Article

Risk Assessments of Epidural Analgesia During Labor and Delivery

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Antonio Herrera-Gómez, PhD, RN[1,2], Elvira De Luna-Bertos, PhD, RN[2], Javier Ramos-Torrecillas, PhD, RN[2], Francisco M.anuel Ocaña-Peinado, PhD, RN[2]3, Concepción Ruiz, PhD, RN[2], and Olga García-Martínez, PhD, RN[2]

Abstract

Epidural analgesia (EA) is one of the methods of choice for labor pain relief, but its adverse effects on the mother and child remain controversial. The objective of this study was to determine whether there is an association between the use of EA and different aspects of labor. The author(s) analyzed the effect of EA on different aspects of labor in a retrospective cohort observational study of deliveries in a public Spanish hospital during a 3-year period. Women with EA administration were found to increase the risk of stimulated labor, reduce the percentage of spontaneous deliveries, increase the risk of instrumental labor due to stalled labor or loss of fetal well-being, and increase the percentage of episiotomies. However, women with EA were not and increased risk for perineal laceration or the condition of the membranes at the delivery or with the type of placental expulsion. Thus, the

[1]Hospital "San Juan de la Cruz"—Servicio Sanitario Público Andaluz, Jaén, Spain
[2]University Biomedical Group (BIO277). Biomedical Group (BIO277). Department of Nursing, Faculty of Health Sciences, University of Granada, Spain. Instituto Investigación Biosanitaria, ibs.Granada University of Granada, Spain.
3. Department of Statistics and Operations Research, School of Pharmacy, University of Granada, Spain.
4. Institute of Neuroscience, University of Granada, Spain

Corresponding Author: [AQ1]

Elvira De Luna-Bertos, Departamento de Enfermería, Faculty of Health Sciences, University of Granada, Avda. de la Ilustración 60, 18071 Granada, Spain.
Email: elviradlb@ugr.es

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administration of EA should be assessed in each case by the health care professional.

Keywords
epidural analgesia, labor onset, labor progression, instrumental delivery, midwifery

Introduction

Pain during labor is a common phenomenon and relief of labor pain is important for women. This type of pain can be relieved by pharmacological and nonpharmacological therapies. According to the scientific evidence, pharmacological methods are the most effective to relieve labor pains but adverse effects are also more frequent (Camann, 2005; Gaiser, 2005; Kukulu & Demirok, 2008; Jones et al., 2012). Currently, the most widely used method of pain relief in labor is the epidural analgesia (EA) due to its high efficiency (Mousa, Al-Metwalli, & Mostafa, 2012). Women who received EA are highly satisfied (Brander & Beinder, 2007; Nystedt, Edvardsson, & Willman, 2004). Over the past 10 years, there has been a major increase in the use of EA in developed countries, where it is administered in 20% to 60% of women who have vaginal deliveries (Anim-Somuah, Smyth, & Jones, 2011). However, there is continuing controversy and no clear evidence about the potential adverse effects of EA on the labor process of women (Hasegawa et al., 2013; Mousa et al., 2012).

EA administration during labor process interferes with the main hormones involved in labor, reducing the secretion of oxytocin, prostaglandin-F2α, β-endorphin, and inflammatory cytokines (Handlin et al., 2009; Mantha, Vallejo, Ramesh, Jones, & Ramanathan, 2012). The undesired effects related to EA result from these hormonal changes, although Steinberg (2013) reported that the undesired effect related to EA resulted in increased oxytocin use. When a laboring woman has an EA, she is more likely to have adverse effects such as slowly progressing labor, which in turn increases the risks of instrumental or cesarean delivery, hypotension, motor blockade, fever, and urinary retention. However, the adverse effects of EA are highly controversial (Anim-Somuah et al., 2011; Frölich, Esame, Zhang, Wu, & Owen, 2012; Herrera-Gómez et al., ~~2016~~2017; Indraccolo et al., 2010; Moore, Shan, & Hatzakorzian, 2013). **~~[AQ2]~~**

Therefore there remains a need for further in-depth research into whether laboring women who have EAs have increased risks. The objective of this study was to determine whether there is an association between the use of EA when administered to women in labor and their need for instrumental delivery and for episiotomy, the presence of intact or ruptured membranes

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at delivery, and the type of placental expulsion (spontaneous, manual, or Crede maneuver); these could be potential problems during delivery. Other risk factor are mother-related (maternal age, weeks of gestation) and newborn-related (weight of the newborn) (Laughon, Branch, Beaver, & Zhang, 2012).

Materials and Methods

A retrospective cohort study was conducted at "San Juan de la Cruz" Hospital of Ubeda in Jaen (Spain) and included all deliveries between March 2010 and March 2013. The study was approved by the ethics and health research committee of Jaen Province. Only full-term (>37 weeks of gestation) deliveries were included. Exclusion criteria were induced delivery (medical or obstetric indication), elective cesarean section, or the presence of a major pregnancy risk factor, including hypertension, diabetes, toxemia, retarded intrauterine growth, chronologically prolonged pregnancy, prolonged membrane rupture (>24 h), oligohydramnios or polyhydramnios, and severe disease. Previous medical-surgical situations with a negative impact on the health of the mother or on the pregnancy, including cardiac, renal, immunologic, or neoplastic diseases, among others were considered as severe disease.

The mothers were divided between those who had received epidural anesthesia for pain relief during labor and those who had not. For the EA, ropivacaine or bupivacaine was associated with fentanyl and continuously infused at a dose of 4 mg/kg. Data were collected on: labor onset (spontaneous or stimulated), labor progression (spontaneous or stimulated), delivery (instrumental or noninstrumental); reasons for instrumental delivery (e.g., stalled labor, risk to fetal well-being, or other); perineal laceration; need for episiotomy, membrane condition at delivery; placental expulsion (spontaneous, manual, or Crede), maternal age, weeks of gestation, and weight of the newborn (in grams). The database used for the study was complete and derived from an electronic clinical records system designed by gynecology/obstetrics team at this hospital.

SPSS version 22.0 software (SPSS Inc., Chicago, IL) was used for the statistical analysis. A descriptive univariate analysis was performed for the quantitative variables (maternal age, newborn weight, and weeks of gestation), using a numerical summary table including maximum, minimum and mean values with standard deviation. The Fisher test and Pearson chi-square test were applied to analyze the relationship between the application

or not of EA and the study variables, calculating the odds ratio (OR) with 95% confidence interval (CI); $\alpha = .05$ was considered significant.

Results

A total of 2,683 births were attended in a public hospital in Spain between March 2010 and March 2013. EA was received during labor by 562 mothers (with EA) and not received by 1,889 (without EA). Table 1 exhibits the main

Table 1. Description of the Quantitative Variables of the Mothers and Distribution of the Study Population as a Function of EA Administration.

	Patients			EA status		
Data	Maximum	Minimum	Medium	Without EA (*n* = 1,889)	With EA (*n* = 562)	*p* (Mann-Whitney *U* Test)
Age (years)	49	16	30.66 ± 5.292	30.65 ± 5.351	30.59 ± 4.941	.724
Weight of Newborn (g)	5,790	300	3,349.14 ± 417.757	3,348.95 ± 409.662	3,354.50 ± 430.822	.847
Weeks' gestation	42	37	39.54 ± 1.141	39.54 ± 1.152	39.83 ± 1.077	.060

Note. EA = epidural analgesia.

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demographic data of the participants. No statistical significant difference was observed between with EA and without EA in relation to age, weight of newborn, or weeks of gestation at the delivery.

Effect of EA on Labor Onset, Labor Progression, and Delivery

As observed in Table 2, labor onset was spontaneous ~~women who had spontaneous onset of labor~~ in 94.0% of epidural group versus 96.6% of the nonepidural group, a statistical significant difference (p = .010)**[AQ3]**. Stimulation was required by 6% of the mothers who received EA versus 3.4% of those who did not (p = .006), and the likelihood of spontaneous labor onset was more than 1.8-fold higher with the nonadministration versus administration of EA (OR = 1.807; 95% CI = [1.180, 2.767]).

Spontaneous labor progression was normal ~~Women who had spontaneous onset of labor~~ among 50.4% of the without EA versus 89.5% of the with EA, a statistical significant difference (p = .0001)**[AQ4]**. The likelihood of spontaneous labor progression was more than eightfold higher with the nonadministration versus administration of EA (OR = 8.372 95% CI = [6.711, 10.445]) (Table 2).

As shown in Table 2, women experienced instrumental delivery among 20.6% of the epidural group versus 6.0% of the nonepidural group, a statistical significant difference ($p \leq .0001$). The likelihood of instrumental delivery was more than fourfold higher with the administration versus nonadministration of EA (OR = 4.085; 95% CI = [3.091, 5.401]).

The data in Table 3 show the main reasons for instrumental delivery: stalled labor, observed among 62.4% of the with EA versus 52.7% of the without EA (p = .004); and loss of fetal well-being, recorded in 30.7% of the with EA versus 24.0% of the without EA (p = .004).

Effect on Perineal Laceration, Condition of Membranes at Delivery, Need for Episiotomy, and Placental Expulsion

As shown in Table 4, there was no statistical significance of whether a woman had a perineal laceration (p = .918), regardless of its degree (I, II, and III and IV), with the condition of membranes at delivery (p = .803), or with the type of placental expulsion (p = .302). However, a weak (contingency coefficient of 15.41%) but highly significant ($p \leq .0001$) association was found with the performance of episiotomy. The risk of a women receiving an episiotomy was over 1.9-fold higher with the administration versus nonadministration of EA (OR = 1.936; 95% CI = [0.391, 0.672]).

Table 2. Comparison of Onset, Progression, and Outcome of Labor as a Function of the Receipt of EA.

	Without EA	With EA	*p* value (Fisher´s Test)	Contingency coefficient	OR, [95% Confidence Interval]
Labor onset					
Spontaneous	96.6%	94.0%	.010*	0.056	1.807, [1.180, 2.767]
Stimulated	3.4%	6.0%	.006*		
Labor progression					
Spontaneous	89.5%	50.4%	.0001*	0.383	8.372, [6.711, 10.445]
Stimulated	10.5%	49.6%	.0001*		
Delivery					
Instrumental	6.0%	20.6%	.0001*	0.207	4.085, [3.091, 5.401]
No Instrumental	94.0%	79.4%	.0001*		

Note. EA = epidural analgesia; OR = odds ratio.
*Significant difference.

Table 3. Reasons for Labor Instrumentation (Stalled Labor, RLFW, or Other) as a Function of EA Administration.

Labor	Without EA	With EA	*p* value (Pearson chi-square test)	Contingency coefficient
Stalled labor	52.7%	62.4%	.004*	0.216
RLFW	24.0%	30.7%		
Others	23.3%	6.9%		

Note. RLFW = risk of loss of fetal well-being; EA = epidural analgesia.
*Significant difference.

Table 4. Influence of the Administration of EA on the Presence of Perineal Laceration, Appearance of Membranes at Delivery, Need for Episiotomy, and Type of Placental Expulsion (in %).

Variables		Without EA	With EA	*p* value	Contingency coefficient	OR
Perineal laceration	Yes	54.4%	54.6%	.819[a]	0.006	1.032, [0.825, 1.2911]
	No	44.6%	45.4%			
Membranes	Torn	5.4%	5.8%	.803[a]	0.006	0.931 [0.576, 1.504]
	Intact	94.6%	94.2%			
Placental expulsion	Spontaneous	97.3%	96.9%	.302[b]	0.035	—
	Manual	1.3%	2.2%			
	Credé	1.4%	0.8%			
Episiotomy	Yes	15.6%	26.4%	.0001[a]*	0.109	1.936, [0.397, 0.672]
	No	84.4%	73.6%			

Note. EA = epidural anesthesia; OR = odds ratio.
[a]Fisher's test.
[b]Pearson chi-square test.

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*Significant difference.

Discussions

In this study of hospital births in Southern Spain, the women receiving an EA had slower progression of labor, requiring stimulation and increased the risk of instrumental delivery and episiotomy. It did not have a significant effect on the risk of perineal laceration, on the condition of membranes at delivery, or on the type of placental expulsion.

Numerous studies have been conducted on the effects of EA administration (Hawkins, 2010; Kukulu & Demirok, 2008; Moore et al., 2013; Segado Jiménez et al., 2011) but the results have been inconsistent, which may be explained by wide differences in study populations, inclusion/exclusion criteria, and study designs (Kotaska, Klein, & Liston, 2006).

No significant differences were observed in the characteristics of the mothers receiving or not receiving EA, and the profile of the study population was highly similar to that reported in most previous studies (Hasegawa et al., 2013), suggesting that these data can be extrapolated to other settings.

In the present study, women how received an EA increased the risk of stalled labor, which is associated with a slowing down of the labor process, one of the best-documented adverse effects of this approach (Leighton & Halpern, 2002; Wu, Ren, & Wang, 2005). The higher percentage of labors that require stimulation and/or stall in EA-treated mothers may result from a reduction in the release of labor-related hormones, including oxytocin, in response to the analgesia (Handlin et al., 2009; Rahm, Hallgren, Högberg, Hurtig, & Odlind, 2002). Oxytocin is applied to stimulate labor onset in women receiving EA (Steinberg, 2013). However, in a recent review of 16 quasi-experimental studies, Costley and East (2013) concluded that the combination of oxytocin with EA does not reduce the risk of a slowly progressing labor[AQ5]. Therefore, other factors must be involved in this adverse effect of EA besides a reduction in oxytocin concentration.

The association observed between EA and a higher risk of the women receiving an instrumental delivery is in agreement with most previous reports and is related to the slowing of labor progression (Anim-Somuah et al., 2011; Indraccolo et al., 2010; Marucci, Cinnella, Perchiazzi, Brienza, & Fiore, 2007). In the present series, the most frequent reason a woman had an instrumental delivery was for stalled labor, followed by risk to fetal well-being. These data could also help explain why the EA is associated with an increased risk of cesarean mainly due to the risk of loss of fetal well-being (Herrera-Gómez et al., ~~2016~~2017). Also and in this sense, our working group recently shows a relationship between the administration of EA and adverse effects on the newborn (Herrera-Gómez et al., 2015).

One study weakness is the retrospective design, which limits us to the demonstration of associations among variables, although the database used was complete and derived from an electronic clinical records system designed by gynecology/obstetrics team at this hospital. Also, for future studies, it would be interesting to include new items in the electronic clinical records system in relation to the feelings of the mother with or without epidural.

The women who had EAs in this study had no effect on the need for perineal laceration, the condition of membranes at delivery, or the type of placental expulsion, which can all have a major impact on the mother's quality of life and recovery (Fitzpatrick & O'Herlihy, 2005). Pergialiotis, Vlachos, Protopapas, Pappa, and Vlachos (2014) concluded that EA administration increased the likelihood of perineal laceration. In contrast, the mothers receiving EA in the present study were more likely to undergo an episiotomy, which may be in part related to a slowing of the labor process and the need for an instrumental delivery.

With regard to the strength off associations, the contingency coefficients range from 7.91% for stimulated labor onset to 15.41% for episiotomy, 29.27% for instrumental delivery, and 54.16% for stimulation of labor progression.

Clinical Implications

Women who received EA may have negative effects on their labor progression and delivery. It may increase the risks of stimulated, instrumental, and/or stalled labor and reduces the percentage of spontaneous deliveries. In addition, EA may increase the percentage of episiotomies and increases the risk of loss of fetal well-being. These results, with a representative population, contribute to clarify the controversies in relation to risks–benefits of EA (Hasegawa et al., 2013; Mousa et al., 2012).

Based on the findings of the current study, it is suggested that administration of EA should be assessed in each case by the health care professional (midwiferies and obstetricians). Education regarding EA should begin during the prenatal period by helping to make a decision on the use of this alternative or the other for labor pain relief.

Conclusion

According to the present findings, women who received EA administration may have adverse effects on the labor process, which may increase the morbidity risk for the mother. It is important for nurses and midwives to have the greatest possible information on the areas where there may be some risk

and on the level of that risk. It is also important to identify the undesirable effects that do not appear to be influenced by EA administration, including perineal laceration, torn membranes at delivery, or nonspontaneous placental expulsion. The results of the present study allow the health professionals and mothers to make the best-informed decision possible on the selection of pain relief method for the labor.

Declaration of Conflicting Interests

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Author Biographies

Antonio Herrera-Gómez, PhD, is a midwife in the Hospital "San Juan de la Cruz" (Servicio Sanitario Público Andaluz), Úbeda, Jaén (Spain); a researcher in Biomedical Group (BIO277) Department of Nursing, Faculty of Health Sciences, University of Granada; and member of Institute of Investigación Biosanitaria, ibs.Granada University of Granada.

Elvira De Luna-Bertos, PhD, is a professor at Nursing Department, Faculty of Health Sciences, University of Granada (Spain); a researcher in Biomedical Group (BIO277) Department of Nursing, Faculty of Health Sciences, University of Granada; and member of Institute of Investigación Biosanitaria, ibs.Granada, University of Granada.

Javier Ramos-Torrecillas, PhD, is a professor at Nursing Department, Faculty of Health Sciences, University of Granada (Spain); a researcher in Biomedical Group (BIO277) Department of Nursing, Faculty of Health Sciences, University of Granada; and member of Institute of Investigación Biosanitaria, ibs.Granada, University of Granada.

Francisco Manuel Ocaña-Peinado, PhD, is a professor at Statistics and Operations Research Department, School of Pharmacy, University of Granada, Spain.

Concepción Ruiz, PhD, is a full professor at Nursing Department, Faculty of Health Sciences, University of Granada (Spain); a principal researcher in Biomedical Group (BIO277) Department of Nursing, Faculty of Health Sciences, University of Granada; member of Institute of Investigación Biosanitaria, ibs.Granada, University of Granada; and member of Institute of Neuroscience, University of Granada, University of Granada.

Olga García-Martínez, PhD, is a professor at Nursing Department, Faculty of Health Sciences, University of Granada (Spain); a researcher in Biomedical Group (BIO277)

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Department of Nursing, Faculty of Health Sciences, University of Granada; and member of Institute of Investigación Biosanitaria, ibs.Granada, University of Granada.