Prostaglandin D₂, a Mediator in Both Immediate and Delayed-Type Immune Reactions in the Skin

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Prostaglandin (PG) D₂ is a naturally occurring prostanoid that shows various kinds of pharmacological activity such as inhibition of platelet aggregation, bronchoconstriction, sleep induction, and hypothermia under various physiological and pathological conditions [1, 2]. In the skin, however, the in vivo function of PGD₂ is not yet fully understood, although PGD₂ is the major cyclooxygenase product from arachidonic acid in the epidermis and dermis [2].

In this paper, we report the enzymatic properties and immunohistochemical localization of PGD synthetase in adult rat skin to make clear the biological significance of PGD₂ in the skin.

Determination of PGD synthetase activity and preparation of anti-rat spleen PGD synthetase antibody were described previously, including the procedure of immuno-histochemistry of PGD synthetase [3, 4].

The activity of PGD synthetase, which isomerizes PGH₂ to PGD₂, was detected in the 100,000 g supernatant of the homogenate of adult rat skin. The epidermis, which was separated from whole skin by heating (55 °C, 30 s), exhibited about three times higher activity than the dermis. The enzymatic properties of both layers were similar, absolutely glutathione-dependent and completely absorbed by anti-rat spleen PGD synthetase antibody.

Immunohistochemical studies using this antibody and the immunoperoxidase method, showed that cytoplasmic distribution of PGD synthetase was prominent in the dendritic cells in adult rat skin. The positively stained dendritic cells were rich in hair follicles. In the dermis, a number of infiltrating cells were immunohistochemically positive for PGD synthetase.

By immunoelectron microscopy, positively stained cells in the epidermis showed marked folded nuclei and Birbeck granules with their characteristic rod-shape structure. These cells were considered to be Langerhans' cells. In the dermis, some of the positive cells showed large nuclei and irregularly projecting narrow cytoplasm with abundant vacuoles and lysosomes. The other positive cells contained oval nuclei and numerous granules in the cytoplasm. The reaction products were also distributed homogeneously in their cytoplasm. The former cells were considered to be macrophages, and the latter, mast cells.

These results suggest that PGD₂ plays significant roles in immunological functions in the skin, including inflammatory and immediate type immune reactions via mast cells in the dermis, and delayed type immune responses via macrophages in the dermis and Langerhans' cells in the epidermis.

References

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