大韓獸醫學會誌(1998) 第38卷 第3號
Korean J Vet Res(1998) 38(3) : 600~605

Spontaneous infection of *Capillaria hepatica* in wild rats(*Rattus norvegicus*) of Korea

Je-kyung Seong, Young-min Yun, Jeong-hee Han*, Joon-sup Lee**, Yang-seok Oh***

Division of Laboratory Animal Medicine, Medical Research Center, College of Medicine, Yonsei University
*Department of Veterinary Medicine, Kangwon National University**
*Department of Histology and Embryology, College of Veterinary Medicine, Seoul National University***
*Experimental Animal Center, College of Medicine, Hallym University****
(Received May 5, 1998)

한국 야생 랫드의 *Capillaria hepatica* 자연 감염

성제경 · 윤영민 · 한정희* · 이준섭** · 오양석***

연세대학교 의과대학 실험동물부 · 강원대학교 수의학과*
서울대학교 수의과대학 조직학교실** · 한림대학교 의과대학 실험동물부***
(1998년 5월 5일 접수)

초 록 : 춘천지역에서 포획한 한국 야생랫드(시궁쥐)에서 *Capillaria hepatica*에 자연감염된 예를 보고한다. *Capillaria hepatica*의 충란이 포획된 68마리의 랫드중 17마리에서 발견되었다. Capillaria에 감염된 랫드의 간장은 충란과 함께 림프구, 단핵구, 호산구의 침윤이 관찰되었고 심한 괴사소견을 보였다. 또한 섬유화, 출혈 hemosiderin의 침착이 뚜렷하게 관찰되었다. 최근 국내에서 자연에서 채집된 랫드의 *Capillaria hepatica*의 감염을 보고한 자료가 없는 것으로 미루어 *Capillaria hepatica*의 숙주감염을 파악하는 자료로 활용될 수 있을 것이다.

Key words : Korean wild rats(*Rattus norvegicus*), *Capillaria hepatica*.

Introduction

Capillaria hepatica (*Trichinelloidea : Trichuridae : Capillarinae*) is a nematode discovered by Bancroft in 18931. It is also called *Callodium hepaticum* by Moravee since 1982[2]. It is well known that this parasites can be naturally infected in liver of many kinds of mammals such as rodents,

Address reprint requests to Dr. Je-kyung Seong, Division of Laboratory Animal Medicine, Medical Research Center, College of Medicine, Yonsei University, Republic of Korea.

marmots, dogs, hares, rabbits, cats, pigs and monkeys, especially in house rats[3~5]. In humans, however, it is very rare case to be infected by *Capillaria hepatica* in spite of the high incidence of this parasites in the rat. To our knowledge, the human hepatic capillariasis have been reported just only 26 cases[6~8] in the world. Recently, however, in Korea there were a few reports for spontaneous infection of *Capillaria hepatica* in wild rats. Furthermore, the first human case of hepatic capillariasis was reported in Korea[6].

In present studies, we report a case of hepatic capillariasis in wild rats(*Rattus norvegicus*) captured in Chunchon, Korea and describe histopathological findings of infected liver by *Capillaria hepatica* .

Materials and Methods

Animals : Total 68 Korean wild rats were examined. The rats were captured by artificial metal trap or protected hand gloves in Chunchon, Korea in 1994~1996. The rat species was identified through the measurements of length of head, body and tail by the methods of Jones and Johnson[9].

Gross and histological examinations : Under anesthesia, all rats were autopsied for gross and histopathological findings of liver in the laboratory. For histopathological findings, the liver tissues were fixed in 10% neutral buffered formalin (NBF) and processed according to the routine histological methods. The tissues were embedded in paraplast and sectioned to 4μm. The slides stained with hematoxylin and eosin(H&E) and Masson trichrome were examined by two pathologist respectively under light microscope.

Results

All 68 rats used in this experiments were identified to *Rattus norvegicus* . The coat color of dorsal part of *Rattus norvegicus* is dark brown and ventral part is white belly(Fig 1). The eggs of *Capillaria hepatica* were found in 17 cases (male 11, female 6) of total 68 rats(male 38, female 30). They were found as irregular yellowish white appearance on the surface in the liver of Korean wild rats(Fig 2). Massive depositions of eggs of *Capillaria hepatica* were very significant in the liver tissue(Fig 3). Liver tissues infected by *Capillaria hepatica* showed hepatic necrosis and accumulation of hemosiderin in the peripheral of liver lobule. Also severe infiltrations of lymphocytes, monocytes and eosinophils were shown around eggs(Fig 3). The ductual dilatation and widely proliferations of fibrous tissue were very distinct(Fig 4). The eggs of this parasites were bioperculated shaped and surrounded by double wall; inner homogenous and outer pitted wall(Fig 5). Radiated stripe were distinct between inner and outer layers. The eggs measured 42~58μm in length and 25~30μm in width. The tissues round depositions of eggs were composed of fibrous tissues and infiltrated inflammatory cells(Fig 5). Where granuloma with infective eggs were not present, the liver tissues were normal.

Discussion

To survey the natural parasitic infections in wild rodents is very important information for understanding the infections of zoonotic parasites. Because wild rodents could be the most serious source of zoonotic parasitic infections. *Capillaria hepatica* is a zoonotic nematode that is one of the most fatal infectious parasites for human. It common as a hepatic infection in rodents and domestic animals. However hepatic Capillariasis of human is a rare case. Recently, it was reported for human capillariasis of Korea[6] and Japan[7,10].

The incidence of infection by *Capillaria hepatica* in the rodents has been studied by many researchers in the different part of the world. Momma[11] reported 57.2% infection rate of 2,222 house rats in Osaka. Wu[12] found out 30.4% infection case of 69 Soochow rat in China. Tubangui[13] reported 90.0% infection rate in 950 brown rats collected in Phillippines. Chen[14] 7.1% in 89 Canton rats in China. Luttermoser[15] 85.6% in 2,636 Baltimore house rats in USA. Schacher and Cheong[16] reported infection rate 1.5% in Kuala Lumpur, Malaya. Ash[17] 28% in 75 rats in Hawai. Kamiya *et al*[18] reported 34% infection rate in *Rattus rattus* in Southern Amami Islans in Japan. Childs *et al*[19] described that Norway rat of Baltimore area, USA from 1980 to 1986 were frequently infected(87.4%) by *Capillaria hepatica* but house mice rarely infected(5.4%). El Nassery *et al*[20] re-

ported *Capillaria hepatica* of wild caught rats in Egypt with 15.8% infection rates. Singleton *et al*[21] surveyed *Capillaria hepatica* in 4629 house mice, *Mus domesticus*, 263 black rats, *Rattus rattus* and 58 Norway rats, *Rattus norvegicus* in Australia. Roberts *et al*[22] surveyed the faunal composition, distribution and abundance of *Capillaria hepatica* in the Polynesian rat, *Rattus exulans* (Peale). Borucinska and Nielsen[23] described the first report of hepatic Capillariasis in muskrats Ondatra zibethicus. Hasegawa *et al*[24] detected *Capillaria hepatica* of 53 *Rattus rattus* captured on Lanyu, Taiwan.

Also in Korea there are some studies on this parasites. Nakamura and Kobayashi[25] reported 36.0% infections rates in 1,251 house rats in Seoul. Seo *et al*[26] surveyed *Capillaria hepatica* in 286 rats(88.0%) of 325 *Rattus norvegicus* examined in Seoul. Seo *et al*[27] described 12.1% infection rates only in 33 *Rattus norvegicus* at the areas of Pochun and Chungpyong in Korea but no other species of wild rats was infected. Min[28] reported 38% infection rates by *Capillaria hepatica* of 1,000 house rats(*Rattus norvegicus*) in Seoul and none of 64 wild mice(*Mus musculus* spp, and *Microtus mandarinus*) were infected by *Capillaria hepatica*. Recently, Seong *et al*[29] reported 11.9% infection rates of *Capillaria hepatica* in Korean wild rats.

Capillaria hepatica is known as one of the commonest parasites of the brown rat in Korea[26,28]. But in our survey, we could find out this parasites with 18.5% infection rates in the Korean wild rats. These results were very similiar with those of Seo *et al*[27] in Pochun and Chungpyong, but very significant differences with those of Seo *et al*[26] and Min[28] in Seoul. Also the infection rates was not related to differences in sex of the hosts. This is the same results of those of Childs *et al*[19] and Roberts *et al*[22]. The life cycle of this parasites is unique. Only a single host such as rats are required. This parasites are marked organotrophic. After experimental infection of *Capillaria*, the larvae always migrated to the liver without settling in any other organ[30]. The eggs are not excreted from this host. When the liver of the animal host infected by this parasites is eaten by other animals or when the animal host dies and decomposes, liberating the eggs in soil, the eggs are liberated from the tissue of host animal by digestion, and excreted with feces, and then became infective in a human environment. The liver of this host contains both eggs and adult worms. Only embryonated eggs are infectious, nonembryonated eggs pass unchanged through the intestinal tract.

Human can be infected with *Capillaria hepatica* by ingesting water and foods contaminated with embryonated eggs. Thus infection occurs usually in poor sanitary condition such as developing countries especially among children with habit eating dirty. In spite of high prevalance of this parasites in rats of Korea and Japan, the incidence in children is not high. Perhaps this low incidence of human on Korea and Japan may be related with well-controlled sanitary condition.

Lee[30] observed pathological findings of liver infected by *Capillaria hepatica* in the experimentally infected mouse. El Nassery *et al*[20] and Davoust *et al*[31] observed severe liver destruction and necrosis in experimental *Capillaria hepatica* infection of white mice. Ferreira and Andrade[32] observed fine, long, fibrous septa in the acinar zone III of liver of rats experimentally infected with *Capillaria hepatica*. These findings of the other researchers in experiments was same of ours. In our survey, the sample size is not enough for fully understanding the aspects of spontaneous zoonotic parasitic infection in the wild rats compared with the attempts of another researchers. To our knowledge, however, this is the first report on pathological findings of liver infected by *Capillaria hepatica* in wild rats(*Rattus norvegicus*) captured in chunchon, Korea. Further studies should be required in another various areas of Korea and another species of the rodents.

Acknowledgements : We wish to thank Mr. Kang-bong Soo for his excellent skills of capturing wild rats and Mr. Deok-joo Kwon, Mr. Seung-chul Kim, Mr. Joo-han Kim, Mr. Jeong-hyun Sim and Mr. Byoung-ook Jung for their assistance of animal handling and autopsy.

Legend for figures

Fig 1. The Korean wild rats(*Rattus norvegicus*).
The coat color of dorsal part in *Rattus norvegicus* is dark brown and ventral part is white belly.

Fig 2. The gross findings in the liver of Korean wild rats.
The eggs of *Capillaria hepatica* were identified by irregular yellowish white appearance(arrow head) on the surface of liver.

Fig 3. The histological findings in the liver of Korean wild rats. × 100, HE stain.
Massive eggs of *Capillaria hepatica* (C) were very significant. Liver tissues infected by *Capillaria hepatica* showed hepatic necrosis and accumulation of hemosiderin(arrow head). Severe infiltrations of lymphocyte, monocyt and eosinophils were shown (arrow).

Fig 4. The histological findings in the liver of Korean wild rats. × 400, Masson trichrome stain.
The ductual dilatation(D), wide proliferations of fibrous tissues (arrow head) and depostions of hemosiderin(arrow) were very distinct.

Fig 5. The histological findings in the liver of Korean wild rats. × 400, HE stain.
The eggs of *Capillaria hepatica* were shown. The eggs of this parasites were bioperculated shaped and they surrounded by double wall inner homogenous and outer pitted wall. The tissues round depositions of eggs were composed of fibrous tissues and infiltrated inflammatory cells(arrow).

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