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Prevalence of *Dirofillaria immitis* in Raccoon Dogs (*Nyctereutes procyonoides*) in Korea

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Abstract : Heartworm infection is a fatal disease causing heart failure and pulmonary diseases in dogs. This heartworm infection can also occur in wild carnivores including Raccoon dogs. Recent study found that relatively high prevalence rate in wild Raccoon dog population. Therefore, this study was designed to evaluate the prevalence rate of *D. immitis* in free-roaming Raccoon dogs and the recovery rate of microfilariae in infected Raccoon dogs in Korea. Overall prevalence rate of *D. immitis* in Korean Raccoon dogs was 17.8%. Prevalence rate in male Raccoon dogs was 21.8%, while that in female Raccoon dogs was 12.8%. Microfilariae were not detected in 17 Raccoon dogs having positive in heartworm antigen test. Our study result suggested that the prevalence rate of *D. immitis* in Korea is twice higher than that of Japan. In addition, microfilaremia is rare in Raccoon dogs as commonly noticed in cats.

Key words **:** Raccoon dogs, *D. immitis,* heartworm, microfilaria, prevalence rate.

Introduction

Heartworm infection caused by *Dirofilaria immitis* is a dangerous disease causing cardiopulmonary problems in dogs. Heartworm infection has also been reported in companion animals (e.g., cats and ferrets) and wild animals (e.g., wolves, coyotes, foxes, California gray seals, sea lions, and raccoon dogs) (1). Although clinical disease from heartworm infection has rarely been reported in wild animals, one study found clinical disease could be possible in raccoon dogs experimentally inoculated L3 larvae (4). Prevalence of *D. immitis* in Raccoon dogs has been reported in Japan (4,6). The prevalence rate was 7.4% in the heartworm antigen test and 16-24.3% in the post-mortem examination (6). Experimental inoculation to Raccoon dogs revealed heartworms could mature normally and could produce microfilariae (7). Therefore, infected raccoon dogs can be a carrier of heartworm in companion animals especially dogs, which are more susceptible to heartworm infection. This study was designed to evaluate the prevalence rate of *D. immitis* in free-roaming Raccoon dogs and the recovery rate of microfilariae in infected Raccoon dogs in Korea.

Materials and Methods

Raccoon dogs

Ninety-five Raccoon dogs (56 males and 39 females) estimated to be over one year of age (according to their body length and tooth eruption pattern) were only included in this study. They were collected throughout Korea.

Heartworm test

Heartworm antigen test against adult heartworms and modified Knott's test against microfilariae were performed in all raccoon dogs enrolled. To do heartworm tests, blood samples from raccoon dogs were collected from either jugular or cephalic vein under manual restraint. Heartworm Antigen test (Anigen Rapid Canine Heartworm Ag 2.0 Test Kit, Bionote, Korea) was performed immediately after withdrawn blood samples as instructed by manufacturer. For the modified Knott's test, 1-ml blood was added to 10 ml of 2% formalin, mixed, centrifuged for 5 minutes at 1000 to 1500 rpm and decanted off supernatant fluid. The sediment was mixed with equal volume of 1:1000 aqueous methylene blue and then examined under light microscopy.

Results

Overall prevalence rate of *D. immitis* in Korean Raccoon dogs was 17.8% (17/95). Prevalence rate in male Raccoon dogs was 21.8% (12/56), while that in female Raccoon dogs was 12.8% (5/39). Microfilariae was not detected in 17 Raccoon dogs having positive in heartworm antigen test.

Discussion

Several studies have documented *D. immitis* infection in

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the raccoon dog (3,4,6,8). There are three studies concerning the prevalence of *D. immitis* infection in the raccoon dog (4,6,8). Two studies were based on the postmortem examination (6,8), while one study was based on the immunological examination (4). Interestingly, the prevalence rate was 2-3 times lower in the study based on the immunological examination (4), even in the same region studied. One claimed this difference was resulted from the lower sensitivity of immature heartworms in heartworm antigen test and out-numbered young raccoon dogs in the study population (4). The heartworm antigen test used in this study was based on immunochromatographical assay using direct sandwich method to improve the sensitivity and specificity of test. Unlike other commercially available heartworm test kits (against female genitalia antigen), the lower sensitivity from immature or male worms may not affect our study result, because the test kit used in this study based on the somatic antigen, according to the manufacturer. Furthermore, 0% of recovery of microfilariae in Raccoon dogs positively reacted in the antigen test strongly suggested Raccoon dogs might be resistant hosts of heartworms and microfilaremia, as commonly noticed in cats (2). However we are not sure that Raccoon dogs also are able to rid themselves of the infection spontaneously, as reported in cats (2). According to one study experimentally inoculated *D. immitis* to raccoon dogs, microfilaremia was only transiently present in the blood stream (7), suggesting Raccoon dogs might also have the ability to get rid of the infection. Further study should aim to reveal clinical consequence of natural infection in Raccoon dogs. Another possible reason for the absence of microfilaremia is that all Raccoon dogs were infected recently so that there was insufficient time for *D. immitis* to mature. Last possible reason is the Knott's test could not detect lower number of microfilaria in Raccoon dogs, because the sensitive of this test is relatively lower when blood microfilariae are present at low densities (1).

One problem in our study is that the heartworm antigen test used was designed for dogs. Although we found this antigen test was still valid for Raccoon dogs, the sensitivity and specificity of test might be differed by species. Therefore there is still possibility that we underestimated the prevalence rate of *D. immitis* in Korea.

In conclusion, our study suggested that the prevalence rate of *D. immitis* in Korea is quite similar to Japan. Also microfilaremia is rare in Raccoon dogs as commonly noticed in cats. Further study should be directed to understand the clinical consequence from the natural infection of *D. immitis* in Raccoon dogs.

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References

1. American Heartworm Society. Diagnosis, prevention, and management of heartworm (Dirofilaria immitis) infection in cats. http://www.heartwormsociety.org/pet-owner-resources/feline-heartworm.html/. Lastly updated 28/07/2012.
2. American Heartworm Society. Diagnosis, prevention, and management of heartworm (Dirofilaria immitis) infection in dogs. http://www.heartwormsociety.org/pet-owner-resources/canine-heartworm.html/. Lastly updated 28/07/2012.
3. Christensen, BM, Shelton ME. Laboratory observations on the insusceptibility of raccoons to Dirofilaria immitis. J Wildl Dis 1978; 14: 22-23.
4. Kido N, Wada Y, Takahashi M, Kamegaya C, Omiya T, Yamamoto Y. Prevalence of Dirofilaria immitis infection in living raccoon dogs assessed by hematological examination. J Vet Med Sci 2011; 73: 845-847.
5. Kawabata A, Nakagaki K, Yoshida M, Shirota K. Histopathological comparison of pulmonary artery lesions between raccoon dogs (Nyctereutes procyonoides) and domestic dogs experimentally infected with Dirofilaria immitis. J Vet Med Sci 2008; 70: 301-303.
6. Nakagaki K, Suzuki T, Hayama SI, Kanda E. Prevalence of dirofilarial infection in raccoon dogs in Japan. Parasitol Int 2000; 49: 253-256.
7. Nakagaki K, Yoshida M, Nogami S, Nakagaki K. Experimental infection of Dirofilaria immitis in raccoon dogs. J Parasitol 2007; 93: 432-434.
8. Uchida A, Uchida K, Kawakami Y, Murata Y. Helminthological surveys of raccoon dogs captured in Tokyo and Kanagawa Prefectures. J Jap Vet Med Assoc 1999; 52: 715-721.

한국 너구리(*Nyctereutes procyonoides*)의 심장사상충감염에 대한 유병률

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요 약 : 심장사상충 감염은 개에서 심부전과 폐질환을 유발하는 치명적인 질환이다. 이러한 심장사상충 감염은 너구리들을 포함한 야생육식동물에서도 발생을 한다. 최근 연구를 통해, 야생 너구리 집단에서 상대적으로 높게 발생하는 유병률을 확인할 수 있다. 그러므로, 본 논문은 한국의 야생너구리에서 발생하는 *D. immitis* 의 유병률과 감염된 너구리의 회복률에 대한 평가를 하기 위해 고안되었다. 한국 너구리의 *D. immitis* 에 대한 전체의 유병률은 17.8%이었다. 수컷 너구리의 유병률은 21.8%이었고, 암컷 너구리의 유병률은 12.8% 이었다. 심장사상충 항원 검사에서 양성이 나온 17마리의 너구리들에게 마이크로필라리아는 관찰되지 않았다. 본 논문의 결론은 한국의 *D. immitis* 의 유병률이 일본에 비해 2배이상 높은 것으로 확인되었다. 또한, 고양이와 마찬가지로 너구리들도 마이크로필라리아혈증이 드문 것으로 나타났다.

주요어 : 너구리, *D. immitis,* 심장사상충, 마이크로필라리아, 유병률.