

## The First Korean Case of Human Pulmonary *Dirofilariasis*

Kyu-Jae Lee<sup>1</sup>, Gab-Man Park<sup>2</sup>, Tai-Soon Yong<sup>2</sup>, Kyung-il Im<sup>2</sup>, Soon-Hee Jung<sup>3</sup>, Nak-Young Jeong<sup>4</sup>,  
Won-Yeon Lee<sup>4</sup>, Suk-Joong Yong<sup>4</sup>, and Kye-Chul Shin<sup>4</sup>

### Abstract

Human pulmonary dirofilariasis has been documented from many parts of the world, but not in Korea so far. We experienced a patient of pulmonary dirofilariasis who had visited a local clinic because of chest pain for 1 month. On chest radiograph, a coin lesion of 2 cm diameter and enlargement of the mediastinal lymph node were shown. An exploratory lung resection was done. Pathologically the lesion was a pulmonary dirofilariasis complicated with necrotic pneumonia, fibrosis, and infarction. At the center of the lesion, degenerated nematode sections with multilayered cuticle, thick musculature, and bilateral internal ridges on each side were found, which was identified to be *Dirofilaria immitis*. This is the first report of human pulmonary dirofilariasis in Korea.

**Key Words:** Pulmonary dirofilariasis, *Dirofilaria immitis*, infarction

### INTRODUCTION

*Dirofilaria* is a genus of filarial nematode, which infects dogs, racoons, bears and bobcats. Adults of the type species, *Dirofilaria immitis*, live in the right heart of dogs and produce a debilitating disease. This filaria is transmitted by mosquitos.<sup>1</sup> When an infected mosquito takes blood from a human, the larvae invade and develop for a time in subcutaneous tissues, migrate to the right heart and are swept into the pulmonary arteries, lodged in a small-caliber vessel, produce an infarct, and, ultimately, a granulomatous coin lesion.<sup>2,3</sup>

Patients with pulmonary dirofilariasis are asymptomatic in more than half of infections, but they sometimes complain of cough, chest pain, fever and hemoptysis.<sup>4</sup> On laboratory study, 20% peripheral eosinophilia was reported among the 76 cases of pulmonary dirofilariasis.<sup>5</sup> In asymptomatic individuals, lesions are discovered incidentally during routine radiographic examination or in the course of exami-

nation for other clinical problems. The coin lesion measures about 1–3 cm in diameter and mimics a primary or metastatic lung tumor.<sup>6,7</sup> Pathologically, the typical nodule is a spherical subpleural infarct with a central thrombosed artery containing the parasite in stages of degeneration. Pathologic features of the pulmonary lesions may include infarction, vasculitis, eosinophilic pneumonitis and granuloma formation.<sup>4,8</sup>

In this report we describe a Korean patient with pulmonary dirofilariasis which caused infarction.

### CASE REPORT

In March, 1998, a 47-year-old male government officer living in Chungju City, Chungchongbuk-do visited the Department of Internal Medicine of Wonju Christian Hospital with a symptom of left chest pain for 1 month. He was informed that he had an abnormal lesion at a local clinic. Laboratory examination, chest and pulmonary function test were normal except for 9.5% of eosinophilia.

In chest radiograph, a pulmonary nodule with a sharp margin was found at the left lower lobe (Fig. 1A). In computerized tomographic scan, a solitary pulmonary lesion with low density, measuring 2.5 × 2 cm, was found at the lateral basal segment of the left lower lobe. The nodule was shown to be connected

Received August 6, 1999

Accepted December 2, 1999

Departments of <sup>1</sup>Parasitology, <sup>3</sup>Pathology, and <sup>4</sup>Internal Medicine, Yonsei University Wonju College of Medicine, Wonju, <sup>2</sup>Department of Parasitology, Yonsei University College of Medicine, Seoul, Korea

Address reprint request to Dr. K. J. Lee, Department of Parasitology, Yonsei University Wonju College of Medicine, Kangwon 220-701, Korea. Tel: 82-371-741-0336, Fax: 82-371-748-2709, E-mail: kjlee@wonju.yonsei.ac.kr

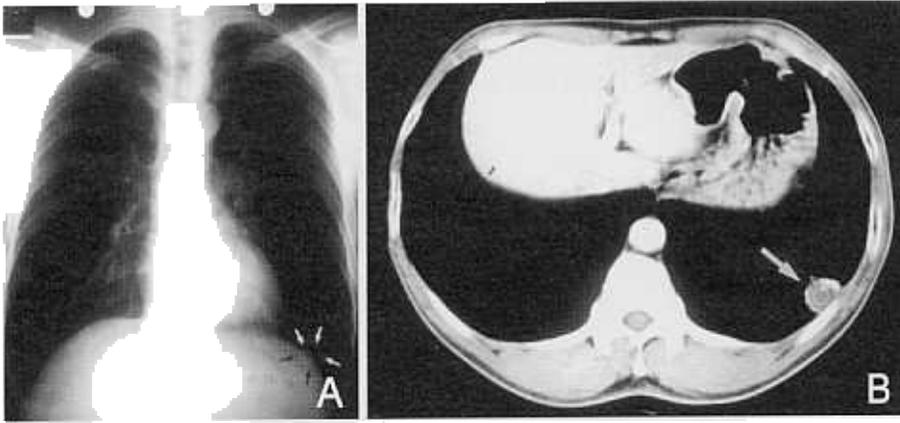


Fig. 1. (A) Chest radiograph of the patient showing a mass (surrounded with arrows) at left lower lung field. (B) Chest C-T scan showing a solitary pulmonary mass (arrow) with sharp margin and no enhancement at lateral basal segment of left lower lobe.

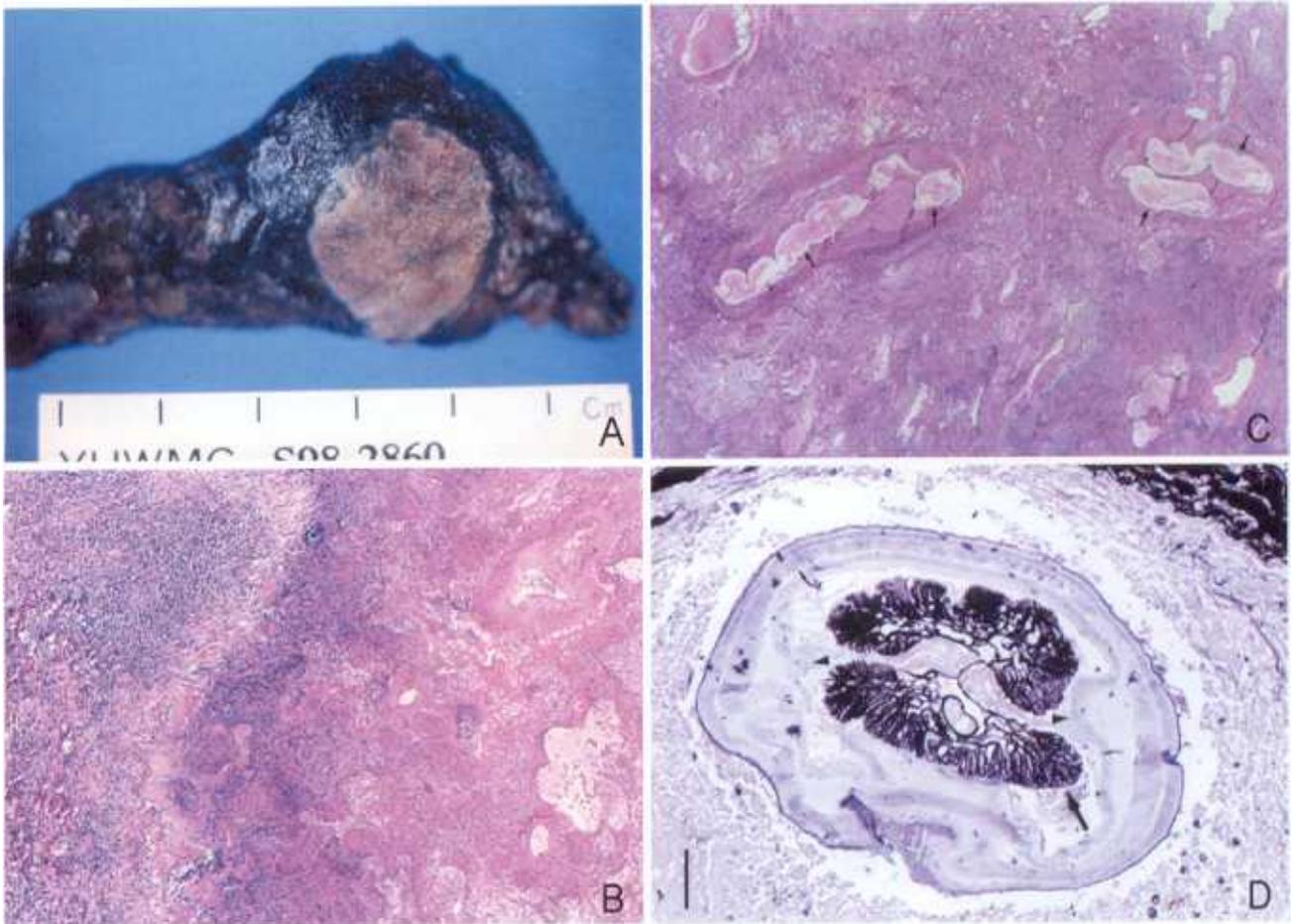


Fig. 2. Gross and microscopic findings of case. (A) The cut surface of the lung reveals a round, well-demarcated, necrotic mass (2 cm diameter), which is attached to the adjacent pleural surface. (B) A low-power view shows necrotizing pneumonia surrounded by the fibrous tissue infiltrated by numerous lymphocytes and epithelioid cells (H & E staining,  $\times 40$ ). (C) Several parts (arrows) of the parasite within the blood vessels (H & E staining,  $\times 40$ ). (D) The transverse section of the worm showing characteristic structure of bilateral internal cuticular ridges (arrowheads) and musculature (arrow) are consistent with *D. immitis* (Methenamine silver stain,  $\times 400$ , Bar = 50  $\mu$ m).

to the pleura (Fig. 1B). In contrast enhanced image, a reactive, bean-shaped, nodal hyperplasia of less than 1 cm was found in mediastinum. In lung perfusion scan, a non-segmental patched perfusion defect was recognized at the corresponding area of the lesion. Abdominal sonography and bone scan image showed normal findings. The presumptive diagnosis was an infarction or a benign tumor.

On the 8 th day of admission, a wedge lung resection was performed. In pathological examination, a section revealed grossly a round, gray-yellowish, well-defined solid mass, measuring  $2.5 \times 2$  cm, attached to the adjacent pleural surface (Fig. 2A). Microscopically, the lesion was surrounded by necrotic pneumonia with hemorrhage, and fibrosis (Fig. 2B). The lesion contained nematode sections of different degrees of degeneration (Fig. 2C). A transverse section of the worm measuring  $432 \times 296 \mu\text{m}$  showed a thick, swollen, multi-layered cuticle that bore a prominent internal ridge on each side. With methenamine silver stain, the nematode muscle was impregnated black with silver (Fig. 2D). No sections of organs were recognized. Disintegrated midgut sections were shown at the center of the muscle mass. Based on these morphologic features, the worm section was identified as *D. immitis*. After the diagnosis and treatment, the patient was discharged without any complication.

## DISCUSSION

*D. immitis* is a nematode parasite of mammals such as dogs,<sup>9,10</sup> cats,<sup>11</sup> and foxes.<sup>12</sup> In Korea, 28.3% of 127 German shepherds were found infected with *D. immitis* by antigen test in 1996.<sup>13</sup> *Dirofilaria* is transmitted by infective bites of vector mosquitoes.<sup>14</sup> Species of mosquitoes intermediate host has not been elucidated in Korea. In Japan, *Culex tritaeniorhynchus* and *Aedes albopictus* were reported as vectors of *D. immitis*.<sup>15</sup>

The infective stages of the filaria accidentally invade human tissues after a blood meal by an infected vector. Human dirofilariasis manifests subcutaneous or pulmonary infections. Premature adult nematode is a major form found in human dirofilarial infection. In subcutaneous infections, upper extremity and body cavities are involved.<sup>16</sup> *Dirofilaria* infections involving the heart and lungs are caused mostly by

*D. immitis*.

Larvae migrate to the right heart. There, they either die or become moribund and are swept up into the pulmonary arteries, where they lodge in a small-caliber vessel and produce a granulomatous lesion.

Recent reports of the human dirofilariasis showed that more than 50% of the patients had presented in the age group 40–59 years.<sup>17</sup> Ninety-five percent of the pulmonary dirofilariasis cases showed a single nodule. In chest x-ray examination, 76% of the cases showed a lesion smaller than 2 cm.<sup>18</sup>

The pulmonary mass caused by dirofilariasis should be differentiated from benign or malignant tumors and metastatic cancers. The present case also needs to be differentiated from malignancies. No specific diagnostic methods are available for human dirofilariasis, having high specificity and sensitivity. Peripheral eosinophilia may be a helpful clue.<sup>8</sup> Detection of microfilaria or circulating antigen is known as a diagnostic method in dog infection.<sup>9,13</sup> But it is of no use in human pulmonary infection.<sup>19</sup> The only useful diagnostic method is biopsy. In a few instances, *D. repens* has been identified in masses in the lungs.<sup>3,20</sup> The classification of species is possible by the geographic distribution of the *Dirofilaria* species and distinct features of the worm. Animal infections of *D. repens* have not been reported in Korea. As for human dirofilariasis in Korea, Rim reported a 33-year-old woman of abdominal dirofilariasis in 1976.<sup>21</sup> She had lived in Thailand and Sri Lanka for 5 years prior to the diagnosis. She was presumed infected overseas.

Dirofilarial infection can be diagnosed at the generic level on the basis of worm morphology, such as thick, multilayered cuticle with lateral internal ridges, large lateral chords, and coelomyarian musculature. The gender of the nematode is most reliably identified by the morphology of reproductive tubes if any. A study on the surface of the cuticle, such as the presence or absence of longitudinal ridges, small lateral alae, etc. helps to some extent in identifying species. The worms are generally dead and found in different degrees of degeneration. In the dead or dying worm, the appearance of these structures can be altered. In the present case, the cuticle showed remarkable multilayered characters due probably to degeneration. This case has compatible worm structures such as a thick cuticle, lateral

internal ridges and coelomyarian musculature to diagnose *D. immitis*.

We have described here the first human case of pulmonary dirofilariasis infection by *D. immitis* in Korea.

## REFERENCES

1. Beaver PC, Jung RC, Cupp EW. Clinical Parasitology. 9th ed. Philadelphia: Lea & Febiger; 1984. p.388-90.
2. Asimacopoulos PJ, Katras A, Christie B. Pulmonary dirofilariasis-The largest single-hospital experience. Chest 1992;102:851-5.
3. Pampiglione S, Rivasi E, Paolino S. Human pulmonary dirofilariasis. Histopathology 1996;29:69-72.
4. Kochar AS. Human pulmonary dirofilariasis. Am J Clin Pathol 1985;84:19-23.
5. Ro JY, Tsakalakis PJ, White VA, Luna MA, Chang-Tung EG, Green L, et al. Pulmonary dirofilariasis: the great imitator of primary or metastatic lung tumor. A clinicopathologic analysis of seven cases and a review of the literature. Hum Pathol 1989;20:69-76.
6. Fabbretti G, Fedeli F, Alessi A, Boaron M, Salpietro V, Brisigotti M. Human pulmonary dirofilariasis: report of a new European case. Histol Histopathol 1990;5:311-3.
7. Bailey TS, Sohrabi A, Roberts SS. Pulmonary coin lesions caused by *Dirofilaria immitis*. J Surg Oncol 1990;44:268-72.
8. Hawkins AG, Hsiu JG, Smith RM 3rd, Stitik FP, Siddiky MA, Edwards OE. Pulmonary dirofilariasis diagnosed by fine needle aspiration biopsy. Acta Cytol (Baltimore) 1985;29:19-22.
9. Hatsushika R, Okino T, Shimizu M, Ohyama F. The prevalence of dog heartworm (*Dirofilaria immitis*) infection in stray dogs in Okayama, Japan. Kawasaki Med J 1992; 18:75-83.
10. Perez-Sanchez R, Gomez-Beutista M, Grandes AE. Canine filariasis in Salamanca (northwest Spain). Ann Trop Med Parasitol 1989;83:143-50.
11. Miller MW. Feline dirofilariasis. Clin Tech Small Anim Pract 1998;13:99-108.
12. Gortazar C, Castillo JA, Lucientes J, Blanco JC, Arriolabengoa A, Calvete C. Factors affecting *Dirofilaria immitis* prevalence in red foxes in northeastern Spain. J Wildl Dis 1994;30:545-7.
13. Lee JC, Lee CY, Shin SS, Lee CG. A survey of canine heartworm infections among German shepherds in South Korea. J Parasitol 1996;34:225-31.
14. Buxton BA, Mullen GR. Field isolations of *Dirofilaria* from mosquitoes in Alabama. J Parasitol 1980;66:140-4.
15. Konishi E. *Culex tritaeniorhynchus* and *Aedes albopictus* (Diptera: culicidae) as natural vectors of *Dirofilaria immitis* (Spirurida: Filariidae) in Miki City, Japan. J Med Entomol 1989;26:294-300.
16. Billups J, Schenken JR, Beaver PC. Subcutaneous dirofilariasis in Nebraska. Arch Pathol Lab Med 1980;104:11-3.
17. Ciferri F. Human pulmonary dirofilariasis in the United States, A critical review. Am J Trop Med Hyg 1982; 31:302-8.
18. Cordero M, Munoz MR, Muro A, Simon F, Perera ML. Small calcified nodule- An undescribed radiologic manifestation of human pulmonary dirofilariasis. J Infect Dis 1992;165:398-9.
19. Jelinek T, Schulte-Hillen J, Loscher T. Human dirofilariasis. Int J Dermatol 1996;35:872-5.
20. Macdougall LT, Magoon CC, Fritsche TR. *Dirofilaria* repens manifesting as a breast nodule. Diagnostic problems and epidemiologic considerations. Am J Clin Pathol 1992; 97:625-30.
21. Rim HJ. A case of human infection with *Dirofilaria* (*Noctiella*) species. [abstract] Korean J Parasitol 1976;14: 164.