MINI-REVIEW

Human Dirofilariasis: “An Emerging Zoonosis”

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Abstract

Dirofilariasis is one of the zoonotic filarial infections inadvertently affecting the humans. It is caused by filarial nematodes of genus *Dirofilaria*. There are about 40 recognized species of *Dirofilaria* and at least six of them i.e., *Dirofilaria immitis*, *Dirofilaria repens*, *Dirofilaria striata*, *Dirofilaria tenuis*, *Dirofilaria ursi* and *Dirofilaria spectans* are known to cause accidental infections in humans. The epidemiology of human dirofilariasis is directly correlated to the prevalence of canine dirofilarial infection. *D. repens* is also the main causative agent of subcutaneous dirofilariasis in Asia. Most of the cases reported from India are due to infection with *D. repens*, some of the *D. immitis* and *D. tenuis* infections have also been reported. Mosquitoes belonging to the genera *Aedes*, *Armigeres*, *Culex*, *Anopheles*, and *Mansonia* species are reported to be involved in its transmission. Humans are accidental dead-end hosts of *Dirofilaria*. Dirofilariasis cannot be transmitted from person-to-person. Human dirofilariasis typically manifests as either subcutaneous nodules or as lung parenchyma disease.

Keywords: *Dirofilaria* spp., Zoonotic, Mosquitoes, Dead-end host, Subcutaneous nodules.

1. Introduction

Dirofilariasis is one of the zoonotic filarial infections inadvertently affecting the humans. It is caused by filarial nematodes of genus *Dirofilaria*. Though canines are the principal reservoir host even then it naturally infects several domestic and wild animals. The genus dirofilaria includes various species that are natural parasites of dogs, cats, foxes and other wild animals. There are about 40 recognized species of *Dirofilaria* and at least six of them i.e., *Dirofilaria immitis*, *Dirofilaria repens*, *Dirofilaria striata*, *Dirofilaria tenuis*, *Dirofilaria ursi* and *Dirofilaria spectans* are known to cause accidental infections in humans (Reddy, 2013).

2. History

The first known description of Dirofilaria may have been by Italian nobleman Francesco Birago in 1626 in his Treatise on Hunting. The first documented case of human *Dirofilaria* infection was reported by de Magalhaes in 1887, who reported a subcutaneous infection in a male child from Brazil (Shah, 1999). The first case of human pulmonary dirofilariasis was reported in a child from Rio e Janeiro, Brazil, in 1887 (Siliva et al., 1995). A First Human Case of Ocular Dirofilariosis due to *Dirofilaria repens* in Northeastern France in 1965 (Vizzani et al., 2006). In the united states, first case of subcutaneous dirofilariasis to be reported in 1941 in New Orleans, in which *Dirofilaria* infection was discovered in a female (Shah, 1999).

3. Etiology

Dirofilariasis is caused by zoonotic filarial nematodes. The genus dirofilaria includes various species that are natural parasites of dogs, cats, foxes and other wild animals. Although about 40 different species of dirofilaria are recognized, fewer than 6 are known to cause human infections, which can be found worldwide (Padmaja et al., 2005). *D. Immitis* live in pulmonary artery and the right ventricle of dog while *D. repens* is commonly encountered in the subcutaneous tissues of dogs (Sabu et al., 2005).

4. Epidemiology

The epidemiology of human dirofilariasis is directly correlated to the prevalence of canine dirofilarial infection (Reddy, 2013). *Dirofilaria immitis* infection is found in temperate, tropical, and
subtropical areas of the world (Simon et al., 2009). The infection caused by *D. repens* is the most widely reported dirofilariasis with endemic foci in Eastern and Southern Europe, Asia and Sri Lanka. Italy is known to be one of the worst affected country. *D. repens* is also the main causative agent of subcutaneous dirofilariasis in Asia (Pampiglione et al., 2001). Most of the cases reported from India are due to infection with *D. repens*, some of the *D. immitis* and *D. tenuis* infections have also been reported (Bhat et al., 2003). Though Kerala State in India seems to be the focus for human dirofilariasis, few cases have also been reported from States of Karnataka, Assam and Orissa (Reddy, 2013).

5. Transmission
Mosquitoes belonging to the genera *Aedes, Armigeres, Culex, Anopheles*, and *Mansonia* species are reported to be involved in its transmission (Joseph et al., 2011). Mosquitoes are vectors for this parasite, which take up the microfilaria while feeding the blood of an infected host. Microfilaria develops in the malpighian tubules into the third stage larva and then migrates to the proboscis through the body cavity. The transmission takes place when a potential vector bites the dogs or other hosts including humans during a subsequent blood meal (Sabu et al., 2005). As humans are accidental dead-end hosts of *Dirofilaria* and not the natural hosts, in most of the cases it is thought that the infective larvae injected through mosquito bites perish before attaining maturity. As natural transmittance of dirofilariasis is through microfilariae, which any way does not occur in humans, dirofilariasis cannot be transmitted from person-to-person (Reddy, 2013). The increase in the population of the vectors and the infection of reservoir hosts are directly associated with climatic changes, which in turn influenced in the increase of the incidence of human infections (Simon et al., 2009).

6. Clinical Signs and Symptoms
Human dirofilariasis, therefore, can be categorized into two groups: pulmonary and extra-pulmonary dirofilariasis. Extra-pulmonary dirofilariasis is classified further into four groups: cardiovascular, subcutaneous, visceral, and ophthalmic dirofilariasis (Akao, 2011). Human dirofilariasis typically manifests as either subcutaneous nodules or as lung parenchyma disease. Patients infected with *D. repens* notice a subcutaneous lump in the affected area which most commonly includes; face and conjunctiva of the eye and sometimes chest wall, upper arms, thighs, abdominal wall and male genitalia (Simon et al., 2012). Ocular involvement is usually peri-orbital, orbital, subconjunctival, or subtenon infection (Nath et al., 2010). Human *D. immitis* infection has been associated with the human pulmonary dirofilariasis and is usually asymptomatic. Those with symptoms have cough, chest pain, fever, and pleural effusion (Badhe and Sane, 1989).

7. Diagnosis
Diagnosis is the key point in the management of human dirofilariasis. Surgical removal of the worm and biopsy help in both diagnosis and treatment (Simon et al., 2012). The identification of *Dirofilaria* worm is carried out by studying the fully matured adult worm (Nath et al., 2010). Human dirofilariasis can also be diagnosed by histological finding, imaging technique and laboratory tests like ELISA and PCR technique (Simon et al., 2012).

8. Treatment
Surgical excision of lesion and affected areas is the treatment of choice for patients with dirofilariasis (Sabu et al., 2005). There is no need for chemotherapy as microfilaraemia is extremely rare. In a small number of cases, ivermectin and/or diethylcarbamazine has been tried with good results. The symbiosis of filarial nematodes and intracellular *Wolbachia* bacteria has recently been exploited as a target for antibiotic therapy of filariasis. Antibiotic treatment of filarial nematodes results in sterility and inhibits larval development and adult worm viability (Khurana et al., 2010).

9. Public Health Significance
Human dirofilariasis typically manifests as either subcutaneous nodules or as lung parenchyma disease. People living in houses near the water lodgment where infected mosquitoes are common may have higher risk for exposure. Humans are accidental dead-end hosts of *Dirofilaria* and not the natural hosts. Global demographic changes like increased movement of infected dogs, high vector population density. Person to person transmission is not reported. Lack of awareness amongst people increase the risk of disease.

10. Prevention and Control
Vector control is important in primary prevention. To control the vector population, classical methods such as insecticide and bed nets are widely applied in endemic areas. Dirofilariasis can be prevented by avoiding mosquito bites in areas where mosquitoes may be infected with *Dirofilaria* larvae. The risk of such mosquito bites can be reduced by leaving as little skin exposed as possible, by the use of insect repellent when exposed to mosquitoes, and by sleeping under an insecticide-treated bednet in areas where *Dirofilaria*-infected mosquitoes bite at night and
have access to sleeping areas (Simon et al., 2012). The most effective means of prevention is to reduce the incidence and prevalence of infection in the animal hosts (Shah, 1999).

11. Conclusion
Dirofilaria are a group of arthropod borne filarial nematodes that cause pulmonary and subcutaneous infection in human beings. Dirofilariasis is a zoonotic parasitic disease mainly located in temperate, tropical and subtropical areas of the world. Mosquitoes belonging to the genera Aedes, Armigeres, Culex, and Anopheles species are act as intermediate host in order to complete their life cycle. Domestic and wild canine, feline act as a definitive host while human act as dead- end host. The epidemiology of human dirofilariasis is directly correlated to the prevalence of canine dirofilarial infection. The reasons of this emergence are global warming, changes in vector epidemiology and movements in animal populations. Diagnosis is done with help of laboratory diagnostic methods and clinical diagnostic methods. Surgical care, excision of lesions and affected areas is the treatment of choice for patients with human dirofilariasis. Human dirofilariasis can be controlled by taking proper measures against Vectors, animal reservoirs and by personal protection.

References