Infections of concern in imported dogs?

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Infections of concern?

- Brucellosis
- **Canine heartworm**
- Canine influenza
- Canine lungworm
- *Echinococcus multilocularis*

- **Leishmaniasis**
- Rabies
- Screwworm
- Tick-borne diseases

(Canine Importation working Group 2016)
Heartworm

1. A mosquito bites an infected animal, ingesting heartworm microfilariae

2. Microfilariae mature into heartworm larvae inside mosquito (10-14 days)

3. Infected mosquito bites a dog, transmitting the larvae

4. Larvae enter the dog's bloodstream, migrate to the heart and lungs, grow to a foot long and become sexually mature (6-7 months)

5. Adult heartworms can live within the heart and lungs for 5-7 years

Treatment: 3 doses of melarsomine (Immiticide)

(American Heartworm Society 2009)
Heartworm risk in USA

Heartworm Incidence Map

The severity of heartworm incidence as shown in this map is based on the average number of cases per reporting clinic. Some remote regions of the United States lack veterinary clinics, therefore we have no reported cases from these areas.
Heartworm risk in USA

Animals originating from Gulf Coast area in 4 months following Hurricane Katrina:
- 195/400 (48.8%) dogs = heartworm antigen positive
- 4/50 (8.0%) cats = heartworm antigen positive

(Levy et al 2011)
Impact of hurricane Katrina dogs in Canada?

- What has been the impact of “Katrina” dogs in Ontario?
- Tested for heartworm in Louisiana immediately prior to departure for Canada:
  - If test negative, sold as heartworm negative
  - If test positive, often treated with one dose of melarsomine and being sold as negative.
- Some owners refusing to pay for adulticide treatment
- Still being imported into Canada?
Importation of drug-resistant heartworm infections?

- Anecdotal evidence from Mississippi River Valley area, USA (Hampshire, 2005).

- First published case of macrocyclic lactone resistance in *Dirofilaria immitis* in North America:
  - Labrador cross dog in Welland, Ontario – first seen in June 2008
  - Transferred to Canada for adoption in January 2008 by Boudreaux Rescue crew, New Orleans

(Bourguinat et al 2011)
Leishmaniasis?
Has dog lived in a *Leishmania*-endemic area within the last 7 years?

- Clinical signs develop 3 months to 7 years after infection -

www.straysofgreece.org
**Leishmania** life cycle

Sandfly

- Promastigotes in gut

- Amastigotes in macrophages

Greene 2012

[www.medicinenet.com/leishmaniasis/article.htm](http://www.medicinenet.com/leishmaniasis/article.htm)
Leishmania species

Primarily transmitted by sandflies:
- *Phlebotomus* species  – outside Americas
- *Lutzomyia* species  – throughout Americas

*Leishmania infantum*:
- typical species found in dogs & zoonotic
- dogs = main reservoir for visceral leishmaniasis in people:
  - Mediterranean basin
  - Middle East
  - South America
Leishmania infantum in dogs

- Infection prevalence = 70-90% in highly endemic foci:
  - Much of Greece
  - Marseille, France
  - Naples area, Italy
- Most infected dogs remain subclinical carriers for life, i.e. do not develop disease.
- Dogs with or without clinical signs and seropositive are infective to sandflies.
Skin lesions – rarely pruritic

(i) exfoliative dermatitis and alopecia (81-89%)
Skin lesions

(ii) mucocutaneous ulceration
Ocular lesions
- uveitis and conjunctivitis (16-81%)
Weight loss and muscle atrophy (64%)
Therapy for canine leishmaniasis

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage (mg/kg)</th>
<th>Route</th>
<th>Interval (hours)</th>
<th>Duration (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meglumine antimoniate</td>
<td>75-100</td>
<td>SC</td>
<td>24</td>
<td>4-8</td>
</tr>
<tr>
<td>Allopurinol</td>
<td>10</td>
<td>PO</td>
<td>12</td>
<td>At least 6-12 months</td>
</tr>
</tbody>
</table>

- rarely are *Leishmania* parasites completely eliminated
- relapses requiring re-treatment are common
Public health concerns in Canada

- *L. infantum* → visceral leishmaniasis in people
- Dogs are main reservoir for *L. infantum* in much of world
- Sizeable wild canid populations across Canada
- 14 *Lutzomyia* species recorded in North America:
  - most common = *L. shannoni* (Delaware – Louisiana)
  - New York State = *L. vexator*

*L. diabolica* distribution, model 2, 2080

Gonzalez et al 2010
Importation of dogs from countries endemic for *Leishmania*?

- Dogs should be tested prior to departure for Canada.
- Dogs that test positive should not be imported.
- Dogs that test negative prior to importation – after arrival in Canada should be tested for at least 2 years:
  - Quantitative serology (ELISA, IFAT) after 4 months, 1 year, 2 years.
  - Nested PCR (ideally of kDNA) after 1 year and 2 years:
    - Ideally on bone marrow or spleen
    - Realistically = blood