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Research Article

HISTOPATHOLOGICAL CHANGES IN CANINE DEMODICOSIS

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ABSTRACT

An investigation was carried out to study the pathological changes in canine skin due to demodicosis. The predominant changes included folliculitis, perifolliculitis, furunculosis, acanthosis and hyperkeratosis, parakeratosis and hyperplasia of superficial epidermis. The cut sections of mites were seen in hair follicles, stratum corneum, sweat glands, sebaceous glands as well as in the dermis and epidermis with mild to heavy mononuclear cell reactions. There was ulceration of the epidermis in the severe pustular lesions.

Key words: Dogs, demodectic mange, skin, histopathological changes

Canine demodicosis is a common skin disease of dogs in which proliferation of *Demodex canis,* an acarine parasite of canine hair follicles, is associated with the development of cutaneous lesions (Caswell *et al.,* 1997). The mite is able to complete its entire life cycle within the hair follicles and sebaceous glands. The mites probably actively enter the hair follicle soon after the new host's birth. As their number increases, they mechanically distend the follicles and penetrate them more deeply. With mechanical distension of the follicle, the hairs are loosened and fall out so that alopecia commences. Some follicles may rupture, releasing bacteria and follicle debris in to the dermis where an inflammatory reaction occurs and pustular demodicosis results (Baker, 1969). The present paper reports on histopathological changes in dogs having natural infection of *Demodex.*

MATERIALS AND METHODS

The canine cases with the dermatological problem presented at the Teaching Veterinary Clinical Services Complex, College of Veterinary Science and Animal Husbandry, Anand for a period of nine months were utilized for this study. For the detection of demodectic mange in skin, deep skin scrapings were collected. The adult mites, nymphs, larvae and eggs were identified as per description of Nutting and Desch (1978), Soulsby (1982) and Medleau (1990). A total of 84 dogs were found positive for demodicosis.

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For histopathological studies, skin biopsies were collected from dogs affected with demodicosis (n=10) as well as from the healthy areas (n=1) for comparison. The affected area was gently cleaned with 70% alcohol and the site was desensitized with local anaesthetic solution (Lignocaine hydrochloride, 1-2%) subcutaneously (Wilkinson and Harvey, 1994). Punch biopsy instrument (5 mm diameter "Bakers" biopsy punch) was placed on the area of skin to be biopsied and the punch was drilled into the tissue with rotary motion in one direction applying moderate pressure (Muller and Kirk, 1969; Nesbitt, 1983). The punch was withdrawn and the circular piece of skin was snipped off from the punch by a sterile scalpel while holding the piece of skin with a plain forceps. The wound was closed with one skin stitch. The biopsy of the skin thus obtained was preserved in 10% formalin. The biopsy samples were processed for paraffin sectioning method as described by Luna (1968). The paraffin sections of 6-8 µ thickness were cut and stained by routine Mayer's Haematoxylin and Eosin staining method and Periodic Acid Schiff (PAS) stain (Drury and Wallington, 1980).

RESULTS AND DISCUSSION

The histopathology of skin biopsy sections from clinically suspected cases of demodicosis revealed that there was excessive degeneration of the hair follicles in all the affected dogs. The degenerative changes included desquamation of the papillary cells, detachment

of the hair shaft and its extrusion from the follicle, loss of the hair cuticle as well as the inner root sheath, degeneration of the glossy membrane of the hair follicle, desquamation and degeneration of external root sheath cells with pigment deposition. A large number of dark pigmented granules of variable sizes were found accumulated at the periphery of the parasitized hair follicles suggesting hyperpigmentation. The hyperpigmentation was due to increased melanocytic activity in the epidermis (Baker, 1975). The hair follicles were necrotic, markedly distended and filled with keratin, debris, purulent material and numerous *Demodex* mites cut in different planes inside hair follicles (Fig. 1). Demodectic mange was characterized by folliculitis with oedematous changes in the collagen fibers (Fig. 1). The parasitized hair follicles were seen enlarged with mites covering the distended space tightly, atrophy of follicular epithelial cells and cystic dilatation of hair follicles due to presence of mites as also reported by Dadhich and Khanna (2008). It has been postulated that the disease is primarily a chronic inflammatory response to the mechanical presence of mites in the hair follicles.

Sweat glands were distended with numerous mites cut in various planes. There was complete destruction of the sweat glands, which presented cyst-like cavities containing the sections of parasites. There was desquamation of the lining cells of the sweat glands. Dense accumulation of plasma cells and lymphocytes were seen around many sweat glands alongwith focal granulomas. Histopathological examination of the affected skin revealed large number of *Demodex* mites cut inside sebaceous glands covered with thick cornified layers of the epidermis (Fig. 2). Sebaceous glands were also observed to be degenerated and necrotic. There was hyperplasia of epithelial cells of sebaceous glands. Kral and Novak (1953) observed destruction of the root sheath and sebaceous glands in suppurative folliculitis due to penetration of the *Demodex* mites into the hair follicles. Infiltration of lymphocytes and plasma cells might be due to the attraction of these cells by antigens present in the mite cuticle (Baker, 1969; Neog *et al.,* 1995). In ectoparasitic infestation mainly eosinophilic infiltration is observed, however, the presence of neutrophils observed in the present study indicated secondary bacterial infection (Barta and Grant, 1983; Neog *et al.*, 1995).

Formation of granuloma in stratum corneum was also observed. The principal epidermal changes were hyperkeratosis and acanthosis with follicular hyperkeratosis, folliculitis and furunculosis with *Demodex* mites in the follicles (Fig. 1). Hyperkeratosis and acanthosis observed in the present study have been suggested to be characteristic histological features of demodicosis (Das, 1985; Nedunchyelliyan, 1989; Chhabra *et al.*, 2002; Ballari *et al.*, 2009). Hyperkeratosis might have occurred due to cutaneous mechanical irritation caused by the infesting mites (Muller *et al.*, 1989). There were focal granulomatous changes in the stratum corneum, which extended up to the dermal papillae resulting in to their destruction. Similar observations have been made earlier (Nutting, 1976; Neog *et al.*, 1995).

There was hyperplasia and exfoliation of superficial epidermis. In the skin, cut sections of mites were seen embedded in keratinized mass of epidermis with mild to heavy mononuclear cell reaction. There was ulceration of the epidermis indicating that the sample might have been taken from pustular lesions as reported by Sheahan and Gaafar (1970). Massive infiltration of neutrophils, lymphocytes and macrophages were a feature of the inflammatory reactions in pustular lesions (Fig. 3).

The dermis manifested severe changes in all cases. The most consistent change in the dermis was moderate to marked infiltration of lymphocytes, macrophages, mast cells and plasma cells, often accompanied by small numbers of neutrophils and few eosinophils with oedema of the collagen fibers. These findings were indicative of a chronic inflammatory response. Affected areas were congested and dermal lymphatics were enlarged. Mast cells were numerous (Fig. 4) and there were many melanophores in the upper dermis. Focal granulomas, many containing demodicids in various stages of degeneration, developed in the dermis at the sites of ruptured follicles. The upper dermal layer was markedly oedematous and the capillaries were dilated. More or less similar observations have been recorded earlier (Ballari *et al.*, 2009).

Histopathological study of skin biopsy samples can be used as a confirmatory diagnostic tool for canine demodicosis. The histopathological alterations observed in the biopsy specimens of demodectic mange comprised

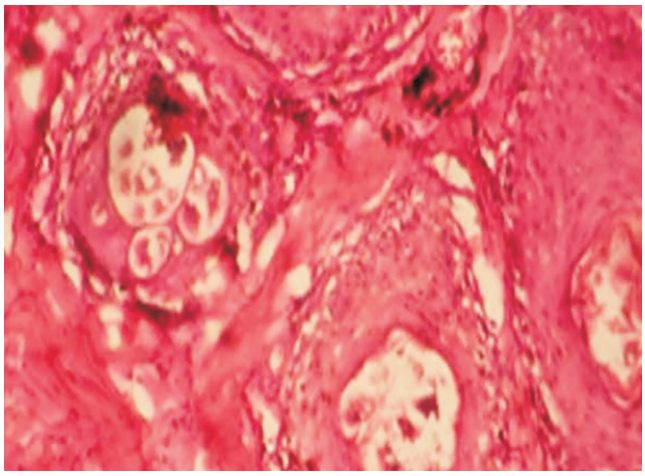

Fig 1. A horizontal section of skin of a dog affected with *Demodex* mite showing pink coloured pieces of mite in the hair follicle. Oedematous changes in the collaen fibers and folliculitis are also noticed. (H. & E. x 240)

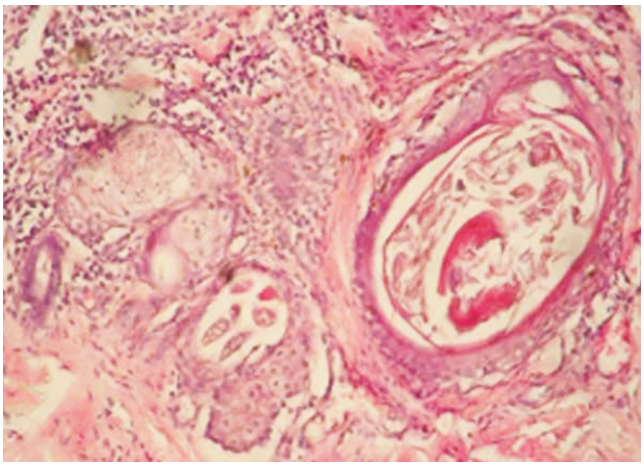

Fig 2. A horizontal section of skin of a dog affected with *Demodex* mite showing parakeratosis and hyperkeratinization of hair follicle. The cut sections of *Demodex* mite inside the sebaceous gland covered with thick cornified layer are also noticed. (H. & E. x 240)

of folliculitis, perifolliculitis, furunculosis, acanthosis and hyperkeratosis, parakeratosis and hyperplasia of superficial epidermis. Massive infiltration of neutrophils, lymphocytes and macrophages were a feature of the inflammatory reactions in pustular lesions.

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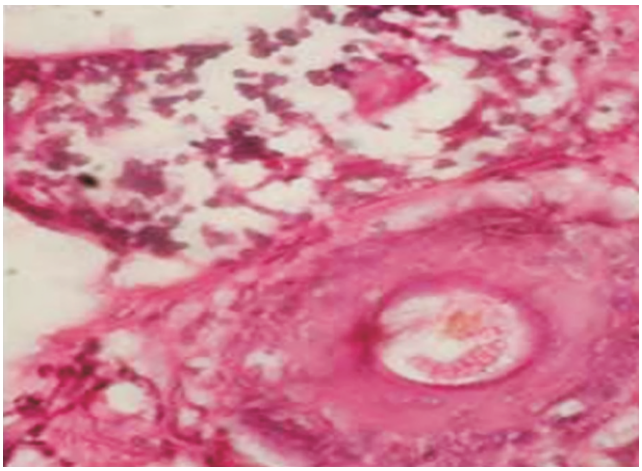

Fig 3. Microphotograph of affected skin of a dog showing pustular form of demodicosis with diffuse cellular infiltration around the hair follicle. (H. & E. x 180)

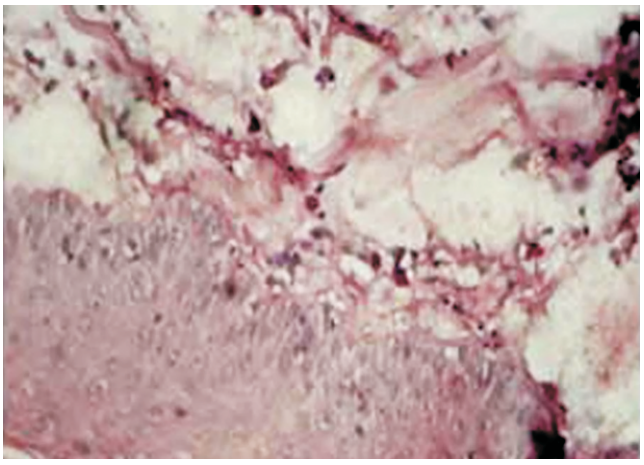

Fig 4. Section of skin of a *Demodex* mite affected-dog showing mast cells in the papillary layer of the dermis. (PAS stain x 45)

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