

Full Length Research Paper

An ultrastructural study of epidermal dendritic cells in mole rats (*Spalax leucodon*)

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Dendritic cells (DC) are strong antigen secreting cells (ASC) collecting antigens by taking them from the tissues, carrying them to the lymph nodes and giving them to T cells in order that they could obtain immunity. They are called as melanocytes, Langerhans cells and epidermal dendritic cells in the literature of dermatology. These cells are placed as suprabasal in the mole rats dermis having a deep notched nucleus with a great number of mitochondria and small vesicles in their cytoplasm. Since they do not have tonofibrils and desmosomes in their structure, they can be separated very easily from keratinocytes and the other cells. These cells do not have any membrane contact with basal membranes and neighboring keratinocytes. Dendritic cells are surrounded by neighboring keratinocytes tightly, having a character of open cytoplasm (light cell). In the epidermis of mole rats, Langerhans cells and dendritic cells were rarely observed, while no melanocyte and melanin granules were encountered. In the current study, it was aimed to investigate the fine structure of dendritic cells met on the basal lamina of mole rat epidermis and to compare them with some other rodents samples.

Keywords: Epidermis, dendritic cell, ultrastructure, mole rats (*Spalax leucodon*)

INTRODUCTION

Dendritic cells (DC) are strong antigen secreting cells (ASC) collecting antigens by taking them from the tissues, carrying them to the lymph nodes and giving them to T cells in order that they could obtain immunity (Yrliid and Macpherson, 2003; Villadangos and Heath, 2005; Willard-Mack, 2006). Dendritic cells grow out of bone marrow and then spread to all the tissues of the body except for brain, eyes and testicles (Hart, 1997). There are various kinds of dendritic cells including Langerhans cells in the skin and endocytosis cells recently defined in small intestines (Henri et al., 2001; Yrliid and Macpherson, 2003; Rothoef et al., 2006; Willard-Mack, 2006). Epidermis cells which make up the upper-stratum of the skin are naturally keratinized as

they come up the surface. These keratinized epidermal cells are called keratinocytes. The stratum on the basal lamina under epidermis is called stratum basale. There are some extensions coming from different origins mostly on the basal cells in this stratum and rarely between basal cells. Compared to keratinocytes, these few numbers of cells are called dendritic cells. Dendritic cells are also named as melanocytes, Langerhans cells and epidermal dendritic cells in the literature of dermatology (Snel, 1965; Tsuji et al., 1969; Yrliid and Macpherson, 2003; Randolph et al., 2005; Willard-Mack, 2006). According to some researchers, Merkel cells are also regarded as dendritic cells because of their light cytoplasm (Allen and Potten, 1974). Since epidermis has

some more dendritic cells other than keratinocytes, they have partly heterogeneous tissues. It was asserted that among dendritic cells, Langerhans cells play important roles in various immunological reactions (Salmon et al., 1994; Villadangos and Heath, 2005).

The mole rats used in this study are interesting rodent animals spending most of their lives underground galleries and nests and not coming up to the surface in normal conditions. Their main habitats are Balkans, Anatolia, Southern Russia and Northern Africa. As mole rats live relatively in limited habitats in certain parts of the World in underground galleries, they cannot be used as laboratory subjects like other rodent samples. In the literature, no histological study was found with regard to the dendritic cell within the epidermis of the mole rats. Therefore, the purpose of this study was to investigate the fine structure of dendritic cells that are met relatively less on the basal lamina of mole rat epidermis, and to compare them with some other rodents.

MATERIAL AND METHODS

In the current study, 4 mole rats caught in Ankara and neighboring district with a weight of 180-200 g were used. Mole rats were applied general anesthesia by injecting 0.01 "ketas" dose in 1 g body weight in the quadratus muscle of thigh. The anesthetized animals were shaved on the back and a part of skin was biopsied and they were cut into parts of 2 mm³ at 0.1 M sodium phosphate (pH 7.4) buffer. The samples were fixed in glutaraldehyde of 3% at +4°C for three hours, washed in the buffer for 4 hours, then they were fixed in osmium tetroxide of 1% for 1 hour once more and washed again in the buffer for 4 hours. Dehydration process was made with ethyl alcohol. "Araldite CY212" was used as the embedding medium. A number of blocks were prepared out of the samples taken from the animals. Fine sections taken by ultratome were placed on grids without a film and painted with saturated uranyl acetate for 60 minutes and then painted with lead citrate for 15 minutes. These samples were examined by Jeol 100 CX-II electron microscope and their micrographs were taken.

The experiment was carried out in accordance with the university guidelines for the care of the experimental animals. Besides, guiding principles for experimental

procedures presented in the World Medical Association's Declaration of Helsinki regarding animal experimentation were followed in the study.

FINDINGS AND OBSERVATION

In the examination made in the epidermis of mole rats through electron microscope, four strata of skin were separated. These are called stratum basale, stratum spinosum, stratum granulosum and stratum corneum from the bottom towards the top (Figure 1).

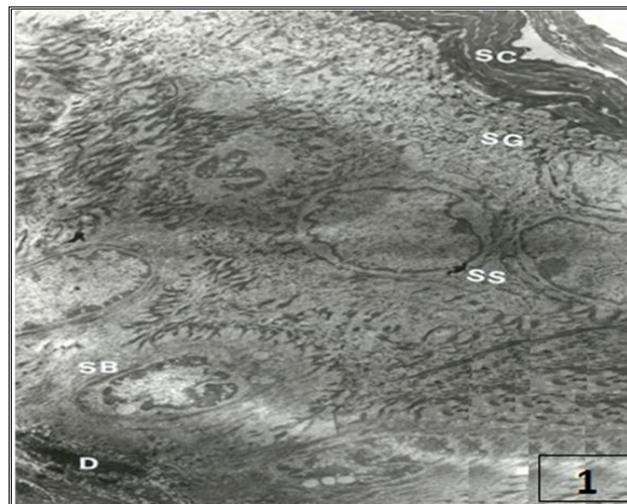


Figure 1: General view of the epidermis of mole rats. Stratum corneum (SC), Stratum granulosum (SG), Stratum spinosum (SS), Stratum basale (SB) and Dermis (D). X3900

While no melanocytes were seen in the electron microscopic observations in the epidermis of mole rats, the Langerhans cells were encountered rarely and the epidermal dendritic cells were seen as suprabasal between the keratinocytes. Surrounded by basal and spinosum cells, the epidermal dendritic cells have typical extensions. Their nuclei are generally notched and in some cases they are deeply lobulated. The heterochromatin is located in the periphery of the nucleus. They have a great number of mitochondria and small vesicles in their cytoplasm. Endoplasmic reticulum has short cistern and ribosomes are scattered in the cytoplasm. Nuclear membrane is surrounded outside by

a perinuclear gaps. These cells do not make desmosomes with keratinocytes and there are no tonofilament bundles in their cytoplasm. There are large intercellular gaps between cells (Figure 2, 3, 4).

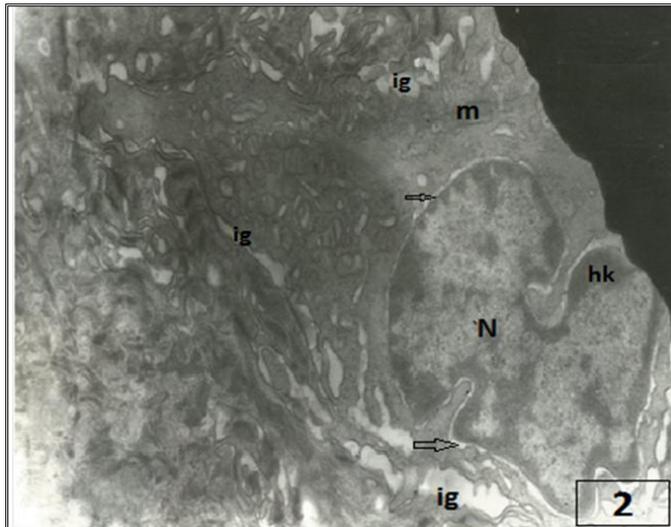


Figure 2: General view of a dendritic cell in the basal lamina of mole rat epidermis. Nucleus (N), perinuclear gap (arrow), intercellular gap (ig), mitochondrion (m) and heterochromatin. X14000

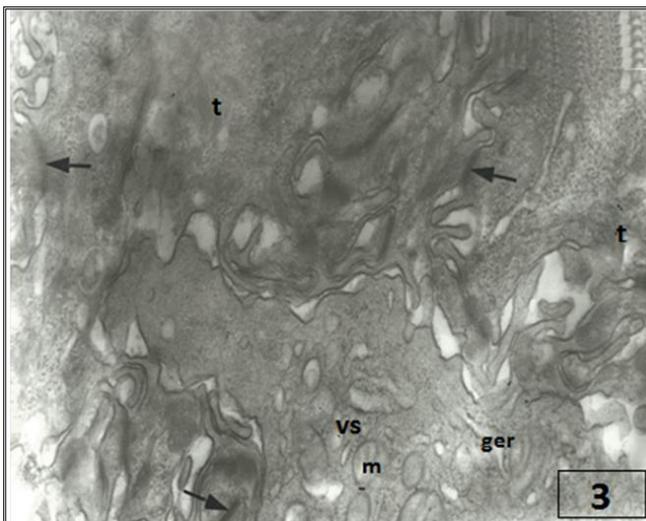


Figure 3: Mitochondria (m), vesicles (vs) and granular endoplasmic reticulum (ger) in the cytoplasm of the dendritic epithelial cell. X26000

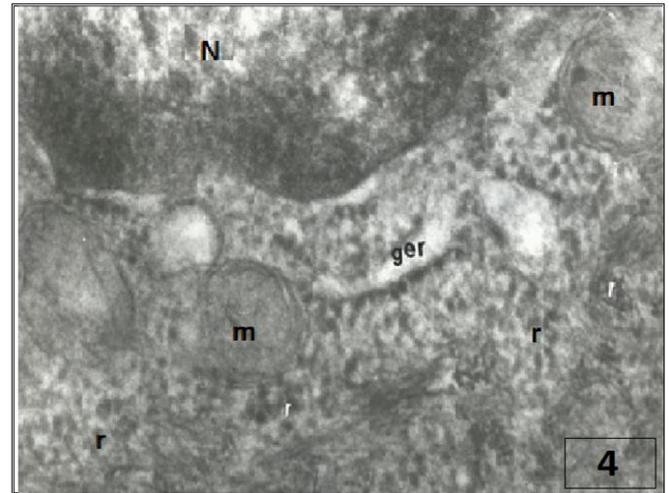


Figure 4: Nucleus (N), mitochondria (m), granular endoplasmic reticulum (ger) and ribosomes in the cytoplasm of the dendritic epithelial cell. X8300

DISCUSSION

In the stratum basale of mammal epidermis are other cells from different embryological origins besides the keratinocytes. These cells are known as dendritic cells, since they generally have extensions. Tonofilament bundles are abundant in the keratinocytes surrounding them and their cytoplasm is intense in terms of electrons. Because of these features, keratinocytes are darker in color compared to dendritic cells. Dendritic cells in epidermis are called light cells because of their appearance (Tsuji et al., 1969; Allen and Potten, 1975; Huang et al., 2000). Light cell population in the literature of dermatology is melanocytes, Merkel cells, Langerhans cells and dendritic cells (Snel, 1965; Villadangos and Heath, 2005; Willard-Mack, 2006). It was pointed out that there are no melanocytes from dendritic cells in the mole rat epidermis and that these cells can be observed after the application of dimethylbenzanthracene (DMBA), which is a carcinogen material (Tsuji et al., 1969). It is likely to say that lack of melanocytes in mole rats is because of the fact that these animals are not exposed to the sun light. The task of melanocytes in these animals might be performed by other dendritic cells in epidermal cells.

Dendritic cell population in mouse epidermis is around 12-13%, and 10% of it is Langerhans cells, 2-3% are

dendritic cells or melanocytes (Allen and Potten, 1975; Henri et al., 2001). In the current study, it was found that these cells were dendritic cells due to the fact that they are placed between the basal and spinosum strata of the epidermis of mole rates, and they have nuclei with deep notches and intense chromatin and light colored appearance. This finding is consistent with the related literature (Raknerud et al., 1971; Randolph et al., 2005; Willard-Mack, 2006). It was found that other cells were Langerhans cells because their nuclei are multi-lobular, have typical stick profiles and have such structures as tonofilaments and desmosomes, despite their light colored appearance. These findings are also consistent with the literature (Tsuji et al., 1969; Potten and Allen, 1975; Seité et al., 2003; Villadangos and Heath, 2005).

The epidermal dendritic cells observed in the current study resemble the cells observed in the rat epidermis by Raknerud et al. (1971) because of the fact that they are placed in the subbasal position between keratinocytes and their characteristic features.

Conclusion: Dendritic cells are vital immunological structures. They are overlooked easily and are rather featureless structures at the gross level, but they are very complex structures at the microscopic level.

Abbreviations

DC: Dendritic cells

ASC: Antigen secreting cells

LC: Langerhans cells

g: Gram

DMBA : Dimethylbenzanthracene

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