Acta Derm Venereol (Stockh) 1989; 69: 470–476

Immunochemical Analysis of the Distribution of the Desmosomal Protein Desmoglein I in Different Layers of Plantar Epidermis

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An antiserum raised against the bovine desmosomal protein desmoglein I (DG I), M_r approximately 160 kDa, was used in an immunochemical analysis of human plantar epidermis. Different layers of the tissue were prepared by means of horizontal freeze sectioning. Loosely attached surface layers were obtained by means of scraping of the skin surface with a scalpel. Tissue extracts were analysed by means of sodium dodecylsulphate polyacrylamide gel electrophoresis followed by immunoblotting. Significant amounts of a component with M_r approximately 160 kDa, reactive with the DG I-antiserum, were found in all layers except the loosely attached surface layers. In these layers the antiserum detected a component with M_r approximately 80 kDa, not found in other layers. This component may be a degradation product of DG I. Since DG I belongs to the group of transmembrane desmosomal proteins that is believed to constitute the link between the intracellular parts of desmosomes of opposing cells, it is concluded that desmosomes may play an important role in plantar stratum corneum cell cohesion, and that degradation of desmosomes may be an important step in desquamation in plantar epidermis.

(Accepted May 12, 1989.)

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The stratum corneum serves as the physico-chemical barrier between the interior and exterior of the body. The pronounced mechanical resistance of the stratum corneum emanates from its building blocks, the corneocytes. With their tightly packed keratin fibres surrounded by an envelope of cross-linked proteins, these cells are highly adapted to their function (1). A question that is still without a definitive answer concerns the mechanisms by which the properties of individual corneocytes are transferred to the tissue as a functioning unit, i.e. mechanisms of intercellular cohesion in the stratum corneum. There are a number of structures and anatomical relationships that may be of importance. The folded nature of the cell surfaces (2), most pronounced in palmo-plantar stratum corneum, serves to increase the intercellular contact area. The lipid-rich intercellular substance (3, 4), and intercellular glycoproteins (5) may contribute to cell cohesion.

The extent to which desmosomes contribute to cell cohesion in the stratum corneum remains unclear. In viable epithelia the cohesive function of desmosomes is well established (6). During cornification, some desmosomes are probably degraded (7, 8, 9), leading to an apparent decrease in the number of desmosome-related structures in the intercellular space. This decrease is found mainly in non-palmoplantar skin (7). In palmo-plantar stratum corneum, as compared with viable epidermal layers, the intercellular space appears to contain a relatively unchanged number of structures resembling desmosomal plates in the electron microscope (10, 11). Correspondingly, a smaller fraction of the intercellular space of this tissue is occupied by lipid-rich material, compared with stratum corneum at other body sites. At the skin surface, where corneocytes dissociate and are shed, remaining desmosomes may be expected to have lost most of their cohesive capacity. The question then arises where this loss of desmosome cohesive function occurs, whether in the transition between granular and cornified layers, during the migration of the cells from the deepest layers of the stratum corneum towards the skin surface, or in direct association with desquamation.

Questions concerning mechanisms of cell cohesion in the stratum corneum are intimately related to the elucidation of the mechanisms of desquamation. A well-regulated desquamation is a prerequisite for an epidermal steady state. The shedding of cells at the skin surface may be expected to be a complicated process involving the interaction of several different mechanisms. The metabolism of intercellular lipids is most likely important (4), as is illustrated by such findings as in X-linked ichthyosis (12, 13).

This study attempted to elucidate the functional