

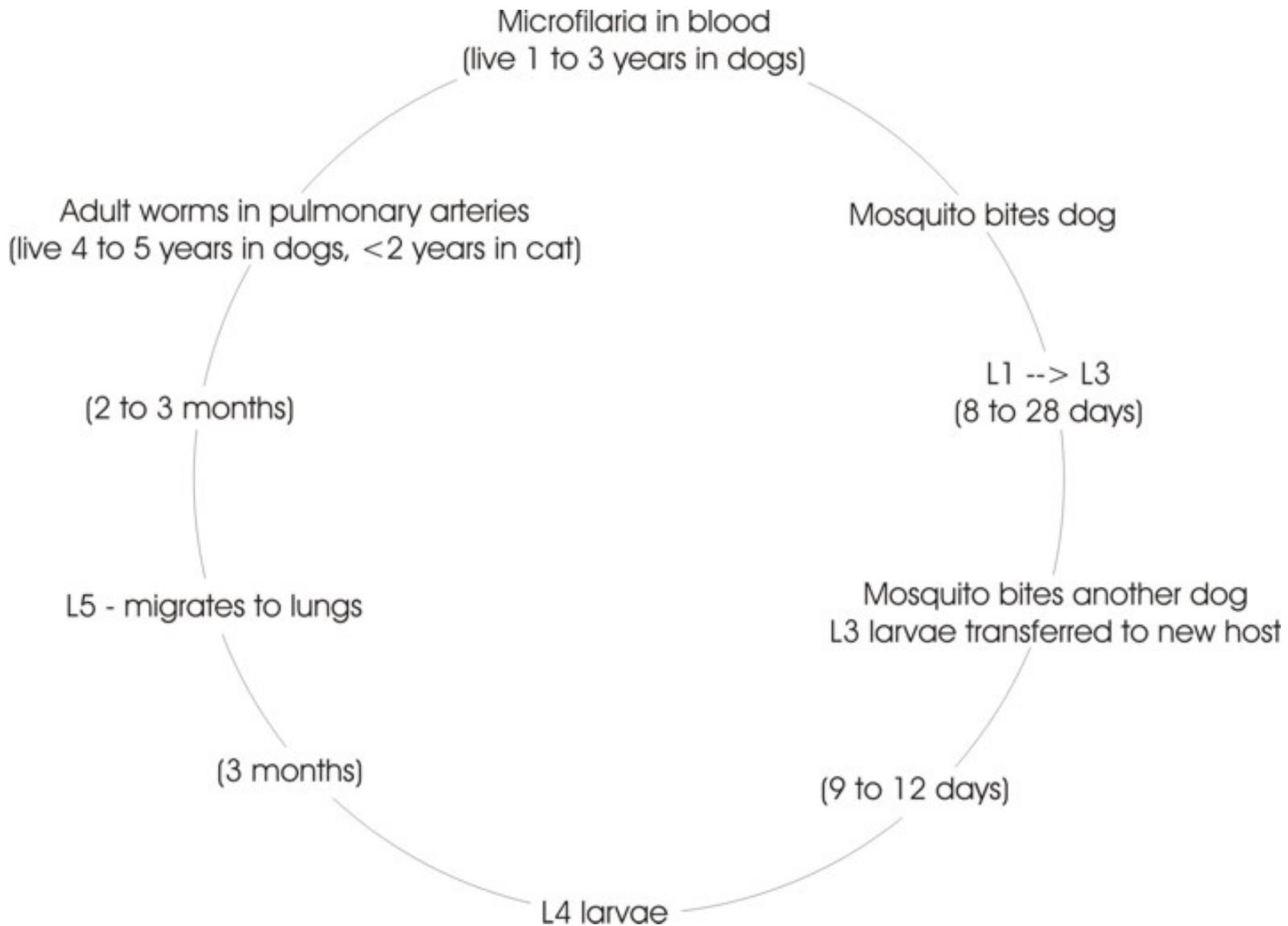
## Heartworm Disease

### I. Infection Rate

Approximately 250,000 dogs *diagnosed* with heartworm disease per year (actual number infected is higher).

Rate of infection in cats is lower - estimated to be 10% the rate in dogs. Both indoor and outdoor cats are infected.

### II. Heartworm life cycle



### III. Why is cat infected at lower rate?

A. Mosquito prefer to bite dogs

B. Due to cat's immune response, fewer of L3 mature to adult worms

Avg # of worms: dog - 15 worms, cat - 1 to 3 worms

C. Due to cat's immune response they have fewer circulating microfilaria

Avg % having circulating microfilaria: dog - 60%, cat <10%

#### IV. Clinical Signs

##### A. Dogs

1. often none at time of diagnosis
2. can see exercise intolerance
3. dyspnea
4. coughing
5. right-sided heart failure

##### B. Cats

1. vomiting
2. asthma-like signs
3. acute respiratory distress and sudden death

##### C. Pathophysiology (What is happening?)

1. Presence of adult worms stimulates constriction of pulmonary (lung) arteries, proliferation of the muscular wall of the arteries, as well as inflammation and thickening of the vessel linings. All of these changes lead to increase resistance to blood flow in the lungs. The worms also cause inflammatory cells to move into the lungs and change the clotting parameters within the lung.

2. The host's (dog's or cat's) reaction to the worm is more important than the number of worms in determining the extent of clinical signs.

- a. Inflammation is a function of the immune system
- b. Inflammation is made worse by exercise
- c. Inflammatory response is greater to dead and dying worms

3. So, who gets the most severe disease?

- a. Cats
- b. Athletic dogs
- c. Dogs that have occult infections

d. Dogs at the point when worms are dying

## V. Diagnostics

### A. Terms

#### 1. Sensitivity vs. Specificity

- a. Sensitivity - if it is there, will you find it?
- b. Specificity - if test is positive, is it really there?

#### 2. Antigen vs. Antibody

- a. Antigen - foreign substance
- b. Antibody - immune molecule produced by body in reaction to foreign substance

### B. Testing in Dogs

#### 1. Microfilaria testing (Filter test)

- a. Sensitivity - 40% of infections are occult (hidden) - no microfilaria present. Why? Adults may all be same sex; adults may be sexually immature; patient's immune system may be destroying microfilaria
- b. Specificity - may be complicated by the fact that another parasite resembles Heartworms - *Dipetelonema reconditum*. *Dipetelonema* microfilaria are usually seen in fewer numbers and have a blunt anterior end as opposed to a tapering anterior end of *Dirofilaria immitis* microfilaria.

#### 2. Antigen testing - detects protein made by adult female worm

- a. Sensitivity - 96% if > 3 worms present; approximately 60-70% if < 3 worms present
- b. Specificity - 99%
- c. What does a positive mean? Dog is truly infected.

### C. Testing in Cats

#### 1. Microfilaria testing - not a useful test as Cats have extremely low numbers of circulating microfilaria.

#### 2. Antigen testing

- a. Sensitivity - 30-40% (few numbers of worms and high possibility of single sex infection)
- b. Specificity - 99%
- c. What does a positive mean? Cat is truly infected.

3. Antibody testing - tests for an antibody against the L4 to adult stages, either male or female
  - a. Sensitivity - > 90%
  - b. Specificity - 99%
  - c. What does a positive mean? Cat has been *exposed*.

## VI. Treatment (What to do?)

### A. Dog

1. Treat with an adulticide (kills adult worms) - Rx = Immiticide
2. Pretreatment work-up needed - CBC, SAP, UA, Thoracic Radiographs
3. Typically requires a 2 day stay in hospital (two treatments, 24 hours apart)
4. Strict exercise restriction for four weeks after treatment
5. Physical exam at 2 weeks and 4 weeks post-treatment
6. Treat microfilaria at 4 weeks post adulticide
7. Filter test at 8 weeks - start preventive if negative. (Can start preventive sooner if occult infection)
8. Antigen test at 4 months post adulticide

### B. Cat

1. Adulticide causes approximately 50% mortality
2. If showing clinical signs, confirm infection with antigen test or cardiac ultrasound
3. Treat clinical signs with anti-inflammatory drugs (corticosteroids)
4. Place cat on Heartguard which will prevent further infection and *may* kill adult worms slowly.

## VII. Prevention

### A. Dog

1. Diethylcarbamazine - "Nemacide" - daily - not readily available now
2. Ivermectin - "Heartguard" and "Heartguard Plus" - monthly
3. Milbemycin - "Interceptor" - monthly

4. Selamectin - "Revolution" - monthly - topical

5. Moxidectin - "Proheart 6" - every 6 months - injection - temporarily pulled off market by FDA

## B. Cat

1. Ivermectin - "Heartguard" - monthly

2. Milbemycin - "Interceptor" - monthly

3. Selamectin - "Revolution" - monthly