

Clinical Letter

Hemodialysis improves skin moisture and sebum secretion but not elasticity in chronic renal disease patients

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Dear Editors,

Patients with chronic renal disease suffer from many manifestations of skin diseases, which may reflect systemic involvement in certain cases [1]. Dryness and pruritus appear to be the most common cutaneous complaints; recent epidemiologic data suggest that up to 40 % of patients with end-stage renal disease experience moderate to severe pruritus [2]. Management of uremic pruritus can be challenging, mainly because the etiopathogenesis underlying this disorder is complex and remains unclear, so that targeted treatment is not possible [3]. In most cases, an interdisciplinary therapeutic approach including internal medicine doctors, neurologists, psychologists and dermatologists is necessary to reduce the intensity of the itching [4]. During the past 20 to 30 years, investigations on the etiology of uremic pruritus have focused on five different pathophysiological hypotheses: stimulating influences (e. g. calcium deposits in the epidermis), hormonal stimuli (e. g. secondary hyperparathyroidism), neuropathic disorders (e. g. uremic peripheral neuropathy), disorders of the central nervous system (e. g. accumulations of endorphins) and immunological conditions (calcineurin, which plays a significant role in the immune system, seems to relieve the itching) [5]. It seems to be clear that the epidermal barrier of patients on hemodialysis has some dysfunctions that make the skin more vulnerable to irritants, allergens and microorganisms, in a pattern similar to that of atopic dermatitis [6].

Although the technique of hemodialysis (HD) has evolved over past decades, fluid management remains a major challenge in current HD care [7]. The aim of this study is to

examine the effect of HD on cutaneous moisture, elasticity and sebum secretion.

We designed a single-subject study in which each patient serves as his/her own control. Fifty-four patients participating in an HD program for chronic skin disease were included. Each subject was examined with a skin moisture analyzer (Triplesense® model: K10229, Japan) by the same predetermined dermatologist. The device was placed on the inner aspect of the non-dominant arm to avoid bias in data collection, e. g. due to different extents of exposure to the sun. Triplesense® makes semi-quantitative measurements on a scale that ranges from 1 (lowest) to 5 (highest). Patients were hemodialyzed for four hours, three times a week (Tuesday – Thursday – Saturday) and measurements of cutaneous parameters were performed on Sundays and Mondays. Patients were excluded if they had diagnosed skin disease, systemic diseases that might cause skin lesions (e. g. systemic lupus erythematosus), or malignancies. Demographic data and the duration of HD for each participant are shown in Table 1. Skin moisture and sebum secretion increased after HD (moisture: 1.803 ± 0.585 vs. 2.053 ± 0.795 , $p = 0.047$; sebum: 1.392 ± 2.137 vs. 2.178 ± 2.328 , $p = 0.013$), while elasticity did not (4.125 ± 1.145 vs. 3.678 ± 1.453 , $p = 0.051$).

Table 2 summarizes the outcomes of skin parameters before and after HD as well as the mean differences. There was a significant positive correlation (linear) between moisture and sebum secretion (Pearson's coefficient: 0.411, $p = 0.002$), and a negative correlation between moisture and elasticity (Pearson's coefficient: -0.337 , $p = 0.011$).

We found that certain skin parameters, such as moisture and sebum secretion, increased with the duration of HD. Since sebum helps to maintain the integrity of the epidermal barrier and blocks transepidermal water loss, its presence on the surface enhances the skin moisture [8]. It is possible that the uremic state affects the ability of dermal cells to secrete sebum, making the skin more susceptible to dryness and infections. Our study suggests that HD may help to restore sebum secretion and thus skin hydration. The significant positive linear correlation found between these two outcomes supports this hypothesis. In a recent study, the lipid content of the stratum

Table 1 Demographic data of patients in the sample and distribution of kidney diseases.

Kidney disease	Age (years)	Gender (female/male)	Duration of HD (months)	Weight
Chronic glomerulonephritis	58.35 ± 12.93	6/5	82.85 ± 72.67	74.78 ± 15.22
Interstitial Nephropathy	55.64 ± 17.84	5/5	51.64 ± 63.34	71.92 ± 13.97
Nephrosclerosis	65.78 ± 12.01	3/8	31.25 ± 41.24	73.55 ± 14.61
Diabetic nephropathy	56.42 ± 17.38	6/7	39.71 ± 40.97	69.16 ± 15.65
Polycystic kidney disease	58.63 ± 14.84	5/6	45.65 ± 38.16	70.35 ± 16.47
Total (n = 56)	59.05 ± 15.38	25/31	51.31 ± 58.21	72.42 ± 14.61

Table 2 Skin outcomes before and after hemodialysis with mean differences.

Parameter	BEFORE HEMODIALYSIS (mean \pm SD)	AFTER HEMODIALYSIS (mean \pm SD)	DIFFERENCE (mean \pm SD)	P value
Moisture	1.803 \pm 0.585	2.053 \pm 0.795	0.251 \pm 0.919	0.047
Elasticity	4.125 \pm 1.145	3.678 \pm 1.453	-0.446 \pm 1.694	0.051
Sebum Secretion	1.392 \pm 2.137	2.178 \pm 2.328	0.785 \pm 2.286	0.013

corneum in uremic patients was compared with controls. The authors found that in the dialysis group, the content of ceramides 1, 2 and 3 was higher but the content of cholesterol and triglycerides was significantly lower. No differences between the two groups were found regarding the quantity of free fatty acids, cholesteryl esters and squalene [9]. The authors concluded that the dysregulation of the epidermal barrier in patients on hemodialysis might be explained in part by an altered lipid composition of the stratum corneum. The discrepancies between the results of our study and of this investigation may be due to differences in the methods: controls in our study were the same patients (single-subject design) while other studies used healthy controls (group design). Differences in the lipid content of the skin in uremic patients may vary widely if they are compared with healthy controls instead of using single patients as their own controls.

We found that skin elasticity decreased after hemodialysis, and this finding is consistent with the previous literature [10]. The significant negative linear correlation found between cutaneous moisture and elasticity shows that rapid removal of body fluids by HD affects physical parameters of the skin: early changes in skin thickness occur in the dermis and these affect the mechanical distensibility of the skin. The decrease in water content of the upper layers of the skin after HD appears later, with a delayed impact on skin moisture [10].

In conclusion, our findings show that HD improves cutaneous moisture and sebum secretion, but decreases skin elasticity. Further research is needed on how HD influences water kinetics and sebum secretion in the skin.

Conflict of interest

None.

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