

# Leptospirosis in humans and dogs

## Introduction

Leptospirosis is the most widespread zoonotic disease in the world, with great economic and health importance is an infectious disease caused by serovars of *Leptospira interrogans*. It is a worldwide public health problem that affects both industrialized and developing countries; the number of cases is difficult to establish, but approximately 1.03million cases are estimated to occur each year throughout the world, with 59,900 deaths.<sup>1</sup> The World Health Organization (WHO) and the Pan American Health Organization (PAHO) classify *Leptospirosis icterohaemorrhagiae* with the key A 27.0.<sup>2</sup> is caused by a spirochete belonging to the pathogenic strains of the genus *Leptospira*, which affects wild animals, domestic animals and humans.<sup>3,4</sup> This genus is traditionally classified based on the phenotypic properties, serological reactions and pathogenesis of each strain. Saprophytic species of *Leptospira* are grouped mainly into *L. biflexa*, (after *L. biflexa sensu lato*) and *L. interrogans* (after *L. interrogans sensu lato*); these include most of the pathogens.<sup>5</sup> Currently, the classification of the genus *Leptospira* is based on DNA homology and is divided into 17 species.<sup>6,7</sup> Leptospire are strictly aerobic microorganisms; morphologically, they are spirochetes of about 0.1 $\mu$  wide and 6-15 $\mu$  long, with flexion, translation, and propulsion movements, as well as active ondulation. They are Gram-negative and divide by binary fission, this microorganism is sensitive to drying, heat, excessive cold and pH variations; they do not tolerate the acid medium due to the loss of their motility in approximately 15min, the optimum pH for their multiplication is from 7.2 to 7.4, they do not survive in salt water, but they can remain up to 180days in fresh water, three weeks in stagnant waters and up to about a year in viscous solutions, such as sludge with low content of organic matter,<sup>8</sup> moist soil they survive for a long time, while in dry soil the survival is short.<sup>9</sup> The natural regions of leptospirosis are generally found in humid and rain areas in conditions with high temperatures and humidity with a higher proportion of surface fresh water such as lakes, rivers, dams, channel systems among others.<sup>10-12</sup> In the tropical climatic zone, environmental conditions are more favorable for the survival of leptospire and the highest morbidity is observed, extreme weather phenomena such as cyclones and floods can lead to an increase in the incidence of the disease, as well as the magnitude of leptospirosis outbreaks.<sup>13,14</sup> Socioeconomic factors such as migration give rise to the transmission of acquired infections in tropical countries, people with lower income or poor communities, whose consequence is less hygienic conditions.<sup>15</sup> Infection is typically transmitted through direct contact of oral or nasal mucosa, with contaminated urine or water, and dogs are at risk of infection from drinking contaminated water.<sup>16,17</sup> Dogs play an important role as potential indicators of areas with high endemicity for leptospirosis. Thus, recognizing and preventing canine leptospirosis has implications for human health as well as dogs.<sup>18,19</sup> Leptospire infect an organism penetrating through mucous membranes, skin lacerations or skin softened by moisture, and intake of contaminated food and water. They then migrate through the blood, tending to locate and grow in parenchyma organs such as liver, kidney, spleen and, occasionally, the meninges. They remain in sites such as renal tubules, ocular humors and the uterus, where antibody activity is minimal; they cause vascular damage to the endothelium, producing

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bleeding.<sup>20-22</sup> The serovars icterohaemorrhagiae and pomona produce hemolysins, which are responsible for hemoglobinuria.<sup>23</sup>

In the case of the serovar icterohaemorrhagiae, it causes severe jaundice in dogs, very similar to the infection caused in humans. It presents more frequently in dogs younger than two years old; there is a transient increase in body temperature that usually goes unnoticed, sudden or progressive onset of jaundice, going from a pale yellow to an orange yellow color in skin and mucous membranes, yellowish brownish urine, weakness, chills, depression, anorexia, emesis, polydipsia, emaciation, dehydration, petechial bleeding, ecchymosis of conjunctiva and oral cavity, and halitosis.<sup>24-26</sup> In humans The clinical manifestations and severity of leptospirosis vary from a flu-like illness to severe renal and hepatic failure, myocarditis, hemorrhage and death, depending on the concentration of the inoculum, the virulence of the infecting serovar, the susceptibility of the host, and the affected organ or systems.<sup>27</sup> Two cases of the disease have been recorded in patients transplanted with kidneys infected with *Leptospira*, one of them fatal.<sup>28,29</sup> Is characterized by two phases, the first bacteraemic or leptospirémic, has an abrupt onset of duration seven to ten days, the signs and symptoms are not pathognomonic, they can easily be confused with other infectious processes of bacterial type or viral, such as dengue, zika, chincungunya, malaria, brucellosis, rickettsiosis. The second phase presents the characteristics of the immune phase and correlates with the appearance of circulating antibodies of the IgM class and the invasion of vital organs.<sup>30-32</sup> Two clinical types are generally distinguished: icteric and anicteric. The icteric or hepatonephritic type (Weil's disease) is found in approximately 10% of the cases, while numerous infections occur in anicteric form.<sup>31,33</sup> The invasive power of leptospire is related to their mobility and their chemical and antigenic structure; they cause cellular damage, not only by mechanical strain, but by the production of cytotoxic substances, which damage the capillary endothelium. This cytotoxic protein has been found in the serovars Pomona and Copenhageni.<sup>34,35</sup> The diagnosis of leptospirosis is performed by various methods, including direct immunofluorescence, silver staining of fixed tissues, polymerase chain reaction (PCR), culture isolation, evidence of serum antibodies (ELISA), fast plate agglutination and latex agglutination, as well as rapid card tests (Lepto dipstick); however, plate micro agglutination (MAT) is regarded as the gold standard. The reactions determine the presence of agglutinating antibodies against the tested serovars.<sup>36,37</sup> Animals may remain serologically positive for the disease

for years. In dogs, leptospirosis is mainly caused by *L. canicola* or *L. icterohaemorrhagiae*; these serotypes are internationally considered as the most important. The main source of infection for animals, especially dogs, is the urine of asymptomatic carrier animals (dog to dog), as well as vectors, rodents being a natural reservoir<sup>38,39</sup>. Leptospirosis continues being serious public health problem, for humans and animals diagnostic and control are complicated by the great adaptability and pathogenic characteristics, treatment not complicated by diagnosis is early, new researches provide more information to propose better public health policies for control and diagnosis of disease.

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## Conflicts of interest

The author declares that there are no conflicts of interest.

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