

# PULMONARY LESIONS OF SLAUGHTERED CAMELS (*Camelus dromedarius*) IN SOUTHERN IRAN

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## ABSTRACT

In present study, lungs of 100 dromedary camel of different ages and both sexes slaughtered in Yazd and Fars Provinces, Iran were examined morphopathologically. Out of these, pathologic lesions were found in 58 (58%) of the lungs. The main pulmonary lesions included dipetalonemiasis (27%), interstitial pneumonia (18%), hydatidosis (16%), anthracosis (15%), abscess (8%), fibrinopurulent bronchopneumonia (6%) and pleuritis (4%). In dipetalonemiasis, several nodules measuring 1-4 cm diameter contained large number of adult *Dipetalonema evansi* were observed in the affected lungs. Histopathologically, cross sections of the parasite within large arteries, endarteritis, granulomatous and eosinophilic arteritis, periarteritis, hypertrophic semioccluded arteries, arteries with fibrinous or organised thrombi, periarterial fibrosis and interstitial pneumonia were observed. Hydatid cysts were located randomly in different lobes full of clear fluid and had whitish thick membranes. In conclusion, it seems dipetalonemiasis and hydatidosis constitute important health problems to camels in this area.

**Key words:** Camel, gross pathology, histopathology, Iran, pulmonary lesions

Diseases of the respiratory system are some of the leading causes of morbidity and mortality in animals and a major source of economic losses (Lopez, 2007). The pulmonary disturbances can be a major cause of impaired production and working capacity and also mortality of camels. Despite the importance of pulmonary lesions in many camel rearing countries, very few pathologic surveys have been carried out (Asil *et al*, 2004; Zubair *et al*, 2004; Bekele, 2007). Therefore, the present study was undertaken to investigate the pulmonary lesions of camels slaughtered in southern Iran.

## Materials and Methods

The lungs of 100 dromedary camels of different ages and both sexes were collected from slaughterhouses of Yazd and Fars Provinces of Iran. Gross changes in different lobes such as parasitic nodules and cysts, abscess, emphysema and atelectasis and consolidate lesions were examined by palpation and in cut sections. The trachea, bronchi, and all other air passages and lung parenchyma were opened or cut and examined carefully for the presence of pathologic changes such as frothy fluids, exudates, parasites and pneumonic lesions. Appropriate tissue samples from affected areas were fixed in 10% buffered formalin, embedded in paraffin, sectioned at about 5  $\mu\text{m}$ , stained with haematoxylin and eosin and studied microscopically.

## Results

Out of 100 examined lungs, 58 (58%) had pathological changes. The main diagnosed lesions include dipetalonemiasis (27%), interstitial pneumonia (18%), hydatidosis (16%), anthracosis (15%), abscess (8%), fibrinopurulent bronchopneumonia (6%) and pleuritis (4%). Also, secondary lesions such as alveolar emphysema and atelectasis (39%) and haemosiderosis (12%) were observed in association with other pneumopathies.

Grossly, hydatid cysts were located randomly in different lobes and when incised were full of clear fluid and the cysts had whitish thick membranes (Fig 1). In dipetalonemiasis, several nodules measuring 1-4 cm in diameter were observed in the parenchyma (Fig 2). These raised nodules when incised, contained large number of adult *Dipetalonema evansi* associated with bloody debris (Fig 3). Histopathologically, the cross sections of nematodes were seen in the large arteries of affected lungs (Fig 4). Necrotising arteritis, rupture of the arterial wall, periarterial haemorrhage, presence of dead parasites in the adjacent alveoli associated with eosinophilic granulomatous reaction were diagnosed. Moderate to severe degrees of hypertrophy of musculature of arteries and bronchioles, vasculitis and perivasculitis with infiltration of eosinophils, lymphocytes, plasma cells and macrophages, periarterial fibrosis and sclerosis

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were also seen. The walls of affected arteries were markedly thickened and some of the lumen were partially occluded by fibrinous or organised thrombi. In the lumens of some vessels, sections of *D. evansi* were associated with erythrocytes and inflammatory cells (Fig 5). Necrotising arteritis, haemorrhage, fibrosis associated with calcification of the walls of affected vessels were also seen. In some arteries, endarteritis was remarkable with proliferation of endothelial cells and underneath fibrous connective tissue that resulted in intimal thickening and protruding into the lumen and made it semi-occluded. Also, in many medium-size arteries in the interstitial tissue, eosinophilic arteritis and periarteritis were observed as micronodules. Furthermore, thickening of perivascular, peribronchiolar and adjacent interstitial tissues due to fibrosis and granulomatous reaction with aggregation of eosinophils, giant cells, macrophages, lymphocytes and plasma cells were another findings.

Fibrinopurulent bronchopneumonia was diagnosed in 6 lungs. Grossly, consolidation of anteroventral lobes and microscopically, congestion, oedema, haemorrhage, necrosis, alveoli and bronchioles full of fibrin and neutrophils and rare fibrinous thrombi within vessels were observed in affected areas (Fig 6).

Lungs affected to interstitial pneumonia showed chronic interstitial inflammatory reaction characterised by fibrosis and mononuclear cell infiltration including lymphocytes, plasma cells, macrophages and sometimes eosinophils. In addition, in 2 lungs granulomatous reaction with accumulation of macrophages, giant cells, eosinophils and lymphocytes were present in peribronchiolar tissue.

Various degrees of emphysema and atelectasis were found associated with most of other lesions such as pneumonia.

Haemosiderosis was seen as shiny golden or yellow-brown intracellular granules in the interstitial tissue and also in location of chronic arteritis due to dipetalonemiasis. It implies that there was prior haemorrhage in lungs due to parasitic infection.

In lungs of 8 camels, there was a large raised abscess, usually in the parenchyma of diaphragmatic or anteroventral lobes. These were full of creamy pus when incised.

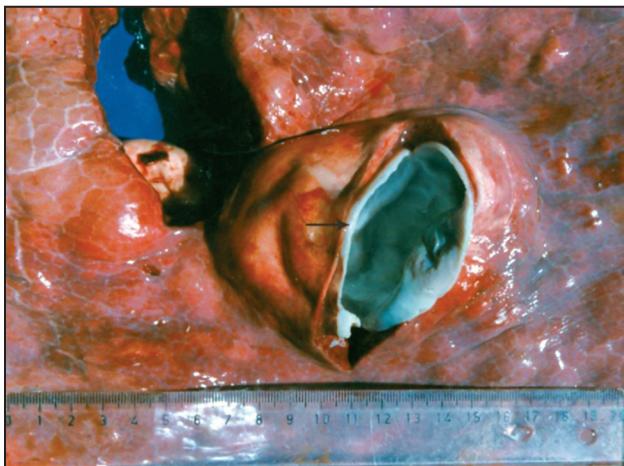
In the 15 lungs, carbon particles were seen as fine black granules extracellularly or intracellularly. This exogenous pigment was localised in interstitial

tissue mostly in peribronchial and peribronchiolar areas.

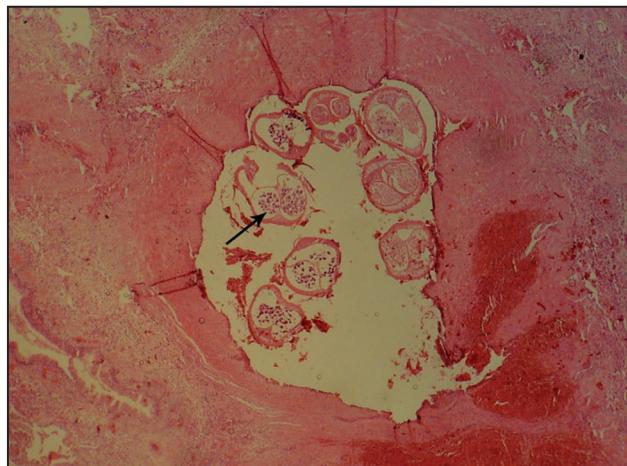
## Discussion

Despite reputation of camels for hardiness and resilience, they are vulnerable to a number of infectious and parasitic agents (Tafti *et al*, 2001). There are few reported investigations about pathological lesions of lungs in dromedary camel. In present study, hydatid cysts were found in 16% of studied camels. Asil *et al* (2004) with postmortem inspection of 260 camels reported hydatidosis (in 98 lungs) as main cause of lung condemnation in 2 regions of Sudan. In 2 slaughterhouses studies of 125 and 60 carcasses of camels in central parts of Iran, it is reported that 70% and 28% of the camels were infected with hydatid cysts, respectively (Mowlavi *et al*, 1997; Radfar *et al*, 2006). Zubair *et al* (2004) observed the prevalence of hydatidosis as 40% in a gross examination of camel lungs from 2 Pakistan abattoirs. Hamdy *et al* (1980) found test 144 (7.95%) were infected with hydatid cysts out of 1811 camels in Egypt abattoirs.

In present study, dipetalonemiasis was diagnosed in 24% of camel lungs. *Dipetalonema evansi* is a common nematode of camels that inhabits the hepatic, spermatic and pulmonary arteries, as well as lymphatic system, mesenteric lymph nodes and heart (Soulsby, 1982; Elamin *et al*, 1993; Kaufmann, 1966; Mowlavi *et al*, 1997). Infection of camel with this parasite has been reported from a few countries including Sudan, Pakistan, India, Iran and Egypt (Elamin *et al*, 1993; Pathak *et al*, 1998; Muhammad *et al*, 2004; Mirzayans and Halim, 1980; Mehran, 2004). Light infection has not been detectable and clinical signs and diagnosis made accidentally during blood examination, postmortem examination or slaughterhouse study. Heavy infections may cause emaciation, cachexia, apathy, orchitis, haematoma, cardiac insufficiency, infarction and nervous manifestations (Soulsby, 1982; Mowlavi *et al*, 1997; Oryan *et al* 2008). Oryan *et al* (2008) reported 34.5% of 197 studied lungs of camels slaughtered in the slaughterhouse of Mashhad city of Iran were infected with *Dipetalonema evansi* with similar pathological changes. Mowlavi *et al* (1997) found the adult form of this parasite in the testicular veins of 50% of 125 studied camels slaughtered in Najafabad, Iran but they could not find any parasite in the lungs. There are also few reports showing infection about 17.5 to 28.1% of camels in southern provinces of Iran (Moghaddar *et al*, 1992; Rahbari and Bazargani, 1995; Zarif-Fard and Hashemi-Fesharaki, 2000).



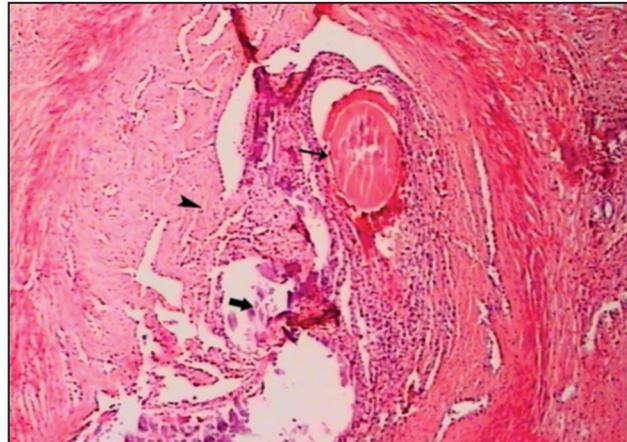
**Fig 1.** A hydatid cyst with thick 2 layers wall (arrow) is observed in the parenchyma of camel lung.



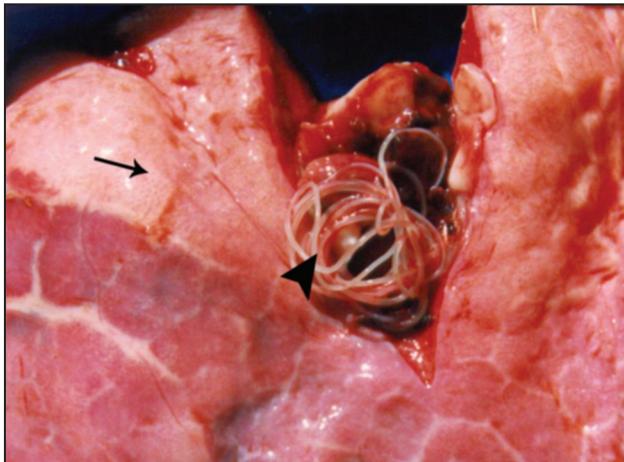
**Fig 4.** The cross sections of *Dipetalonema evansi* within an artery (arrow) associated with marked necrohaemorrhagic arteritis. (H & E x 250).



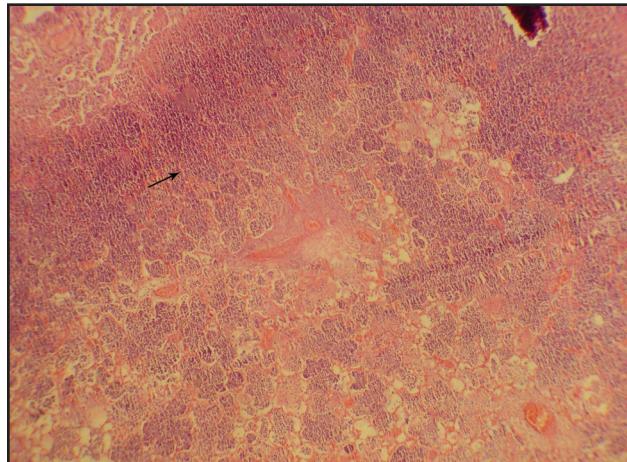
**Fig 2.** Camel lung manifested multiple nodules (arrows) in the parenchyma in a case of dipetalonemiasis.



**Fig 5.** Endarteritis with proliferation of endothelial cells and underneath fibrous connective tissue (arrowhead), presence of degenerated (thin arrow) and calcified parasite cross sections (thick arrow) associated with inflammatory cells. (H & E x 250).



**Fig 3.** Camel lung showing large numbers of intertwined white nematodes (*D. evansi*) (arrow head) located in an incised nodule (arrow) in a case of dipetalonemiasis.



**Fig 6.** Fibrinopurulent bronchopneumonia showing alveoli and bronchioles full of neutrophils (arrow) associated with congestion and oedema. (H & E x 250).

In present study, fibrinopurulent bronchopneumonia and interstitial pneumonia were diagnosed in 6% and 18% of slaughtered camels, respectively. Relatively high prevalence of interstitial pneumonia can be due to *D. evansi* infection so that the parasite caused eosinophilic granulomatous pneumonia, interstitial pneumonia and fibrosis. There are only a few reports about prevalence and pathological lesions of pneumonia in the camel. On the basis of a study reported from India, 4 and 32 samples of 157 samples of camel lungs had fibrinous and interstitial pneumonia, respectively (Bhardwaj *et al*, 2006). Mehmoud *et al* (1988) found pneumonia in 6 lungs of 52 studied camels of Egypt. In a study from Sudan, 32% of 206 condemned lungs were diagnosed as suppurative pneumonia (Asil *et al*, 2004). Bekele (2007) reported pulmonary fibrosis as most common lesion in 50% of 104 adult slaughtered camels in Ethiopia.

Anthracosis was found histologically in 15% of studied lungs of the present study. Zubair *et al* (2004) were found pneumoconiosis in lungs of 5% of slaughtered camels in Pakistan. Dust or carbon particles deposit extracellular or intracellular mostly as fine black foci in the peribronchiolar and peribronchial lymphoid tissues. Carbon inhaled in environments with substantial air pollution deposited into the alveoli and then phagocytosed by macrophages and transported to peribronchial region (Myers and McGavin, 2007).

In conclusion, it seems dipetalonemiasis and hydatidosis constitute important health problems to camels in this areas.

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