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Canine Leishmaniasis

Understanding, Recognizing and Preventing Infection

Educational Guide for
Veterinary and Public Health Professionals

Co-funded by the European Union

UK Research and Innovation

climate-health cluster

GUIDE OVERVIEW

This guide is organized into five main sections. Each section provides key information to help veterinarians understand, recognize, and manage canine leishmaniasis, and contribute to One Health control efforts.

1

UNDERSTANDING THE DISEASE

What canine leishmaniasis is, the parasite (Leishmania infantum), its life cycle, and the sand fly vector.

2

THE VECTOR AND TRANSMISSION

How sand flies become infected and transmit Leishmania infantum between dogs and other mammalian hosts.

3

CLINICAL RECOGNITION

How the disease may appear in dogs, including dermatological, mucosal, ocular, systemic signs, and laboratory abnormalities.

4

DIAGNOSIS AND MANAGEMENT

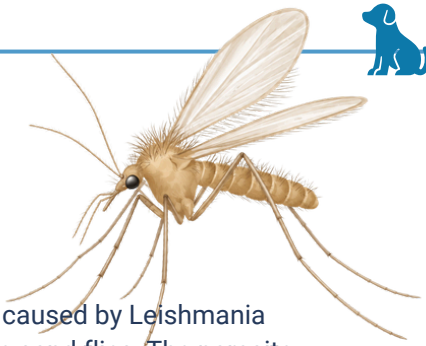
How laboratory tests support diagnosis, how results are interpreted, and how treatment and monitoring are carried out.

5

PREVENTION AND ONE HEALTH CONTROL

How repellents, vector control, vaccination, surveillance, and cross-sector collaboration reduce the risk and impact of canine leishmaniasis.

What is Canine Leishmaniasis?



Canine leishmaniasis is a vector-borne disease caused by Leishmania infantum protozoa, transmitted by phlebotomine sand flies. The parasite infects macrophages and can disseminate to multiple organs. Dogs are the principal domestic reservoir in endemic areas, sustaining transmission to both canine and human populations.

- Chronic parasitic disease affecting skin, lymph nodes, spleen, liver, and kidneys. Presents with dermatological lesions, weight loss, lethargy, and organ involvement.
- Caused by protozoan parasites of the genus *Leishmania infantum,* most commonly in Mediterranean and other endemic regions.
- Transmitted through the bite of infected female sand flies during blood feeding; vector activity and seasonality influence risk.
- Parasite infects immune cells, especially macrophages, and can disseminate throughout the body causing multi-organ involvement.
- Dogs are the principal domestic reservoir in endemic areas, sustaining transmission cycles and contributing to zoonotic risk.

Additional Transmission Routes

Although sand fly bites are the primary route of infection, *Leishmania infantum* can also be transmitted through **non-vectorial pathways**, including:

- vertical transmission (from mother to offspring)
- venereal transmission
- blood transfusion

These routes are less common but epidemiologically relevant, particularly in endemic areas.

Leishmania promastigote (arrows) within canine macrophages. Giemsa stain, 1000× magnification.

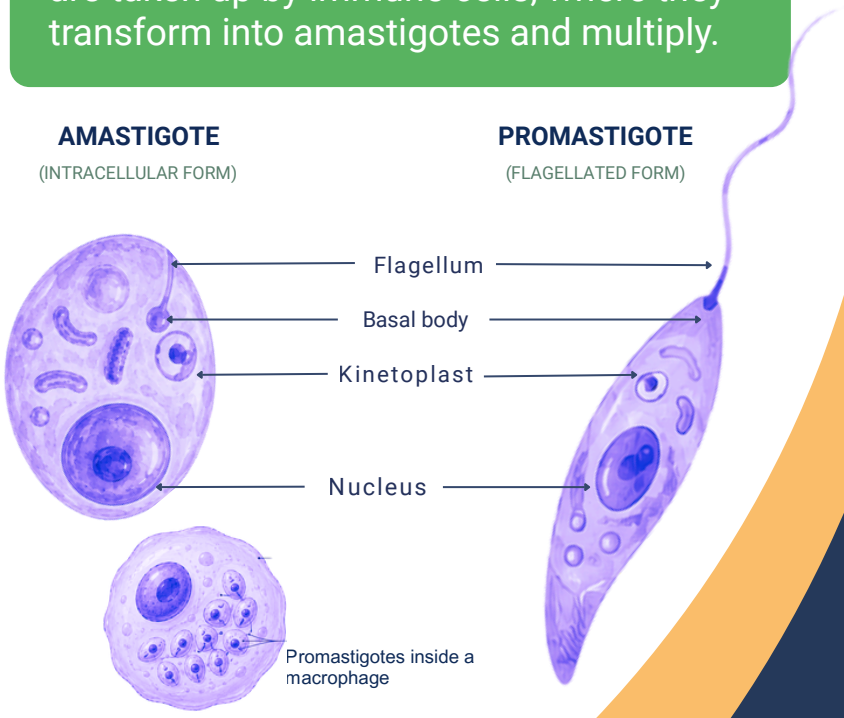
Not all infected dogs develop clinical disease. Many remain asymptomatic carriers and may contribute to transmission, highlighting the importance of surveillance and prevention.

Parasite Life Cycle

Leishmania exhibits a dimorphic life cycle involving two main forms:

- **Promastigotes** – Promastigotes are the flagellated, extracellular motile form of Leishmania found in the digestive tract of the sand fly vector.
- **Amastigotes** – Amastigotes are the intracellular form found within host phagocytic cells (mainly macrophages) in tissues of infected mammals.

Following transmission by an infected sand fly, promastigotes enter the skin and are taken up by immune cells, where they transform into amastigotes and multiply.



The Sand Fly Vector

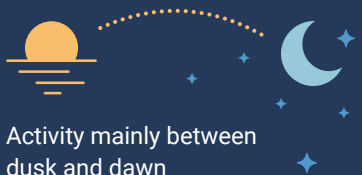
Sand flies are small blood-feeding insects belonging to the ***genera Phlebotomus*** (Old World) and ***Lutzomyia*** (New World).

Development in humid environments rich in organic matter

Sand flies are significantly smaller than mosquitoes, typically measuring 2–4 mm.

In Europe and the Mediterranean region, transmission of *Leishmania infantum* parasite is mainly associated with:

- *Phlebotomus perniciosus*
- *Phlebotomus perfiliewi*
- *Phlebotomus neglectus*
- *Phlebotomus ariasi*

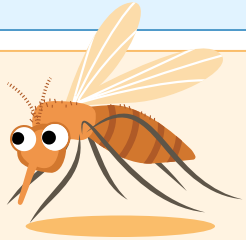


Activity mainly between dusk and dawn

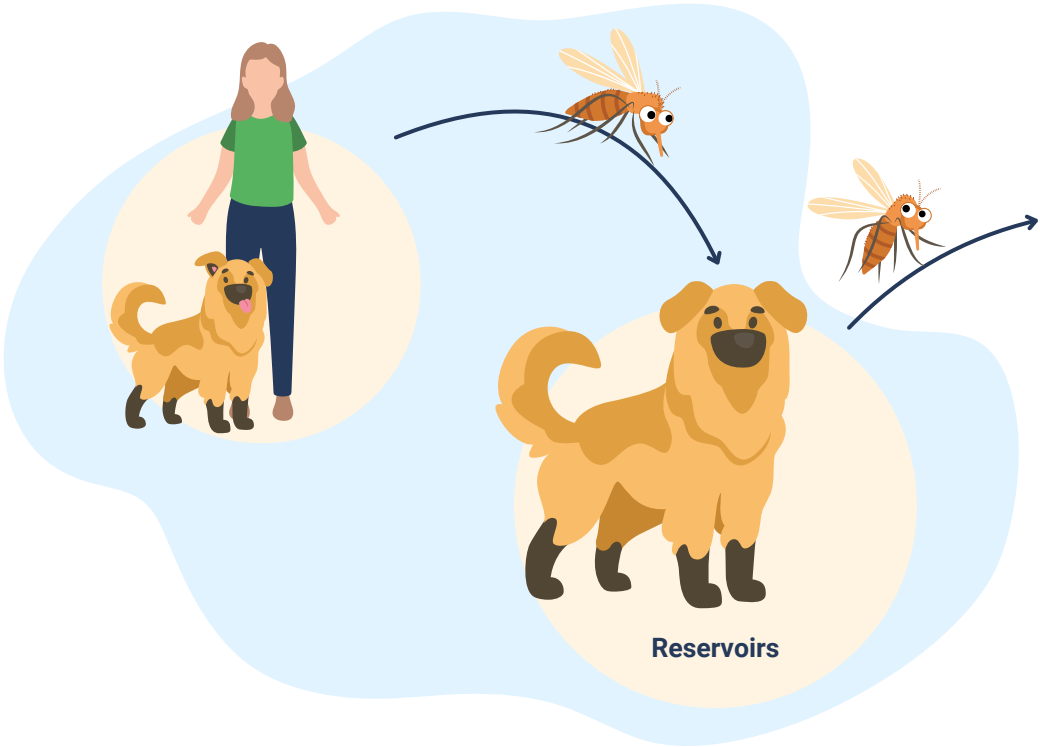
Preference for warm climates

Weak flight capacity, usually remaining within a few hundred meters of breeding sites

Sand flies do not breed in standing water like mosquitoes. Instead, their larvae develop in soil rich in decomposing organic material, including animal shelters, cracks in walls, leaf litter, and peri-domestic environments.



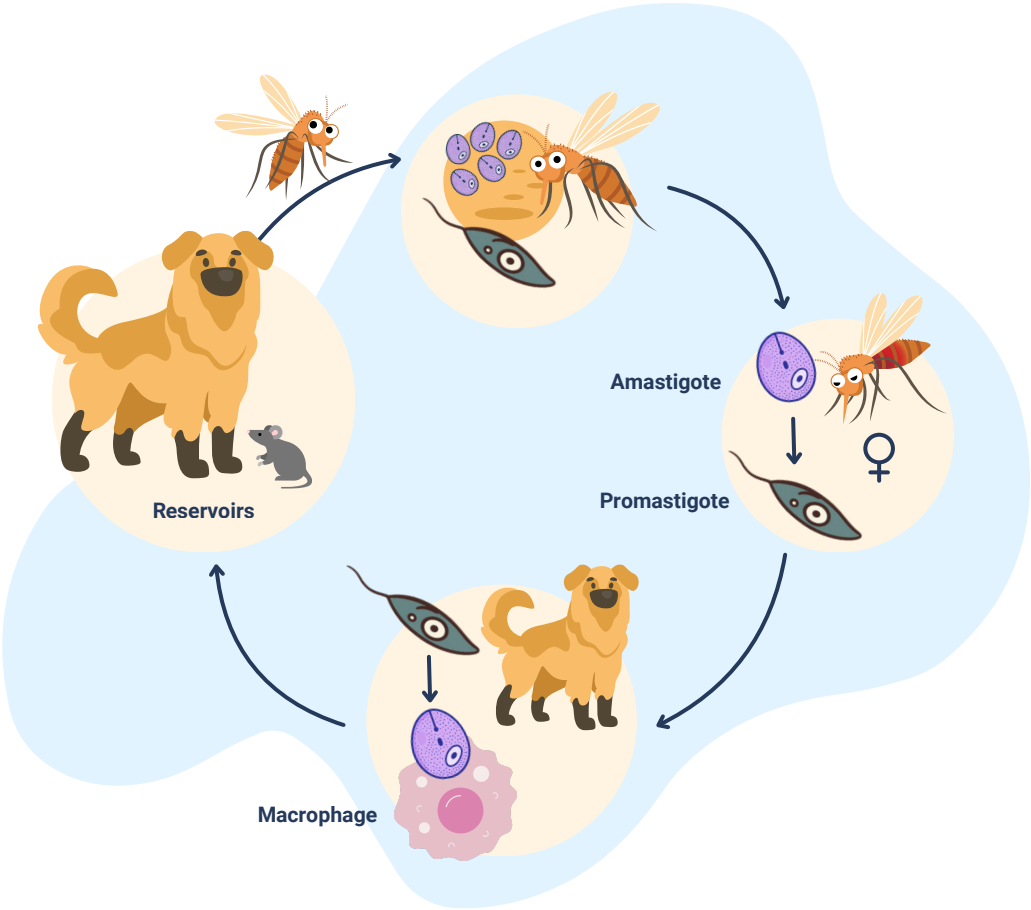
Transmission Cycle



The transmission of *Leishmania infantum* involves a biological cycle between **sand flies and mammalian hosts**.

1. A female sand fly bites an infected dog and ingests parasites present in the blood or skin.
2. Inside the sand fly gut, the parasites transform into **flagellated promastigotes** and multiply.
3. During a subsequent blood meal, the infected sand fly inoculates the parasites into another host.
4. In the dog, parasites invade macrophages where they transform into **amastigotes**, multiplying within host cells.
5. Infected dogs can serve as a source of infection for new sand flies.

This cycle allows the parasite to persist in endemic areas.



1. Infected dog
2. Sand fly takes blood meal, ingests parasites
3. Parasites develop in sand fly gut (promastigotes)
4. Infected sand fly transmits to new host

Transmission cycle of *Leishmania infantum* between canine reservoir hosts and phlebotomine sand fly vectors.

Geographic Distribution

Distribution is dynamic and influenced by environmental and anthropogenic factors.

Canine leishmaniasis is endemic in regions where competent sand fly vectors are established.
High-prevalence areas include:

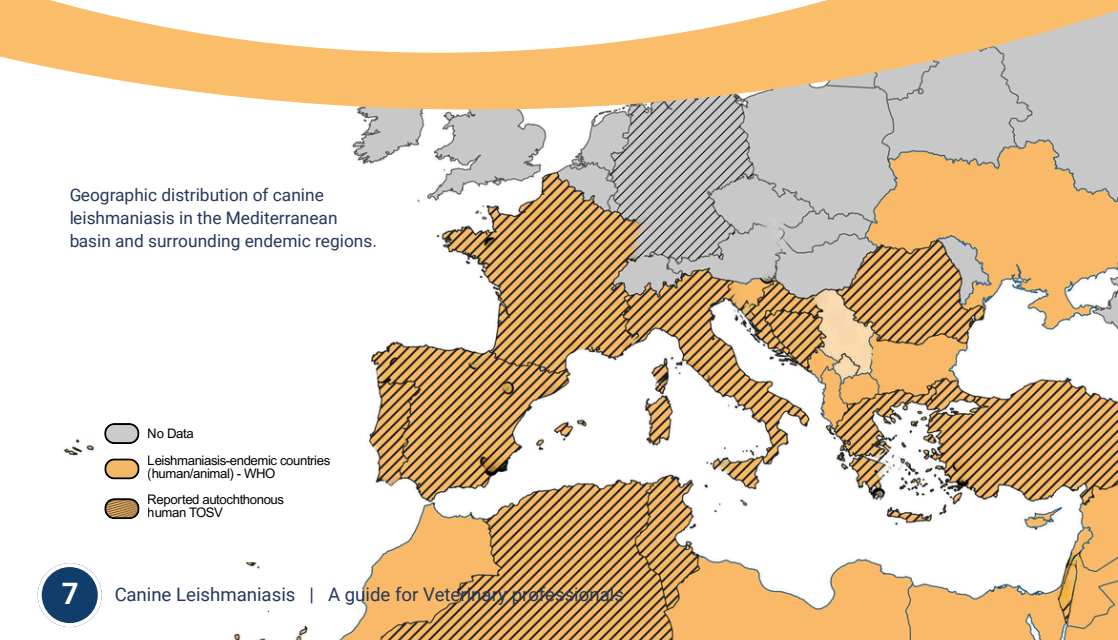
- **the Mediterranean basin** (southern Europe, North Africa),
- **Middle East,**
- parts of **Central and South Asia.**

Climate change and canine movement may expand geographic range.

In the Mediterranean basin, the disease is endemic in several countries including Spain, Portugal, Italy, Greece, Turkey and Israel.

Transmission has also been reported in parts of southern France, the Balkans, and the Middle East.

Environmental changes, urban expansion, and climate variability may influence the distribution of sand flies and the epidemiology of the disease. Movement of infected dogs between regions can also contribute to the spread of infection.



Geographic distribution of canine leishmaniasis in the Mediterranean basin and surrounding endemic regions.

Infection Outcomes and Host Immunity

Clinical outcome is determined by the host immune response. Dogs with effective **cell-mediated (Th1) immunity** are able to control parasite replication and often remain asymptomatic or develop only mild disease. In contrast, inadequate Th1 responses permit parasite proliferation and dissemination, leading to progressive visceral and/or cutaneous disease. Host genetics, age, and overall immunocompetence influence susceptibility and the severity of clinical manifestations.

Protective immunity is associated with a Th1-dominated response, whereas disease progression is linked to impaired cellular immunity and ineffective parasite control.

Resistant infection
Some dogs mount an effective **cell-mediated immune response**, controlling parasite replication and remaining clinically healthy.

Susceptible infection
Other dogs develop **progressive disease**, characterized by parasite dissemination and the appearance of clinical signs. Genetic factors, age, co-infections, and immune status may influence disease progression.

Leishmania infection

Effective Th1 immunity

Asymptomatic or oligosymptomatic infection

Low parasite load

Absence of clinical signs

Controlled infection

Inadequate immunity

Progressive disease

High parasite load

Clinical manifestations

Multi-organ involvement

RISK FACTORS

Genetics, Immunosuppression, Age, Comorbidities

Clinical Manifestations

Canine leishmaniasis presents with variable clinical signs, often with a delayed onset ranging from months to years after infection.
Clinical signs range from subclinical infection to severe systemic disease. Manifestations may involve dermatological, systemic, and organ-specific signs. Renal disease is the most serious complication.

Main Clinical Presentations

Dermatological

- Alopecia (hair loss)
- Scaling and exfoliative dermatitis (skin lesions)
- Skin ulcers
- Onychogryphosis (abnormal nail growth)

Systemic

- Weight loss
- Lymphadenomegaly (enlarged lymph nodes)
- Lethargy

Organ-specific

- Ocular lesions
- Hepatosplenomegaly
- Nephropathy (In advanced cases, kidney dysfunction is one of the most important causes of mortality)

Laboratory Abnormalities

Serum proteins and electrophoretogram

- Hyperglobulinemia (Polyclonal beta and/or gammaglobulinemia)
- Hypoalbuminemia
- Decreased albumin/globulin ratio

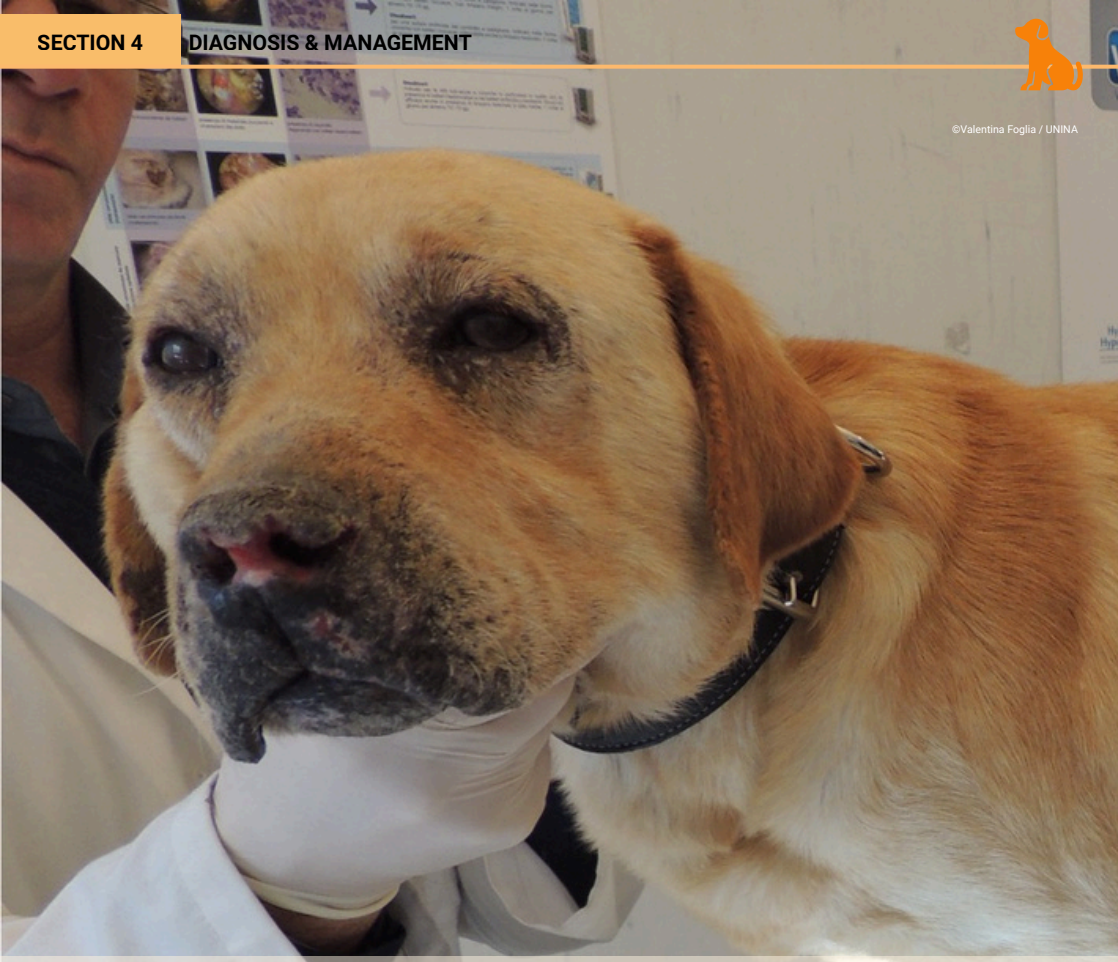
CBC/Hemostasis

- Mild to moderate non-regenerative anemia
- Leukocytosis or Leukopenia
- Thrombocytopathy
- Thrombocytopenia
- Impaired secondary hemostasis and fibrinolysis

Biochemical profile/urinalysis

- Mild to severe proteinuria
- Renal azotemia
- Elevated liver enzyme activities

Many infected dogs remain asymptomatic, while others develop progressive disease depending on the immune response.



Facial and ocular manifestations of canine leishmaniasis. Periocular lesions, alopecia, scaling, and ulcerative changes of the muzzle are among the most common clinical signs observed in infected dogs.

Clinical Recognition Atlas

Clinical Recognition Atlas

External Signs

1 Poor body condition

Weight loss and muscle wasting may occur in systemic disease.

2 Exfoliative dermatitis

Difuse scaling and alopecia are common dermatological findings.

3 Facial and Nasal lesions

Ulceration, periocular alopecia, and exfoliative dermatitis, crusting, or depigmentation may occur in chronic disease.

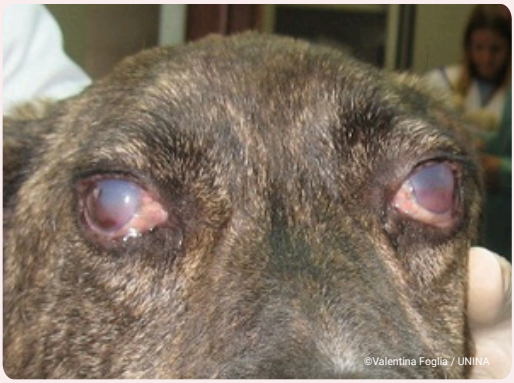
4 Oral/mucosal lesions

Mucosal ulcerations may develop in advanced infection.

Clinical Recognition Atlas

External Signs

5 Ocular involvement



Blepharitis and periocular lesions are frequently reported.

6 Nail abnormalities

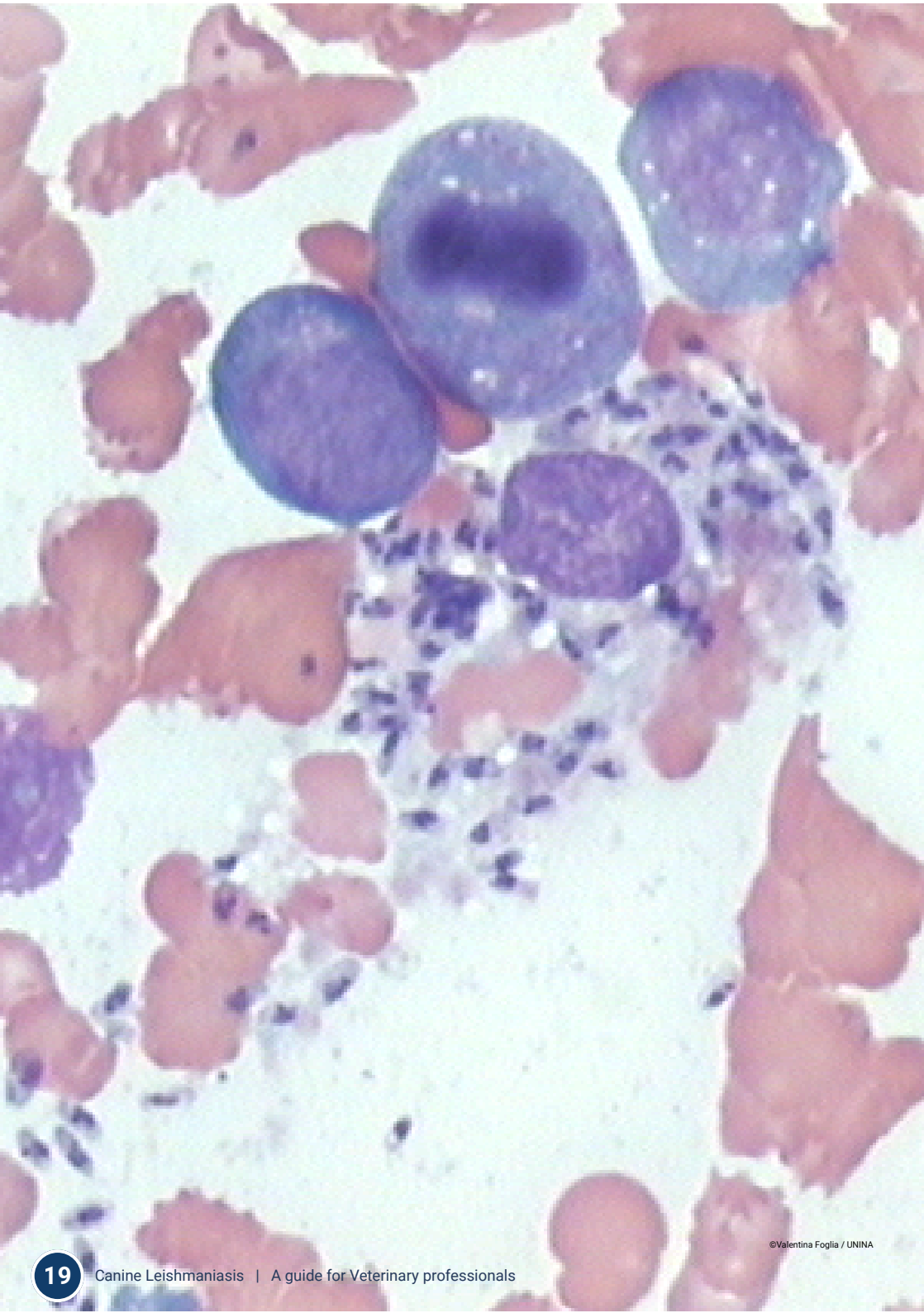
Onychogryposis is a characteristic chronic manifestation.

7 Oral/mucosal lesions

Ulcerative lesions of the tongue and oral mucosa may occur in chronic or advanced canine leishmaniasis.

8 Lymphadenomegaly

Peripheral lymphadenomegaly is a common clinical finding in canine leishmaniasis (in the picture, the popliteal lymph node)



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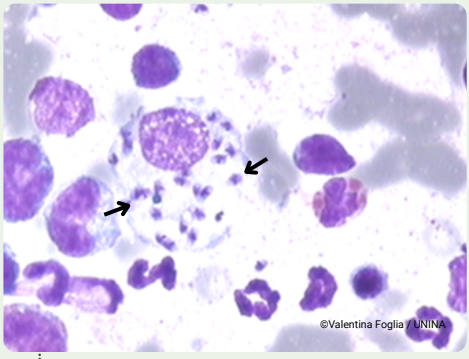
Clinical Recognition Atlas

Systemic and Laboratory Findings

Laboratory testing and microscopic examination are essential to support suspicion, confirm infection, and reflect systemic involvement or diseases impact.

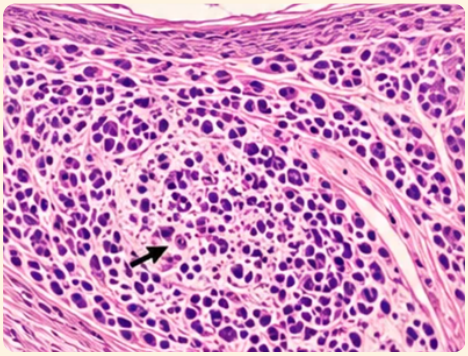
1 Microscopy and Cytology

Amastigotes within macrophages



Cytology may reveal intracellular amastigotes in macrophages from skin, lymph nodes, bone marrow, or other tissues.

Histopathology (skin)



Histopathology can support diagnosis by demonstrating amastigotes in tissue sections, along with inflammatory changes.

2 When should veterinarians suspect CanL?

- Chronic dermatological lesions Non-responsive to routine therapy
- Weight loss With or without muscle wasting
- Lymphadenopathy Generalized or peripheral enlargement
- Renal disease Proteinuria and/or azotemia
- Ocular abnormalities Blepharitis, uveitis, or periocular lesions
- Poor response to routine therapy Persistent clinical signs despite treatment
- Dogs from endemic or travel areas History of exposure risk

Diagnosis of Canine Leishmaniasis

Diagnosis requires integration of clinical findings, laboratory abnormalities, exposure history, and confirmatory testing.

1. SEROLOGY

Detection of anti-Leishmania antibodies in serum.

Common tests

- IFAT (Indirect fluorescent
- antibody test)
- ELISA
- Rapid immunochromatographic tests

Advantages

- Widely available
- Useful for screening
- Good sensitivity in many endemic areas

Limitations

- Cannot differentiate current from past infection
- Cross-reactivity may occur
- Lower sensitivity in early infection or immunosuppressed dogs

Best used for

Screening and supporting evidence in clinically suspect cases.

2. PCR

Detection of Leishmania DNA in clinical samples.

Common samples

- Whole blood
- Bone marrow
- Lymph node
- Skin
- Conjunctival swab

Advantages

- High sensitivity and specificity
- Detects infection early
- Useful in low-parasitemia
- or immunosuppressed dogs

Limitations

- Higher cost
- Requires specialized
- laboratory
- Risk of contamination (false positives)

Best used for

Confirmation of infection, especially in early or atypical cases and for monitoring.

3. PARASITOLOGY

Direct detection of parasites in tissues or cells.

Common samples

- Bone marrow aspirate
- Lymph node aspirate
- Skin impression or biopsy
- Splenic aspirate (rare)

Advantages

- Definitive diagnosis
- Allows visualization of amastigotes
- Low cost

Limitations

- Low sensitivity
- Invasive sampling
- Requires trained personnel and good microscopy

Best used for

Definitive diagnosis in animals with compatible clinical signs, when parasites are detected.

Interpretation reminder

No single diagnostic test should be interpreted in isolation.
Results must always be evaluated together with clinical findings and epidemiological context.

Clinical Management

Canine leishmaniasis is usually considered a chronic infection. Canine leishmaniasis requires long-term management. Treatment aims to reduce parasite burden, improve immune control of infection, resolve clinical signs, and prevent relapse. Combination therapy is standard, and lifelong monitoring is required, as parasitological cure is rarely achieved.

1 Assessment

PHASE 1

Clinical examination; Laboratory testing (serology, biochemistry, urinalysis); Disease staging (www.leisvet.org)

2 Treatment

PHASE 2

Antileishmanial therapy:
- Meglumine antimoniate + allopurinol (commonly used first-line combination)
- Miltefosine + allopurinol (alternative regimen)

Supportive care and nutritional management as needed.

3 Monitoring

PHASE 3

Regular clinical and laboratory evaluation according to disease severity (typically every 1–6 months). Treatment adjustment based on clinical response and laboratory findings.

4 Long-term follow-up

PHASE 4

Periodic reassessment; relapse detection; long-term quality of life management.

Note:
Parasites may persist; lifelong surveillance is required. Treatment controls disease but does not eliminate infection.

Current treatments aim to:
reduce parasite load;
control clinical signs;
improve quality of life

Prevention and Control

Vector control and personal protection measures reduce transmission risk. Integrated strategies combining multiple interventions provide optimal protection.

Implementation should be tailored to local epidemiology and guided by veterinary professionals.

1 VECTOR REPELLENTS

- Insecticide-impregnated collars (e.g., pyrethroids such as deltamethrin or flumethrin)
- Topical spot-on formulatios
- Regular replacement/application according to manufacturer instructions

2 ENVIRONMENTAL MANAGEMENT

- Reduce peridomestic organic matter
- Manage/ eliminate potential sand fly breeding habitats
- Maintain clean and dry animal housing

3 BEHAVIORAL MEASURES

- Keep dogs indoors during peak vector activity (dusk–dawn)
- Install fine-mesh screens in animal housing
- Limit exposure in high-risk areas during transmission periods

4 IMMUNOPROPHYLAXIS

- Vaccines are available in some regions
- Reduce risk of clinical disease
- Do not provide protection against infection

IMPORTANT: Vector repellents should also be applied to infected / sick dogs to reduce onward transmission. Combining reservoir control, vector control, and environmental management provides the greatest impact.

One Health Approach to Leishmaniasis Control

Canine leishmaniasis exemplifies the One Health concept, linking animal, human, and environmental health. Dogs serve as the primary domestic reservoir of zoonotic *Leishmania infantum*, sustaining transmission through sand fly vectors.

Transmission to humans occurs primarily through infected sand fly bites; direct transmission from dogs does not occur under natural conditions (not through direct contact with infected dogs)

Effective control requires Integrated control strategies targeting canine reservoirs, vector populations, and environmental risk factors that benefit both animal and human health.

ANIMAL HEALTH

Dogs act as reservoirs and sources of infection for sand flies. Canine surveillance, prevention, and treatment reduce reservoir prevalence and transmission risk.

ENVIRONMENTAL HEALTH

Sand fly ecology is shaped by climate, land use, and habitat conditions. Environmental management influences vector abundance and transmission dynamics.

HUMAN HEALTH

Human infection occurs via sand fly bites. Prevention depends on reducing exposure to vectors and controlling infection in reservoir hosts.

Arrows indicate relationships among components; the central element (Vector Control) connects and mediates interventions across animal, human, and environmental health.

Key Messages

- Transmission requires sand fly vector
- No direct dog-to-human transmission
- Canine control reduces community risk
- Integrated surveillance essential

Coordinated interventions across sectors provide the greatest impact.

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