Splenic Paragonimiasis—A case in a Dog

Je G. Chi

Department of Pathology, College of Medicine, Seoul National University

Ok Ran Lee and Won Young Choi

Department of Parasitology, Catholic Medical College, Seoul, Korea

INTRODUCTION

As a site of ectopic paragonimiasis the spleen is very rarely involved. So far available in the literature there are few reports describing paragonimiasis involving the spleen. However, all of them are either found in the capsular portion instead of within the parenchyme or forming abscesses without worm inside (Mugrave, 1907). And in experimental infections only larvae were seen showing surface scratches of the spleen. Therefore it should be extremely unusual to find *Paragonimus* adult worms residing deep inside the splenic parenchyme.

Recently we had a chance to observe a case of splenic paragonimiasis in a dog that was experimentally infected and was killed 90 days after oral administration of metacercariae.

CASE REPORT

This spleen was obtained from an autopsy done on an adult dog that was experimentally infected with 100 metacercariae of *Paragonimus westermani* through oral route. The metacercariae were procured from gills and muscles of *Eriocheir japonicus* harvested in Choong-Mun Myun, Cheju island. This dog was killed three months after infection.

At autopsy the lungs were the sites of num-

erous, well formed parasitic cysts and multifocal hemorrhage. Many adult worms usually residing in pairs were found in these cysts. The remainder of the organs was unremarkable except for the spleen.

The spleen was slightly enlarged, $12 \times 2.8 \times 1.4$ cm in maximum dimensions and was of normal shape. The surface was generally smooth except for one area where dark purplish dome-shaped lesion that was located on the superior aspect of the spleen (Fig. 1). This lesion measured 1.5 cm in maximum cross and was relatively demarcated from the surrounding normal capsular structure. The surface of this lesion was slightly exuded with fibrinous material but did not show ulceration or perforation wound. The remaining splenic capsule also showed minute foci of fibrin clots with central pits of dark reddish appearance, reminiscent of miniature craters. These minute craters measured less than 1 mm in diameter in average, but were scattered throughout the superior capsular surface of the spleen.

Multiple cut sections of the spleen showed a well formed round parasitic cyst through the dome-shaped capsular lesion. This cyst was deeply embedded inside the splenic pulp at a distance of at least 2 mm from the capsule (Fig. 2). It measured 7 mm in diameter and was containing two adult worms, each measuring 4 mm and 3 mm, and closely juxtaposed. They

- Fig. 1.** Superior surface of the affected spleen, showing a dome-shaped darkish elevation (arrows). Note also minute dark pits surrounded by a whitish exudate resembling miniature craters.
- Fig. 2.** Cut section of the same spleen, showing a well demarcated cystic structure (arrow) in which a pair of *Paragonimus westermani* adult worm is found situated included.
- Fig. 3.** Photomicrograph of the worms and surrounding tissue reaction in the spleen. Necrotic debris and eggs are seen inside a thick collagenous connective tissue wall. H&E×40.
- Fig. 4.** Higher magnification of a cyst wall and a worm. The cyst wall is densely collagenous, and there is a direct contact between the worm and the cyst (The space between is an artefact). H&E×100.

were fairly well demarcated from the surrounding parenchyme, and no connection between this cyst and the splenic capsule was noted. No signs of worm degeneration were present. In addition to this focus there were three other areas of parasitic cysts showing similar features with those described above. They were found under the splenic capsule. And there were no overlying surface lesions of the splenic capsule as was shown in the one described already (Fig. 1). All of them were adult worms and were found in pairs, thus making the total number of intrasplenic *Paragonimus* adults to be eight.

Microscopically sections from every parasitic cyst showed basically similar features, being characterized by presence of viable adult worms of *Paragonimus westermani*, necrotic debris, scattered eggs, hemorrhage and fibrous wall formation around the worms. Suckers, testes, uterus and other important structures were identified in the worms and they were well preserved without any signs of degeneration. Tissue reaction in immediate vicinity of the worms was somewhat different by different areas. Quite active necrotizing exudative lesion was seen in some areas but in many areas there was inert fibrous reaction around the worm without exudation (Fig. 4). Fibrous wall formation around the worms was quite prominent feature in the spleen. These worm-containing cysts were generally round and were compressing the surrounding splenic pulps. Slightly increased number of plasma cells was noted around these parasitic cysts. However, eosinophils were not prominent in number. Hemosiderin pigments, mild pulpal fibrosis and scattered parasite eggs were seen near the parasitic cysts. No egg-related granuloma formation was noted in the spleen.

COMMENT

Human infection of *Paragonimus westermani* is well known to oriental countries. Its morphological descriptions, however, are usually fragmental particularly in cases of ectopic paragonimiasis. There are seldom complete and extensive autopsy descriptions. And the great majority of the descriptions are merely concentrating on the organ or tissue where the ectopic lesion was found.

In this sense, Musgrave's detailed pathological descriptions on human paragonimiasis in Philippines, based on 17 cases with 8 autopsies are of great value in understanding general pathology of human paragonimiasis.

Among Musgrave cases, there are two cases that are relevant to splenic involvement. His case No. 2 was described, "the spleen is enlarged, soft, and studded both on the surface and internally with small cystic abscesses similar to those found in the other organs." Unfortunately he does not specifically mention whether there indeed was a worm parasite inside the spleen or not. It seems, however reasonable that he did not see the worm grossly or microscopically. In his case No.3, he described, "The spleen contains a number of superficial abscesses, which show both parasite and ova." However, it says further that "no abscesses or parasites are found in the deeper portion of the organs." Therefore it seems true that Musgrave's series did not include a case of splenic paragonimiasis in the sense of formation of worm-related lesion established inside the spleen.

Among descriptions of experimental infections of paragonimiasis one finds that most of them neglected the histopathological examinations of organs or tissues other than the lungs or the specific organs they searched for lesion. In

heavy-infected groups of animals studied by Soh *et al.* (1962) and Chu (1962) the spleen was checked as the site of involvement. Unfortunately they do not give the detailed information on the nature of the lesion. A description saying involvement could have been foci of fibrin exudation or hemorrhage, or superficial abscess formation. We only can presume that they were not the kind of lesion we have in this case. For the future reference the informations related to this organ should be specific and in detail since the spleen is a rare site of involvement.

The route of infection into the spleen in this case is undetermined. It would be reasonable to consider that the spleen was mechanically disrupted and penetrated by the migrating larvae in early phase of infection eventually maturing into adult worms inside the spleen. This notion can be supported by the presence of the dome-shaped hemorrhagic, yet organized lesion between the parasitic cyst and the splenic capsule, and by the facts that the spleen is the site of "scratches" and superficial penetrations during infections in man (Musgrave, 1907) and experimental animals (Soh *et al.*, 1962; Chi *et al.*, 1979). The reason why superficial disruptions and fibrin exudations are seen but seldom penetrate deep into parenchyme to grow into adults is not certain at this moment. Tense capsule, probable immunological barrier or other factors might play a role in pathogenesis. Nevertheless this case certainly confirms the fact that the spleen can be the site where the larvae mature into adults at least in an experimental animal.

Another point of interest in pathological aspect was the nature of the lesion inside the spleen. It is to say that a well formed fibrous wall, so-called parasite cyst, was seen, and these cysts regularly contained a pair of worms. These findings were very much reminiscent of

those seen in the lungs. We have confirmed that the adult worms found in the lungs of infected cats and dogs were mostly residing in pairs (Lee, 1978; Choi *et al.*, 1979). However, this pairing phenomenon is not well documented in cases of ectopic paragonimiasis. We have observed the worms were often impacted in the diaphragm or the liver during larval migration in experimental animals (Chi *et al.*, 1979). However, in all instances the worms were seen singly and never formed a connective tissue cyst around the worms.

Finally, since the spleen is a large blood reservoir multiple large cysts with active worms inside should be considered as a potential source of massive intraperitoneal hemorrhage in cases of rupturing into the capsule. Fortunately it seems extremely rare occurrence in humans if any.

SUMMARY

A case of *Paragonimus westermani* cysts found deep inside the spleen is described. This spleen was from a dog that was experimentally infected via oral route with a hundred metacercariae and was killed 3 months after.

At autopsy, beside the usual lesions due to *Paragonimus* in the lungs, the spleen was the site of multiple parasitic cysts. The involved spleen was slightly enlarged and showed an area of hemorrhagic dome on the capsular surface. There found a total of 8 adult worms in four well demarcated parasitic cysts containing a pair of worms each. All of them were found deep into the splenic parenchyme and were surrounded by a well formed connective tissue wall, thus resembling the features of the pulmonary paragonimiasis.

The route of infection was assumed to be a direct transcapsular invasion during the phase of larval migration.

REFERENCES

- Chi, J.G., Choi, W.Y., Lee, O.R. and Jin, Y.K. (1979) Pathological Changes of the Liver and Diaphragm during Early phase of Experimental Paragonimiasis. *Korean J. Parasit.*, 17:169 (Korean abstract).
- Choi, W.Y., Lee, O.R., Jin, Y.K. and Chi, J.G. (1979) Lung Findings of in Experimental Paragonimiasis. *Korean J. Parasit.*, 17:132-146.
- Chyu, I. (1962) Studies on the experimental paragonimiasis. I. Parasitological and histopathological study on dog paragonimiasis. *Korean J. Int. Med.*, 5:241-250.
- Lee, O.R. (1979) A Histopathologic Study of the Lungs infected with *Paragonimus westermani* in the dog. *Korean J. Parasit.*, 17:19-44.
- Musgrave, W.F. (1907) Paragonimiasis in the Philippine. *Phil. J. Sci.*, 2(1):15-65.
- Soh, C.T., Kim, J.H. and Ahn, Y.K. (1962) Distribution of lung fluke in dogs. *Medical Digest*, 4(4): 75-78.

=國文抄錄=

脾臟內 肺吸蟲 成蟲 感染의 實驗症例

서울대학교 醫科大學 病理學敎室

池 堤 根

가톨릭醫科大學 寄生蟲學敎室

李 玉 蘭 · 崔 源 永

肺吸蟲症에 있어 異所寄生은 잘 알려진 現象이다. 그 侵犯部位는 腦, 筋肉, 肝, 脊髓, 心囊 및 生殖器 등 多樣하며 全身性이다. 異所寄生部位의 病理學的 所見도 또한 多樣하여 蟲體가 發見되는 例로부터 蟲卵만이 나타나는 여러가지 形態가 있으며 蟲體도 幼蟲에서 成蟲에 이르기까지 여러모양으로 나타난다.

脾臟은 一般的으로 各種 感染에서 保護되는 경향을 가지는 臟器로서 網內系를 直接 侵犯하는 感染이 아닌 限 그 感染例를 찾아 보기가 어렵다. 特히 寄生蟲性 疾患中 蠕蟲性 感染에 있어 脾臟을 寄生部位로 하는 例는 거의 없다.

한편 實驗的 肺吸蟲 感染에 있어서 重感染의 경우 그 幼蟲이 脾臟의 表在部에 나타날 수 있음은 報告되어 있으나 成蟲이 脾臟實質內에 侵犯한 例는 없으며, 人體寄生例에서도 이와 같은 報告例는 없다.

本例는 實驗的으로 被囊幼蟲 100個를 經口投與를 하여 感染을 일으킨 후 3個月에 屠殺한 개의 剖檢例로서 兩肺에는 典型的인 肺吸蟲 病變을 나타내었다. 脾臟은 약간 커져 있었으며, 그 表面은 部分的으로 약간 거칠었다. 切面에서 완전히 脾髓內에 包埋된 肺吸蟲 成蟲을 볼 수 있었는데 이들은 2마리씩 짝지어 작은 cyst를 만들고 있었으며 주위에 結核적으로 된 皮막을 형성하고 있었다. 蟲卵이 이들 成蟲주위에서 많이 發見되었고 약간의 섬유화와 壞死를 同伴하고 있었다.

本感染은 肺吸蟲幼蟲이 腹腔內 移行時 機械的 損傷을 脾臟內에 侵入하였다고 생각되었으며 비록 대단히 드문 것이지만 복강내 출혈의 잠재적 原因이 될 수 있다고 생각되었다.