

PATHOLOGICAL STUDIES ON MIXED DERMATOMYCOSIS AND MANGE INFECTION IN CAMELS ACCOMPANIED WITH CHRONIC GRANULOMATOUS HIDRADENITIS

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ABSTRACT

The authors describe the histopathological features of dermatomycosis and sarcoptic mange mixed infection accompanied with chronic granulomatous hidradenitis in five camel's skin samples collected from Al-Najaf slaughter house in Republic of Iraq. Direct examination of the skin scraping with 10% KOH revealed fungal organisms (mycelia and arthrospores) and mites which were consistent with *Sarcoptes* spp (*Sarcoptes scabiei* var *cameli*) in the macerated debris. Histological examination of the skin sections revealed dermatitis characterised by acanthosis with marked parakeratosis, hyperkeratosis and crust formation, rete-pegs, hyperplastic changes in sebaceous glands and hair follicles cells, granulomatous hidradenitis and infiltration with eosinophils, lymphocytes, macrophages and neutrophils. Sections stained with periodic acid-Schiff (PAS) and Gomori's Methenamine silver (GMS) stain, revealed large numbers of fungal arthrospores and hyphae coloured bright magenta with PAS and black with GMS. In conclusion, this study reported mite infestation that occurs concurrently with dermatomycosis accompanied with granulomatous hidradenitis in a species belonging to the Camelidae. Additional studies including better understanding of pathogenesis of mixed infection and its effects on the skin immunity will be desirable for further understanding of those skin diseases in camels.

Key words: Camel, dermatomycosis, mange, Iraq, mixed infection, *Sarcoptes scabiei* var *cameli*

Sarcoptic mites are the commonest parasites affecting dromedary camels (Al-Rawashdeh *et al*, 2000; Gabaj *et al*, 1992; Mochobo *et al*, 2006; Muhammad *et al*, 2006), while, psoroptic and chorioptes mites are affecting llamas (Curtis *et al*, 2001; Jon *et al*, 2007). Previous studies revealed demodectic mange in camels in Iraq (Hussain *et al*, 2012) and high incidence of *Sarcoptes scabiei* var *cameli* was demonstrated in Kingdom of Saudi Arabia.

Dermatomycosis is considered as a common disease of camels worldwide (Wernery and Kaaden, 2002). *Trichophyton* spp is the most prevalent causative fungus (Higgins, 1986; Al-Ani *et al*, 1990). Animal less than 1 year of age are at greater risk for dermatomycosis. Older animals with decreased immune function also may be at increased risk for generalised dermatomycosis (Scott, 1988; Gupta and Singh, 1969; McPherson, 1957). Ringworm caused primarily by *Trichophyton schoenleinii* is a common skin disease in Iraqi camels, especially in the young - those under three years of age (Al-Ani *et al*, 1995).

Hidradenitis (apocritist) is inflammation of apocrine glands usually seen in association with suppurative or granulomatous dermatitis. The granulomatous reaction pattern is defined as a distinctive inflammatory pattern characterised by the granulomas (Weedon, 2000). Fully developed granulomas with sheets of epithelioid histiocytes and giant cells are easily recognised, but more subtle lesions containing a few epithelioid histiocytes still qualify as granulomatous (Rabinowitz and Zaim, 1996; Hirsh and Johnson, 1984).

This article describes the histopathological features of mite infestation mixed with dermatomycosis in the skin of the camel.

Materials and Methods

At the end of spring season (May 2012), skin scrapings were collected from the skin of 5 camels showing skin lesions at Al-Najaf province slaughter house in Iraq. Skin scrapings were cleared in 10% potassium hydroxide for direct microscopic

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examination. Unfortunately, skin samples were not sent for fungal culture. Skin samples from different areas of the body (neck, forelegs, hind legs, back, flank and abdomen) were also collected from these camels after slaughter, and fixed in 10% neutral buffered formaldehyde. Samples were routinely processed for histopathological sectioning. Sections cut 4 µm thick were routinely stained with haematoxylin and eosin (HE). Selected sections were stained with periodic acid Schiff (PAS) and Gomori's methenamine silver special stains. All stained sections were examined carefully under light microscopy (Nikon microscope ECLIPSE E 600) to study the parasitic and fungal infections.

Results

Direct examination of the skin with 10% KOH revealed fungal mycelia and arthrospores (Fig 1A, B). Mycelia of the causative fungus were seen inside the hair shaft and surrounded the length of the hair. Mites and their numerous developmental stages consistent with *Sarcoptes* spp (*Sarcoptes scabiei* var *cameli*) were also identified.

All skin sections revealed variable pathological lesions. The epidermis was in generally severely hyperplastic. Mixed orthokeratotic or parakeratotic hyperkeratosis was a frequent feature, and in all cases serocellular exudation with degenerated neutrophils and crust formation was seen. Crust composed of degenerating neutrophils appeared in superficial keratin layer. Acanthosis and rete ridges formation was characterised by prominent irregular hyperplasia and elongated pegs of epidermis that appeared to project downward into the underlying dermis and were severely invaded with leukocytic cells. Some acanthotic areas revealed intracellular oedema of the epidermis which showed spongiosis accompanied by infiltration of lymphocytes and eosinophils. Occasional vacuolated keratinocytes were found in the spinous and granular strata. Formation of keratin cysts was noted in the epidermis and dermis. Hair follicles as well as superficial vessels were surrounded by lymphocytes, macrophages, eosinophils and neutrophils (Fig 2 A & B).

The surface as well as intrafollicular hairs was colonised by large numbers of refractile or slightly basophilic arthrospores and hyphae. These were coloured bright magenta with periodic acid-Schiff stain and black with Gomori's methenamine silver stain. The Keratin-filled follicles ruptured leading to prominent furunculosis (Fig 3 A&B).

In some sections, intact mites or mite fragments were lying free on the surface among keratin

fragments, embedded in crusts. The mites were seen in niche-like burrows in the epidermis, and the adjacent epidermis had grown in the form of rete papillae (Fig 4 A & B).

All sections revealed hyperplastic changes in sebaceous glands, which were filled with bright magenta spores with periodic acid-Schiff and black with Gomori's methenamine silver stain (Fig 5 A&B).

Apocrine glands (sweat glands) revealed hyperplastic changes and solitary granulomatous lesion. Granulomatous lesion was predominant with histiocytes or epithelioid histiocytes, and admixed with multinucleated giant cells and other types of inflammatory cells (Fig 6 A, B).

Discussion

Scabies caused by the ectoparasitic mite *Sarcoptes scabiei* var *cameli* had been reported in Kingdom of Saudi Arabia, which caused severe dermatitis not only in the dromedary camels but also in llamas (Mouchira and Khalid, 2009). Orion *et al* (2004) reported that direct contact of camelidae enhanced the infection with the same mange mite i.e. *sarcoptic scabiei* var *cameli*. Other epidemiological studies suggested that transmission of mites among a group of animals is most likely through direct contact or via contaminated bedding. The prevalence of scabies appears to be affected with tropical and subtropical areas (Shelley and Bart, 2007). Previously, Ravindran and Subramanian (2000) found the highest prevalence in the months of August, associated with low atmospheric temperatures, high mean relative humidity and high mean rainfall. However, other authors found a high prevalence of acariaosis during rainy seasons in camels (Zelege and Bekele, 2001). The present study demonstrated generalised *Sarcoptes scabiei* var *cameli* mites infestation in the skin that collected from camels at the end of spring and this result is compatible with the previous study which revealed that the prevalence and the activity of the *Sarcoptic scabiei* mite was observed from the end of February to the end of March (in the normal temperature), in absence of humidity and rainfall (Mouchira and Khalid, 2009). Generally, *Sarcoptes scabiei* infestation reveals varying degrees of superficial perivascular dermatitis with numerous eosinophils. Eosinophilic microabscesses and focal areas of epidermal oedema, leukocytic exocytosis and necrosis (epidermal nibbles) may be seen. Mites may be seen within parakeratotic scale crusts and in sub corneal tunnels. Occasionally, deep perivascular dermatitis with lymphoid nodules may be seen

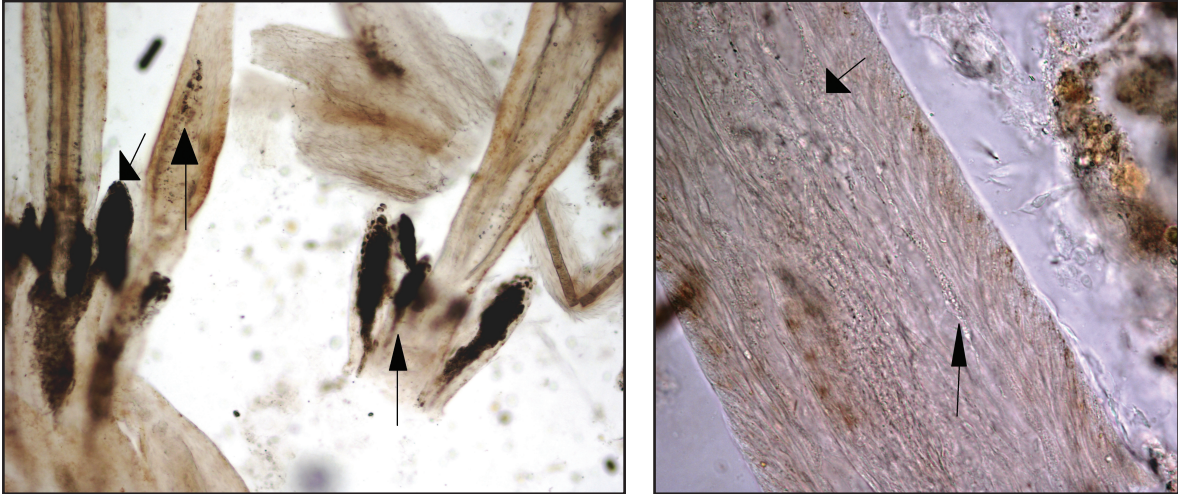


Fig 1. A skin scraping after treatment with 10% KOH shows: A) Sheet of arthroconidia X10 (arrows) ; B) Fungal hyphae in the infected hair (arrows) X 20.

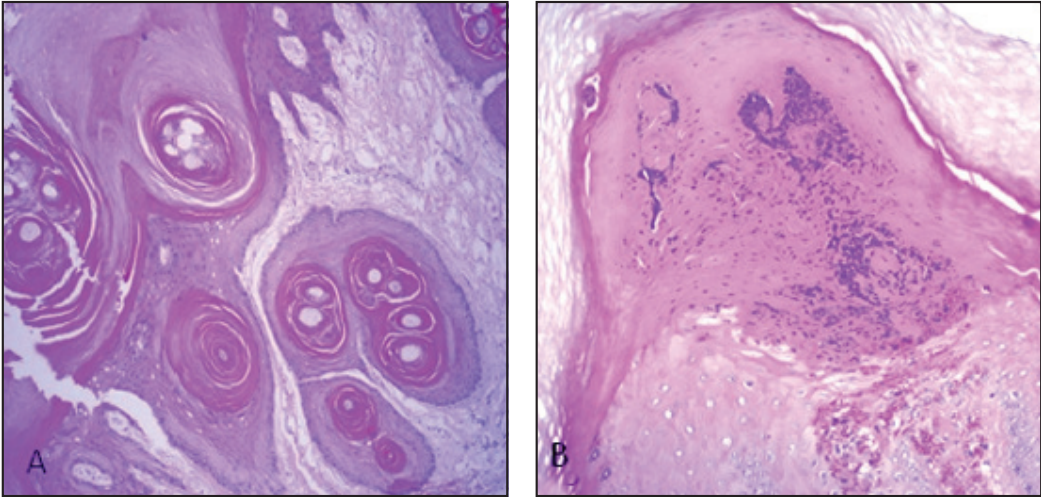


Fig 2. A. The epidermal hyperkeratosis, acanthosis, and rete ridge formation, deep reaction in the dermis layer, formation of keratin cysts, congestion and serocellular exudation (H& E) X10. B. Crust formation composed of degenerating neutrophils appeared in superficial keratin and spongiosis. (H& E) X10.

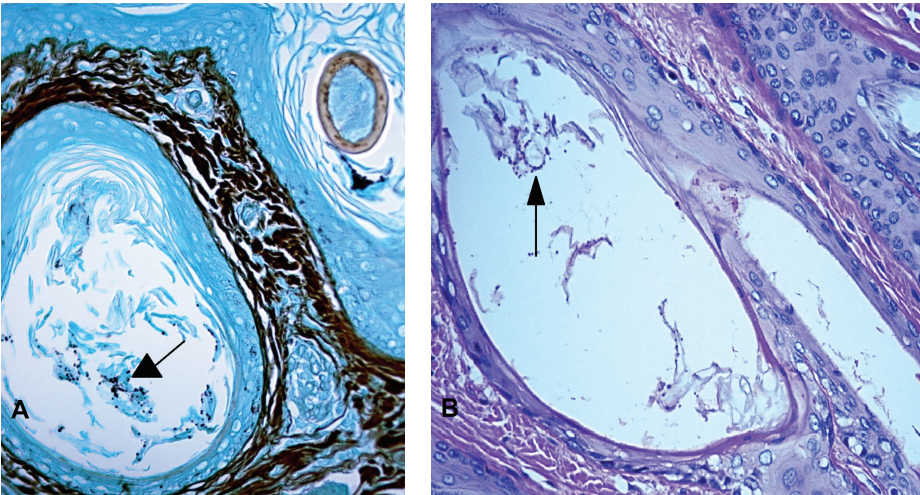


Fig 3. Refractile arthrospores and hyphae appear: bright magenta with Periodic Acid-Schiff stain (A) and black with Gomori's Methenamine Silver stain (arrows) (B).

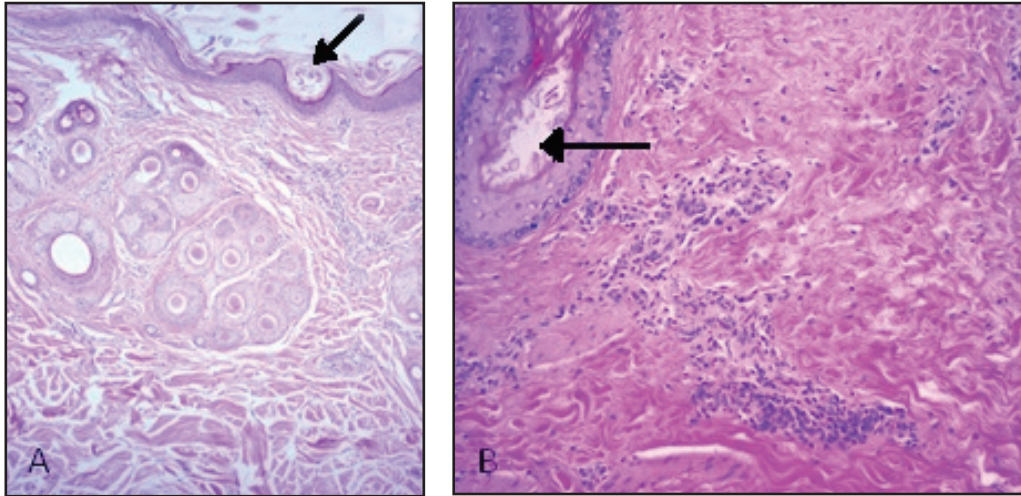


Fig 4. Sections show the Mites lying (arrow) on the surface among keratin fragments, H&E X10. (A) and mite fragments (arrow) appeared in niche-like burrows in the epidermis, in addition to the extensive cellular infiltration, H&E X20. (B).

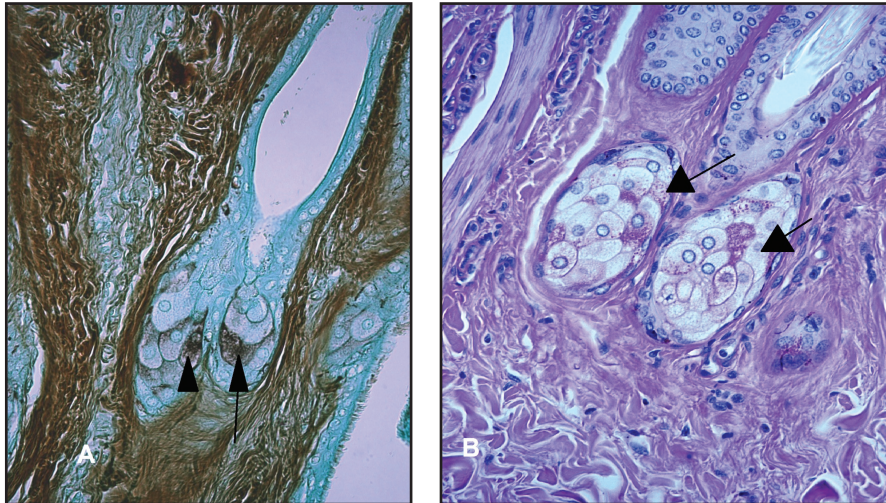


Fig 5. Hyperplastic changes in sebaceous glands which were filled with spores that appeared black (arrows) with Gomori's methenamine silver X10. (A) and sebaceous glands filled with bright magenta spores (arrows) (Periodic Acid-Schiff) X40 (B).

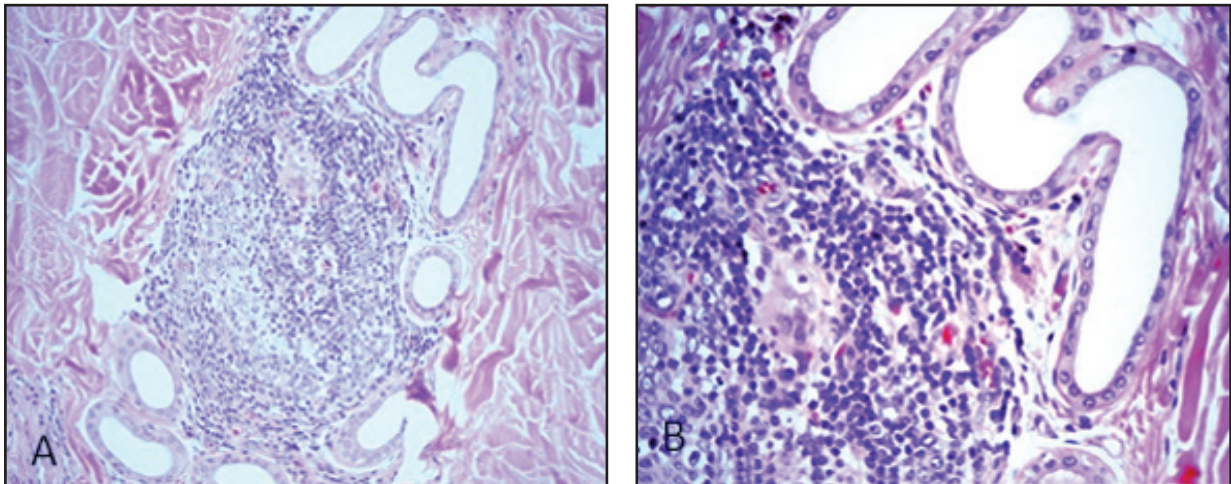


Fig 6. Hyperplastic changes and solitary granulomatous lesion in the apocrine glands (H&E X10) (A) and granulomatous lesions revealed infiltration of histiocytes or epithelioid histiocytes, and admixed with multinucleated giant. H&E X40 (B).

(Thelma *et al*, 2005). Development of scales, scabs, keratinisation, acanthosis and hyperkeratosis due to mites infestation have been reported in animals (Oraon *et al*, 2000; Chandey *et al*, 2000; Elder *et al*, 2006). The histopathological features which have been seen in the present study are in agreement with previous by mentioned studies observations. This study revealed deep burrowing and severely crusted lesions and mites appeared below the crusts that might be resulted from weakness in hypersensitivity reactions. Characteristic eosinophilic inflammations with some mononuclear cells were prominent in dermis and hypodermis layers, and were in agreement with previous study (Richard *et al*, 2006).

Demodectic mange was diagnosed in camels in Iraq (Hussain *et al*, 2012). In addition *Sarcoptes scabiei var cameli* mange was first reported in Iraq by Leiper (1957). Camel's Sarcoptic mange caused by *Sarcoptes scabiei* in Al-Najaf governorate, has also been reported by Al-Ramhay and Haider Mohammed (2000). Features of sarcoptic mange appeared in all histopathological sections examined in this study, and it is compatible with previous study which approved that *Sarcoptes scabiei* was contagious in Al-Najaf province. It seems that *Sarcoptes scabiei* are more contagious for Iraqi camels and generalised infestation which appeared in this study is compatible with the previous studies (Leiper, 1957; Lodha, 1966; Pegram and Higgins, 1992) that consider mange as the second important disease in camels after trypanosomosis due to its rapid spread.

Ringworm, or dermatomycosis, is a highly contagious fungal infection of the keratinised tissue of domestic animals and man. Wernery and Kaaden, (2002) considered that dermatomycosis is a common disease of camels worldwide. *Trichophyton spp* is the most prevalent causative fungus. *Microsporum gypseum* infection in camels has been reported previously (Boever and Rush, 1975; Mancianti *et al*, 1988). Other dermatomycosis that have been reported in camels include *Trichophyton verrucosum* (Fadlelmula *et al*, 1994) and *Trichophyton schoenleinii* (Al-Ani *et al*, 1995; Chatterjee *et al*, 1978; Khamiev, 1982). However, no mixed infection involving both mange and a dermatomycosis, has been reported in camels. In this study, all examined skin sections showed a mixed infections of sarcoptic mange and dermatomyosis infection. The pathogenic effects of mites have been attributed to their burrowing activity and mechanical damage caused by the parasites during excavation, irritant action of their secretions and excretions, allergic reactions to some of their

extracellular products and especially cytokine release and IL-1 (Henry, 1996; Wall and Shearer, 1997). On the other hand, dermatophytes invade cornified tissue by producing proteolytic enzymes, which help them penetrate the surface lipid coat. The fungal hyphae invade the cornified tissue, and the hyphae break into chains of arthrospores. The products elaborated by the dermatophytes cause dermal irritation and damage to the epidermis. The fungal products and cytokines released from damaged keratinocytes result in epidermal hyperplasia (hyperkeratosis, parakeratosis, acanthosis) and dermal inflammation.

The intermixing and similarity of the pathological features and the appearance of both pathogens (mites and arthrospores and hyphae) in this study, confirmed the mixed infection. However, there is a challenge argumentation about which pathogen was the cause of primary infection and play as predisposing factor for another infection. A compromised immune system may also be important risk factor for pathogenesis of skin infection (Scott *et al*, 2001; Gupta and Singh, 1969; Zeleke and Bekele, 2001; Khamiev, 1982).

In this study sebaceous glands and epitrichial (Apocrine) glands showed distinct pathological changes. Epitrichial granulomatous lesions were prominent in all sections and this reaction called granulomatous hidradenitis which has not been reported previously in camels.

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