

## Case Reports of Infections with *Dirofilaria immitis* in Lung and *Wuchereria bancrofti* in Epididymis, Diagnosed by Cross Section Morphology of Worms in Pathological Specimens

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During past two decades, more than 80 cases of pulmonary dirofilariasis and about 200 instances involving subcutaneous tissues with *Dirofilaria* larvae have been reported from various parts of the world.

In Japan, the first case of *D. immitis* infection, revealing coin lesion in lung was reported by the authors (1970), thereafter 9 additional such cases have been known (Yamane *et al.*, 1977; Kumada *et al.*, 1980; Yoshimura *et al.*, 1980). On the other hand, six cases of extra-pulmonary dirofilariasis were reported from our country in the same period (Kaneda *et al.*, 1980; Yoshimura, 1980).

Present paper dealt with two cases with filariasis; one was pulmonary dirofilariasis and the other was *Wuchereria bancrofti* infection in the epididymis. Clinico-pathological observations and morphological studies were carried out in order to clarify the histological structures of worms in cross sections.

### Case Report

#### Case 1. 64-year-old man, living in To-

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yama city was admitted to The Toyama Prefectural Hospital because of hematemesis due to rupture of esophagus varix, on February 4, 1980. At roentgenological examination no abnormal shadow like as coin lesion was seen. The patient died on the same day of hospitalization because of a large amount of bleeding and necropsy was performed. Besides pathological diagnosis of liver cirrhosis and esophagus varix, a greyish-white nodule with a bean-size was palpable in the apical part of left lung.

**Parasite;** Sections of the worm found within a pulmonary artery were surrounded by inflammatory tissues composed of a large number of eosinophils, mononuclear cells, fibroblasts and a few giant cells (Figs. 1, 5). The size of worms of transverse sections was averaged  $330 \times 350 \mu\text{m}$  in diameter. Cuticle was  $25 \mu\text{m}$  thick and at least three layered. The surface of cuticle was smooth and no external cuticular ridges was present. The internal longitudinal ridges expanding inwardly at the lateral chords were seen (Figs. 2, 3). Although lateral chords were somewhat degenerated, they were tall and protruding into the body cavity. Muscle cells of polymyarian-type were numerous and well developed. There were two tubular architectures, representing testis and intestine. Various shaped and thin-walled structures (U in Fig. 2)

were seen in a pulmonary arteriole containing the parasite, however, they were unidentified objects which were not assumed to be derived from the worm. These objects were almost similar to those seen previously by Yoshimura and Yokogawa (1970).

In oblique-longitudinal specimen of the worm, two spicules measuring  $156\ \mu\text{m}$  or  $79\ \mu\text{m}$  each were seen at the posterior end of the worm (Figs. 4, 5). From the morphological finding of the worm, the parasite was identified as an adolescent or young adult male worm of *D. immitis*.

Case 2. 73-year-old man, living in Yatsuo-machi, Toyama Prefecture, was admitted to Toyama University Hospital with two years history of hemiplegia. The patient noticed a nodule in right side of scrotum and the tumor gradually grew in size. Filariasis was clinically suspected, however, no microfilaria was detected in blood and urine on repeated examinations. The patient has had an episode of undergoing puncture of scrotum because of hydrocele testis about 30 years ago.

Pathological findings; Surgical operation was performed on December 8, 1979. A tumor-like cystic nodule, measuring approximately  $3\times 3\ \text{cm}$  in diameter was located in head portion of the right side of epididymis. Histopathologically, cyst wall consisted of hyalinized granulations harboring transverse sections of worms.

Parasite; Several sections of worms with different sizes and architectures were found to be embolizing in the lymph canal. Average diameter of sections of small sized worm was approximately  $100\times 98\ \mu\text{m}$  at the level of male reproductive organ which revealed partially degeneration or calcification. The cuticle was smooth, about  $2\ \mu\text{m}$  thick, not distinctly layered, however, an inner layer at lateral chords expands gradually to form low ridges about  $5\ \mu\text{m}$  thick on each side. Lateral chords were not preserved well, but relatively wide and

divided into sublateral bands, having small nuclei in their bases. Muscle cells were disintegrated, therefore, it was difficult to estimate the number of cells per quadrant. The parasites were identified as adult male worm of *W. bancrofti* (Figs. 6, 7). Average diameter of large sized worm was approximately  $180\times 140\ \mu\text{m}$  at the level of uterus. In the paired tubes of uterus a number of microfilariae and round unfertilized eggs were seen. The intestine was relatively small. Average diameter of most sections of the worm was evidently larger than those of male worm. The features of cuticle and muscle cells were almost same to those of male worm. Basing on the morphological features, the worm was identified as female adults of *W. bancrofti* (Fig. 8).

### Discussion

Following the first case of human pulmonary dirofilariasis reported by Faust *et al.* (1952), 82 such cases have been known in the world. Fifty three cases of them were roentgenologically characterized by coin lesion, alarming lung tumor. The foci of 48 cases were located in right lung and 25 of them were in lower lobes (Yoshimura *et al.*, 1980). Present case manifested neither coin lesion nor respiratory discomfort before admission to the hospital and the focus was incidentally noticed to be located in left upper lobe at necropsy. Except for the findings of spicules, morphological architectures of the worm exactly coincided with those of previously reported cases (Navarrete-Reyna and Noon, 1968; Yamane *et al.*, 1977; Kumada *et al.*, 1980; Yoshimura, 1980). As pointed out by Beaver *et al.* (1971) and Beaver and Cran (1974), the causative agents causing pulmonary infarction are not only *D. immitis*, but also *Wuchereria*-like or *Brugia*-like filariae. Regarding extra-pulmonary dirofilariasis, Tada *et al.* (1979) and Yoshimura *et al.* (1980) reported *D. immitis* infesta-

tions in the abdominal cavities of patients. The relation between worm's location and species of parasite should be correctly identified to understand the entity of the disease. The detailed histological descriptions of *D. immitis*, *D. tenuis*, *D. repens* and *D. ursi* have been given by Beaver and Orihel (1965), Ohmori *et al.* (1977), MacLean *et al.* (1979) and Uni *et al.* (1980). On the other hand, morphological findings of *W. bancrofti* have been described by Mattland (1894), Mochizuki (1914), Kimura (1920), Rosenblatt *et al.* (1962) and Gupta (1964).

In present observations, morphological differences between *D. immitis* and *W. bancrofti* in sections were clearly recognized. The size or diameter of cross-section of *D. immitis* is larger than *W. bancrofti*, although the variety of size is inevitable, according to sex or development of the worm. *D. immitis* have thicker multi-layered cuticle with at least three layers and its outer surface is smooth or no ridged. Innermost layer of cuticle at lateral chords distinctly formed internal cuticular ridges. *D. immitis* has also heavier, more numerous muscle cells of polymyarian-type and narrower but taller lateral chords than those of *W. bancrofti*. In contrast, *W. bancrofti* has smooth, thin and not evidently laminated cuticle, except for inner layer showing thickening at lateral chords which is wide and divided into sublateral bands. The number of muscle cells is obviously smaller than that of *D. immitis*. In our specimens of *W. bancrofti*, the number of cells per quadrant was not easily estimated because of disintegration and various tissues of worm were partially calcified, though the histological characteristics of the worms were considerably well preserved. Further study of criteria for identification of filarial worms infesting human body should be needed from clinico-parasitological aspect.

## Summary

Two cases with pulmonary dirofilariasis and bancroftian filariasis diagnosed by cross section morphology of worms in pathological specimens were reported and comparison of the histological features of the worms was performed, referring to the literatures.

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## 病理組織切片内虫体の断端所見により診断された肺イヌ糸状虫症と バンクロフト糸状虫の副睾丸内寄生の2例

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第1例: 64歳, 男. 富山市居住. 食道瘤破裂で死亡し, 剖検した. 剖検前には肺所見はなかったが, 左肺尖部に小指頭大の腫瘤をふれ, 病理組織学的検査により肺血管内に栓塞した線虫断面をみとめた. 横切像で大きき径  $330 \times 350 \mu\text{m}$ . 角皮, 筋層の特徴, 角皮最内層の internal cuticular ridges の明らかなことおよび斜従断面の虫体末尾に1対の交接刺(大  $150 \mu\text{m}$ , 小  $79 \mu\text{m}$ )を確認した. 以上よりイヌ糸状虫 (*D. immitis*) の雌幼成虫と同定した.

第2例: 73歳, 男. 富山県八尾町八尾町居住. 右睾丸腫瘍で手術. 右副睾丸に接し径  $3 \times 3 \text{cm}$  の囊腫様腫瘤をみとめ摘出. 囊腫壁は肉芽組織で形成され, その

リンパ管腔内に多数で横断面で大小2群の線虫を認めた. 径  $180 \times 140 \mu\text{m}$  の虫体群は2腔を形成する子宮内に多数のミクロフィラリアが確認された. 径  $100 \times 98 \mu\text{m}$  虫体群では体腔内に睾丸組織と腸管を認めた. 共に角皮は薄く ( $2 \mu\text{m}$ ), 層状構造は明らかでないが, 内層 (inner layer) は側索基底底部において肥厚 ( $5 \mu\text{m}$ ) した. 側索は広く大きく亜分葉 (sublateral band 形成) をなし, 前者の断面群をバンクロフト糸状虫の雌成虫, 後者群を同雄成虫と同定した.

上記イヌ糸状虫とバンクロフト糸状虫の横切像の組織学的特徴を比較し, 文献的考察をなした.

### Explanation of Figures

(Each bar indicates 100  $\mu\text{m}$ )

Figs. 1-5 Sections of lung of Case 1.

Fig. 1 Transverse sections of worm in thrombosed pulmonary artery.

Figs. 2-3 Magnification of the sectioned parasite.

Thick laminated cuticle, polymyarian-type muscle cells, intestine (Int), lateral chord (LC), inner layer of cuticle (ICR) and male reproductive organ (R) in the worm and some unidentified structures (U) in the vicinity of the worm.

Figs. 4-5 Oblique-longitudinal section of posterior end of the worm. Two spicules and possibly postcloacal papilla (P).

Figs. 6-8 Sections of worm in thrombosed lymph canal.

Fig. 6 Transverse sections of partially calcified worm of *Wuchereria bancrofti*.

Fig. 7 High power view of male worm. Thin and smooth cuticle, but showing thickening of its inner layer (ICR) at lateral chord (LC).

Fig. 8 Transverse section of female worm. Paired uteri containing microfilariae (L) and rounded eggs.

