.3	50, 10, 32	1262	4.4
OFC	6, 70, -18	388	3.9			ns
Precentral gyrus	40, -2, 46	1044*	4.2			ns
	-32, -12, 42	348	3.8			ns
Amygdala-HPC	20, -4, -20	36259*	5.1	32, -16, -18	320	3.8
	-22, -8, -20	36259*	3.8			ns
Thalamus	14, -26, -2	36259*	5.5			ns
	-10, -24, -6	36259*	4.1			ns
Fusiform gyrus	38, -56, -20	36259*	6.9	38, -56, -16	27576*	5.1
	-40, -44, -20	36259*	5.1	-49, -52, -22	27576*	7.9
Precuneus	6, -56, 44	36259*	4.3			ns
Superior Parietal	26, -60, 48	36259*	4.1			ns
	-26, -54, 46	207	3.4			ns
Temporal	50, -72, 0	36259*	12.6	50, -72, -2	27576*	11.7
	-44, -76, -2	36259*	10.5	-42, -74, -2	27576*	9.8
Occipital	16, -88, 6	36259*	11.4	8, -86, -8	27576*	13.8
Deactivations						
ACC			ns	6, 34, 14	2198*	4.3
Orbitofrontal	-26, 58, 6	366	3.7	-34, 54, 2	2198*	4.0
Middle PFC			ns	34, 28, 36	399	4.4
			ns	-34, 12, 44	862	4.6
SMA			ns	30, -16, 58	528	5.2
Insula			ns	48, 8, -6	2323*	4.9
			ns	-44, 18, -6	258	3.8
Middle PCC			ns	-2, -18, 66	829	4.2
Angular	50, -54, 36	636	5.2	48, -50, 40	3303	5.8
			ns	-44, -58, 38	3117	4.5
Temporal			ns	64, -22, -10	2323*	3.5
				-64, -30, -6	859	4.2

x,*y*,*z*¼ MNI peak coordinates; kE, cluster extent in voxels; IPV, intimate partner violence; GV, general violence; N, neutral; ns, nonsignificant; *part of a larger cluster; PFC, prefrontal cortex; OFC, orbitofrontal cortex; PCC, posterior cingulate cortex; PAG, periaqueductal gray; ACC, anterior cingulate cortex; HPC, hippocampus; SMA, supplementary motor area.

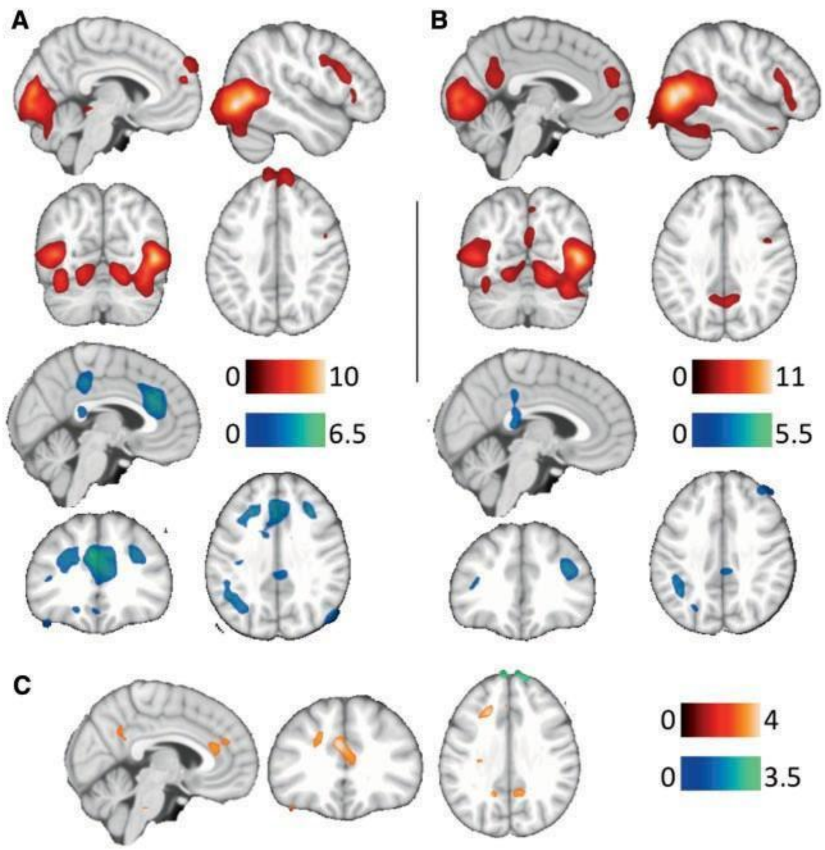

Fig. 1. Main group activations (red) and deactivations (blue) to IPV>N in criminals (A) and batterers (B). Between-group differences (C) show increased (red) and decreased (blue) brain activity in batterers. The right hemisphere corresponds to the right side of the axial and coronal views. Sagittal images show the right hemisphere in B and C views, and the left hemisphere in A view. The color bar indicates *t*-values.

Table 4. Brain regions showing significantly differences between groups during IPV > N and GV > N contrasts

Brain region	*x*, *y*, *z*	kE	*t* value
IPV > N			
Other Criminals2: Batterers			
Superior PFC	10, 60, 40	156	3.4
Batterers2: Other Criminals			
Middle PFC	-20 26, 34	130	3.9
ACC	-2, 30, 26	252	4.0
PCC- Precuneus	14, -52, 34	98	3.5
GV > N			
Other Criminals2: Batterers			
Superior PFC	-8, 62, 34	145	3.7
Batterers2: Other Criminals			
Precentral	28, -16, 62	360	5.1
SMA-Precuneus	6, -12, 52	696	4.0
Middle PFC	-24, 28, 30	131	3.4
Insula	48, 8, -6	958	3.8
	-54, -8, 10	316	3.6

*x,y,z*¼ MNI peak coordinates; kE, cluster extent in voxels; IPV, intimate partner violence; GV, general violence; N, neutral; PFC, prefrontal cortex; ACC, anterior cingulate cortex; PCC, posterior cingulate cortex;

the criminal group (Figure 3, Table 5). A group*condition interaction with the extracted signal eigenvariate of these brain regions did not yield significant findings (all *P*s > 0.05). This was also the case for the PCC, that was initially hypothesized to show an increased activation to IPV compared to GV images in batterers relative to criminals.

IPV processing across groups (collapsed analysis). The angular gyrus was the only region significantly associated with the processing of IPV images (MNI coordinates, *x* ¼ -50, *y* ¼ -60, *z* ¼ 28, kE ¼ 649, *t* ¼ 3.4, *P*<0.005) across the study groups. A group*condition interaction with the extracted signal eigenvariate of the angular gyrus did not yield significant findings (*F*(1,39)¼0.138, *P*¼0.713).

Discussion

The main aim of this study is to compare the brain functioning of batterers with that of other criminals when they observe IPV or GV pictures. Results reveal that batterers, as compared to other criminals, show higher activation in the anterior and PCC to IPV images compared to neutral images. In addition, batterers demonstrate higher activation in the insula and parietal regions to GV images compared with neutral images. They also show a higher activation in the middle prefrontal cortex and a decreased activation in the superior prefrontal cortex to both IPV and GV images compared to neutral images. Nevertheless, batterers do not show the hypothesized higher activation of the PCC-precuneus during the viewing of IPV pictures compared to GV images when compared with the criminal group, although the PCC-precuneus is more activated in response to the IPV images in the batterers only. Therefore, our hypotheses were partially confirmed. This distinct brain functioning is observed

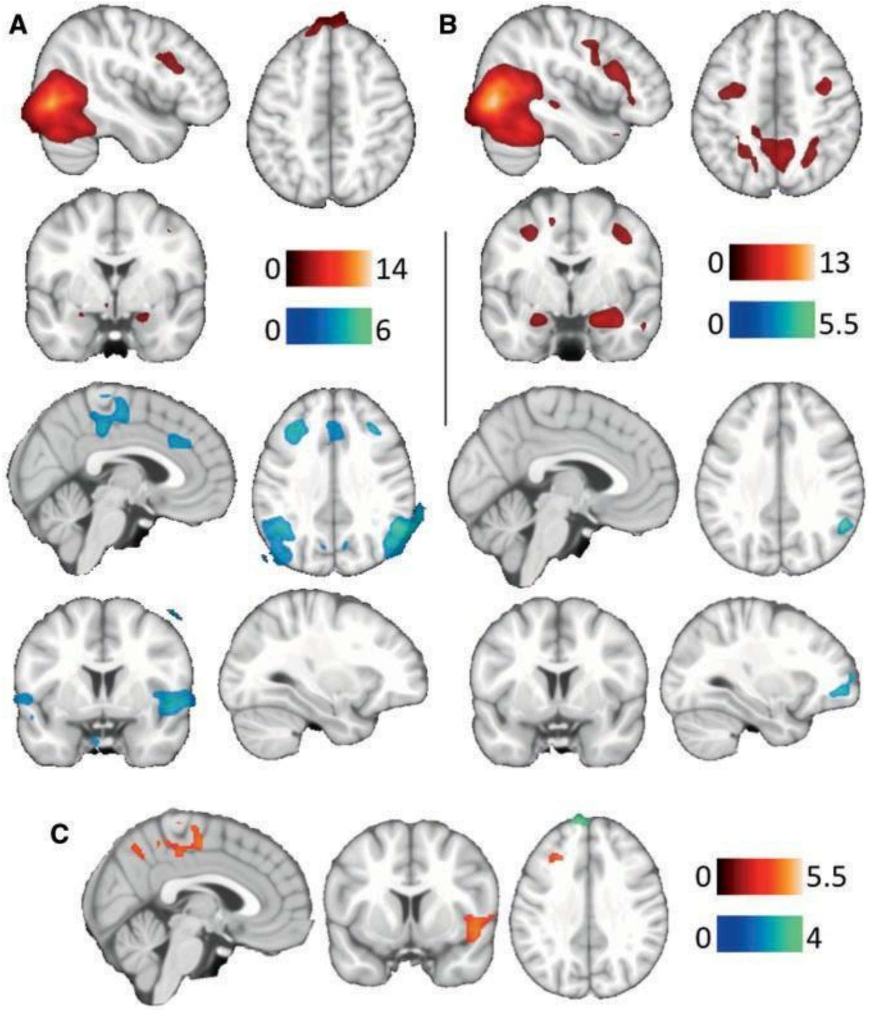

Fig. 2. Main group activations (red) and deactivations (blue) to GV>N in criminals (A) and batterers (B). Between-group differences (C) show increased (red) and decreased (blue) brain activity in batterers. The right hemisphere corresponds to the right side of the axial and coronal views, and sagittal images show the right hemisphere in all views. The color bar indicates *t*-values.

regardless of differences in the subjective emotional responses between the study groups.

The finding of a higher activation in the PCC extending to the precuneus in response to IPV *vs* neutral images in batterers is consistent with our hypothesis and the study of Lee *et al.* (2009). In this study, the authors similarly found that batterers show an increased activation in the precuneus to aggressive-female *vs* neutral images, when compared to a sample of controls non-criminals. Our approach of comparing the batterers' brain functioning to that of other criminals extends these findings, demonstrating that the activation of the PCC-precuneus specifically characterize the brain functioning of batterers, above those of other criminals, while processing IPV images. The PCC is key in episodic memory retrieval and emotional reasoning (Rekkas and Constable, 2005). For example, PCC activation has been reported following moral judgment of harmful actions and increased negative attitudes toward others (Greene *et al.*, 2001; Bruneau *et al.*, 2010). Furthermore, batterers also show a higher activation in the ACC to the IPV *vs* neutral images. At a functional level, the ACC has been involved in self-referential aspects of thinking, emotional contagion and affective perspective taking (Raichle *et al.*, 2001; Raine and Yang, 2006; Harrison, 2008;), and its activation during the observation of pain have been predicted by individual differences in neuroticism (Cheetham *et al.*, 2009). This observation may be directly related to findings showing that lower perspective taking abilities and higher levels of personal distress in reaction to the emotions of others are related to violence perpetration in batterers (Covell *et al.*, 2007). Overall, increased activation in the PCC and ACC in batterers to intimate partner images may underlie the increased negative feelings of emotional distance that raise fears of abandonment from the significant other. This may in turn lead batterers to have maladaptive coping and regulation of affect in the form of obsessions about his/her partner and stalking, as documented by George *et al.* (2006).

The significant higher activation of the insula and the SMA-precuneus in the parietal cortex in batterers to the GV images, relative to other criminals, is also consistent with the brain over-activation to threatening situations found by Lee *et al.* (2009) in these individuals, and interpreted as a hyper-response to threatening stimuli. Hyperactivation of these brain regions is one of the most common neuroimaging findings across fear conditioning studies (Etkin and Wager, 2007; Fullana *et al.*, 2015). Previous clinical and scientific work showing that batterers experience fear, autonomic activation and bias toward the processing of negative stimuli (George *et al.*, 2000; Bitler

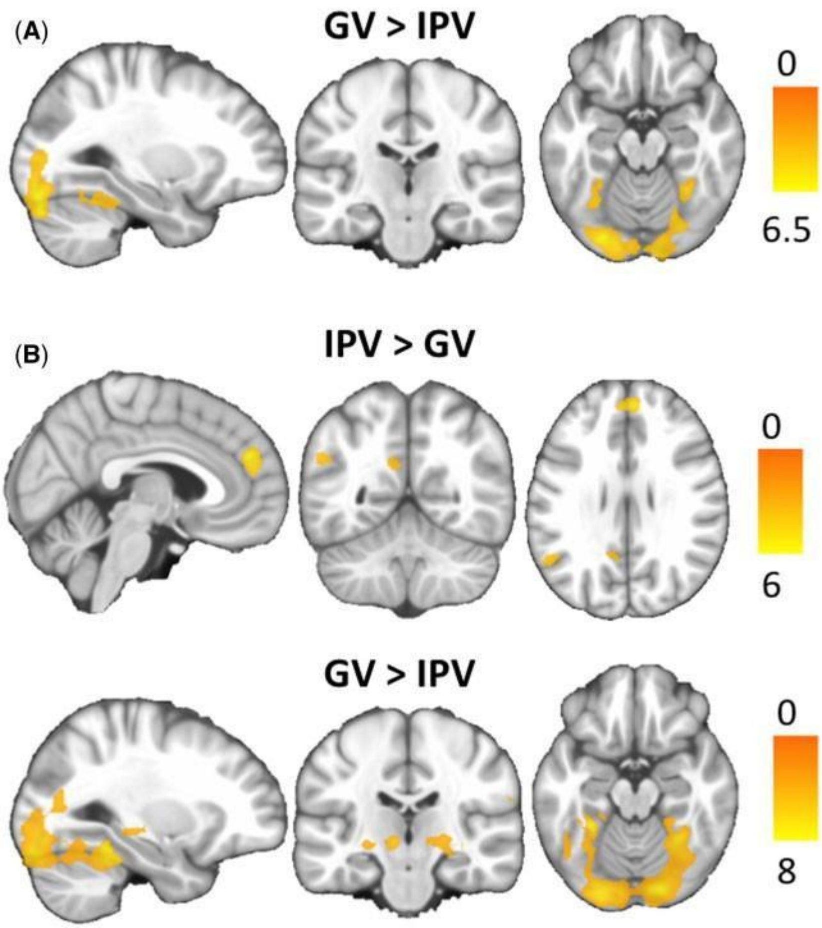

Fig. 3. Brain regions showing significant differences in the comparison between GV and IPV conditions in criminals (A) and batterers (B). The right hemisphere corresponds to the right side of the axial and coronal views. Sagittal images show the right hemisphere in B 'IPV>GV' view, and the left hemisphere in the other sagittal views. The color bar indicates *t*-values.

Table 5. Brain regions showing significantly differences within groups (paired *t*-test) between IPV and GV images

Brain region	Batterers			Brain region	Other criminals		
	x, *y*, *z*	kE	*t* value		*x*, *y*, *z*	kE	*t* value
IPV2:GV							
Medial PFC	2, 48, 26	328	5.9				
PCC	-4, -62, 24	111	3.3				
Angular	-56, -56, 28	216	3.9				
GV2:IPV				*GV2:IPV*			
Fusiform gyrus	30, -40, -20	8528*	6.1	Fusiform gyrus	30, -60, 10	4635*	4.8
	-28, -42, -22	8528*	6.5		-32, -60, -18	4635*	4.5
Occipital	-20, -88, -20	8528*	8.0	Occipital	-28, -86, -20	4635*	6.3
Thalamus	24, -20, -2	178	4.6				
	-10, -20, -4	289*	5.4				
HPC	24, -24, -6	178	3.2				
	-24, -24, -6	289*	4.2				
Supramarginal	64, -24, 26	103	4.3				

x,*y*,*z*¼ MNI peak coordinates; kE, cluster extent in voxels; IPV, intimate partner violence; GV¼ general violence; *part of a larger cluster; PFC, prefrontal cortex; PCC, posterior cingulate cortex; HPC, hippocampus.

et al., 1994; George *et al.*, 1989; Chan *et al.*, 2010) may be consistent with this neural over-activation to the GV images in batterers. Interestingly, the anterior insula has recently been associated particularly with perceived anxiety sensations independent from anxiety traits (Harrison *et al.*, 2015). This finding may be consistent with the sudden affective instability in the form of increased anxiety, fearful mood states, anger or rage described by batterers when challenged by his/her partner

(George *et al.*, 2006). Furthermore, the decreased activation of the superior frontal and the increased activation of the middle frontal gyri to both IPV and GV images may also contribute to the affective instability and bias toward the processing of negative information in batterers (Kensinger and Schacter, 2006; Gross 2013). This is consistent with the deficient top-down regulatory control over excessive limbic activation already suggested by previous studies with batterers (Lee *et al.*, 2009; George *et al.*, 2004) and the preferential activation of the middle frontal gyrus to negative valence information (Kensinger and Schacter, 2006).

However, not all hypotheses were supported in this study. Specifically, the PCC was not preferentially activated in response to IPV images relative to the GV situations in batterers *vs* criminals. This was also the case for the angular gyrus, a region that shows a preferential activation in all participants during the viewing of IPV images and was only activated in batterers for the paired *t*-test. The angular gyrus is considered an important cerebral hub (Timoty and Volkow, 2011), consistently involved in semantic processing, attentional shifting, spatial cognition, episodic and autobiographical memory retrieval, DMN, conflict resolution and the theory of mind (Seghier, 2013). Therefore, the activation of the angular gyrus in the BG when they viewed IPV compared to GV images in paired analyses could be explained by the fact that IPV images activated autobiographical and episodic memory of past IPV events in batterers. Further studies with larger samples may be interested in investigating whether impairment of the angular gyrus in batterers is associated with their capacity to judge attempted harms as morally right or wrong.

Despite differences in brain functioning, there are a lack of differences between batterers and other criminals in the emotional behavioral responses. The absence of such differences may be related to the batterers' response bias for social desirability. Social desirability has not been previously reported in emotional tasks, but it has been measured in personality questionnaires (Gibbons *et al.*, 2011). This important concern, referred to as explicit subjective measures in batterers, has motivated the development of new implicit tasks to measure attitudes in batterers. Its inclusion may likely benefit further studies with batterer samples (Eckhardt *et al.*, 2012).

Nevertheless, the generalization of our results is limited for several reasons. First, the sample size is relatively small, which may have made it difficult to reach statistical significance in some comparisons. Even so, our results are similar to other published articles that use smaller samples, and the sample size of this study is the largest to date. Second, categorizing types of crime is difficult due to the complex characteristics of each case. Another limitation was related to the representativeness of the IPV group. In order to reduce the influence of confounders in the MRI analyses, participants with a history of substance abuse or personality disorder were excluded. Third, we do not have objective evidence that the stimuli were attended to equally by both groups, although there were no differences between groups in the activation of the occipital cortex in the comparison between task conditions (Vuilleumier, 2005). Lastly, our research has been conducted in 'first episode' batterers with low severity of violence. Despite this limitation, the findings from this study indicate that even batterers who are not imprisoned show brain differences.

In sum, our results have shown that batterers have different brain functioning, as compared to other criminals, when they observe both IPV and GV images as compared to neutral images. Future studies should replicate our results in batterers who have committed more severe offenses.

Funding

This work was supported by the Spanish Ministry of Science and Innovation (Project: PSI 2009-13585), Ministry of Economy and Competitiveness (Project: PSI2013-42792-R), and Regional Ministry of Economy, Innovation and Science from Andalusian Government (Project: P2012-SEJ1723). A Sara Borrell postdoctoral fellowship (CD14/00246) of the Carlos III Health Institute to O.C.R.

Acknowledgment

We acknowledge the support of the General Secretary of Penitentiary Institutions, Ministry of the Interior, Spain.

Supplementary data

Supplementary data are available at *SCAN* online.

Conflict of interest. None declared.

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ANEXO VI

STRUCTURAL BRAIN DIFFERENCES IN EMOTIONAL REGULATION AREAS BETWEEN MALE BATTERERS AN OTHER CRIMINALS: A PRELIMINARY STUDY

Under review

Verdejo-Román, J., Bueso-Izquierdo, N., Daugherty, J., Pérez-García, M., & Hidalgo-Ruzzante, N. (2017). Structural brain differences in emotional regulation areas between male batterers and other criminals: A preliminary study. *Social Neuroscience*.

Structural brain differences in emotional regulation areas between Male Batterers and Other Criminals: A preliminary study

Journal:	*Social Neuroscience*
Manuscript ID	Draft
Manuscript Type:	Research
Date Submitted by the Author:	Paper n/a
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Keywords:	neuroimaging, batterers, emotional processing, intimate partner violence

"Structural brain differences in emotional regulation areas between Male Batterers and Other Criminals: A preliminary study"

Word count: 4557

Abstract

Poor emotion processing is thought to influence violent behaviors among male batterers in abusive relationships. Nevertheless, little is known about the neural mechanisms of emotion processing in this population. **Objective**: With the objective of better understanding brain structure and its relation to emotion processing in male batterers, the present study compares the cortical grey matter thickness of male batterers to that of other criminals in brain areas related to emotion. Differences among these brain areas were also compared to an emotional perception task. **Method**: An MRI study and an emotional perception assessment was conducted with 21 male batterers and 20 men convicted of crimes other than Intimate Partner Violence (IPV). **Results**: Results demonstrated that batterers' had significantly thinner cortices in prefrontal (orbitofrontal), midline (anterior and posterior cingulate) and limbic (insula, parahipocampal) brain regions. The thickness of the dorsal posterior cingulate cortex in the batterer group correlated with scores on the emotional perception task. **Conclusion**: These findings shed light on a neuroscientific approach to analyzing violent behavior perpetrated by male batterers, leading to a better understanding of the underlying mechanisms involved in IPV.

Keywords: neuroimaging, batterers, emotional processing, intimate partner violence

Introduction

Difficulties in resolving conflicts or communicating effectively with partners or ex-partners constitute key features of the male batterer's (MB) psychological profile (Holtzworth-Munroe & Stuart, 1994). MBs often choose violent strategies, using verbal violence, control, or even physical strength as a method of domination over their partners (Arce & Fariña, 2006; Echeburúa & Amor, 2016). Another relevant characteristic among this population is their difficulties in communicating emotions to their partners, which can lead to a continuum of violent psychological and physical episodes (Castillo et al., 2005). Emotion regulation is a key aspect of normative behavior among human beings in social situations (Ekman, Friesen, & Ellsworth, 1972; Gross, 1999). The concept of emotion regulation has been defined as: "the ability of the human being to experience strong emotions, whether positive or negative, with the ability to handle them in personal or conflict situations" (Walden & Smith, 1997). Having difficulties in processing or regulating emotions may explain why there are MBs who do not resolve conflicts adequately, using violent tactics to control the situation instead (Harper et al., 2005).

In 2008, Babcock et al. explored this lack of emotional processing according to the typology of batterers suggested by Holtzworth-Munroe and Stuart (1994). This study utilized the Ekman's Emotional Recognition Test to measures one's ability to detect emotional capacity in others (Young, Perrett, Calder, Sprengelmeyer & Etcoff, 2002). In their results, generally violent or antisocial men showed problems in recognizing emotions (Babcock, Green & Webb, 2008). These findings suggest that poor emotional performance, among other variables, may be an important risk factor in violence against partners (Chase, O'Leary &

Heyman, 2001; Harper et al., 2005; Mc Nulty & Hellmuth, 2008). Nevertheless, Bueso-Izquierdo et al. (2015) demonstrated that MBs have better emotional recognition of anger and surprise than other criminals.

Despite the importance of emotional processing and regulation, these variables cannot explain the IPV phenomenon on their own. Recent studies have pointed out the importance of a more comprehensive approach to the male batterers' behaviour which includes patriarchy, psycho-social, personality, neuropsychological and biological variables (Bueso-Izquierdo et al, 2015; Chester et al., 2018; Corvo & Johnson, 2013; Pinto et al., 2010).

This approach comprises novel neuroscientific studies that are beginning to use techniques such as neuroimaging to advance knowledge on partner violence. From this neuroscientific perspective on intimate partner violence, few studies have used neuroimaging techniques to study the brain structure and functioning of batterers. Of this limited research, a structural MRI study suggests reduced volume in the right amygdala of male perpetrators of violence, when compared to healthy controls and non-violent alcohol dependent men (Zhang, 2011). However, this study has some limitations due to the fact that it was conducted on men who were not convicted for IPV. As a result, these findings could be linked to other criminal behavior and not specifically to intimate partner violence.

To date, only three neuroimaging studies have explored the specific brain functioning of batterers while they viewed pictures with emotional content. These studies have shown increased limbic and decreased frontal activation in response to aggressive stimuli with men (Lee et al., 2008) and increased frontal, anterior and posterior cingulate, and precuneus activations while viewing images of violence against women, when compared with controls or other criminals (Bueso-Izquierdo et al., 2016; Lee et al., 2009). These authors suggest that hyperactivation in these areas may underlie their maladaptive coping and lack of emotional regulatory control.

To the best our knowledge, no studies have specifically analyzed whether differences in brain structure are related to emotion processing and regulation in male batterers. Furthermore, no study has examined the brain areas that could be related to problems in resolving couple disputes and or that may be specific to male batterers.

In this sense, comparing batterers' brain structure to that of other criminals could help to better understand the mechanisms of IPV and the how the minds of male batterers work (Bueso-Izquierdo et al., 2015). Recent studies have linked cortical grey matter thickness to emotion regulation (Vijayakumar et al. 2014) and impulsive behaviour (Hoptman et al., 2014). Therefore, the purpose of the present study is to compare the cortical grey matter thickness of male batterers to that of other criminals in the brain areas related to emotional processing and regulation. We also aim to establish whether those differences correlate with behavioural measures of emotional perception.

We hypothesize that batterers, relative to other criminals, will show reduced cortical thickness in brain areas involved in emotion processes. If male batterers show a decreased cortical thickness, these differences should also be related to scores on the Ekman emotional perception face task.

Materials and Methods

Participants

Forty-one men convicted of crimes were recruited from the Center for Social Insertion (CSI) "Matilde Cantos Fernández", in Granada (Spain). They were divided into two groups: 1) twenty-one batterers (batterers group, BG) convicted for a crime of violence against women, and 2) twenty men convicted of crimes other than IPV (other criminal group, OCG). One participant from the OCG was excluded due his excessive movement during the MRI acquisition.

Details of inclusion and exclusion criteria, as well as further information about the Spanish IPV law and the crime severity of participants, are described completely elsewhere (Bueso-Izquierdo et al., 2016). In short, participants from both groups were convicted for the first time and had similar sanctions. Table 1 shows the socio-demographic and severity of crime information. Groups did not differ significantly in age, education level, and intelligence quotient (IQ). Individuals in the OCG with a score greater than or equal to 11 on the severity scale of the CTS2 (Conflict Tactic Scales) (Straus, Hamby, Boney-McCoy & Sugarman, 1996) were excluded. This criterion was established in a previous study (Cohen et al., 2003) to rule out physical or psychological violence against partners.

The study was approved by the Research Ethics Committee of the University of Granada, Spain. Participants were invited to collaborate in the study on a voluntary and anonymous basis. The confidentiality of personal information was guaranteed in accordance with the Spanish legislation protection of personal data (Organic Law 15/1999, December 13). All of the participants signed a written informed consent document and received 25 euros for participating in the study.

Materials

An interview evaluating socio-demographic information and the risk of serious couple violence was used (Echeburúa et al., 2008).

IPV Severity. The CTS2 Spanish version (Loinaz et al., 2012) of the original CTS2 (Conflict Tactic Scales; Straus et al., 1996) was used to detect the existence of physical, psychological, and/ or sexual violence towards a partner in a relationship.

Intelligence Quotient. The K-BIT (Brief Intelligence Test) (Kaufman et al., 1997): The K-BIT obtains a compound IQ by measuring cognitive functions through two tests: verbal (vocabulary, comprised of two tests) and non-verbal (matrix), which evaluates crystallized and fluid intelligence.

Emotional Perception. Ekman's Emotional Perception test (Ekman & Friesen, 1975) is a computerized test that presents faces of people displaying facial expressions corresponding to six basic emotions: anger, disgust, fear, happiness, sadness, and surprise (for reliability and validity values, see Young et al., 2002). The participant is required to identify the emotion expressed by each face. The main dependent variable is the number of hits in each emotional category.

Magnetic Resonance Imaging

Participants were scanned using a 3.0 T clinical MRI scanner equipped with a eight-channel phased-array head coil (Intera Achieva, Philips Medical Systems, Eindhoven, The Netherlands). A high resolution sagittal three-dimensional T1-weighted turbo-gradient-echo sequence was obtained with the following parameters: 160 slices, Repetition time (TR) = 8.3

ms, Echo time (TE) = 3.8 ms, Field of view (FOV) = 256 x 256 mm, flip angle = 8º, voxel resolution: 1 mm isotropic. Foam positioners were used to minimize head motion.

All images were manually inspected for major artifacts and realigned to the AC-PC line. Image processing was performed using the automated processing pipeline in FreeSurfer (version 5.1.0), involving intensity normalization, registration to Talairach space, skull stripping, segmentation of WM, tessellation of the WM boundary, and automatic correction of topological defects. Cortical thickness was generated by combining adjacent labels from the Destrieux atlas (Destrieux et al., 2010) using weighted averaging, based on the number of vertices in each label. Complete technical details are described extensively elsewhere (Fischl et al., 2000).

Procedure

In session 1, the initial interview and behavioral tasks were administered in the CSI. All participants were assessed in an individual and quiet room for approximately one hour. In session 2, MRI acquisition was taken in the Centro Diagnóstico CEDISA (Granada, Spain).

Regions of interest

Following the aims of this research, we constricted the neuroimaging analyses to brain regions indicated by the automated meta-analysis of emotion processing and regulation that included 1,340 previous studies, provided by www.neurosynth.org (Yarkoni, 2011). These areas, included in the anatomical parcellation of Destrieux (2010), comprised frontal areas (inferior, middle, superior and orbital cortices), the cingulate gyrus (anterior and posterior), the insulas, the precuneus, the inferior and intra-parietal cortices, the superior temporal gyrus, and the middle and superior occipital gyrus.

Statistical analyses

Demographic, behavioral, and cortical thickness data were analyzed with SPSS 19 (Chicago, IL, USA). We conducted independent t-tests (two-tailed) to compare the two groups. We also examined whether cortical thickness of the region of interest differed between groups using independent t-tests. To discard the differences that could be driven by the different age distribution, we conducted additional analyses of group comparisons using age as a covariate. Finally, we performed a pearson correlation analysis to estimate the relationship between the Ekman face performance and the cortical thickness of the selected areas in the batterers group.

Results

BG showed thinner cortex in the left dorsal posterior cingulate cortex and parahippocampal gyrus, the right anterior cingulate cortex, the central sulcus of the insula, and bilaterally in the medial orbital sulcus (See table 2 and Figure 1).

Correlation analyses showed that the dPCC cortical thickness positively correlated with the total Ekman score in the BG (r = 0.53, p = 0.029). No other correlation reached statistical significance.

Discussion

The main aim of this study was to examine cortical thickness of brain regions involved in emotional processing in a group of male batterers compared to other criminals. We found that batterers have thinner cortices in prefrontal, midline, and limbic brain regions. Further, the thickness of the dorsal posterior cingulate cortex in the batterer group correlated with scores on the Ekman's Emotional Perception test.

Our results are in line with the findings of Zhang et al., (2011), who provided the first evidence in male perpetrators of violence of reduced amygdala volume, a key region involved in emotional processing. Our study expands on these findings to include several additional cortical brain areas that have been previously related to emotion processing and regulation. In our results, cortical thickness is reduced in male batterers in the posterior cingulate cortex (PCC), which is correlated with the Ekman emotional perception scores. To the best of our knowledge, this is the first study to provide empirical evidence for the relationship between emotional impairment and differential brain structure in male batterers. The involvement of this brain region in IPV is consistent with previous functional neuroimaging studies that demonstrate a higher activation of the PCC in batterers while viewing images of violence against women (Bueso-Izquierdo et al., 2016; Lee et al., 2009). Other studies have also similarly shown activation in the PCC in relation to moral judgement in harmful actions and elevated negative attitudes toward others (Bruneau et al., 2010; Greene et al., 2001). Nevertheless, the preliminary results of the present study should be considered with caution considering a correlation was found in only one cerebral region of those that were examined.

Previous studies in healthy controls have likewise demonstrated involvement of the ACC in modulating emotional reactions (Bush et al., 2000; Etkin et al., 2011; Luu & Posner, 2003) and interpersonal emotion regulation (Hallam et al. 2014). For example, some studies have found a higher activation in the ACC in response to IPV vs neutral images in male batterers (Bueso-Izquierdo et al., 2016). The ACC has also been found to be involved in self-referential aspects of thinking, emotional contagion and affective perspective taking (Harrison, 2008; Raichle et al., 2001; Raine & Yang, 2006).

Two recent meta-analyses help to explain the role of emotion processing in the remaining brain areas found to have reduced cortical thickness in batterers. The first demonstrates that the medial orbitofrontal, insular and anterior cingulate cortices are part of a common network that integrates interoception, emotion, and social cognition (Adolfi et al., 2017). Finally, the second meta-analysis which explores up- and down-regulation processes found that the parahippocampal gyrus decreases its activation during emotion downregulation (Frank et al., 2014).

Today, a consensus has still not been reached on the specific causes of violence against women and what leads these men to attack, since their forms of aggression are related to a multitude of factors such as personality, values, the patriarchal and sociocultural context of the couple, circumstances of the event, and neurobiological factors (Lorente Acosta, 2004). Considering this complexity, the present study seeks to makes a closer approximation by involving several of these integral factors and investigating the role of emotions from a neuroscientific perspective.

Neuroscience can offer a better understanding of how brain activity is related to the behavior of this population. Including neuroscientific studies within the psychological study of intimate partner violence may help to explain why male batterers tend to behave in a defiant and cruel manner, without fearing the criminal consequences of their behavior, or assuming responsibility for their maltreatment of the victim (Echeburúa and Corral, 2008). Poor management of emotions may trigger severe aggravation and frustration, especially when accompanied by feelings of abandonment and betrayal. All this, perceived as an injustice, seems to feed the desire to assault women or even to re-offend once they have served their sentence (Fernández-Montalvo & Echeburúa, 1997).

In sum, this preliminary study expands our knowledge on the specific brain structures of batterers and their relation to emotional processing and regulation. It offers a better understanding of the role of the emotions behind abusive relationships with intimate partners.

Research Limitations

This study has the following limitations. First, the sample size is small due to the fact that not all participants could perform the magnetic resonance session as a result of incompatibilities with the machine. Furthermore, various individuals were unable to participate due to difficulties in receiving permissions of leave from the penitentiary. Second, this study only analyzes batterers who committed their 'first episode'. Despite this limitation, the findings from this study indicate that even batterers who are not imprisoned show brain differences.

Future research should increase the sample size and improve the pioneering studies that have been carried out thus far. As such, it may be useful to study emotional processing and brain structure in terms of the batterer's typology as illustrated by Babcock et al. (2008).

Research Implications

These preliminary findings on neuroimaging research in men give light to a new perspective with two goals in mind. First, these results deepen our understanding about the brain structures involved in the behaviors behind violent acts in order to better understand their role. Additionally, it is critical to emphasize that future neuroscientific studies on IPV should never be used to justify violent acts or to exonerate batterers from the responsibility of their actions (Gondolf, 2007). Instead, they should serve to indicate what brain areas may be related to violent behaviors in male batterers (Bueso-Izquierdo et al., 2016).

Clinical and Policy Implications

Interventions in emotion regulation in intimate partners has been shown to decrease conflict between partners (Finkel, 2013). Further research is needed to better understand emotion processing specific to male batterers and whether improvement in this area could prevent violent conflict in relationships. These results offer useful information to professionals who work with male batterers. Furthermore, this preliminary study could serve to improve therapy with this population, bringing attention to the evaluation of emotion recognition. In turn, results from these assessments could lead to different prognoses in rehabilitation programs, serving as an impetus for evaluating emotion management before and after abusive men receive therapy. This approach has previously been recommended by Romero-Martínez et al. (2016), who suggests focusing on empathy skills after the therapy. All these improvements following therapy could potentially lead to non recidivism in male batterers of intimate partner violence.

Disclosure Statement

The authors report no conflicts of interest.

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Table 1. Socio-demographic and severity of crime information

Variable mean (SD)	BG	OCG	p-value
Age	38.38 (8.70)	34.74 (8.76)	0.195
Years of education	9.62 (3.90)	9.53 (2.46)	0.928
IQ	99.83 (14.29)	93.32 (13.52)	0.163
Type of crime [%(n)]			0.369
Misdemeanor	IPV/PV = 38% (8)	SCF/DD = 53% (10)	
Felony	IPV/PPV = 62% (13)	GAR/VF = 47% (9)	

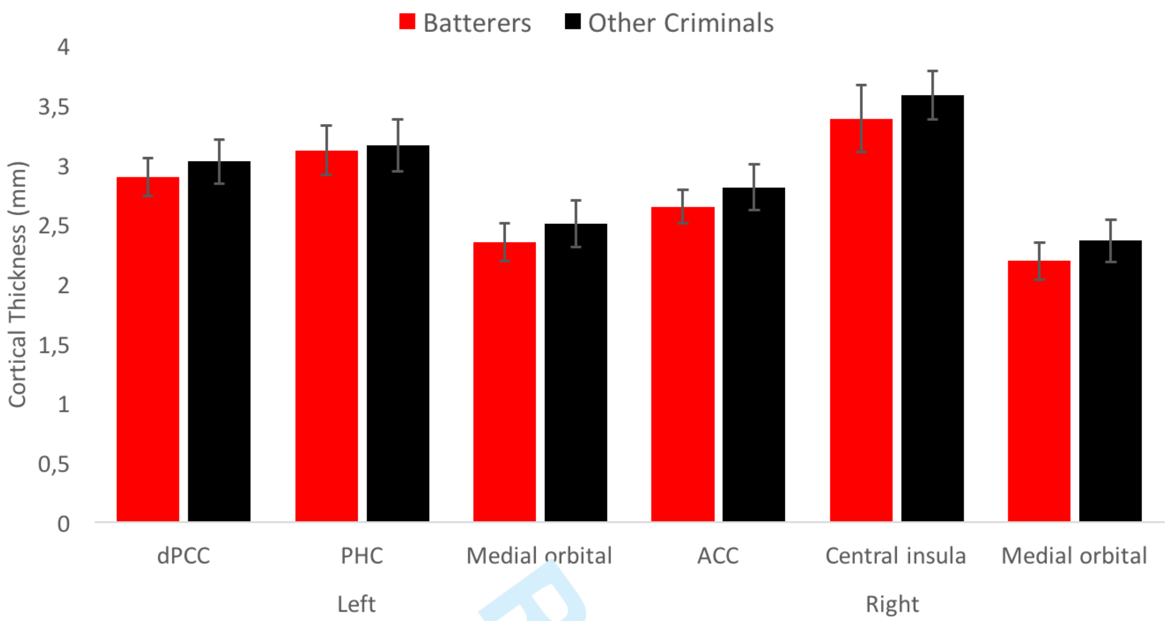
Note: SD, standard deviation; IPV, intimate partner violence; PV, psychological violence; SCF, scams or crime of forgery; DD, dangerous driving; IPV-PPV, IPV-physical and psychological violence; GAR, grave assault/ robbery; VF, violent fight.

Table 2. Mean cortical thickness and correlation with Ekman scores in the batterers group, of brain regions showing statistical differences between groups.

Region	Side	BG	OCG	p-value	p-value (age-adjust)	Correlation with Ekman scores (only BG)
Dorsal Posterior cingulate cortex (dPCC)	Left	2.895 (0.156)	3.026 (0.183)	0.019	0.039	r=0.530 p=0.029
Parahippocampal gyrus	Left	3.119 (0.206)	3.259 (0.218)	0.043	0.040	r=0.225 p=0.384
Medial orbital sulcus	Left	2.350 (0.161)	2.504 (0.195)	0.010	0.007	r=-0.326 p=0.202
Anterior Cingulate Cortex (ACC)	Right	2.648 (0.139)	2.810 (0.192)	0.004	0.010	r=0.353 p=0.165
Central sulcus of the insula	Right	3.385 (0.279)	3.580 (0.202)	0.017	0.043	r=0.036 p=0.891
Medial orbital sulcus	Right	2.191 (0.157)	2.363 (0.178)	0.002	0.005	r=0.091 p=0.729

Note: BG,batterer group; OCG, other criminal group.

Figure 1: Mean group cortical thickness of brain areas showing significant differences between groups.



Note: dPCC: dorsal Posterior Cingulate Cortex; PHC: Parahippocampal gyrus; ACC: Anterior Cingulate Cortex.

"Structural brain differences in emotional regulation areas between Male Batterers and Other Criminals: A preliminary study"

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Funding

This work was supported by the Spanish Ministry of Science and Innovation (Project: PSI 2009-13585), Ministry of Economy and Competitiveness (Project: PSI2013-42792-R), and Regional Ministry of Economy, Innovation and Science from Andalusian Government (Project: P2012-SEJ1723). And a predoctoral fellowship of the Ministry of Economy and Competitiveness.

ANEXO VII

PREVALENCE AND NATURE OF STRUCTURAL BRAIN ABNORMALITIES IN BATTERERS: A MAGNETIC RESONANCE IMAGING STUDY

Major Revision

Bueso-Izquierdo, N., Verdejo-Román, J., Martínez-Barbero, J.C., Pérez-Rosillo, M.A., Pérez-García, M., Hidalgo-Ruzzante, N., & Hart, S. (2017). Prevalence and nature of structural brain abnormalities in batterers: A magnetic resonance imaging study.

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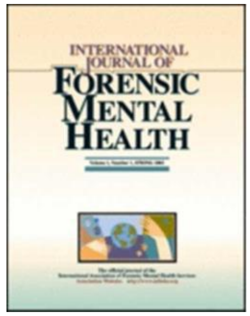

Prevalence and Nature of Structural Brain Abnormalities in Batterers: A Magnetic Resonance Imaging Study

Journal:	*International Journal of Forensic Mental Health*
Manuscript ID	UFMH-2017-078.R1
Manuscript Type:	Original Article
Keywords:	Intimate partner violence, structural brain abnormalities, magnetic resonance imaging.

Abstract: Introduction: Past research has found differences in the brain activation of batterers versus other offenders in response to depictions of violence, but it is not known whether these functional differences are associated with structural brain abnormalities (SBAs). Objective: Investigate the prevalence and nature of SBAs in batterers using neuroimaging methods. Method: Two neuroradiologists independently diagnosed SBAs based on Magnetic Resonance Imaging scans for the 21 batterers and 20 other offenders, as well as for a control group comprising 21 healthy adult males. All participants had been screened to ensure that they had no obvious brain damage secondary to neurological injury or insult. Results: 1 participant had both a major and minor SBA; 17 had one or more minor SBAs. Most were judged to be not clinically relevant. The prevalence of SBAs was significantly higher in batterers than in other offenders, but not significantly higher than that of healthy controls. Conclusion: SBAs are not strongly or specifically associated with IPV, and it is unlikely they are responsible for the differences in brain functioning between batterers and other offenders observed in past research.

Prevalence and Nature of Structural Brain Abnormalities in Batterers: A Magnetic Resonance Imaging Study

Abstract

Introduction: Past research has found differences in the brain activation of batterers versus other offenders in response to depictions of violence, but it is not known whether these functional differences are associated with structural brain abnormalities (SBAs). **Objective**: Investigate the prevalence and nature of SBAs in batterers using neuroimaging methods. **Method**: Two neuroradiologists independently diagnosed SBAs based on Magnetic Resonance Imaging scans for the 21 batterers and 20 other offenders, as well as for a control group comprising 21 healthy adult males. All participants had been screened to ensure that they had no obvious brain damage secondary to neurological injury or insult, including traumatic brain injury. **Results**: 1 participant had both a major and minor SBA; 17 had one or more minor SBAs. Most were judged to be not clinically relevant. The prevalence of SBAs was significantly higher in batterers than in other offenders, but not significantly higher than that of healthy controls. **Conclusion**: SBAs are not strongly or specifically associated with IPV, and it is unlikely they are responsible for the differences in brain functioning between batterers and other offenders observed in past research.

Keywords: intimate partner violence, structural brain abnormalities, magnetic resonance imaging.

Prevalence and Nature of Structural Brain Abnormalities in Batterers: A Magnetic Resonance Imaging Study

Intimate partner violence (IPV) is a serious social problem, and one that appears to reflect the influence of causal factors from biological, psychological, interpersonal, and social domains (e.g., Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002). In recent years, there has been increased focus on biological factors in IPV, and especially on neurocognitive factors (e.g., Bueso-Izquierdo et al., 2015; Chester et al., 2018; Corvo & Johnson, 2013; Pinto et al., 2010), due in part to the advances in neuroimaging technologies and techniques. In addition to its potential for improving our theoretical understanding of the causes of violence generally and IPV more specifically, neuroscientific research may have important clinical implications for risk assessment and treatment, as well as for legal decisions about criminal responsibility or culpability (Eastman & Campbell, 2006; Gazzaniga, 2008; Goodenough & Tucker, 2010; Knabb et al., 2009; Vincent, 2013; but cf. Gondolf, 2007, 2011).

There have been many neuroimaging studies of generally violent offenders (Choudhury, Nagel, & Slaby, 2009) but, as far as we know, there are only three published studies looking specifically with IPV offenders (Bueso-Izquierdo et al., 2016; Lee et al., 2008; Lee et al., 2009), a group commonly referred to as batterers. All three studies examined brain function, that is, brain activation after exposure to various stimuli as assessed by functional Magnetic Resonance Imaging or fMRI. In the first study, Lee et al. (2008) found that male batterers had increased limbic activation and decreased frontal activation in response to aggressive stimuli. In the second and third studies, Lee et al. (2009) and Bueso-Izquierdo et al. (2016) found increased activation of the frontal, anterior and posterior cingulate, and precuneus regions while viewing images of IPV in batterers, as compared with other groups.

At least on the surface, these findings of differences in the brain *function* of batterers (versus other offenders) appear to be consistent with suggestions that there may be a high rate of abnormal brain *structure* in batterers (see, for example, Becerra-García, 2015; Farrer, Frost, & Hedges, 2012; Romero-Martínez & Moya-Albiol, 2013). But there are several reasons why one should be cautious drawing conclusions about structural abnormality on the basis of functional differences. First, functional differences may reflect normal processes or individual differences such as attitudes, personality traits, trauma, or coping mechanisms rather than some congenital, idiopathic, or other pathological process (George et al., 2006). Second, functional differences may be context-specific rather than generalized, evident only when exposed to certain stimuli or while performing certain tasks. Third, it is not safe to assume that functional differences observed at the group level are found in all or even most members of a group.

Current Study

In this study, we investigated the prevalence and nature of structural brain abnormalities in 21 batterers versus 20 other offenders from(Bueso-Izquierdo et al., 2016), as well as a new group of 21 healthy controls. Two neuroradiologists independently diagnosed structural brain abnormalities based on MRI scans taken as part of the original fMRI studies in which the men had participated. If general or specific structural abnormalities are common in batterers who have exhibited functional differences—and especially of the structural abnormalities are more common in batterers than in other offenders or healthy controls—it is plausible that structural abnormalities may account for the functional differences.

Method

Participants

As noted previously, the 21 batterers and 20 other offenders were the same participants studied by Bueso-Izquierdo et al.(2016). A detailed description of the recruitment and selection criteria of that study, as well as the demographic and criminal history characteristics batterers and other offenders, can be found in the original article. Briefly, all the offenders were adult males, aged 18 years or older, and serving custodial sentences. They had been invited and volunteered to take part in a fMRI study. Those who received a more detailed explanation of the study and gave informed consent to participate underwent a screening assessment. Offenders were excluded from participation if they met any of the following criteria: lack of basic literacy skills; unable to attend the research facilities due to security restrictions; lifetime diagnosis of serious mental illness; lifetime diagnosis of substance use according to SCID/DSM-IV criteria (American Psychiatric Association, 1994; First et al., 1999); a history of head injury with loss of consciousness of any duration asked during the initial interview; a history of neurological, systemic, or other disease affecting the central nervous system; or the presence of any contraindication for undergoing neuroimaging in the opinion of the fMRI technicians (e.g., claustrophobia, implanted ferromagnetic objects, or evidence of gross brain damage in the initial fMRI scans).[1] Offenders were classified as batterers if they were serving a sentence for IPV-related crimes, and as other offenders if they were not serving a sentence for IPV-related crimes and did not self-report a history of serious IPV according to the revised Conflict Tactics Scale (Straus et al., 1996; i.e., CTS2 severity score $\leq$ 11, following Cohen et al., 2003) to rule out physical or psychological violence against partners.

The 21 health controls were also adult males, aged 18 and older. They were selected from a larger group of healthy controls who volunteered to participate in another fMRI study of substance abusers (Moreno-López et al., 2013) to match the batters and other offenders with respect to age. All had passed screening to ensure that they did not meet any of the exclusion criteria used to screen the batterers and other offenders. In addition, none reported a history of conviction for IPV-related or other criminal offenses; however, as the healthy controls did not complete the CTS2, we were unable to confirm that they did not have a self-reported history of serious IPV that did not result in conviction.

The final sample, then, comprised 21 batterers, 20 other offenders, and 21 healthy controls. The average age of men in each was as follows: batterers, M = 38.38 yrs, SD = 8.70 yrs; other offenders, M = 34.40 yrs, SD = 8.66 yrs; and healthy controls, M = 34.33 yrs, SD = 4.22 yrs. The groups did not differ significantly in terms of age, F (2, 61) = 2.00, p = 0.144.

The study was approved by the Research Ethics Committee of University of Granada, Spain. Participants were invited to collaborate on a voluntary and anonymous basis. The confidentiality of personal information was guaranteed in accordance with the Spanish legislation on personal data protection (Organic Law 15/1999, December 13). All the participants signed a written informed consent document and received economic compensation for participating in the study.

Procedure

Magnetic Resonance Imaging. Participants were scanned using a 3.0 T clinical MRI scanner equipped with a eight-channel phased-array head coil (Intera Achieva, Philips Medical Systems, Eindhoven, The Netherlands). A high resolution sagittal three-dimensional T1-weighted turbo-gradient-echo sequence was obtained with the following parameters: 160 slices, Repetition time (TR) = 8.3 ms, Echo time (TE) = 3.8 ms, Field of view (FOV) = 256 x 256 mm, flip angle = 8º, voxel resolution: 1 mm isotropic. A T2 single-shot TSE sequence was also obtained: 19 slices, TR = 15 s, TE = 90 ms, FOV = 230 x 230 mm, flip angle = 90º, voxel resolution: 0.5 x 0.5 x 4 mm. Foam positioners were used to minimize head motion.

The acquisition of MRI was taken in a private imaging center under a research agreement with the University of Granada, Spain.

Radiologist Procedure

All images were evaluated for findings by two experienced neuroradiologists (XXXX & XXXX) with 10 and 5 years of experience, respectively, in reading brain MRIs. They diagnosed all brain images independently and group-blinded, then reached consensus in case of discrepancy between them.

The neuroimaging studies were classified in three categories according to their findings: normal findings, findings of minor abnormalities, and findings of major abnormalities. Normal studies were those without any intracranial abnormality. Extracranial findings, such as sinus pathology, were not taken under consideration as they were not related with the purpose of our study. Isolated enlarged perivascular Virchow-Robin spaces without mass effect were also not considered abnormal findings.

Findings of minor abnormalities were those considered not clinically relevant. They included congenital abnormalities such as developmental venous anomalies or DVAs (Töoper et al.,1999); normal variations such as ventricular asymmetry; nonspecific white matter lesions; and cystic lesions with no mass effect, such as small pineal or arachnoid cysts. Findings such as these are frequent in young healthy volunteers and do not require clinical evaluation or follow up (Evans, 2017; Vernooij, 2007).

Findings of major abnormalities were those with clinical relevance, including those that require further study, follow up, or treatment (Katzman, 1999; Bos et al., 2016; Sempere et al., 2005). According to literature, major findings typically include: intracranial solid tumours, intracranial cysts with mass effect or bigger than 10 millimeter, ischaemic lesions (lacunary or major infarctions), intracranial haemorrhage, post traumatic injuries, severe brain atrophy, hypertensive hydrocephalus, vascular malformations, and congenital abnormalities with clinical impairment such as neuronal migration and cortical organization disorders. White matter acquired pathologies such as multiple sclerosis or severe small vessel ischemic disease may also be considered as major findings (Osborn, 2015). It is important to emphasize, however, that categorization of imaging findings may differ among investigators as some may classify normal anatomical variants as minor abnormalities whereas others may not. In addition, the consideration of an imaging abnormality as major may also vary according to the clinical experience of the reader and the symptoms of the patient.

White matter punctuated lesions were first evaluated according to MAGNIMS criteria, to rule out a potential origin (Filippi et al., 2016). If lesions did not meet those diagnostic criteria, they were evaluated according to the Age-Related White Matter Changes or ARWMC scale (Wahlund et al., 2001). This is the reference scale to measure quantitatively white matter lesions secondary to small vessel disease. Brain atrophy was evaluated using the global cortical atrophy scale (Harper et al., 2015).

Agreement between the findings of the two independent neuroradiologists was indexed using Cohen's kappa or χ_2 (McHugh, 2012). Overall agreement was excellent, χ_2 = 0.84.

Results

Major Abnormalities

The prevalence of major abnormalities is summarized in Table 1. Only 1 participant, a batter, was deemed to have major abnormality. It was an enlarged pineal cystic lesion, maximum diameter of 16mm, that caused no mass effect and was judged to be not clinically relevant.

Minor Abnormalities

The prevalence of minor abnormalities is summarized in Table 2. A total of 18 participants were deemed to have minor abnormalities: 10 batterers, 3 other offenders, and 5 healthy controls. Of these, 4 participants presented multiple abnormalities: 1 was the batter with a major abnormality, who also had leukoaraiosis; and the other 3 had brain atrophy plus leukoaraiosis.

White matter lesions consistent with leukoaraiosis were observed in 11 participants: 6 batterers, 2 other offenders, and 3 healthy controls. White matter punctuate lesions are a common finding in neuroimaging studies, and they are commonly cataloged as “nonspecific” in radiology reports. In young patients, the most important task for the radiologist is to rule out multiple sclerosis as the underlying cause; as noted previously, MAGNIMS criteria were used to rule out multiple sclerosis in our subjects. White matter punctuate lesions may be also related to normal ageing, cardiovascular risk factors, or migraine (Osborn, Alder, & Mitchell, 1991). We categorized white matter lesions were according to ARWMC classification, which is based on number and location of lesions, cognitive decline, and cardiovascular risk factors. In 10 of the 11 cases, participants had very few and isolated lesions, consistent with Grade 1 of the ARWMC classification. Grade 1 may be a normal finding in healthy people; it is usually subclinical and does not need to be included in radiology reports. Only 1 participants had a higher number of lesions, consistent with Grade 2 of ARWMC. As this participant was a healthy control, the lesions were judged not to be clinically relevant.

Brain atrophy, or loss of brain volume, was observed in 4 participants: 3 batterers and 1 other offender. Brain atrophy was mild in all 4 cases, who were between 34 and 49 years old. As the results of intellectual assessment using the K-bit (Kaufman et al., 1997) revealed no evidence of deficits, with IQs ranging from 93 to 128, the brain atrophy was considered not clinically relevant.

Small pineal cystic lesions were observed in 3 participants: 2 batterers group and 1 other offender. In two cases, the cysts measured one centimeter; and in the other case, the cyst measured 16 x 13 mm. Pineal cyst are common findings in neuroimaging studies, and their clinical relevance is usually related to their mass effect, as they may cause hydrocephalus (Berhouma et al., 2015). However, the lesion found in our study did not produce relevant mass effect over the *lamina cuadrigemina*, and the supratentorial ventricular system was normal in size and shape (Májovský, Netuka, & Beneš, 2016). Pineal cystic lesions have also been related in certain patients to increased risk of migraine and to sleep disorders (Seifert et al., 2008). Nevertheless, to our knowledge, they have never been related to behavioral disorders, violence or any other psychological alteration allied to the purpose of our study.

Images highly suspicious of developmental venous anomalies (DVAs, also known as *caput medusae*) were observed in 2 participants: 1 batterer and 1 healthy control. As intravenous contrast media was not administered, the diagnosis could not be confirmed. In one case, the suspected DVA was located at the inferior frontal gyrus, and in the other it was located in the left temporal lobe. DVAs are congenital abnormalities of venous drainage that typically do not cause other symptoms and are without clinical significance (Töpper et al., 1999); in these cases, there was no suspicion of complications, as no oedema or bleeding was seen surrounding the suspected DVAs.

An arachnoid cyst was observed in 1 participant, a healthy control. Arachnoid cysts are a common finding in neuroimaging studies, and may be found in both asymptomatic patients and healthy subjects (Vernooij et al., 2007). In the affected participant, the arachnoid cyst was located in the right middle cranial fossa. It did not cause mass effect over the ventricular system, and no edema was found in the underlying temporal pole parenchyma. Thus, it was considered an incidental finding with no clinical relevance, as further studies or follow up were not indicated (Ros López, Martín Gallego, & Iglesias Moroño, 2016).

Non-hypertensive ventriculomegaly was observed in 1 participant, a batterer. Ventriculomegaly is a condition that occurs when the ventricular system grows in volume but intraventricular pressure is not increased and there are not obstructive lesions. It is usually a long-term condition with onset in childhood (Osborn, 2011).

Overall Prevalence and Group Differences

Overall, then, 18 of 62 participants (29%) had at least one structural abnormality: 1 had a major plus a minor abnormality, and 17 had one or two minor abnormalities. The prevalence of abnormalities was highest in batterers, with 10 of 21 participants (48%) having at least one; lower in healthy controls, with 5 of 21 (25%) having at least one; and lowest in other offenders, with 3 of 20 (15%) having at least one.

We indexed the between-group differences in the prevalence of structural abnormalities using odds ratios (ORs). The overall test of the homogeneity approached statistical significance, χ^2 (2) = 5.62, p = .060, indicating substantial heterogeneity among the ORs. This was due to a statistically significant difference between batterers and other offenders, OR = .19, χ^2 (1) = 4.91, p = .027. There was, however, no statistically significant difference between batterers and healthy controls, OR = .34, χ^2 (1) = 2.53, p = .112; or between other offenders and healthy controls, OR = 1.77, χ^2 (1) = 0.49, p = .482.

Discussion

We compared the prevalence of structural brain abnormalities, assessed by neuroradiologists based on MRI scans, in batterers versus other offenders and healthy controls. All participants were carefully screened to control for potential confounding factors, including brain damage secondary to neurological injury or insult. Only one participant, a batterer, was found to have both a major and minor structural abnormality, and 17 had only minor structural abnormalities. Most of the abnormalities were judged to be not clinically relevant. Overall, just under half of batterers had structural brain abnormalities, and although the prevalence of structural brain abnormalities in batterers was significantly higher than in other offenders, it was not significantly higher than in healthy controls. In addition, all SBAs were unrelated to brain damage or TBI and it has also been observed that they were not clinically implicated.

Limitations

Our study, like most brain imaging studies, had a small sample. This limited our ability to make precise estimates of the prevalence of structural brain abnormalities, and also limited our power to detect between-group differences in prevalence. We doubt that most research groups will be able to locate the resources necessary to conduct large-sample brain imaging studies with offenders; however, if enough small-sample studies are conducted, it should be possible to aggregate findings using meta-analytic methods. We therefore encourage attempts to replicate and extend our findings.

We also had difficulty forming “pure” groups in our study. Ideally, in future research, all participants would undergo a review of official records to confirm the presence or absence of arrest, charge, or conviction for IPV-related offenses (as was done in this study), but, in addition, all participants would complete self-reports of IPV perpetration and their intimate partners would complete self-reports of IPV victimization by the participants. Another limitation was that our control group was not assessed for IPV with the CTS2. This was because we only used the CTS2 to discard intimate partner violence for the criminal group.

We controlled for confounding factors, including brain damage secondary to neurological injury or insult, by selection. The major limitation of this strategy is that confounded factors are a fact of life. Most people’s problems in living are complex, and so focusing solely on a minority of people with relatively simple problems may led to results that are not representative of or generalizable to the majority.

Finally, the MRI protocol that we used was not optimal for analyzing the clinical significance of the findings. Specifically, acquisition parameters were adjusted according to the research aims or the original studies and did not include all the specific sequences used in routine clinical practice.

Implications for Theory

Our findings suggest that structural brain abnormalities, **not linked to TBI,** are not strongly or specifically associated with IPV. As a consequence, it is unlikely that structural abnormalities are responsible for the differences in brain functioning between batterers and other offenders observed in past research (e.g., Lee et al., 2008; Lee et al., 2009; Bueso-Izquierdo et al., 2016)—at least, unlikely they are responsible for *all* the observed functional differences.

We speculate that structural brain abnormalities (as well as other neurocognitive problems) may have an adverse influence on human decision making regarding whether or not to commit violence, both IPV and general violence. Specifically, they may play a general disinhibiting or destabilizing causal role. Once people have a motivation (thought, urge, impulse) to engage in violence, structural brain abnormalities may adversely affect the care with which they evaluate the potential negative consequences of perpetrating violence or consider and evaluate the potential positive consequences of alternatives to violence.

Implications for Forensic Mental Health

We plan to continue researching biological factors related to IPV, and we encourage others to do so. Even if these factors are related to violence generally rather than IPV specifically, understanding the nature and extent of their causal influence may assist and improve risk assessment, treatment, and even assessment of criminal culpability.

But in the course of our work, we will continue to heed the warnings of those who are skeptical about the relevance of neuroscience research for the practice of forensic mental health, and in particular Gondolf's comments about neuroscience research on batterers (Gondolf, 2007, 2011). We believe that neuroscience research need not—indeed, *should* not—take a reductionist stance. If one accepts the general utility of an ecological or multi-level approach to understanding violence, then it would be as foolish to over-focus on biological factors as it would be to disregard them.

Neurocognitive factors such as structural abnormalities, then, may be risk factors for violence that play a limited and contributory causal role, but are clearly neither necessary nor sufficient causes. This speculation is consistent with the many rational choice theories of violence, such as situated action theory (Wikström & Treiber, 2009), decision theory (Hart & Logan, 2011), and I^3 theory (Slotter & Finkel, 2011). It may be inconsistent with the view that there are unique biological, sociobiological, or evolutionary mechanisms underlying IPV vis-à-vis general violence. Rational choice theories have been the dominant models of human action in Western thought (including philosophy, law, economics, neuroscience, psychology, and criminology) for the past 2,300 years. They do not assume that people are rational in the sense of acting on the basis of (correct) reason or logic correct, but instead rational in the sense of acting in a reasoned manner, moving from goal to intent to action. With respect to violence, they assume that many factors impinge on or influence a person's decisions, including decisions about whether or how to commit violence, often resulting in bad choices (i.e., those with non-optimal outcomes) or choices made badly (i.e., in a disorganized or incoherent manner) (Hart, Douglas, & Guy, 2016). Researchers and practitioners alike should keep in mind that biological factors are only one out of many families of factors that influence people's decisions about violence, and they do not trump psychological, interpersonal, and social factors. The (potential) existence and influence of biological factors does not rob people of their capacity and responsibility to make better decisions; nor does it rob forensic mental health professionals of the capacity or responsibility to help their patients make better decisions.

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Table 1

Prevalence (Number, %) of Major Structural Brain Abnormalities, Overall and in Batterers, Other Offenders, and Healthy Controls

Major Abnormalities	**Overall (*N* = 62)**	**Batterers (*N* = 21)**	**Other Offenders (*N* = 20)**	**Healthy Controls (*N* = 21)**
Solid tumors	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ischemic lesions	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Demyelinating disease	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Intracranial cyst (> 10 mm)	1 (2%)	1 (5%)	0 (0%)	0 (0%)
Intracranial haemorrhage	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Post traumatic injuries	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Severe brain atrophy	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Hypertensive hydrocephalus	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Vascular malformations	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Any Major Abnormality	**1 (2%)**	**1 (5%)**	**0 (0%)**	**0 (0%)**

Table 2

Prevalence (Number, %) of Minor Structural Brain Abnormalities, Overall and in Batterers, Other Offenders, and Healthy Controls

Minor Abnormalities	Overall (*N* = 62)	Batterers (*N* = 21)	Other Offenders (*N* = 20)	Healthy Controls (*N* = 21)
Leukoaraiosis	11 (18%)	6 (29%)	2 (10%)	3 (14%)
Brain atrophy	4 (6%)	3 (14%)	1 (5%)	0 (0%)
Pineal cyst	3 (5%)	2 (10%)	1 (5%)	0 (0%)
Developmental venous anomaly	2 (3%)	1 (5%)	0 (0%)	1 (5%)
Arachnoid cyst	1 (2%)	0 (0%)	0 (0%)	1 (5%)
Non-hypertensive ventriculomegaly	1 (2%)	1 (5%)	0 (0%)	1 (5%)
Any Minor Abnormality	**18 (29%)**	**10 (48%)**	**3 (15%)**	**5 (25%)**

[1] One important goal of the exclusion criteria was to control via selection for potential confounding factors, including brain damage secondary to neurological insult or injury. Although it is generally recognized that brain damage increase the risk for general violence, there is no reason to believe that it is specifically related to risk for IPV; our focus was on structural brain abnormalities that might be specifically related to risk for IPV.