



Ectopic migration of *Fasciola* sp. in the lung of a water buffalo (*Bubalus bubalis*)

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ABSTRACT

There are few reports of ectopic fasciolosis in the lungs of ruminants. Here, we report a rare case of ectopic pulmonary migration of *Fasciola* sp. in a water buffalo (*Bubalus bubalis*). In October 2021, during the routine veterinary inspection of the carcass and edible offal of a 3-year-old female buffalo in Tabriz industrial slaughterhouse, Iran, a severe liver infection with *Fasciola* parasites was observed. They were diagnosed as *Fasciola hepatica* based on size and gross morphology. One 3-cm fluke was recovered from the caudal lobe of the buffalo's right lung. Histopathologically, chronic active pneumonia, along with mild interstitial fibrosis, alveolar septa and pleura thickening, and necrosis associated with severe mixed inflammatory cell infiltration was observed in the affected lung. This case was observed for the first time in over 15 years of buffalo carcass inspection in the study area, indicating that pulmonary fasciolosis is rare in *Bubalus bubalis*.

Keywords

Buffalo, *Fasciola*, Ectopic, Lung

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Abbreviations

No abbreviations

Introduction

Fasciolosis is a worldwide distributed zoonotic food- and waterborne infection. A wide range of domestic and wild animals as well as humans get infected mainly with *F. hepatica* and *F. gigantica* [1]. In addition, intermediate forms that occur after interspecific hybridization between these two species are present in geographical areas in which both species are endemic [2]. The economic impact of fasciolosis on livestock production, which is estimated to exceed 3 billion USD/year, results from sudden death due to acute infections, high condemnation of infected livers at abattoir inspection, costs of anthelmintic treatments, as well as a reduction in body condition score, milk yield, and live weight gains [2].

Mammalian hosts acquire the infection via ingesting food or water contaminated with metacercariae. Once in the small intestine, metacercariae excyst within an hour in the duodenum, releasing the juvenile stage, which penetrates the host's intestinal wall and appears in the abdominal cavity in approximately 2 hours. Most worms reach the liver within 6 days and migrate through the liver parenchyma for 5-6 weeks, preferentially feeding directly on the liver tissue. They eventually enter the bile duct where they mature sexually and initiate egg production [3]. Furthermore, it has been suggested that immature flukes may enter the bloodstream and be carried to various parts of the body or may reach the liver by traveling up in the bile duct. If the flukes fail to reach the hepatic biliary tree, they die in the abdominal cavity and other parts of the body [4].

Normally, the metacercariae of *Fasciola* cross the duodenal wall, migrate actively across the peritoneal cavity, and reach the bile ducts by penetrating Glisson's capsule and the liver parenchyma. However, some are lost on the way and occasionally grow in the peritoneal cavity or other ectopic foci. In humans, ectopic lesions are reported more frequently in the gastrointestinal tract and subcutaneous tissues. However, they are also found in the heart, blood vessels, pleural cavity, lung, abdominal wall, peritoneum, pancreas, spleen, stomach, appendix, cervical and inguinal lymph nodes, skeletal muscle, brain, eyes, and epididymis [3]. In ruminants, there have been few reports of ectopic fasciolosis in the lungs of cattle [5-8], sheep [9], and goats [10]. A relationship between foodborne trematodes and proximity to fresh water has already been demonstrated [11], which matches the habits of water buffaloes (*Bubalus bubalis*). To our knowledge, there are only two reports of erratic parasitism found in the lungs of water buffaloes in India, indicating the rarity of its occurrence [12, 13].

According to the latest official reports, nearly

224,000 water buffaloes live in 16 of 31 provinces of Iran. Almost 94% of buffaloes are reared in four provinces of Khoozestan, West Azerbaijan, Ardabil, and East Azerbaijan. They are raised traditionally and are used for meat and milk production. In 2020, approximately 27% (6549/24275) of slaughtered buffaloes were from East Azerbaijan province [14]. Herein, we report a case from a slaughtered buffalo in East Azerbaijan province, Iran.

Case Presentation

In October 2021, during the routine veterinary inspection of the carcass and edible offal of a 3-year-old female buffalo in the Tabriz industrial slaughterhouse, a severe liver infection with *Fasciola* parasites was observed. Based on the size and gross morphology, the parasites were diagnosed as *F. hepatica*. One mature *Fasciola* trematode ca. 3 cm was recovered from the caudal lobe of the buffalo's right lung (Figure 1). The lung tissue samples were collected for histopathological evaluation. The tissue was fixed in 10% buffered formalin, processed routinely, sectioned at 5 µm thickness, stained with hematoxylin and eosin (H&E), and finally, studied using a light microscope.

Microscopically, chronic active pneumonia in the affected lung was observed. In addition, mild interstitial fibrosis increased alveolar wall and pleura thickness, and necrosis associated with mixed inflammatory cell infiltration was found. Inflammatory cells included lymphocytes, macrophages, plasma cells, neutrophils, and eosinophils (Figure 2). Although no parasite sections were observed, the histopathological lesions were suggestive of a parasitic infection.

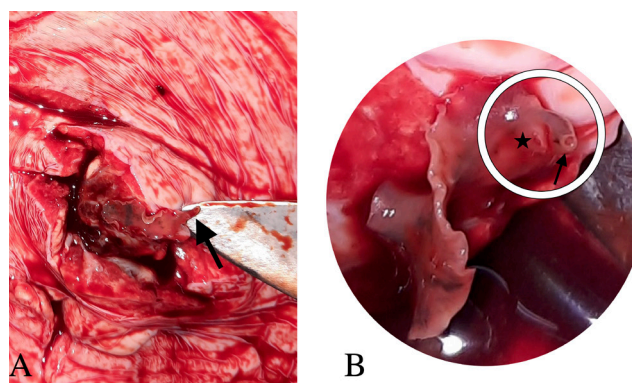


Figure 1. Mature *Fasciola* helminth ca. 3 cm isolated from the caudal lobe of the right lung of water buffalo (*Bubalus bubalis*); A) prominent anterior cone (arrow) and B) anterior end in focus. Note the oral sucker (arrow) and the acetabulum (asterisk).

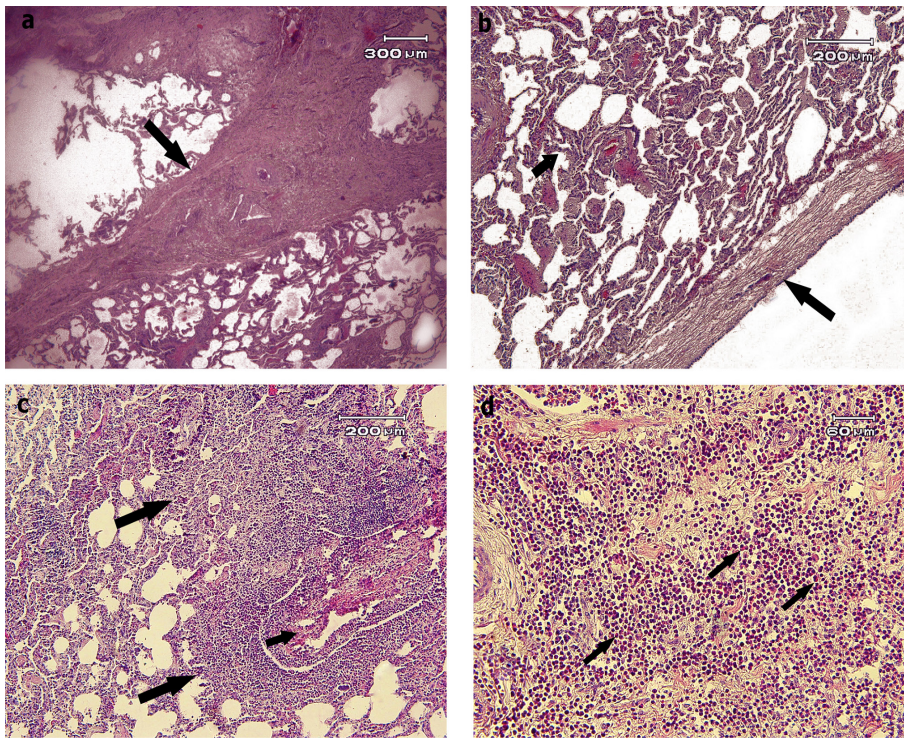


Figure 2.

Chronic active pneumonia was observed in the lung of the patient, H&E staining. Mild fibrosis (a: arrow), increased alveolar wall (b: small arrow) and pleura thicknesses (b: large arrow), and necrosis (c: small arrow) associated with mixed inflammatory cell infiltration (c: large arrows) were found. Inflammatory cells included lymphocytes, macrophages, plasma cells, neutrophils, and eosinophils (d: arrows).

Discussion

Here, we report a rare case of ectopic migration of *Fasciola* sp. in the lung of a water buffalo (*Bubalus bubalis*). Ectopic manifestations usually appear shortly after infection. However, the route of migration toward ectopic sites is still unknown, and different hypotheses have been proposed. For instance, it has been suggested that migration occurs during the acute phase through blood vessels or soft tissues [8]. Further experimental studies using different infectious doses of metacercariae are needed to elucidate the mechanisms underlying ectopic migrations.

This case was observed for the first time during 15 years of buffalo carcass inspection in the study area, indicating that pulmonary fasciolosis is rare in *Bubalus bubalis*. There is only scarce information on the frequency of pulmonary fasciolosis in water buffaloes in the literature [12, 13]. In cattle, the predominant location of ectopic fasciolosis is the lung, and pulmonary fasciolosis has been observed in 2.2% of examined animals in Sudan, of which, one also showed pancreatic involvement [15]. Other researchers have reported erratic pulmonary fasciolosis in 3.7% and 4.1% of slaughtered cattle in Peru [5] and the US [8], respectively. The lower frequency of lung migrations in buffaloes needs further investigation.

Although the live fluke in this study did not reach the laboratory safely for morphometric and molecular examinations, based on the size and morphology (e.g., very prominent anterior cone), the worm could represent a young form of *F. hepatica* (Figure 1). It has been reported that ectopic flukes achieve maturity

only rarely [3]. However, small lung nodules isolated from experimentally-infected calves were found either calcified or containing live specimens of *F. hepatica* [16]. In the latter study, live flukes recovered from the lungs were stunted in their development but sometimes contained mature eggs [16]. In contrast, in an abattoir-based study in Peru, flukes were pale pink to greyish-brown and sized 10.36 ± 3.44 mm long and 4.31 ± 0.97 mm wide, with no evidence of oviposition [5], suggesting that despite maturation in size, the flukes may not reach sexual maturity in the lungs.

Pathological lesions in this study were not specific, and no migratory track was present. In ectopic lesions, the common pathologic effects are due to the migratory tracks that cause tissue damage with inflammation and fibrosis. Flukes may then be calcified or contained in a granuloma [3]. In cattle and sheep, lung pathological alterations result from chronic irritation of the alveoli which are somehow related to the loss of their respiratory function followed by the thickening of the interalveolar septa or occlusion of the alveoli by foreign materials [6, 16]. Furthermore, secondary viral and bacterial infections may occur due to parasite migration into the lung parenchyma [6, 8] which were not observed in this case.

Authors' Contributions

M.S. and Y.N. contributed to sample preparation. Y.N., M.S., D.M., M.K., A.R., and A.S. contributed to the interpretation of the results. A.S. took the lead in writing the manuscript.

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Conflict of Interests

The authors declare that there is no conflict of interest.

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