Wien, 14. November 2003 / Vienna, 14th November 2003
Klinisches Institut für Hygiene und Medizinische Mikrobiologie
Clinical Institute of Hygiene and Medical Microbiology

HELMINTHOLOGISCHE FACHGESPRÄCHE
HELMINTHOLOGICAL COLLOQUIUM

November 2003

Programme and lectures
(Abstracts)[1]

Herausgeber: Österreichische Gesellschaft für Tropenmedizin und Parasitologie;
Austrian Society of Tropical Medicine and Parasitology
Wien/Vienna 2003
Druck: Naturhistorisches Museum Wien
Redaktion: Herbert Auer
Christoph Hörweg
Heinrich Prosl
Helmut Sattmann

[1] Contributions are arranged according to the programme

Programme

09 00

Opening and Introduction

Horst ASPÖCK

09 20 - 11 00

Presentations

Epidemiology and distribution of *Dirofilaria* and dirofilariosis in Europe

Claudio GENCHI (Milano): Dirofilariosis: state of the art
Sanda DIMITRIJEVIC (Beograd): Dirofilariosis in Serbia
Robert FARKAS (Budapest): Dirofilariosis in Hungary

11 00 - 11 30 coffee break

11 30 - 12 30

Presentations

Epidemiology and distribution of *Dirofilaria* and dirofilariosis in Austria

Heinrich PROSL, Ilse SCHWENDENWEIN & Ursula KOLM (Vienna): Dirofilariosis in dogs and cats
Herbert AUER (Vienna): Human dirofilariosis
Video presentation (BAUER et al., Graz)

12 30 - 13 30 lunch

13 30 - 15 30

Presentations

Diagnosis and epidemiology of dirofilariosis in Central Europe – veterinary and medical aspects

Libuse KOLAROVA (Praha): Dirofilariosis in the Czech Republic
Stefan GEIGER (Munich): Dirofilariosis in Germany and the neighbour countries
Norbert MENCKE (Leverkusen): Dirofilariosis and vector control, comparison between *Leishmania* and *Dirofilaria*

Poster

Günter BISCHOF (Schladming): Überraschende Diagnose einer fraglichen Beinvenenthrombose durch ultraschallgezielte Feinnadelpunktion (Kasuistik)

Discussion and demonstration

Organising Committee:
Helmut SATTMANN (Museum of Natural History Vienna)
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Scientific Committee:
Heinrich PROSL (University of Veterinary Medicine Vienna)
Herbert AUER (University of Vienna)

Programm

09 00

Begrüßung und Einführung

Horst ASPÖCK

09 20 bis 11 00

Vorträge

Epidemiologie und Verbreitung von Dirofilarien und der Dirofilariose in Europa

Claudio GENCHI (Mailand): Dirofilarien und Dirofilariose – Eine Übersicht
Sanda DIMITRIJEVIC (Belgrad): Dirofilariosen in Serbien
Robert FARKAS (Budapest): Dirofilariosen in Ungarn

11 00 bis 11 30 Kaffeepause

11 30 bis 12 30

Vorträge

Vorkommen von Dirofilarien und der Dirofilariose in Österreich

Heinrich PROSL, Ilse SCHWENDENWEIN & Ursula KOLM (Wien): Dirofilariosen bei Hunden und Katzen
Herbert AUER (Wien): Humane Dirofilariose-Fälle
Dirofilaria-Operationsvideo (BRAUN et al., LKH Graz)

12 30 bis 13 30 Mittagessen

13 30 bis 15 30

Vorträge

Diagnostik und Epidemiologie von Dirofilarien in Mitteleuropa aus veterinär- und humanmedizinischer Sicht

Libuse KOLAROVA (Prag): Dirofilariosen in Tschechien
Stefan GEIGER (München): Dirofilariosen in der BRD und in den Nachbarländern
Norbert MENCKE (Leverkusen): Dirofilariose und Vektorkontrolle, ein Vergleich zwischen *Leishmania* und *Dirofilaria*

Poster

Günter BISCHOF (Schladming): Überraschende Diagnose einer fraglichen Beinvenenthrombose durch ultraschallgezielte Feinnadelpunktion (Kasuistik)

Diskussion & Demonstrationen

Tagungsleitung:
Helmut SATTMANN (Naturhistorisches Museum Wien)
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Wissenschaftliche Organisation:
Heinrich PROSL (VMU-Wien) & Herbert AUER (Universität Wien)

Tagungsort:
Klinisches Institut für Hygiene und Medizinische Mikrobiologie
1095 Wien, Kinderspitalgasse 15/ 4.Stock, Kurssaal

Anfahrt öffentlich:
mit U6 bis Station Alser Straße – Ausgang Kinderspitalgasse
oder vom Schottentor kommend (U2,1,2,D) mit Straßenbahn
43 (Station Alser Straße) oder 44 (Station Hernalser Gürtel)

Anfahrt mit dem PKW:
am Hernalser Gürtel entlang, auf Höhe U-Bahn Station Alser Straße in Kinderspitalgasse einbiegen (siehe Stadtplan). Vorsicht: innerhalb des Gürtels (Bezirke 8+9) Kurzparkzone!!! Somit entweder außerhalb des Gürtels (Bezirke 17+18) parken oder evtl. Parkgarage AKH nutzen (Währinger Gürtel 18-20, Kosten 2 € je 2 Stunden!)

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Dirofilariae and dirofilarioses: Introductory remarks

Horst Aspöck

Klinisches Institut für Hygiene und Medizinische Mikriobiologie, Abteilung für Medizinische Parasitologie, Universität Wien;
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Dirofilaria RAILLIET & HENRY 1911, is - besides *Wuchereria*, *Brugia*, *Onchocerca*, *Loa*, *Mansonella*, *Acanthocheilonema*, *Dipetalonema*... - a genus of the family Onchocercidae of the superfamily Filaroidea of the order Spirurida of the class Secernentea of the subphylum Nematoda and the phylum Nematozoa, which may form together with the Arthropoda the superphylum Ecdysozoa. (Other hierarchical structures and taxonomic categories are also considered and discussed, of course.)
Filaroidea play an important role in the history of Parasitology as well as of Tropical Medicine and Medical Entomology: *Wuchereria bancrofti*, the causative agent of filarial elephantiasis, was the first pathogen which was clearly recognized as being transmitted by arthropods, namely mosquitoes; these studies were carried out by Patrick MANSON between 1870 and 1884. The basic life cycle - vertebrate species as definitive hosts, arthropods as intermediate hosts and simultaneously vectors - was later found and confirmed in many other species pathogenic for man and animals.
It is of interest that the transmission is neither linked with a release of the pathogen from the salivary glands nor from the intestine; due to their size the 3rd instar larvae of the filariae must take a different way: they migrate actively through the mouthparts (in particular labium), leave their arthropod host and enter the channel produced by the blood-sucking arthropods thus reaching the blood vessels of the vertebrate.
Four names should be mentioned in particular: Timothy Richards LEWIS (1841-1886), who was the first to describe microfilariae in the blood of a patient; Joseph BANCROFT (1836-1894), who was the first who detected an adult filarial worm in a patient; Patrick MANSON (1844-1922), who clarified the life cycle of Wuchereria bancrofti; and, finally Joseph LEIDY (1823-1891), who described *Filaria immitis* - the oldest known species of that monophylum which represents the genus *Dirofilaria* nowadays.
Six species of *Dirofilaria* are known to cause diseases in man: *D. immitis*, *D. repens*, *D. striata*, *D. tenuis*, *D. ursi*, and *D. spectans*. Only two of them - *D. immitis* and *D. repens* - occur in Europe where they are occasionally but regularly found as being associated with diseases in man. They seem to be particularly frequent in the north of Italy, but have been found in many other parts of Southern Europe also and are sometimes even diagnosed in patients in Central Europe. Their real distribution and especially their northern borders of their distribution have not yet been determined clearly.

Epidemiology and distribution of *Dirofilaria* and dirofilariosis in Europe: state of the art

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Introduction

Several species of filarial worms (Filarioidea) infect dogs and cats in Europe: *Dirofilaria immitis*, *D. (Nochtiella) repens*, *Acanthocheilonema (Dipetalonema) reconditum*, *A. (Dipetalonema) dracunculoides*, and *Cercopithifilaria (*syn. *Dipetalonema) grassi*. The parasites are transmitted by an arthropod, which acts either as an intermediate host and as a vector (Table 1). Both *Dirofilaria* species are transmitted by different genera and species of mosquitoes.
The most prevalent species in dogs and cats are *D. immitis* and *Dirofilaria (Nochtiella) repens*, the last being the etiological agent of canine and feline subcutaneous dirofilariosis. Their distribution often overlaps in many areas, as along the Po River Valley in Italy, which is an endemic area for canine and feline dirofilariosis. From the clinical point of view, *D. immitis*, the causative agent of canine and feline heartworm (HW) disease, is the most important species inducing severe/extremely severe pathological changes in both the hosts. Further, both species are able to infect humans. Generally, pulmonary and subcutaneous nodules harboring immature worms are caused by *D. immitis* and *D. repens*, respectively, though at least one case of adult *D. immitis* in the inferior vena cava of an aged black woman, death "probably as a result of acute toxic nephritis", has been observed [20].

Epidemiology and distribution

Canine and feline HW infection is found mainly in the Southern European countries (Spain, Portugal, France and Greece, with scattered reports from Turkey and the eastern European countries) even though the parasite was also diagnosed in northern France, apparently as a consequence of autochthonous infection (Cherburg area, a few degrees below 50°N latitude) [17]. The largest endemic area in Europe is, however, along the Po River Valley in north Italy, between latitudes 45°N and 47°N. To note that the first observation of the worm in dogs was made in this area by Francesco Birago[5] which published in 1626 a treatise of hunting in which he refers of the presence of the parasite in the right heart of a dog and of another worm (probably *Dioctophyme renale*) from the kidney of the same dog.
Along the Po River valley the prevalence of HW infection is up to 40-80% in dogs and 24% in cats that are not receiving chemoprophylaxis [22, 23], though the distribution of feline infection is less homogeneous. A recent study by Kramer and Genchi [34] in nearly 1000 privately-owned asymptomatic cats has shown that, depending on the geographical area surveyed, positive antibody titers to *D. immitis* are present in 9-27% of cats residing in northern Italy, with male cats and outdoor cats at higher risk. Southern and central Italy show much lower infection rates for *D. immitis*, but is endemic/highly endemic for *D. repens* [13] and it has been suggested that infection by *D. repens* might play a protective role against infection with *D.immitis*.[25] Several surveys conducted in the northern provinces of Piedmont, Lombardy and Friuli-Venezia Giulia show that previously disease free-areas are now endemic [48], confirming the northward spread of infection. Further, very recent data suggest that heartworm has in these last years spread also toward southern areas of the Peninsula and the infection has to be considered endemic in some regions of central Italy along the coast of Adriatic sea and in Umbria (prevalence 5-13% in owned dogs) (Valentini and Genchi, 2003, unpublished data).

The distribution of heartworm infection in Spain is patchy.[43] The highest rates for *D. immitis* infection in dogs are found in the southern provinces of Huelva (36.7%), Cadiz (12.0%) and Badajoz (8.0%). The Canary Islands of Tenerife (20.0%) and Las Palmas (36.0%) are also endemic[29] and a more recent report by Montoya et al.[40] estimate that *D.immitis* infects 58.9% of dogs on Gran Canaria Island. *A. (Dipetalonema) dranculoides* and *A. (Dipetalonema) reconditum* are also found in these areas, but at a somewhat lower rate, with the latter being present also in the northern part of the country.[43] The most recent survey, carried out in the Baix Llobregat area of Barcellona[1] has shown 12.8 % of dogs positive for *D.immitis*, 3.7% for *A.* (*Dipetalonema) reconditum* and 2.7% for *A.* (*Dipetalonema) dranculoides*. Moreover, other surveys indicate that *D. immitis* is spreading into some northern provinces. Guerrero et al.[30] report that in the region of Cataluna, the prevalence of *D. immitis* infection in dogs has increased from 0.38% in 1989 to just over 5% in 1995. Recently, high prevalence for *D. repens* (37-85%) was found in south of Spain by Cancrini et al. [9]

In France the infection is found mainly along the Mediterranean coast and positive dogs have been found predominantly in Bouches du Rhone, Vancluse and Corse Island, and to a lesser extent, in Haute-Garonne and Dordogne.[29] Microfilariae of *D. immitis* were identified in the urine, but not in the blood, of a cat in Sommieres, France. The cat also showed radiographic evidence of *D. immitis* infection.[4]

Araujo[2], in an epidemiological survey, reported that canine heartworm infection is prevalent in several southern regions of Portugal, including Ribatejo (16.7%), Alentejo (16.5%) and Algarve (12%). The Island of Madeira has the highest prevalence with 30% of the dogs tested being positive for *D. immitis* microfilariemia.

The prevalence of filarial infection in dogs in Greece range from 10%, 30% and 8% for *D. immitis*, *D. repens* and *Acanthocheilonema reconditum*, respectively, found in 1987-1991[45] to 34%, 33% and 4% for the same parasites, respectively, found in 1999 in dogs from Macedonia region.[21] However, very low prevalence (*D. immitis* 0.7%, *D. repens* 0.4%) was found recently in Attiki region, showing a strong influence of environment on the spreading of the infection.[16]
Even though little data is available from literature, prevalence of heartworm infection in dogs ranges from 2-17% in Slovenia, Bulgaria, Turkey,[7, 18, 26, 41] and up to 65% in Romania.[42]

An increasing number of cases are being diagnosed in northern European countries (Switzerland, Austria, Germany, U K, the Netherlands, Sweden, Hungary) in dogs which were imported from or had spent time in the Mediterranean area, North and South America, or in Middle and Far East.[3, 6, 10, 14, 15, 27, 31, 36, 37, 49, 54, 55, 56]
Meyer et al[39] reported that during 1992-1993, seven cases of canine dirofilariosis were diagnosed in the Netherlands, nearly equal to the number in the preceding 10 years. Furthermore, in a relatively short period of time (June 1993 to May 1996), Zahler et al.[57] diagnosed imported filarial infections in 80 dogs in Germany, 90% of which were due to *D. immitis*.
The spreading of the HW infection in south of Switzerland is a good example of the "new" epidemiological trend of the arthropod-borne infections, such as dirofilariosis, leishmaniosis, ehrichiosis, and babesiosis. In 1995, 4 dogs out of 371 stray and unwanted dogs were found positive for HW infection in southern Switzerland (canton Tessin)[15] and at least one imported dog was treated for HW disease.[3] In 1998, Bucklar et al.[8] have reported both *D. immitis* and *D. repens* in 0.6% and 1.6% respectively of 479 Swiss dogs examined. One of these dogs may have acquired the infection in the Canton Tessin, suggesting an autochthonous cycle. These observations have been confirmed by Genchi et al.[25] in dogs who had never left their resident areas (mainly watchdogs kept in courtyards) in southern Switzerland. Diagnosis was performed by haematology and serology, and worms were visualized by echocardiography. In 2001, the presence of both *D. immitis* and *D. repens* in dogs in south of Switzerland was again surveyed by Petruschke at al.[46] The observed prevalence was 6%.
Finally, it is to note that the number of occult infections has increased significantly in the last decade in some endemic areas such as northern Italy (up to 50% of infected dogs). As a consequence, when HW infection is suspected, both circulating microfilariae (Knott test) and antigen tests have to be performed by the clinician in dogs. About feline infections, very often the microfilaremia is absent and, generally, microfilarie are more frequently observed in *D. repens* than in *D. immitis* infections. If feline HW infection is suspected and microfilariae are absent, the first test to be performed is an antibody test. If the result is positive, it is necessary to perform an antigen test. A positive result is the definite prove of the presence of the parasite. If the test is negative, to confirm the clinical suspicion it is necessary to perform thoracic radiographs, or better, echocardiography that allows the direct visualization of the parasites.

The changing distribution of canine and feline dirofilariosis

Despite the improvement of the diagnostic tests and the increased number of preventive drugs (ivermectin, milbemycin oxime, moxidectin, selamectin), *Dirofilaria* has continued to expand its geographical range during the past decades. In Italy, the infection is spreading from hyperendemic areas of the Po River Valley and the endemic area has now extended to the border of the morenic valleys of the Alpine region and to some central regions of the peninsula. Furthermore, the diagnosis of the infection in resident dogs in the south of Switzerland confirm the presence of an autochthonous life cycle of *D. immitis* in areas beyond the Alpine border and the spread of the parasite from the southern to the northern regions. There are several factors that may influence the spread of *Dirofilaria* including environmental conditions, density of the vector population and the presence of the definitive host that is able to act as a reservoir. The presence and the movement of a microfilaraemic reservoir (mainly dogs, in cats the microfilaremia is low/very low and transient), which can introduce the infection in naive areas, and the increasing number of dogs and cats in endemic areas are both important factors for the spread of the infection**.** It must not be ruled out, however, that other wild canids may play a role as

potential reservoirs. A recent survey from Australia has reported that *D. immitis* infection was detected in 6.4% of the red fox population surrounding Sydney, suggesting the potential for a sylvatic cycle of canine heartworm in this area.[38] *D. immitis* infection has also been shown in coyotes and a recent survey in California estimates prevalence of infection at 19.4%.[51] In Spain, in the Ebro Valley, 13% and 1.7% of foxes captured from irrigated habitat and from semiarid habitat, respectively, were found HW infected by Gortázar et al.[28], while Segovia et al.[52] reported a prevalence of 2.1% in wolves. Nevertheless, in a recent survey carried out in foxes shot in Po River Valley (more than 250 heads), the prevalence was less than 0.5% (Genchi, 2003, unpublished data).

The most important factors, however, are the general climatic trend which is strongly influenced by the global warming and tends to extend the transmission season and to maintain a high incidence of the infection and the abundance of mosquitoes, particularly species which are able to transmit infective larvae, yet are resistant to damage by larvae as they migrate through the insect's body.[24, 25, 32] Laboratory studies on the susceptibility/ resistance of different mosquitoes to harbor microfilarial infection have shown that species from the genera *Aedes* and *Anopheles* are susceptible to infection by *Dirofilaria* following a blood meal, whereas mosquitoes belonging to the genus *Culex (Cx. pipiens)* are relatively resistant to the infection due to damage of the microfilariae as they pass through sharp teeth present on the mouthparts. It has also been shown that blood meals containing large numbers of microfilariae can seriously damage susceptible mosquitos. *Cx. pipiens* would appear to be a more efficient vector in endemic/ hyperendemic areas where microfilariemia is very high (in some areas of Northern Italy, infected dogs can have from 1,000 to 50,000 mf/ml). In fact, this species suffers only minimal damage from migrating larvae, as it destroys most of them during feeding, and is able to competently transmit the infection. In a study by Genchi et al,[24] mosquitoes were collected from bait-captures on a dog and a cat in a hyperendemic area of Italy (Po River Valley). *Culex pipiens* and *Aedes caspius* were the most frequently found engorged mosquitoes from both hosts, representing the two species most likely to be vectors of heartworm disease in this area. *Aedes* can be considered a very competent vector, but non-resistant where blood meals with a high number of microfilariae from infected animals can affect the mosquito's activity. *Culex*, on the other hand, seems to be a "minor" vector but a fully competent one that is able to transmit the infection to a new host, even if it carries a smaller larval burden. This synergistic activity of the two vectors would seem to guarantee the transmission of *D. immitis* in varying epidemiological situations. Moreover, *Culex* is able to adapt to widely differing environmental conditions, including the continuous urbanization of the landscape and the increase in polluted habitats, making this vector an important factor in the spread of heartworm infection.
The general climatic trend which has extended the risk season for infection is particularly important in evaluating the correct timing for chemoprophylaxis, which must ensure protection from infection during the entire risk season. In a recent study, Genchi et al[25] calculated the period of heartworm transmission in northern Italy/Canton Tessin (southern Switzerland) on the basis of the Fortin/Slocombe model, modified as suggested by Knight and Lok,[23] and developed a model for the expected number of mosquito generations per year. Based on this study, the authors conclude that effective chemoprophylaxis could be achieved with a monthly dose of preventive from the end of May/June until November in endemic/hyperendemic areas on north Italy, while in southern Switzerland, treatments should start in July and last until October.

Human dirofilariosis

The retrospective study of previously published human cases can be of great value, since it presents the emergent part of the *Dirofilaria* infections. Nevertheless, from the epidemiological point of view it can offer a partial image. More than 210 cases have been published in the literature most of them attributed to *D. repens* and only 10 caused by *D. immitis*. The country where most cases have been diagnosed is Italy (70%), followed by France (17%), Greece (9%) and Spain (15%). Women are more affected than men. The distribution by ages shows a much higher incidence of cases from 40 years onwards in both sexes and for both the parasites.[44] In France, autochthonous human *D. repens* infection have been reported from Sologne, where enzootic canine dirofilariosis is present, and one case has been reported from Ballon d'Alsace, above latitude 46° N.[48] A number of cases have been diagnosed in northern countries of Europe, but they have been attributed to infections acquired in countries of the southern E.U. Further, each year new cases are diagnosed both in endemic countries and in persons traveling or staying for holidays in risk areas.
Seroepidemiological studies made in an endemic area of Western Spain with a canine prevalence of 33% have shown that the 20.9% of the human population develop antibodies anti-*D. immitis* of different isotypes.[19, 53] This fact indicate that the contact of humans with these parasites is more frequent than it is shown by the number of clinical cases published, and that most individuals do not develop symptoms.
From a clinical point of view, pulmonary dirofilariosis is seriously underdiagnosed. Apart from the classical presentation of solitary pulmonary nodules, it has shown that transitory pulmonary nodules can be a frequent manifestation of the disease.[11] Moreover, we have defined dirofilariosis as a new cause of small calcified

pulmonary nodules.12 These facts stress that as long as this infection is not considered in the differential diagnosis of solitary pulmonary nodules and small calcified granulomas, the etiological diagnosis can frequently go unobserved. In a two year case finding study conducted in western Spain we have found 8 cases of pulmonary dirofilariosis (5 already published and 3 unpublished) among a population of approximately 50,000 where global seroprevalence is 20,9%. This incidence of 4/100,000/year is a clear datum that the parasitosis is underdiagnosed simply because its presence is not generally considered by clinicians.
Further, Langer et al.[35] have suggested that in case of unclassifiable mono- and oligoartheritis, reactive arthritis due to D. *immitis* should be considered in the spectrum of the differential diagnosis.

Table 1. Dirofilaria species of dogs and cats in Europe

Species	Intermediate host	Prepatent period	Micro-filariae	Adults	Localization of adult worms
Dirofilaria immitis	Culicidae	-180 days	290-330 µm	3.5-11 cm	Pulmonary arteries/ right heart
Dirofilaria (*Nochtiella*) *repens*	Culicidae	-259 days	320-370 µm	5-7 cm	Subcutaneous tissue/ muscular fasciae
Acanthocheilonema (syn. *Dipetalonema*) *reconditum*	Fleas and ticks	-476 days	269-283 µm	7-10 mm	Subcutaneous tissue/ muscular fasciae
Cercopithifilaria (syn. *Acanthocheilonema*) *grassi*	Ticks (*R. sanguineus*)		~ 570 µm		Fat tissue/kidney
Acanthocheilonema dracunculoides	Flies (?)		195-230 µm	24-30 mm	Peritoneal cavity

Table 2. Comparison of *D. immitis* prevalence in chemoprophylactically untreated dogs observed in repeated surveys in Italy (1968-1998).

Region	Prevalence	Author(s)
Piedmont	6%	Balbo and Panichi, 1968
	22%	Rossi et al., 1993
Lombardy	10.3%	Locatelli, 1971
	48%	Genchi et al., 2000
Tuscany	4.2%	Marconcini et al., 1976
	28.3%	Magi et al., 1989
Emilia Romagna	29.5%	Canestri-Trotti et al., 1986
	64%	Poglayen et al., 1988
Umbria	0	Genchi et al., 1998
	5-130%	Valentini and Genchi, 2003
Veneto and Venezia Giulia	18%	Piccoli 1980-81
	55%	Poglayen et al., 1996
	12.5-68%	Pietrobelli et al., 1998
Sardinia	0	Arru et al., 1968
	2.2%	Tarantini et al., 1982
	3.2%	Garippa et al., 1993
	12%	Scala et al., 2003

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Prevalence of dog Filariosis in some parts of Vojvodina

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In dogs, 5 species of filariae have been described in Europe, *Dirofilaria repens, Dirofilaria immitis* (the species with the highest clinical significance), *Dipetalonema reconditum*, *Dipetalonema grassii,* and *Dipetalonema dracunculoides.* The prevalence of the different species was determined for the province of Vojvodina (Zrenjanin, Novi Sad, Sombor, Kikinda and Pan_evo), Serbia. All dogs from Zrenjanin, Novi Sad, Sombor i Kikinda, were maintained under controlled conditions (housing, food, daily care, training, health care and veterinary sanitary measures). In Pan_evo we tested a heterogeneous group of dogs not under controlled conditions and stray dogs. Identification and determination was performed on the bases of morphological and morphometric characteristics of microfilaria in the Knott test; furthermore, 150 animals were examined using the DIFIL test.

Among 238 tested dogs (154 males and 84 females; age range: 1-11 years) we found microfilaria in peripheral blood in 47.9 % of the animals. 46. 6 % were infected with *D. repens*, 5.9 % with *D. immitis*, 1.7 % with *Dip. reconditum*. *Dip. grassii* and *Dip. dracunculoides* were not found.

Dirofilariosis is highly prevalent in the area investigated, however *D. immitis* only represent a minority of cases. The differentiation between *D. immitis* and *D. repens/Dip. reconditum* must be made in order to evaluate the clinical significance of the infection.

Dirofilariosis in Hungary

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Abstract
It is known from the literature that 27 species *of Dirofilaria* genus can infect more than a hundred species of mammals. *D. immitis* and *D. repens* are of veterinary importance from these mosquito-borne parasite species, which can also accidentally infect humans. In recent decades increasing number of human cases has been reported worldwide, therefore nowadays dirofilariosis is classified as an emerging zoonosis.

The occurrence of the heartworm disease in Hungary has been reported only in two papers. It has been diagnosed in three dogs. All these animals lived in the USA before taking them to Hungary. Although neither autochthonous infection of animals with *D. immitis* nor infected humans been detected in the country so far, these cases demonstrate the hazard of introduction the disease with infected animals from endemic countries.

Cutaneous dirofilariosis caused by *D. repens* seems to be more important zoonotic disease in Hungary than it was thought earlier. Some human filarioses were reported between 1880 and 1951 but the parasites were not identified properly in these cases. So far nine persons infected with *D. repens* have been detected based on the histopathological and parasitological examinations of the nodules extracted from the patients. Some of them might acquire the infection in Italy as tourists but most of the cases were indigenous because they had not been abroad. Only two papers have been published about dirofilariosis of the local dogs caused by *D. repens*. These authochton cases were detected in three dogs in 1998 when the parasites were found in the nodules located in subcutaneous tissues. Nine dogs were found to harbour microfilariae when the blood samples of 101 animals were tested with modified Knott's method. Cutaneous dirofilariosis has been detected in dogs sporadically because *D. repens* causes only slight cutaneous lesions in dogs which may be even unobserved due to the lack of symptoms.

In conclusion, these results demonstrate that *D. repens* appears to be in Hungary for many decades as indigenous parasite species. Veterinarians should take it into account because animals, mainly dogs are the reservoir for this parasitic infection. Therefore, it is vital to inform and educate vets and dog-owners about dirofilariosis. Further research is needed to shed light on the epidemiology of dirofilariosis and to identity of the mosquito vectors.

Dirofilariosis in Austria

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Abstract
To date in Austria *Dirofilaria* has not been described to be endemic. Among the samples collected at the I. Medical Clinic or submitted to the Central Laboratory (a total of 35,000 canine patients between 1999 and 2003) 87 were submitted for diagnosis of dirofilariosis. In 84 cases a Knott test was performed, 27 samples were subjected to a Canine Heartworm Antigen Test™ (Idexx). All patients were imported from the Mediterranean. The test was requested as part of the examination for imported infectious agents. The Knott test detected 3 positive samples (11 %), while the antigen test found 7 (8.3 %) of the samples to be positive. The positive samples were derived from 5 different patients, 4 with *D. immitis* and 1 with *D. repens*. Possibilities and limitations of the various diagnostic means and meta- and prophylactic measures for travelling dogs are discussed.

Cases of human dirofilariosis in Austria

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Abstract
Although *Dirofilaria repens* and *D. immitis*, the causative organisms of subcutaneous and pulmonary dirofilariosis, respectively, do not occur in Austria autochthonously, several human *Dirofilaria* cases could be observed in our country during the last two decades. In total 14 patients suffering from subcutaneous dirofilariosis could be registered between 1981 and 2003. In addition, 20 serologically positive patients with clinical symptoms and/or geographic anamnesis associated with subcutaneous and pulmonary dirofilariosis have been observed. In order to improve diagnostic tools a PCR for the detection of specific DNA of *D. repens* and *D. immitis* has been established recently.

Dirofilariosis in the Czech Republic

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Abstract

Diagnosis of Dirofilaria species at the Institute for Comparative Tropical Medicine and Parasitology, Munich, Germany

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Abstract

The detection methods for *Dirofilaria immitis* infections in dogs commonly used at our institute are the modified Knott test for the concentration and detection of microfilariae in the peripheral blood, a DiroCHEK® ELISA for the detection of circulating antigens from adult worms and the acidic phosphatase staining of fresh blood smears for the differentiation of microfilariae from *D. immitis*, *D. repens* and *Dipetalonema* species.

During January 2002 to October 2003 a total of 1344 dogs were examined parasitologically and serologically for an infection with the heartworm *D. immitis*. A number of 201 dogs (15 %) were tested positive by modified Knott test and/or circulating antigen ELISA. Additionally, 2.5 % (n=34) of the dogs examined had borderline values in serology. 58.2 % (n=117) of the animals were tested positive in the Knott test, 18.9 % (n=38) were positive in antigen ELISA, and 22.9 % (n=46) were tested positive in both examinations. The majority of positive dogs (58 %) came from animal homes from the Canarian Islands, namely from Teneriffe. Due to incomplete information from veterinarians and pet owners, only marginal conclusions can be drawn from sex, race and age of infected dogs. However, elevated numbers of infected dogs were diagnosed in the range between 1 to 5 years of age.

Dirofilaria and Vector Control: Comparison between Dirofilaria and Leishmania Infection in Dogs

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Abstract

Infection of dogs with the nematode *Dirofilaria immitis* leads to a disease known as canine dirofilariasis or canine heartworm disease. The nematode is transmitted by mosquitoes of the *Aedes*, *Culex* and *Anopheles* genera in endemic areas within North and South America, Japan, Australasia, parts of Africa and around the Mediterranean basin. For prevention of dogs against the infection with *D. immitis*, chemoprophylaxis using macrocyclic lactones is available in a variety of galenic formulations.

In this paper, the use of ectoparasiticides with repellent properties to prevent mosquito bites and their role in heartworm prophylaxis is discussed. The discrepancy of prophylaxis between canine heartworm disease and canine leishmaniasis is highlighted.

Using chemoprophylaxis, heartworm disease in dogs is entirely preventable despite their high susceptibility. The most commonly used heartworm chemoprophylactics are the macrocyclic lactones (ivermectin, milbemycin oxime, moxidectin and selamectin). Compounds of this chemical group, applied regularly during the mosquito season are capable to protect dogs completely. Thus it can be concluded that the use of chemoprophylaxis is a priority and regarded as 'Good Veterinary Practice' in dogs within endemic areas, or those travelling to endemic areas.

In contrast, chemoprophylaxis or a vaccine effective against the infective stages of the protozoan parasite *Leishmania infantum* in the Mediterranean or *L. chagasi* in South America does not exist. *L. infantum* causing leishmaniasis is a zoonosis with dogs as main reservoir. Prophylaxis of dogs may therefore be important in reduction of human cases. Leishmaniasis is transmitted to dogs by sand flies of the *Phlebotomus* genera around the Mediterranean or *Lutzomyia* in South America. Protection of dogs within endemic areas or travelling to endemic areas from sand fly bites, can only be achieved by implementation of protective measures. These include prevention of sand fly bites by exposition prophylaxis, the use of residual insecticides within the environment or the application of an insecticide with a repellent property directly to dogs. The only chemical class of insecticides with a proven repellent effect are the pyrethroids, e.g. permethrin or deltamethrin. Protection of any ectoparasiticide may not be compared with the complete protection delivered by macrocyclic lactones in dirofilaria prophylaxis.

In addition to prophylaxis of these two serious diseases in dogs, it can not be neglected that ectoparasites like fleas and ticks are the most common ectoparasites infesting dogs worldwide. Fleas and especially ticks are known causing vector-borne diseases by transmission of viruses, bacteria or helminths.

We therefore conclude that the use of chemoprophylaxis in prevention of dirofilariasis is a prerequisite for all dogs within endemic areas. As well as the use of insecticides with repellent properties to reduce the risk of leishmaniasis. Furthermore the concomitant use of chemoprophylaxis and ectoparasiticides for therapy and prevention of flea, tick, mosquito and sand fly infestation is recommended.

Überraschende Diagnose einer fraglichen Beinvenenthrombose durch ultraschallgezielte Feinnadelpunktion (Kasuistik)

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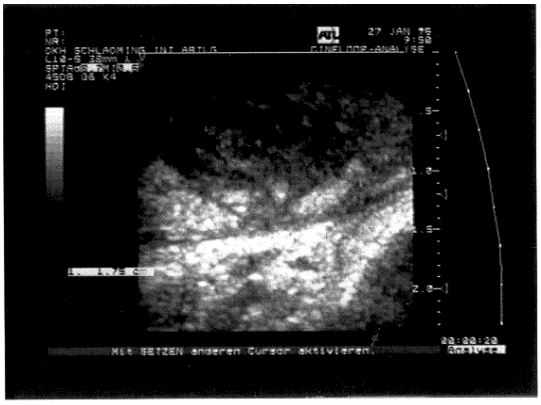
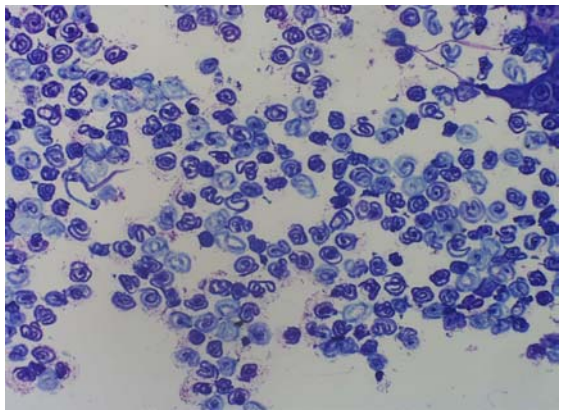
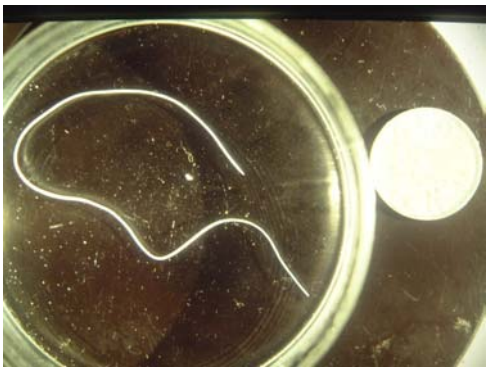
FRAGESTELLUNG: Verd. auf Beinvenenthrombose, lokal Schmerz, diskrete Rötung, Schwellung, geringes Trauma vor 4 Wochen



SONOGRAPHIE, linker Unterschenkel, 20 x 6 mm große, subcutane, inhomogene Läsion, gut gegen Umgebung abgegrenzt



FEINNADELPUNKTION / CYTOLOGIE
Unzählige parasitäre Strukturen, Mikrofilarien von *Dirofilaria repens*



MAKROFILARIE (von Op)

Schlussfolgerung: die ultraschallgezielte, zytologische Feinnadelpunktion zur Diagnostik von Knotenbildungen jeglicher Art sollte als einfache, schnelle, kostensparende Methode mit hoher Aussagekraft viel häufiger Anwendung finden .

NOTIZEN/NOTES