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HISTOPATHOLOGICAL FEATURES OF *ORNITHODOROS LAHORANSIS* BITE ON RAT

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ABSTRACT

This experiment was done to determine histopathological features of adult *Ornithodorous lahoransis* bite on rat. In this investigation adult male rats were infested with *O. lahoransis* ticks. Animals were divided into two groups and euthanized two days and two weeks after infestation. The skin samples were fixed in 10% buffer formal saline and processed and sections were stained with hematoxylin & eosin. The lesions reflected the clinical and gross findings, with hyperemia, edema and vacoulation in the early stages, cellular infiltrations, principally lymphocyte accompanied vascular changes. Newly formed fibrous tissue with large number of hyperemic capillaries and active inflammatory process in which lymphocytes and eosinophiles were the predominant cells were seen after two weeks. Foci of necrosis in the epithelium with remnant of infiltration of polymorphonucular cells with sever hemorrhages were also evident. Vascular changes included prevascular infiltration of lymphocyte and fibrinoied necrosis on the vessel walls.

Key- words: *Ornithodoros lahoransis*, Histopathological features, soft Tick, Tick bite, Rat.

INTRODUCTION

Ticks are obligate blood feeders that parasitize a wide variety of terrestrial and flying vertebrates (Hoogstraal *et al.*, 1985). Ticks of medical and veterinary importance are divided into two families: Argasidae (soft ticks) and Ixodidae (hard ticks) (Sonenshine, 1991*a*). Both are important vectors of disease causing agents in human and animals throughout the world. Ticks transmit the widest variety of pathogens of any blood sucking arthropod, including bacteria, rickettsia, protozoa, and viruses.(Parola &Raoult,2001; Keirans, 1985; Oliver, 1989). More than 800 tick species have been described in the world (Keirans, 1985; Camicas *et al.*, 1998). There are about 170 species of argasid ticks. They have a soft, 'leathery' body and feed for a relatively short period of time, usually 5–25 min (varying from several minutes to days), depending on such factors as life stage, host type, and species of tick (Grattan-Smith *et al.*, 1997).There are approximately 650 species of ixodid ticks which are characterized by a hard body plate and a prolonged period of feeding, sometimes as long as 11 days.

There are three visible components on tick mouth part: the two outside jointed parts are the highly mobile palps; between these are paired chelicerae, which protect the center rod-shaped structure, the hypostome. After a site for feeding has been chosen, the tick begins to lacerate the epidermal layers using the horizontal action of its cheliceral digits. These are paired appendages for cutting, ripping and tearing skin. The rough hypostome has many beak-like projections on it. This is the structure which plunges into the host's skin while feeding. The palps move laterally while the tick is feeding and do not enter the skin of the host. Once the tick is firmly attached, as blood flows into the wound site, the tick begins feeding and the buccal canal becomes a common duct for the intake of host tissue fluids and the output of tick saliva (Kemp *et al*., 1982).

O. lahoransis, originally a parasite of wild sheep resting in the lee of cliffsides, is an important pest of stabled livestock in lowlands and mountains of Tibet, Kashmir, and southern former USSR to Saudi Arabia and Turkey, Iran, Greece, Bulgaria, and Yugoslavia (Fraser, 1986). Six species of *Ornithodoros* are listed between 55 ticks species were reported from Iran. *Ornithodoros lahoransis* is a major soft tick species in Iran (Abbassian-Lintzen, 1960; Rahbari, 1995; Mazlum, 1970) *O. lahoransis* vector of *Theileria ovis* and *Anaplasma ovis* and cause of tick paralysis of sheep in centeral Asia(Soulsby, 1986). Despite of transmit several disease to animals, and tick paralysis (Mamedkulov, 1993) in addition *O. lahoransis* induce skin lesions. This experiment was performed to determine histopathological features of adult *O. lahoransis* bite on rat.

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MATERIALS AND METHODS

Adult male rats (c. 250 gram weight) obtained from The University of Urmia Centeral Animal Breeding House was used in this experiment. Wild-caught adult O. *lahoransis* ticks were collected from infested sheep farms from Tekab city, West Azarbaijan of Iran and kept them in laboratory condition. Adult male Wister rats (n =6 in each group) were anaesthetized by intraperitoneal injection of Ketamine hydrochloride (200 mg/kg). Four ticks were applied to a clipped area over the shoulders of each rat and contained within gauze-covered light plastic rings (2.5 cm diameter) glued to skin. Rats were caged individually and were monitored until ticks engorged. Animals were divided into two groups and euthanized two days and two weeks after infestation.
The skin samples from the infested rats were collected in 10% buffer formal saline and processed for histopathology. Paraffin blocks were made; 4-5 micron sections were cut and stained with hematoxylin and eosin. They were examined under light microscope and observations were recorded.

RESULTS

Soft ticks that used in this experiment were attached at least 1-2 days to rat's skin. Host tissue reaction to salivary component following tick probing and blood feeding on rat skin varied grossly from small papule in group 1 to large pruritic swelling in group 2. The histopathological findings in group 1 included the inflammatory phase marked with edema and hyperemia of capillaries (Fig. 1). Cellular infiltration principally lymphocyte accompanied vascular changes. Vascular damages were endothelial swelling with fibrinoid necrosis. Perivasculitis was present in some vessels with infiltration of lymphocytes (Fig. 2) and eosinophils. Foci of necrosis in the epithelium with remnant of infiltration of polymorphoneuclear cells with severe hemorrhages were also evident (Fig. 3). In group 2 histopathology revealed thinner and smaller collage fibrils and loose arrangement of collagen (Fig. 4). The predominant inflammatory cells were lymphocytes and macrophages.

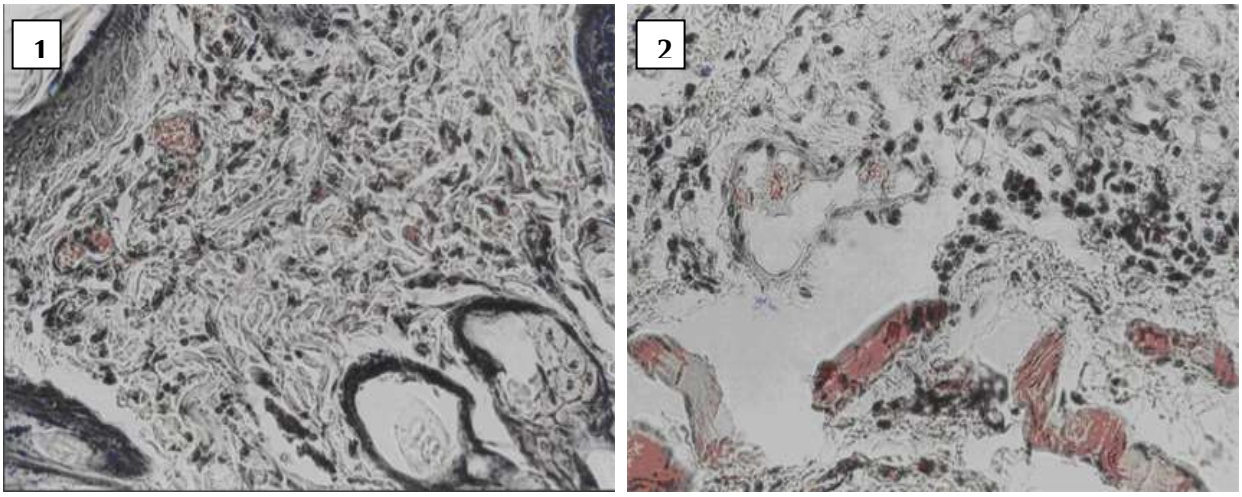

Fig 1. Infiltration of the inflammatory cells mainly lymphocytes in the derm of the skin of a rat in group 1(H &E x 400).
Fig 2 . Pervascular cellular infiltrate mainly composed of lymphocytes and edema (H &E x 400).

DISCUSSION

With respect to the pathology of inflammation in both the groups it was shown cutaneous lesion associated with vasculitis, cutanous necrosis and inflammatory reaction mainly lymphocytic. Lymphocyte infiltration and vascular changes indicate an allergic reaction. A host exposed to tick bites through induction of mast cell degranulation resulting in a local fluid extravasations and recruitment of leukocytes at the site of the tick bite. Symptoms associated with reactions to tick bite peaked in severity at 35-40 hours and thus the response was most likely delayed type IV hypersensitivity (Humphery-Smith *et al*., 1991) Histologic examinations of a pruriginous lesion revealed lymphocytic dermal and perivascular infiltration (Beaudouin *et al*., 1997).
Tick bites most often occur in spring and summer and are painless. The vast majority are uncomplicated and do not transmit disease; they often cause a red papule at the bite site and may induce hypersensitivity or granulomatous foreign body reactions. The bites of *Ornithodoros coriaceus* ticks cause local vesiculation, pustulation with rupture,

ulceration, and eschar, with varying degrees of local swelling and pain. Similar reactions have occurred from bites of other ticks (Fraser, 1986).

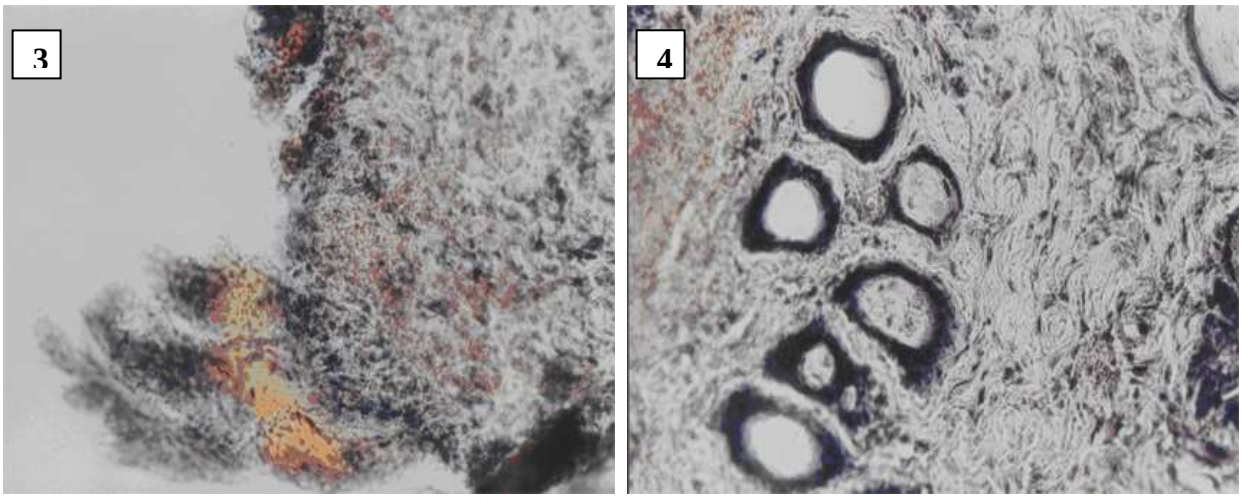

Fig 3 . Epithelial necrosis and hemorrhage in the skin of a rat in group 1(H &E x 400).
Fig 4 . Loose arrangement of thin collagen fibers, in the skin of a rat in group 2 (H &E x 400).

Once on the host, the tick must attach itself, neutralize the host defense and local haemostatic systems and prepare itself for sucked blood from the host (Sonenshine, 1991*b*). When the tick is firmly attached, as blood flows into the wound site, the tick begins feeding and the buccal canal becomes a common duct for the intake of host tissue fluids and the output of tick saliva (Kemp *et al*., 1982). The three components of the host defense system which have to be overcome are homeostasis, the inflammatory response and cell mediated immunity. Anticoagulants and anti-inflammatory agents secreted in the ticks saliva counter the first two problems but cell mediated immunity is more difficult to deal with and many ticks succumb or depart without feeding when attempting to attach to previously exposed hosts (Kemp *et al*., 1982).

Inoculation eschar occurred at the tick bites and consists of epithelial necrosis with hemorrhage. They represent the portal of entery of the infectious agent into the host and the first site of challenge with the host. Epithelial necrosis was found at the limit between the dermal and epithelium suggesting mouthparts pierced skin to the depth where capillaries and vessels are in the upper dermis (Grattan-Smith *et al*., 1997).

The cutaneous damage is dominated by hyperemia, edema and vacoulation, cellular infiltrations, principally lymphocyte accompanied vascular changes in the early stage and newly formed fibrous tissue with large number of hyperemic capillaries and active inflammatory process in which lymphocytes and eosinophiles were the predominant cells were seen after two weeks.

REFERENCES

Abbassian-Lintzen, R. A. (1960). Preliminary list of ticks (Acarina: Ixodidae) occurring in Iran, and their distributional data. *Acarol*., 2(1): 43-61.

Beaudouin, E. G. Kanny, B. Guerin, F. Plenat and D.A. Moneret-vautrin (1997).Unusual manifestations of hypersensitivity after a tick bite: report of two cases. *Ann Allergy Asthma Immunol*., 79(1): 43-6.

Bowman, A.S., J. W. Dillwith and J.R. Sauer (1992). Tick salivary prostaglandins: presence, origin and significance. *Parasitol Today*, 12: 388–96.

Camicas, J.L., J.P. Hervy, F. Adam and P.C. Morel (1998). *Les Tiques du Monde*. Nomenclature, Stades Décrits, Hôtes, Repártition (Acarida, Ixodida), Orstom, Paris; 1998.

Fraser, C.M. (1986). *The Merck Veterinary Manual*, 6th ed. Merck &Co., Rahway, N.J., USA.

Grattan-Smith, P. J, J. G. Morris, H. M. Johnston, C. Yiannikas, R. Malik, R. Russell and R. A. Ouvrier (1997). Clinical and neurophysiological features of tick paralysis. *Brain*, 120:1975–1987.

Humphery-Smith,, I., Y.H, Thony, D, Moorhouse, C. Creevey, M. G auci, and B. Stone (1991). Reactions to argasid tick bites by island residents on the Great Barrier Reef. *Med J Aust*., 5; 155(3):181-6.

Hoogstraal, H. (1985). Argasid and Nuttalliellid ticks as parasites and vectors. *Adv Parasitol*,, 24: 135-238.

Keirans, J.E. (1965). Systematic of the Ixodida (Ar-gasidae, Ixodidae, Nutalliellidae): an overview and some problems. In: B Fivaz, T Petney and I Horak (Eds), *Tick Vector Biology*. Medical and Veterinary Aspects, Springer-Verlag, Berlin. p. 1-21.

Kemp, D.H., B.F. Stone and K.C. Binnington (1982). Tick attachment and feeding: role of the mouthparts, feeding apparatus, salivary gland secretions and the host response. In: *Physiology of ticks* (Obenchain, F,D. and R. Galun eds). Oxford: Pergamon Press.

Mamedkulov, K. (1993). *Tick paralysis in sheep in Turkmenistan farms* .veterinarya - Moskva, No.1: 40 - 41.

Mazlum, Z. (1970). Different ticks occurring in Iran (geographical distribution, seasonal activities, hosts). *Bull Fac Vet Med*., 27(1): 1-32.

Oliver, Jr. JH. (1989). Biology and systematics of ticks (Acari: Ixodida). *Annu Rev Ecol Syst*,, 20: 397-430.

Parola, P. and D. Raoult (2001).Ticks and tickborne bacterial diseases in humans:An emerging infectious threat. *Clin .Infect*, 32:897-928.

Rahbari S. (1995). Studies on some ecological aspects of tick fauna of West Azarbayejan, Iran. *J Appl Anim Res*, 7(2): 189-94.

Sonenshine, D.E. (1991a). *Biology of ticks*, Vol. 1. New York: Oxford University Press.

Sonenshine, D.E. (1991b). The mouthparts and foregut: capitulum, pharynx and oesophagus. In: *Biology of ticks*, Vol. 1, (Sonenshine DE.ed). New York: Oxford University Press.

Soulsby, E.J.L. (1986). *Helminths, arthropoda and protozoa of domesticated animals*, 7th ed., Bailiere Tindall, London, England.

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