Acta Derm Venereol (Stockh) 1985; Suppl. 114: 67–71

Epidermal Changes in Atopic Dermatitis

D. VAN NESTE,[1] M. DOUKA,[1] J. RAHIER[2] and M. J. STAQUET[3]

[1]*Unit for Occupational and Environmental Dermatology,* [2]*Service d'Anatomie Pathologique, Louvain University, Brussels, Belgium and* [3]*Hôpital E. Herriot, Lyon, France*

The epidermal changes occurring in various lesions of atopic dermatitis are reported. Quantitative evaluation or epidermal thickening suggests that both differentiated and undifferentiated compartments are increased in lichenified lesions. In dry skin (xerosis) of atopic dermatitis moderate but obvious inflammatory changes are observed. There is a mild increase of the epidermal volume without folding of the dermo-epidermal interface. The latter is most prominant in exudative and lichenified lesions where a fourfold overall increase of epidermal volume is observed. *Key words: Atopic dermatitis; Differentiation; Epidermis; Keratinization.*

In contrast with the classical histological description of the various types of skin lesions which have been reported on several occasions in the literature (1–6) we will confine this presentation to the quantitative evaluation of the epidermal changes in atopic dermatitis. As there is evidence that the epidermis plays an active role in the immune surveillance, we feel that this reevaluation could be helpful to establish correlations between severity of disease and biological abnormalities.

MATERIAL AND METHODS

Patients

Patients with characteristic atopic dermatitis eruption and history (7) were selected. The aspect of the skin lesions was noted and described as being xerotic (rough or dry skin) exudative or lichenified. Subjects with no atopic history were used as controls.

Skin specimens and histology

Nine punch biopsies were taken from the flexural aspect of the forearm after local injection of lignocaine (without adrenaline, xylocaine R). After fixation in Bouin's fluid, they were processed for light microscopy. Care was taken to cut the specimens at right angles to the skin surface.

Immunoperoxidase labelling of 67000 daltons polypeptides (67^k).

Sections from two specimens taken from the lichenified areas were processed for immunoperoxidase labelling of 67 K polypeptides with a technique that has been described in detail elsewhere (8). The specificity of the serum was tested previously (9).

Morphometric analysis

A digital table was used for the evaluation of the surface of the epidermis. The area was outlined by the dermo-epidermal junction and the granular layer (which was included), appendages and horny layer were excluded. Lengths and surfaces are expressed in mm and mm^2 respectively. The data given by the computer are: length of the specimen, epidermal contour and area, and we expressed all parameters according to the length of the specimen at the surface.

Statistical analysis

Mean values were compared by means of Student's *t*-test.

RESULTS

The generated data are shown in Tables I and II where the various aspects of the skin lesions (Figs. 1, 2 and 3) are compared to controls.

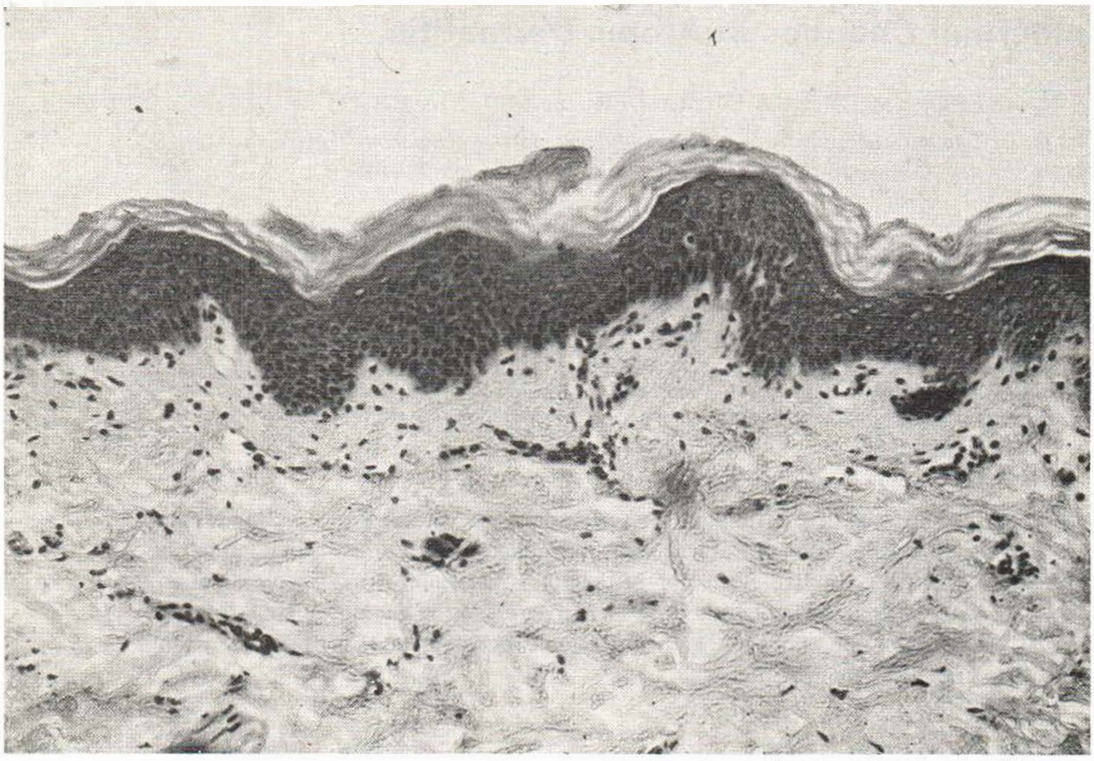

Fig. 1. Xerosis. Although minimal epidermal changes are obvious. Thinning of the granular layer, patchy loss of basket wave pattern of the horny layer, small focus of spongiosis and exocytosis. The upper dermis shows a discrete mononuclear cell infiltrate.

Epidermal area

Epidermal area shows a three- (xerotic and exudative lesions) to fourfold (lichenified skin) increase (Table I) indicating epidermal hyperplasia.

Epidermal contour

The most prominent increase of the contour (Table II) was found in lichenifications, followed by exudative lesions. This indicates severe papillomatosis. Xerotic skin, with an enlarged epidermal area did not show any significant increase in contour. This indicates thickening of the epidermis without increased folding of the dermo-epidermal interface.

Table I. *Epidermal hyperplasia*

Ratio: Surface/length

Lichenified	0.280±0.0907	*
Exudative	0.200±0.0156	**
Xerotic	0.170±0.1225	NS
Control	0.064±0.0263	

Levels of significance as compared to controls: $^{**}p<0.0005$, $^{*}p<0.005$.

Table II. *Epidermal hyperplasia*

Ratio: Length/(contour − length)

Lichenified	0.265±0.057	**
Exudative	0.357±0.021	*
Xerotic	0.465±0.194	
Control	0.508±0.109	

Levels of significance as compared to controls: $^{**}p<0.01$, $^{*}p<0.05$.

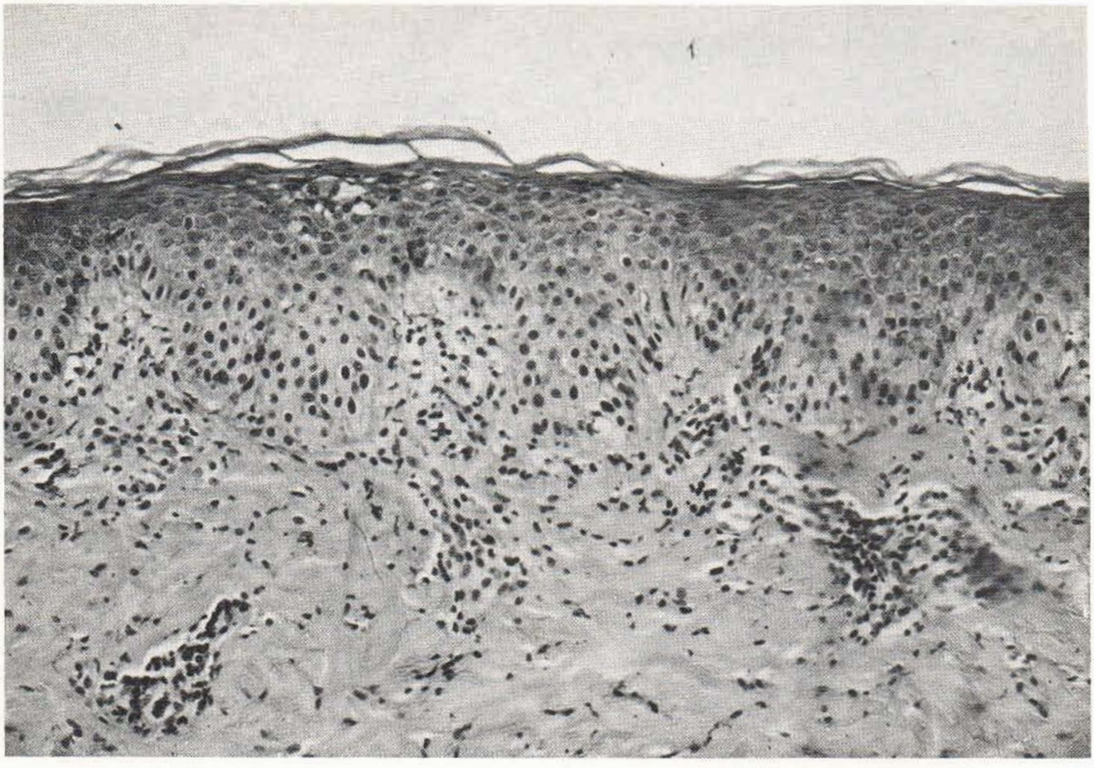

Fig. 2. Exudative skin. Acute and massive oedema blurring the dermo-epidermal interface. The pale staining of the lower half of the epidermis contrasts sharply with the normal staining of the upper half where a spongiotic vesicle contains some mononuclears.

67 K polypeptide labelling

The basal compartment (67 K negative) is calculated by the ratio:

$$\frac{\text{total area}}{\text{total area} - \text{67 K positive area}}$$

The basal compartment represented approximatively 1/3 of the total epidermal surface both in controls (*N*) and in atopic lichenified skin (AD) (*N*: 3.08±0.69; AD: 3.06).

DISCUSSION

From our morphometric study we conclude that epidermal hyperplasia varies according to the clinical aspect of the skin (Fig. 4). In xerotic areas there is a moderate increase in the epidermal volume with no change of the contour: this means essentially no increased folding of the dermo-epidermal interface; in acute and chronic inflammatory lesions the increased volume (×2 to ×4) is associated with a sharp increase of the contour values indicating increased epidermal thickness and folding of the dermo-epidermal junction.

In lichenified skin this increase is due to a homogenous expansion of the proliferative and differentiated compartment. In order to illustrate the practical interest of these data for the evaluation of the skin involvement let us consider a patient with 20% of his skin being lichenified, 20% exudative and the rest xerotic. This means, in terms of epidermal

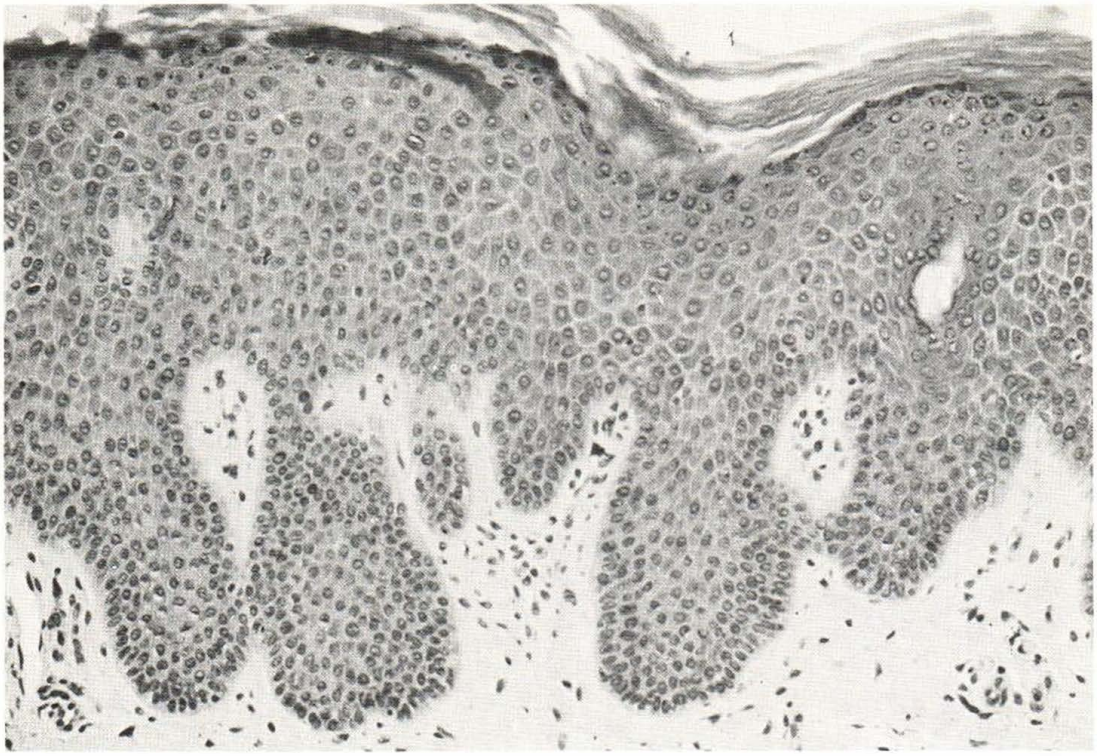

Fig. 3. Lichenification. Massive epidermal thickening with dense orthohyperkeratosis. Increased folding of the dermo-epidermal junction shows papillary dermis engulfed by epidermal buds.

volume expansion an increase that ranges from 250–400%. With this in mind we are tempted to suggest to calculate the epidermal volume instead of evaluating the affected areas as a percentage of skin surface. The following method is proposed: (*a*) establishment of the total body area (according to height and weight), (*b*) evaluation of the relative areas which are lichenified, exudative, xerotic. One has only to take into account the most severely affected skin and cumulative involvement must not exceed 100% of the body

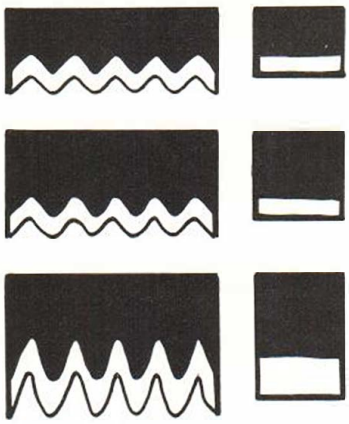

Fig. 4. Models of epidermal hyperplasia. The normal pattern (top) is modified by an expansion of the differentiated (middle) and of the undifferentiated (bottom) compartment.

area, and (*c*) finally evaluation of the increase of epidermal volume is obtained by multiplying the involved areas by a correction factor (2 to 3 for xerotic and exudative areas and 4 for lichenified areas). We hypothesize this could significantly improve correlations between skin involvement and biological abnormalities.

REFERENCES

1. Prose PH, Sedlis E. Morphologic and histochemical studies of atopic eczema in infants and children. J Invest Dermatol 1960; 34: 149–165.
2. Erickson L, Kahn G. The granular layer thickness in atopy and ichtyosis vulgaris. J Invest Dermatol 1970; 54: 11–12.
3. Braun-Falco O, Burg G. Celluläres Infiltrat und Capillaren bei Neurodermitis diffusa. Quantitativ enzymcytochemische und histochemische Untersuchungen. Arch Derm Forsch 1974; 249: 113–124.
4. Mihm MC, Soter NA, Dvorak HF, Austen KF. The structure of normal skin and the morphology of atopic eczema. J Invest Dermatol 1976; 67: 305–312.
5. Van Neste E, Lachapelle JM, Desmons F. Dermatite atopique: étude histologique des lésions cutanées et historadioautographie après incorporation de thymidine tritiée. Ann Dermatol Venereol 1979; 106: 327–335.
6. Soter NA, Mihm MC. Morphology of atopic eczema. Acta Dermatovener 1980; Suppl. 92: 11–15.
7. Hanifin JM, Rajka G. Diagnostic features of atopic dermatitis. Acta Dermatovener 1980; Suppl. 92: 44–47.
8. Van Neste D, Staquet MJ, Viac J, Lachapelle JM, Thivolet J. A new way to evaluate the germinative compartment in human epidermis, using (^{3}H) thymidine incorporation and immunoperoxidase staining of 67 K polypeptide. Br J Dermatol 1983; 108: 433–439.
9. Viac J, Schmitt O, Staquet MJ, Thivolet J, Ortonne JP, Bustamante R. Binding specificity of guinea pig anti-α-keratin polypeptide sera on human keratinocytes comparison of their receptors with those of human epidermal cytoplasmic antibodies. Acta Dermatovener 1980; 60: 189–196.

D. Van Neste, Unit for Occupational and Environmental Dermatology, Clos Chapelle-aux-Champs 30, 8-1200 Brussels.