

What's Eating You? Human *Dirofilaria* Infections

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Although more than 40 different species of *Dirofilaria* exist, only a handful are known to cause human disease. Half of all cases of human dirofilariasis present as nodules in subcutaneous tissue. Exposed areas, especially the hands, frequently are involved. *Dirofilaria repens* often is found in the subcutaneous tissue near the eye. Nodules may be accompanied by pruritus, pain, or a sensation of movement under the skin. Symptoms of allergic reaction such as fever, urticaria, and edema also may be present.

Excisional biopsy is required for a definitive diagnosis and is generally curative. Although some authors have recommended systemic antihelminthic therapy, excision usually is all that is required.¹ Rarely, *Dirofilaria* may be associated with parasitic rheumatism, an arthritis refractory to nonsteroidal anti-inflammatory drugs. Parasitic rheumatism responds to either antiparasitic drugs or excision of the organism.²

Pathogenesis

Examples of common *Dirofilaria* and their natural hosts include: *Dirofilaria immitus* (dogs), *D repens* (dogs and cats), *Dirofilaria tenuis* (raccoons and opossums), *Dirofilaria ursi* (bears), *Dirofilaria lutrae* (otters), *Dirofilaria striata* (bobcats), and *Dirofilaria subdermata* (porcupines). *Aedes*, *Anopheles*, and *Culex* mosquitoes have been implicated as vectors



Figure 1. Adult *Dirofilaria*.

of *Dirofilaria*.³ *D ursi* is unique in that it is transmitted from bear to bear and occasionally to humans through a blackfly vector (Genus *Simulium*).⁴

Early pathology of human dirofilariasis is characterized by abscesses with neutrophils and eosinophils. Later pathology often reveals a 1- to 3-cm granulomatous nodule encircled by dense eosinophilic fibrinoid material.⁵ A single adult worm usually is present in the subcutaneous tissue (Figures 1 and 2). In these cases, because reproduction cannot occur, microfilaria are not seen.

Diagnosis

Diagnosis of dirofilariasis typically is made by surgical excision. Complement fixation testing using the *D immitus* antigen will confirm the diagnosis of filariasis but will not make the distinction between the various species of *Dirofilaria*. It should be noted that the antigens of microfilaria from the uteri of adult *Dirofilaria* has proven to be more specific and slightly more sensitive than antigens of the adult nematode.⁶

Distribution

Florida leads the nation in cases of dirofilariasis. Raccoons and opossums are the natural hosts for

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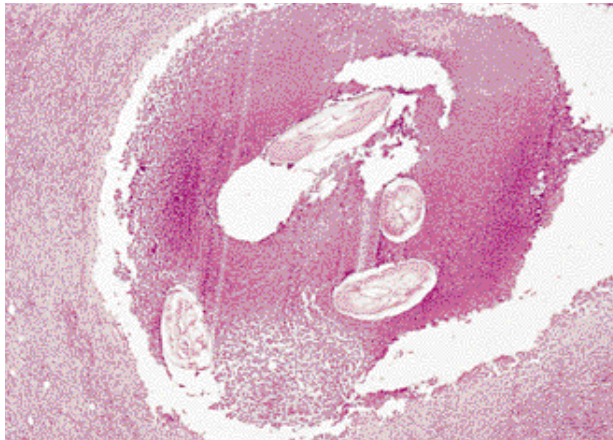


Figure 2. Convoluted *Dirofilaria* in tissue with acute inflammatory response (H&E, original magnification $\times 4$).

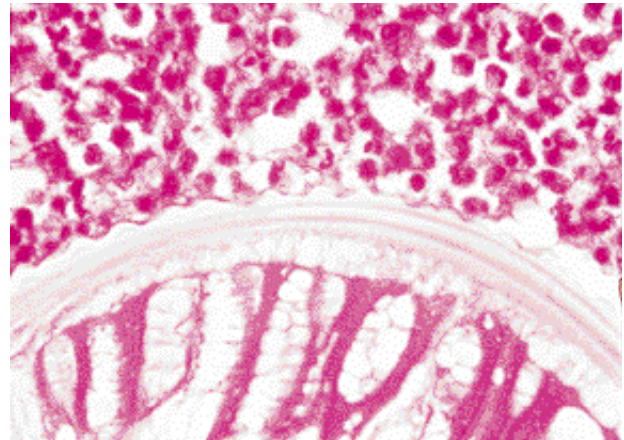


Figure 3. Thick muscular layer is visible beneath the cuticle (H&E, original magnification $\times 20$).

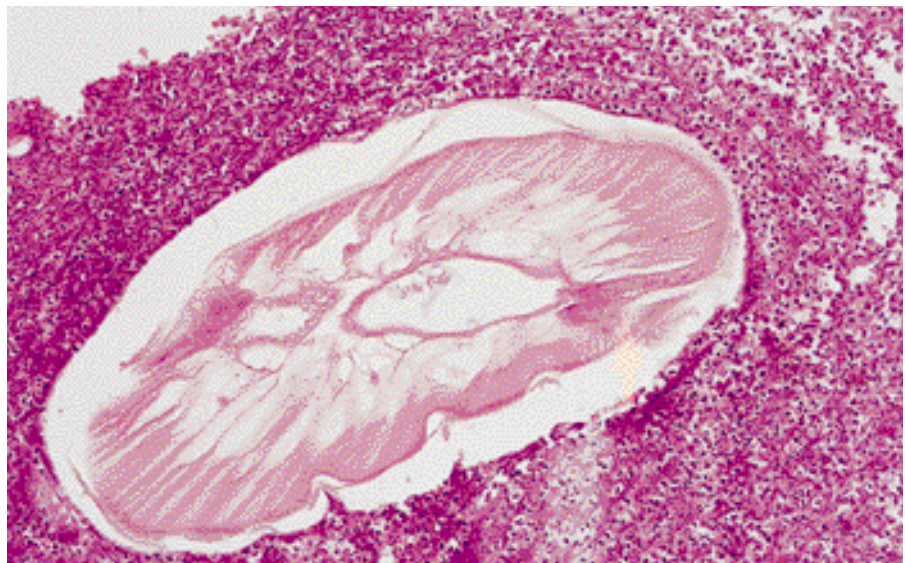


Figure 4. Muscular layer is interrupted on each side by lateral cords (H&E, original magnification $\times 10$).

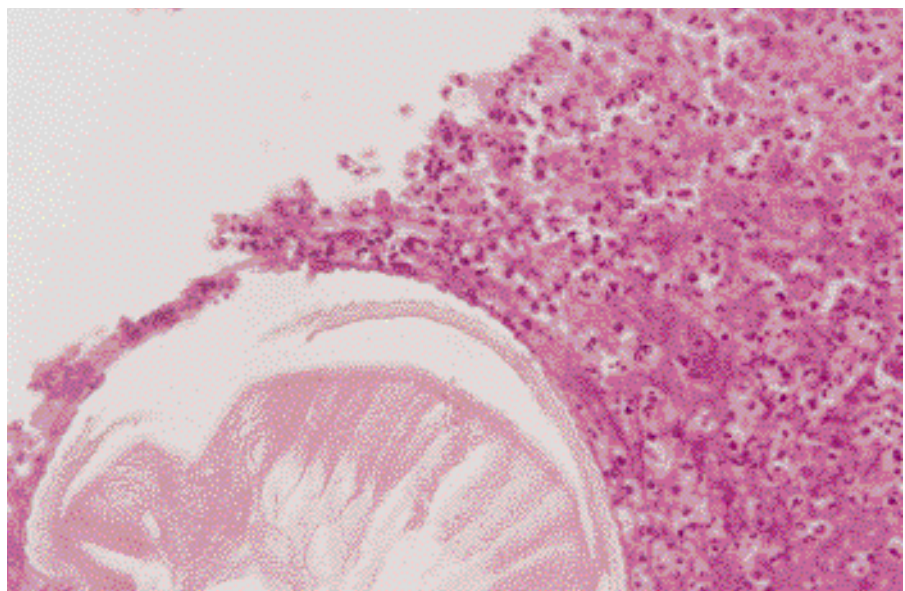


Figure 5. Low, round, closely spaced ridges of *Dirofilaria tenuis* (H&E, original magnification $\times 60$). (Photograph courtesy of the Armed Forces Institute of Pathology.)

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Morphology Differentiating *Dirofilaria* Species*

<i>Dirofilaria</i> Species	Width of Ridges vs Space Between Ridges	Number of Ridges	Ridge Pattern	Width, μm
<i>D tenuis</i>	Ridges wider than spaces between them	M: 60–80 F: 80–115	Branching/ broken	M: 190–260 F: 260–360
<i>D repens</i>	Ridges narrower than spaces between them	95–105 M=F	Sharp	M: 370–450 F: 460–650
<i>D ursi</i>	Spaces are 3–4 \times ridge width	M: 58–62 F: 70–72	Spaced apart	M: often <200 F: 180–200
<i>D immitus</i>	NA (smooth)	NA	Smooth	M: 120–300 F: 120–350

*M indicates male; F, female.

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D tenuis in southern Florida, and the overall infection rate in south Florida raccoons is up to 45%.⁷ *D ursi* is rare in humans and appears to be largely confined to the northwestern and northeastern United States and Canada.

Identifying Features

Members of the genus *Dirofilaria* demonstrate a thick muscularis and a characteristic internal lateral thickening of the cuticle (Figure 3). In *D tenuis*, the cuticle generally is well demonstrated, appearing in cross sections as a 10- μm pointed spine at the level of the lateral cords. The lateral cords are present symmetrically and interrupt the thick circumferential muscular layer under the cuticle (Figure 4). *Dirofilaria* have a multilayered cuticle, with fibers perpendicular to each other and oblique to the long axis of the body (Figure 5). This is most easily demonstrated in the area of the lateral cords.

Twin nongravid uteri and the intestine frequently are prominent in cross section. At the ends of the worm, the uteri form loops, and 4 or more loops may be seen in cross section. This is an indication that the sections represent the end of the worm, where longitudinal ridges are absent. Because the genital structures are attached at only one end, they are easily dislodged from the body during sectioning. Cross sections of the male demonstrate a single genital organ and intestine.

D striata has a smooth cuticle, inconspicuous internal cuticular ridges, and prominent external ala-like lateral cuticular thickenings. *D ursi* is

distinguished by its small size and widely spaced cuticular ridges that form a brushlike pattern. *D tenuis* is characterized by longitudinal ridges that are low, rounded, and spaced close together; *D immitus* lacks ridges. Overall, the female of each species is the more difficult to distinguish based on morphology.⁸ The Table depicts identifying characteristics of the *Dirofilaria* that most commonly affect humans.

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