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ORIGINAL CONTRIBUTIONS

AN ULTRASTRUCTURAL STUDY OF MELANOCYTES AND MAST CELLS IN THE DEPIGMENTED SKIN IN VITILIGO

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In the depigmented patch of ten vitiligo patients, a few melanocytes were seen. Coagulation, fatty degeneration, focal aggregation of melanosomes, and vacuolation were some of the changes seen in their cytoplasm. Many indeterminate cells were also observed. These resembled Langerhans cells morphologically, but were without Birbeck granules. Basement membrane architect was lost. In the dermis, mast cells and plasma like cells were seen. Collagenised nerves, and blood vessels with reactive endothelial cells were the salient features.

Key words: Vitiligo, Electronmicroscopy.

Ultrastructural studies of vitiligo skin have confirmed the absence of normally functioning melanocytes in the depigmented patch.[1] An increased number of dendritic cells were seen in the suprabasal layer.[2] Fitzpatrick and Breathnach[3] believed that the melanocytes and the Malpighian cells operate as a single functioning unit and termed it as epidermal melanin unit. Degenerative and regenerative changes were demonstrated in the terminal and pre-terminal neurites of depigmented areas.[4] Perrot et al[5] observed necrotic melanocytes with abnormal cytoplasmic filaments, mitochondria and cell membranes. Okun[6] demonstrated that mast cells were capable of forming dopa melanin and had peroxidase activity. These studies considered vitiligo as a result and not the cause of the disease.

The present study deals with mast cells and melanocytes observed in the depigmented patch.

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Materials and Methods

Ten patients (6 males and 4 females) aged 15 to 52 years who had depigmented patch for less than one year and had not taken any form of treatment were selected. Boat-shaped skin biopsies from the centre of the depigmented patch were collected.

Five skin biopsies from healthy individuals (4 males and 1 female) aged 6-60 years was taken from the approximate corresponding sites. One micron thick sections were cut and stained with toluidine blue for orientation and screening. Ultra-thin sections were stained with uranyl acetate and lead citrate and observed under Joel 100 S electron microscope at 80 KV, at Foundation for Medical Research, Worli.

Results

Melanocytes showed coagulation of cytoplasm (Fig. 1a), fatty degeneration (Fig. 1b) and focal aggregation of melanosomes (Fig. 1c) and vacuolation (Fig. 1d). Degenerating melanocytes were seen near degenerating nerves (Fig. 6).

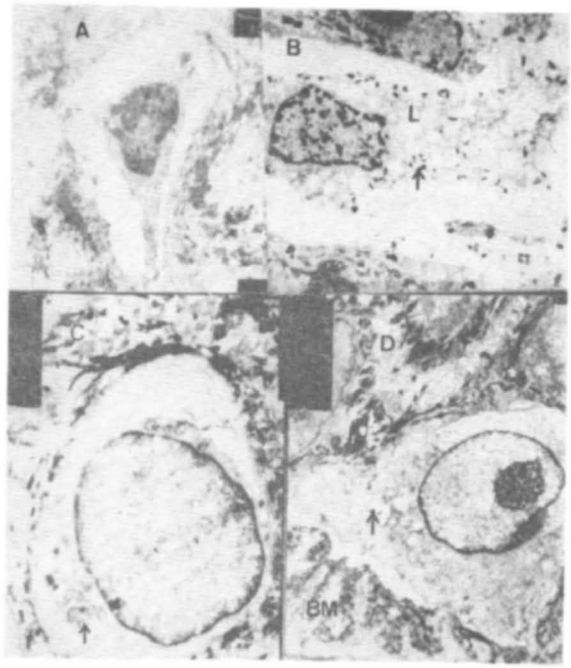


Fig. 1. A. Coagulated cytoplasm (X 10,000).
B. Fatty degeneration (L) in the melanocyte. Few melanin granules (v) are seen (X 6,00).
C. Focal aggregation of melanosomes (v) cytoplasm is scanty. (X 10,000).
D. Note vacuolation (v), melanosomes are absent. Basement membrane (BM) architect is lost (X 20,000).

In the epidermis, indeterminate cells were seen.

Basement membrane was of normal density but folding architect was lost (Fig. 1d).

In the dermis numerous dendritic cells (Figs. 2 and 5), mast cells (Fig. 3a and b) and plasma like cells were seen.

Collagenization and degenerating changes were seen in the nerves (Fig. 4).

Blood vessels showed active endothelial cells with proliferation of the basement membrane (Fig. 5).

Comments

Gokhale and Mehta[7] reported degenerative changes in the epidermis and papilations.

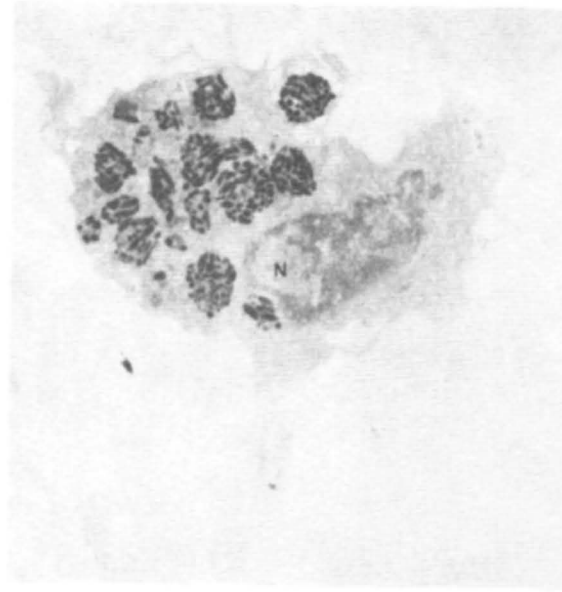


Fig. 2. Dendritic cell with clusters of melanosomes. Many cells of this type were seen in dermis.
N — Nucleus. (X 5,000).

These changes along with changes in the blood vessels, sweat glands and dermal nerves were thought to be an expression of autoimmunity. The present ultrastructural study confirmed these observations. Chanco-Turner and Lerner[8] reported predominance of the cholinergic influence in vitiliginous skin, resulting from local diminution in sympathetic activity as a consequence of degenerated neurites. Melanocytes are neural crest in origin. Their activity may be under neural control and degeneration of nerves may be a link in the pathogenesis of vitiligo. A neurochemical process destroying melanocytes was proposed by Nordlund and Lerner.[9] Norepinephrine or some other similar neural agent released by nerve endings might be deleterious to melanocytes.

In the present study degenerated melanocytes were observed near degenerating nerves. The nerve endings-melanocyte association in normal skin is very rare.[10]

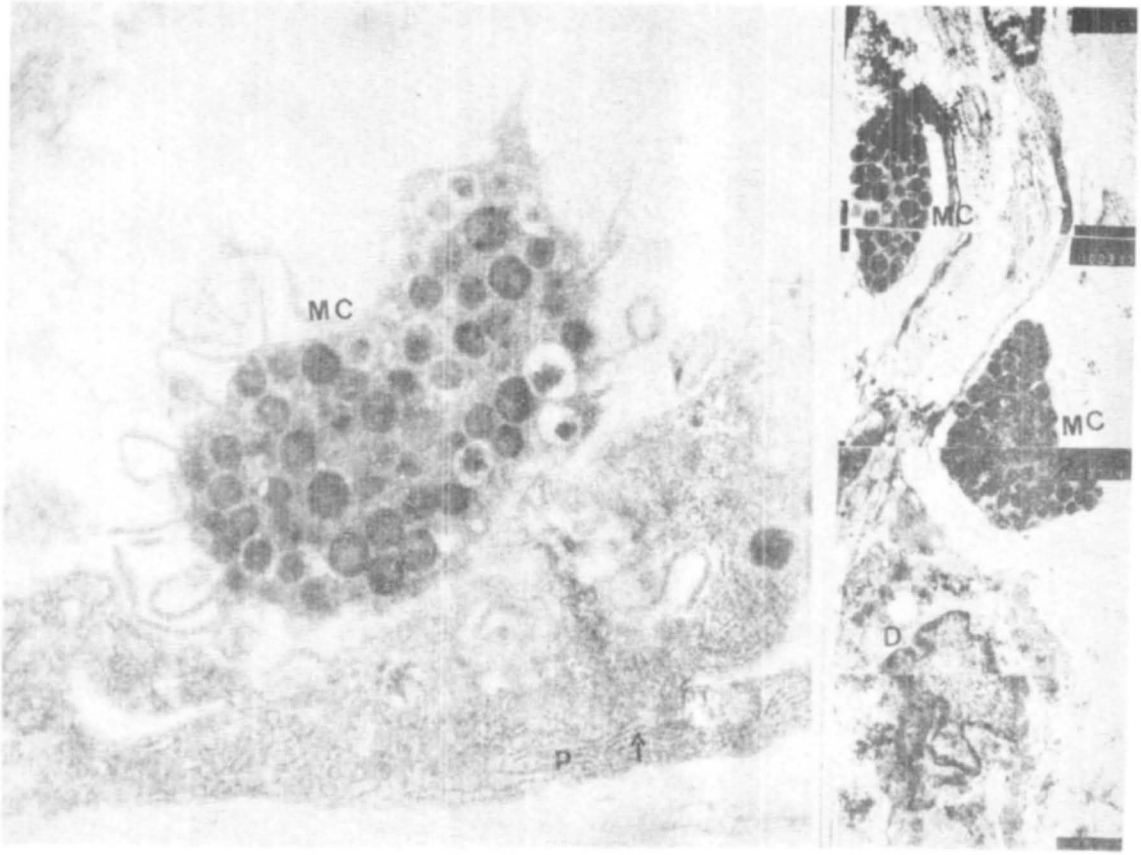


Fig. 3. A. Mast cell (MC) and a plasma like cell (P). Note rough endoplasmic reticulum (v). (X 5,000).

B. A Montage. Mast cells (MC) and dendritic (D) cell in dermis. (X 10,000).

This frequent association of nerve endings with degenerating melanocytes observed here is significant. The neurologic theory would explain the loss of pigment in segmental vitiligo and the abnormal sweating patterns of depigmented skin.

Numerous mast cells were seen in all cases. Okun[6] presented morphologic, histochemical, ultrastructural and embryologic parallels between melanocytes and mast cells and suggested that these cells had a common connective tissue stem cell and that mast cells represented a transitional phase in the development of melanocytes. He showed the similarities in granules of these two cells and noted that both these cells were smaller and more dendritic. The mast cells in the present study were small and dendritic. Melanocytes with aggregations of melanosomes were also observed in dermis. These observations are quite in support of Okun's[6] suggestion that the precursors of epidermal melanocytes are in the subepidermal bed of loose connective tissue.

Mast cells increase in inflammatory conditions and during nerve regeneration.[11] But in the present study none of our patients had taken drugs and the patch was of recent origin and there was no evidence of other inflammatory changes or of nerve regeneration. On the contrary, we observed collagenization and

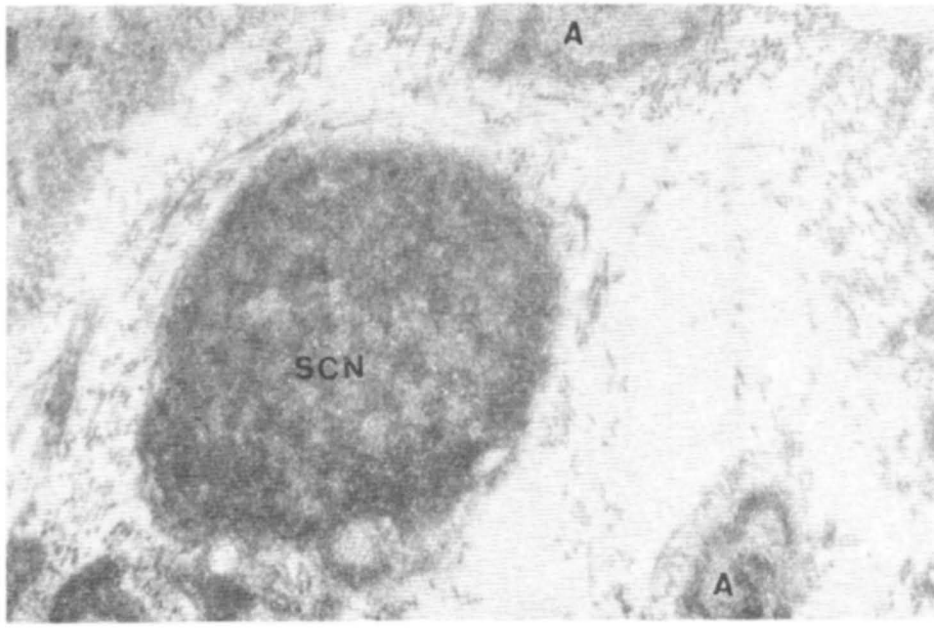


Fig. 4. A degenerated nerve bundle in deep dermis. Note excessive collagen, Schwann cell nucleus-SCN, axon-A (X 8,000).

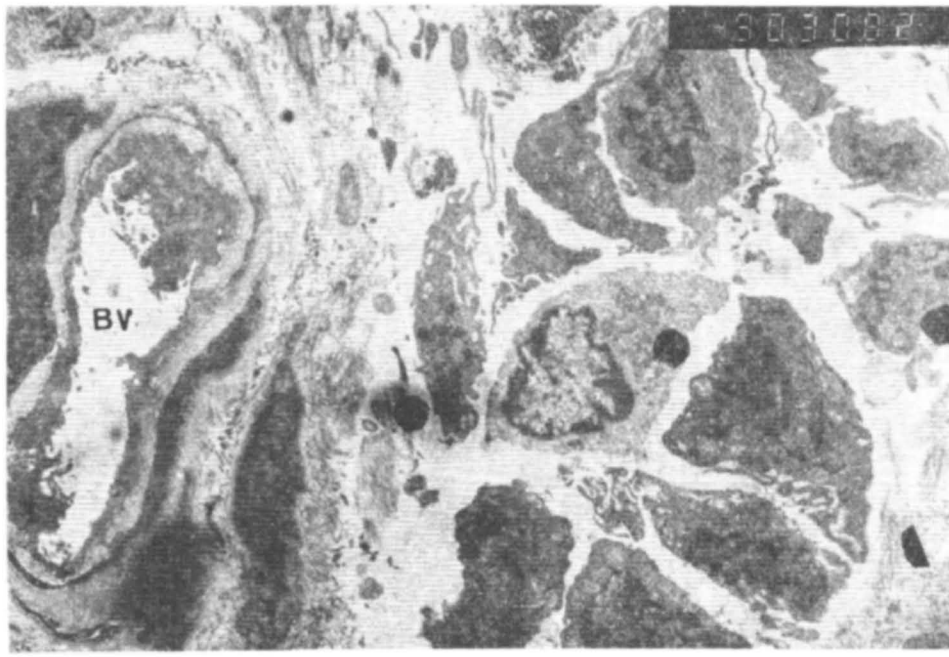


Fig. 5. Blood vessel (BV) having reactive endothelial cells and proliferation of basement membrane. (X 6,000).

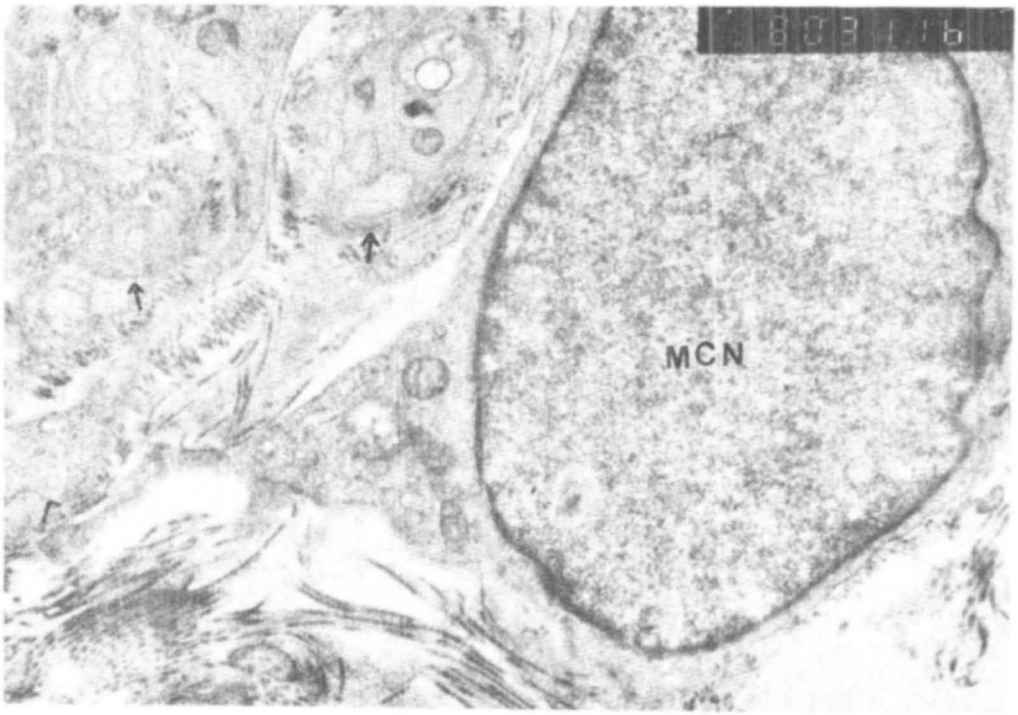


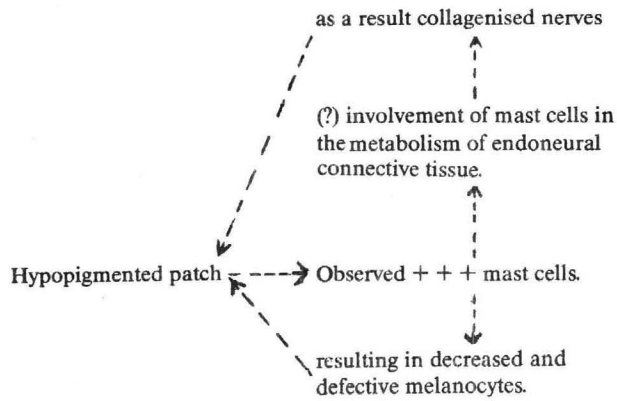
Fig. 6. A degenerating melanocyte near a degenerating non-myelinating nerve bundle (v v) MNC-Nucleus of the melanocyte. (X 8,000).

degenerative changes in the nerves. Riley[12] suggested that the natural function of the mast cell is to store and release mucopolysacharrides for the connective tissues. The carbohydrate precursor substance is formed mainly by fibroblasts. Thus mast cell hyperplasia is marked in conditions of fibroplasia. Abercombie and Johnson[13, 14] reported hyperplasia of mast cells in nerves and related it to the increase in connective tissue collagen. They also suggested that mast cells may play some part in the metabolism of endoneural connective tissue aiding the formation of fibrils but unable to initiate the process.

We can thus speculate that hyperplasia of mast cells is in some way concerned with the pigmentary defect in vitiligo and there is a temptation to give a hypothetical model explaining the increase of mast cells in dermis.

1. The basic hypothesis accepted for the model is that mast cells produce melanocytes.[6]

This model for mast cell participation in the pathogenesis of vitiligo integrates observations of melanocytes and nerves.



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