Journal of Helminthology (2004) **78,** 285–286 DOI: 10.1079/JOH2004234

Research Note

Lesions in the liver of guinea-pigs infected with the swine lungworm, *Metastrongylus apri*

S. Yoshihara*

Department of Epidemiology, National Institute of Animal Health, Kannondai, Tsukuba, Ibaraki 305-0856 Japan

Abstract

Clear spot lesions were formed on the liver surface in guinea-pigs repeatedly infected with swine lungworm, *Metastrongylus apri*. The largest lesion, measuring 0.25 cm in diameter, was hard and yellow and showed a large granuloma in the lobule. The nematode larva was located at the centre of the lesion. This finding is likely to be an example of erratic parasitism in guinea-pigs with metastrongylidiasis.

White spots in the liver of fattening pigs are mainly caused by the visceral larval migration of *Ascaris suum* (Ronéus, 1966; Taffs, 1968). In addition, the presence of larvae from swine lungworm, *Metastrongylus apri* which migrate around the body, is considered to be the cause of liver lesions (Dunn, 1956; Yoshihara *et al.*, 1990). Guinea-pigs are well known as suitable hosts for experimental infection with *M. apri* (Onishi, 1973). However, the relationship between *Metastrongylus* infection and liver lesions in guinea-pigs is not clear. The present study has demonstrated the development of hepatitis in guinea-pigs infected with *M. apri*.

Infective larvae of *M. apri* were collected from earthworms, *Eisenia foetida*, experimentally infected with the nematode using artificial gastric juice (Yoshihara *et al.*, 1990). Isolated larvae were stored at 4°C until use. Fifteen male Hartley strain guinea-pigs, about 400 g in weight, were confirmed as negative for helminth infections on faecal examination, then divided into three groups of five animals (A, B and C), and bred in separate cages. Group B guinea-pigs were inoculated on day 0 with 200 larvae of *M. apri* per host, then reinoculated with the same number of larvae 28 days later, whereas group A guinea-pigs each received one dose of 200 larvae. Group C acted as controls. Guinea-pigs of all three groups were killed under anaesthesia 7 days after the final inoculation. At autopsy, lesions on the surface of the livers and lungs were examined morphologically. Specimens were removed from the livers, fixed immediately in a 10% neutral buffered formalin solution, then embedded in paraffin wax, sectioned at 4 μm and stained with haematoxylin and eosin (H-E). Blood samples were then collected, and an agar gel diffusion test (AGDT) was carried out using crude extracts from adult worms and 1% agarose gel containing 0.15 M of sodium chloride (Yoshihara, 1973). Larvae from the lungs were also recovered using Baermann's technique.

By AGDT, precipitating antibodies were detected in sera from guinea-pigs in group B. Macroscopic findings in the lungs of guinea-pigs in group A were more mild than those in group B. However, the numbers of larvae recovered from group A animals ranged from 13 to 29, and those from group B from 0 to 12. There were significant differences between groups A and B in the numbers of lung stage larvae from guinea-pigs ($P < 0.001$). There were no lesions, except for a small number of pin point spots, on the surface of the livers from guinea-pigs in group A. In group B, several spot lesions were found on the liver surface. The largest lesion, which was hard and yellow, was located in the perilobar region and measured 0.25 cm in diameter. The liver from group A guinea-pigs showed several slight infiltrations of macrophages and eosinophils in the parenchyma. Microscopy of the largest clear liver lesion in group B showed that it was granulomatous. An infiltration of eosinophils was also observed in the surrounding tissue. Two larvae were present in the central part of the lesion (fig. 1). An old boring focus with infiltration of eosinophils was also found (fig. 2).

*Fax: 0084 29 838 7749
E-mail: yoshis@affrc.go.jp

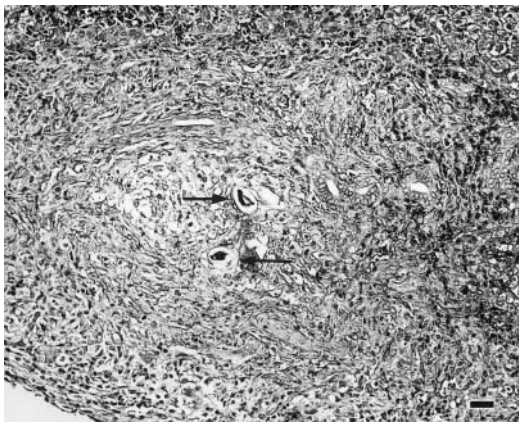

Fig. 1. Liver of guinea-pig with larvae of *Metastrongylus apri* (arrowed) inside a granuloma with slight eosinophilic infiltration. Scale bar 30 μm.

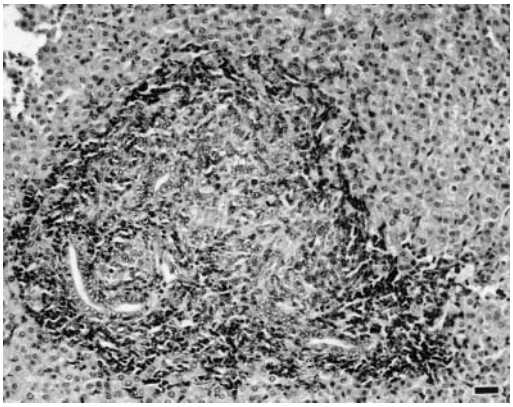

Fig. 2. Liver of guinea-pig infected with *Metastrongylus apri* showing distinct eosinophilic infiltration. Scale bar 30 μm.

While the number of guinea-pigs used in the present study was limited, the data indicated that a distinct lesion was found in the liver of guinea-pig following infection with *M. apri*. The larvae of the nematode were also demonstrated in the yellow spot lesions. Höppli (1923) infected guinea-pigs with embryonated eggs of *Ascaris suum* and observed several small yellow spots on the liver surface. Nakagawa *et al*. (1983) investigated white spots in the livers of fattening pigs at the slaughterhouse and classified his findings into three patterns based on the macroscopic appearance; namely, compact, mesh-worked and lymph nodular patterns. According to their classification, the distinct yellow spot observed in the present study is in agreement with the compact lesion. Dunn (1956), who studied the life history of *M. apri* in pigs, observed white spots on the liver of infected animals and assumed that the lesions were due to the incidental migration of lungworm larvae through the liver. Onishi (1973) concluded that in the guinea-pig *M. apri* has a new migration route, including the peritoneal cavity, in addition to the typical larval migration routes. Nonetheless, it seems likely that the liver lesion observed in the present study may be due to erratic parasitism with *Metastrongylus* larvae. The findings also suggest that the development of resistance in the guinea-pig host results in pathogenesis of the liver to produce a lesion. The development of immunity of pigs or guinea-pigs to *Metastrongylus* spp. infection has been reported by Kumar & Mortelmans (1976). Further studies are required to demonstrate the relationship between the development of resistance and the formation of liver lesions.

References

Dunn, D.R. (1956) The pig lungworm (*Metastrongylus* spp.) II. Experimental infection of pigs with *Metastrongylus apri*. *British Veterinary Journal* **112**, 327–337.

Höppli, R. (1923) Die durch Ascarislarven bei experimenteller Infektion im Tierkörper bewirkten anatomischen Veränderungen. *Virchows Architekutur* **244**, 159–182.

Kumar, V. & Mortelmans, J. (1976) Immune response of guinea-pigs to chemically abbreviated prepatent *Metastrongylus apri* infection. *Parasitology* **72**, 13–18.

Nakagawa, M., Yoshihara, S., Suda, H. & Ikeda, K. (1983) Pathological studies on white spots of the liver in fattening pigs. *National Institute of Animal Health Quarterly (Japan)* **23**, 138–149.

Onishi, T. (1973) Infectivity and migratory behavior of *Metastrongylus apri* in the guinea pig. *Japanese Journal of Veterinary Science* **35**, 515–524 (in Japanese with English summary).

Ronéus, O. (1966) Studies on the aetiology and pathogenesis of white spots in the liver of pigs. *Acta Veterinaria Scandinavica* **7** (Supplement 16).

Taffs, L.F. (1968) Immunological studies on experimental infection of *Ascaris suum* Goeze 1782. VI. The histopathology of the liver and lung. *Journal of Helminthology* **42**, 157–172.

Yoshihara, S. (1973) Origin of isolated *Metastrongylus apri* antigens in the tissue of adult worms detected by fluorescent antibody staining. *Japanese Journal of Parasitology* **22**, 268–275 (in Japanese with English summary).

Yoshihara, S., Nakagawa, M., Suda, H. & Taira, N. (1990) White spots of the liver in pigs experimentally infected with *Metastrongylus apri*. *Japanese Journal of Parasitology* **39**, 365–368.

(Accepted 3 December 2003)