

Fasciola hepatica egg-induced granuloma in a bovine liver: a case report

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Summary

The trematode parasite *Fasciola hepatica* infects a wide variety of mammals, causing considerable economical losses in domestic animals. It is also an important zoonosis. The major pathology of fasciolosis is caused by immature flukes migrating in the liver parenchyma and later by adult flukes in the bile ducts. Egg related immunopathology, commonly observed in the closely related parasite *Schistosoma* sp., is not normally expected in fasciolosis because the parasite matures and produces eggs in the bile ducts. However, the paper reports a case of *Fasciola hepatica*-egg induced granuloma in a bovine liver parenchyma and discusses its significance in the pathogenesis of fasciolosis.

Keywords: *Fasciola*, bovine

The liver fluke *Fasciola hepatica* infects a wide variety of mammals including humans, and causes considerable economic losses in domestic animals. The prevalence of fasciolosis in Turkey ranges from 0.1% to 95% depending upon the geographical location, the host species infected and the animal management system employed (1). The Mediterranean climate in the province of Hatay, where this case occurred, is very favourable for the maintenance of the snail intermediate hosts and for the development of the free-living larval stages of the parasite. Although most cattle are kept indoors in Hatay, the prevalence of fasciolosis nonetheless ranges between 8 and 13%, according to local abattoir records.

In the pathology of fasciolosis, the migration of immature parasites through the liver gives rise to considerable damage. Immature flukes leave tracks which fill with metabolic waste, blood and necrotic hepatocytes, and are then infiltrated by lymphocytes, macrophages, eosinophils and neutrophils. When the parasites enter the bile ducts, the pathology of the disease is characterised by dilated and thickened bile ducts (2). The parasites mature upon entry to the bile ducts, where they produce eggs which are then carried in the bile into the intestine. Therefore, egg-related immunopathology, which is commonly observed in the closely-related parasite *Schistosoma* sp., is not normally expected in fasciolosis. In schistosomiasis, eggs trapped in the liver parenchyma cause well-documented granulomatous pathology, characterised by multi-

-nucleate giant cells, haemosiderin pigmentation, and neutrophil and eosinophil infiltrations (6, 8). Recently granulomatous erratic parasitism with *Capillaria hepatica* has been reported in cattle in Japan (10). Interestingly, and in contrast to the typical pathology of the disease, *F. hepatica* related granulomas have been observed in the liver parenchyma of rats, sheep, goats and llamas in the course of various experimental immunological studies (5, 11, 12, 14). Here, we also present a finding of *F. hepatica* egg-induced granuloma, the first to be reported in the liver parenchyma of a naturally infected cow.

Material and methods

The fluke infected liver of an adult cow (over three years old) was obtained from a local abattoir for use in pathology lectures. Histopathological examination of the liver revealed the presence of granuloma around eggs trapped in the parenchyma, and it was therefore decided to report this unusual case. The liver pieces were fixed in 10% formaline, processed routinely, stained with haematoxylin and eosin and with Giemsa, and examined under a light microscope.

Results and discussion

The liver was shrunken, firm and light brown. The liver capsula was thickened and pale greyish-white in colour. Numerous yellowish-white migratory tracks were observed on the surface and cut surface of the liver. There was common fibrosis and diffuse cirrhosis. The liver was heavily infected with *F. hepatica*.

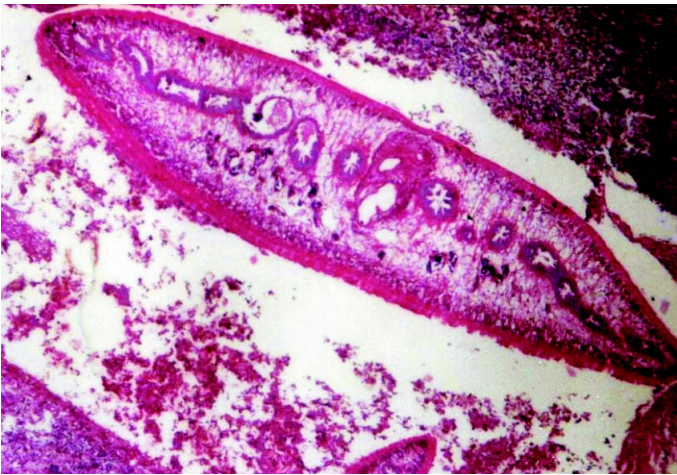


Fig. 1. Young flukes in liver parenchyma. HE – (40 ×)

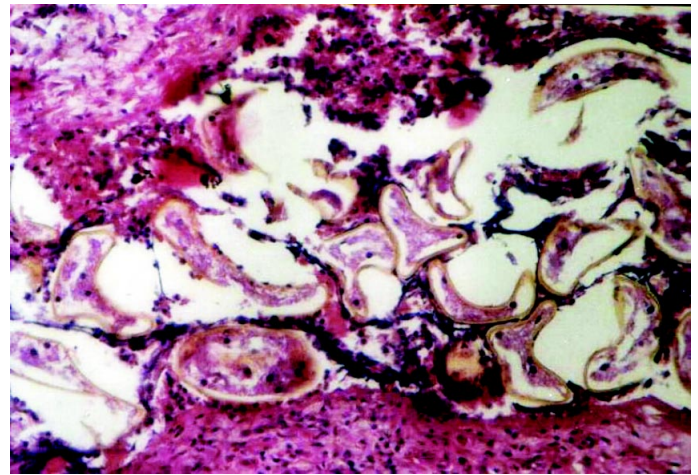


Fig. 2. Fluke eggs in liver parenchyma. HE (400 ×)

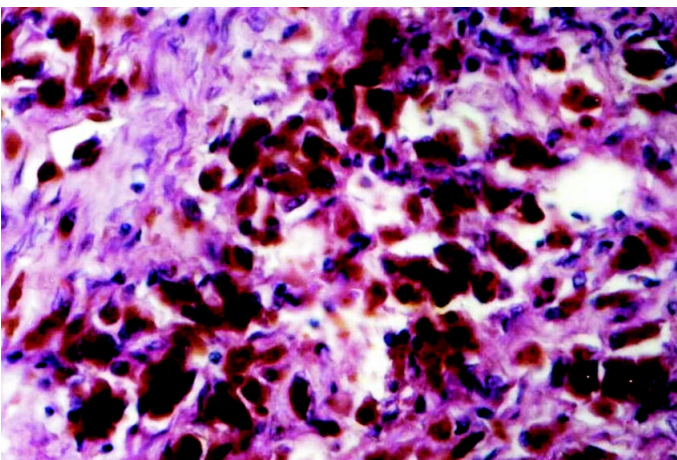


Fig. 3. Heavy haemosiderin pigmentations. HE – (1000 ×)

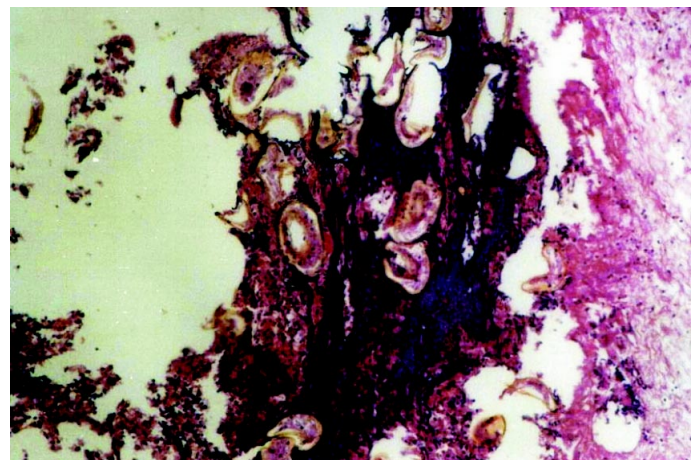


Fig. 4. Calcified material around fluke eggs. HE – (100 ×)

There were numerous young flukes of different sizes in the parenchyma (fig. 1), and adults in the main bile ducts.

Microscopically, the most striking finding was the presence of fluke eggs trapped in the parenchyma (fig. 2) and surrounded by mononuclear, polymorphonuclear and multinucleate giant cell infiltration, causing the granuloma. The granuloma was also surrounded by fibrous connective tissue. Histopathological examination of the liver also revealed the presence of severe cirrhosis and bile duct proliferations. The migration tracks were filled with blood, fibrin and cellular debris and surrounded with heavy cellular infiltration, which consisted of eosinophils, neutrophils, lymphocytes, macrophages and plasma cells. Haemosiderin pigment was also noticed in some macrophages near to these tracks (fig. 3). Some of the tracks were filled with calcified material and fluke eggs (fig. 4).

In this study, we observed *F. hepatica* eggs trapped in the liver parenchyma of a naturally infected cow, causing granulomatous pathology. The granuloma were similar to those induced by the closely-related trematode parasite *Schistosoma* sp. Most *Schistosoma* egg granulomas are dominated by epithelioid cells, mixed with variable numbers of multinucleated giant cells,

show infiltrates of eosinophils and small mononuclear cells, mainly lymphocytes and some plasma cells, and contain a single egg in the centre (6, 8). However, *Fasciola*-related granulomas are slightly different in that they contain more intensive haemosiderin pigmentation, with accumulated rather than single eggs in the granuloma centre. Egg accumulation has been seen in *Capillaria* sp. related granulomas, but the morphology of *Schistosoma*, *Fasciola* and *Capillaria* eggs are significantly different (4).

Since liver flukes mature upon entry into the bile ducts where they start producing eggs, the presence of such eggs in the parenchyma is unusual. One possible explanation for this finding is that the bile ducts might have been ruptured by the parasite or by stasis so that the eggs passed into the parenchyma. Alternatively, fibrotic changes induced by a primary infection might have impeded the migration of the flukes in the second or subsequent infections, to the extent that the migrating parasites matured in the parenchyma before managing to reach their final destination, the bile ducts. This type of pathological change has also been reported to play a role in the resistance of cattle to challenge infections (3, 7, 13). In our case, the second of the explanations is the more likely since the presence of young flukes of different sizes in the parenchyma and

of adults in the main bile ducts suggests a „trickle” infection, where flukes were acquired over several weeks. In the past, large dose experimental infections were generally used to study the details of the time-course pathology of fasciolosis (2), therefore egg-induced granulomatous pathology may not have been present. More recently, trickle infection protocol has been adopted in immunological works because it closely simulates the type of challenge encountered in natural field conditions (9, 15). In the course of experimental immunological research where a similar protocol has been employed, *F. hepatica* egg-related granulomas have started to be encountered, in the liver parenchyma of sheep and goats (11, 12). In the light of this, our observation warrants further detailed study to determine whether egg-induced granulomas are common in cattle in the field and whether they represent a significant problem in the pathogenesis of fasciolosis.

References

1. *Akyol C. V.*: Tarihçe ve epidemiyoloji, [in:] Tinar R. and Korkmaz M. (eds.): Fasciolosis, META Basım, Bornova, Izmir 2003, 85-106 (in Turkish).
2. *Behm C. A., Sangster N. C.*: Pathology, Pathophysiology and Clinical Aspects, [in:] Dalton J. P. (ed): Fasciolosis. Cabi Publishing, Wallingford, UK 1999, 185-224.
3. *Boray J. C.*: Experimental fascioliasis in Australia. *Adv. Parasit.* 1969, 7, 95-210.
4. *Ceruti R., Sonzogni O., Origgi F., Vezzoli F., Cammarata S., Giusti A. M., Scanziani E.*: Capillaria hepatica infection in wild brown rats (*Rattus norvegicus*) from the urban area of Milan, Italy. *J. Vet. Med. B* 2001, 48, 235-240.
5. *Hamir A. N., Smith B. B.*: Severe biliary hyperplasia associated with liver fluke in an adult Alpaca. *Vet. Pathol.* 2002, 39, 592-594.
6. *Hogan L. H., Wang M., Suresh M., Co D. O., Weinstock J. V. Sandor M.*: CD4_ TCR repertoire heterogeneity in *Schistosoma mansoni*-induced granulomas. *J. Immunol.* 2002, 169, 6386-6393.
7. *Hughes D. L.*: Fasciola and Fascioloides. [in:] Immune response in parasitic infection: immunology, immunopathology and immunoprophylaxis. Vol. 2 trematodes and cestodes. Soulsby E. J. L. (ed.), CRC Press Inc., Boca Raton, Florida 1987, 91-114.
8. *Hurst M. H., Willingham A. L., Lindberg R.*: Experimental schistosomiasis japonica in the pig: immunohistology of the hepatic egg granuloma. *Parasite Immunol.* 2002, 24, 151-159.
9. *Mulcahy G., Joyce P., Dalton J. P.*: Immunology of Fasciola hepatica Infection, [in:] Dalton J. P. (ed.): Fasciolosis. CABI Publishing, Wallingford, Oxon 1999, 341-376.
10. *Nakamura N.*: Parasitic lesions of Bovine liver attributed to Capillaria species. *J. Comp. Pathol.* 2005, 132, 228-231.
11. *Perez J., Martin de las Mulas J., Carrasco L., Gutierrez-Palomino P. N., Martinez-Cruz M. S., Martinez-Moreno A.*: Pathological and immunohistochemical study of the liver and hepatic lymph nodes in goats infected with one or more doses of Fasciola hepatica. *J. Comp. Pathol.* 1999, 120, 199-210.
12. *Perez J., Ortega J., Moreno T., Morrondo P., Lopez-Sandez C., Martinez-Moreno A.*: Pathological and immunohistochemical study of the liver and hepatic lymph nodes of sheep chronically reinfected with Fasciola hepatica, with or without triclabendazole treatment. *J. Comp. Pathol.* 2002, 127, 30-36.
13. *Ross J. G.*: Studies of immunity to Fasciola hepatica. Acquired immunity in cattle, sheep and rabbits following natural infection and vaccine procedures. *J. Helminthol.* 1967, 41, 393-399.
14. *Topfer F., Lenton L. M., Bygrave F. L., Behm C. A.*: Importance of T-cell dependent inflammatory reactions in the decline of microsomal cytochrome P450 concentration in the livers of rats infected with Fasciola hepatica. *J. Parasitol.* 1995, 25, 1259-1262.
15. *Umur S., Akca A.*: Bagisik Yanit, [in:] Tinar R, Korkmaz M. (eds.): Fasciolosis, META Basım, Bornova, Izmir 2003, 163-206 (in Turkish).

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