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A Study on Trans Epidermal Water Loss in Eczematous Skin Conditions

KEYWORDS: TEWL, skin barrier function, eczema, atopic dermatitis

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ABSTRACT *A case-control study wherein, a total of 100 subjects were included in the study. In this, 50 were cases diagnosed with eczematous skin condition and 50 were healthy controls. The mean TEWL was higher in patients with eczematous skin condition than that of the normal controls. Patients with atopic dermatitis and contact dermatitis had higher TEWL than that of the normal controls, as well as patients with other eczematous dermatoses.*

INTRODUCTION

Transepidermal water loss (TEWL) is a measure of the steady-state water vapour flux crossing the skin to the external environment and it has been used extensively to characterise skin barrier function. TEWL is directly related to the reciprocal of the diffusional permeation path length through the *stratum corneum* (SC).[1] TEWL and percutaneous absorption measurements accurately gauge stratum corneum skin water barrier integrity. Both TEWL and percutaneous absorption rates increase when the integrity of the SC barrier is compromised. Experiments to discern a quantitative and/or qualitative correlation between the two indicators have resulted in controversy.[2] Skin permeability barrier function is impaired in eczema, particularly in contact and atopic dermatitis (AD). In contact dermatitis disruption of the barrier by irritants and allergens is the primary event, followed by sensitization, inflammation, increased epidermal proliferation and changes in differentiation. Common treatment strategies for eczema include the application of lipid-based creams and ointments, which aim toward the restoration of the defective permeability barrier, thus helping to normalize proliferation and differentiation.[3]

MATERIALS AND METHODS:

A total of 100 subjects were included in the study, 50 cases diagnosed with eczematous skin condition compared with 50 healthy controls .Written informed consent and photographs / digital image release consent was obtained before enrollment in the study. All the patients underwent a thorough clinical examination, evaluation which was recorded in the proforma. Only those patients diagnosed to have eczematous skin condition were included in the case group in the study. In these 50 patients as well in 50 healthy controls TEWL was evaluated .The stratum corneum (SC) water barrier quality was assessed through measurements of TEWL using the closed chamber evaporation method (VapoMeter). The Primary objective of the study was to measure TEWL in various eczematous conditions and to compare it with that of the normal skin.

RESULTS

A total of 100 subjects were included in the study out of which 50 patients diagnosed with eczematous condition and 50 were normal healthy volunteers. The mean age group of the patients in the cases was 26±17years (Mean±SD) and in the healthy volunteers was 27±17years (Mean±SD). Out of the 50 patients, 12 patients had atopic dermatitis, 4 patients had irritant contact dermatitis, 12 patients had allergic contact dermatitis, 5 patients had nummular eczema, 2 patients had pompholyx, 6 patients had foot eczema, 4 patients stasis eczema, 5 patients had phytodermatitis. The Mean Trans Epidermal Water Loss (TEWL) in patients with eczematous dermatoses was 31.76±22.246 $g^{-1}m^{-2}h$ while in healthy controls it was 10.35±2.063 $g^{-1}m^{-2}h$ .i.e. it was significantly higher in patients with eczematous conditions. The average TEWL was highest in patients with Atopic dermatitis with an average TEWL of 47.389 $g^{-1}m^{-2}h$ and in patients with contact dermatitis like irritant contact dermatitis and allergic contact dermatitis the average TEWL was 32.15 $g^{-1}m^{-2}h$ and 35.26 $g^{-1}m^{-2}h$ respectively. TEWL was least in stasis eczema (TEWL-14.36 $g^{-1}m^{-2}h$). TEWL had a highly significant association with scaling and erythema with $p<0.001$ while it had significant association with oozing stating that higher the scaling, erythema and oozing, higher was the water loss. Thus, showing that in patients with higher oozing, scaling and erythema, a higher compromise of epidermal barrier function is to be expected. TEWL had no association with crusting and lichenification ,.i.e., water loss was lesser in patients with lichenification and crusting. Fifty two percent of the patients in the study had a history of dry skin and 44% of the patients had a history of atopy and it was observed that TEWL was significantly higher in these individuals than the other patients with eczema as well as the normal healthy volunteers.

TABLE 1: DISTRIBUTION OF PATIENTS IN VARIOUS ECZEMATOUS SKIN CONDITIONS AND THEIR AVERAGE TRANSEPIDERMAL WATER LOSS

Eczematous skin condition	Frequency	Percentage	Average TEWL ($g^{-1}m^{-2}h$)
Atopic Dermatitis	12	24%	47.389
Irritant contact dermatitis	4	8%	32.15
Allergic contact dermatitis	12	24%	35.26
Nummular eczema	5	10%	15.2
Foot eczema	6	12%	18.44
Pompholyx	2	4%	24.21
Stasis eczema	4	8%	14.36
Phytodermatitis	5	10%	18.24

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TABLE 2: SHOWING MEAN AND STANDARD DEVIATION OF AGE, TEWL, TEMPERATURE OF THE CASE AND CONTROL GROUPS IN THE STUDY.

	group	N	Mean	Std. Deviation	Std. Error Mean
Age	cases	50	26.76	17.048	2.411
	controls	50	27.38	17.044	2.410
TEWL	cases	50	31.76	22.246	3.146
	controls	50	10.35	2.063	.292
TEMP.	cases	50	28.02	1.407	.199
	controls	50	27.18	.983	.139

TABLE 3: CO-RELATIONS BETWEEN THE VARIOUS-CLINICAL PARAMETERES AND TEWL IN THE PATIENTS WITH ECZEMATOUS SKIN CONDITION

CLINICAL PARAMETER	PEARSON CHI SQUARE CO-RELATION (p value)	STATISTICAL SIGNIFICANCE
Scaling	0.000	Highly significant
Oozing	0.010	Significant
Erythema	0.000	Highly significant
Crusting	0.416	Not significant
Lichenification	0.432	Not significant

DISCUSSION:

As stated earlier the skin barrier function is compromised in eczematous conditions, especially in atopic and contact dermatitis.[3] Similarly, in our study we observed that the average TEWL was significantly higher in patients with atopic dermatitis and allergic contact dermatitis.

As observed in Linde YW in his study wherein TEWL measured with evaporimeter, TEWL was increased in dry skin and in clinically normal skin of atopics on predilection areas.[4]In our study patients with atopic dermatitis had the highest average TEWL, while 52% of the patients with a history of dry skin and 44% off the patients with a history of atopy had a significantly higher TEWL compared to other patients as well as the healthy volunteers. In a study by Berardesca E et al. showed that the pathological dry skin, because of the impaired barrier function is associated with increased TEWL and low corneum water content. It was suggested that with this model it may be possible to differentiate uninvolved pathologic skin from healthy skin.[5] Similarly, in our study we found that patients with a history of dry skin (26 patients, 52%) had higher TEWL than the healthy volunteers. We also found in our study that patients with a skin pathology .i.e. eczema had a higher mean TEWL than that of the healthy skin.

In a study by Werner Y, forty patients with atopic dermatitis were studied- 20 with dry skin and 20 with clinically normal skin on non-eczematous areas. The stratum corneum in dry skin was found to have a lower content of water than that in the clinically normal skin (p less than 0.01).[6] Similar results were seen in our study.

If TEWL is increased, it indicates a impaired barrier function.[7] TEWL is one of the most important biophysical parameters for evaluating the efficiency of the human skin water barrier.[8] In our study, we observed that the mean TEWL was significantly higher in patients with eczematous skin conditions than that of normal controls, stating that TEWL is higher and also the water loss is higher in patients with impaired barrier function than the normal skin.

CONCLUSION

TEWL is an important tool to assess the epidermal integrity, .i.e., the barrier function. It also helps us to differentiate between pathologically involved and uninvolved skin as well as to assess the clinical improvement in these patients. It is also a non-invasive technique to assess the severity as well as improvement in patients with eczematous skin conditions, especially atopic and contact dermatitis.

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