

*Chapter 9*

**ACUTE LEPTOSPIROSIS IN ITS ICTERIC  
FORM: A CASE STUDY**

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## ABSTRACT

Canine leptospirosis affects domestic and wild canids. In its clinical form the infection is generally associated with *Leptospira canicola* and *Leptospira icterohaemorrhagiae* that produce a presentation of acute and febrile course, with a high potential to cause interspecies infection and zoonosis, with signs of hepatic and renal alteration in most cases of the disease. In this case study of canine leptospirosis in its icteric form related to Weil's disease, a dog (French Poodle) with jaundice of hepatic origin, possibly caused by *L. icterohaemorrhagiae*, was examined by physical and pathological study. It courses a serious disease which progress to multiorgan failure. The symptoms in the animals included: jaundice, fever, severe dehydration and lumbar and abdominal pain, which were related to acute renal and hepatic disease. Cardiovascular disorders present in the dog and the poor response to treatment resulted in the death of the animal. Histopathological diagnosis revealed the presence of the microorganism by Warthin-Starry stain, in addition to cellular hepatic necrosis, hepatic cholestasis and tubulointerstitial nephritis with mononuclear leukocyte infiltration compatible with canine leptospirosis.

**Keywords:** leptospirosis, jaundice, case study, dog

## INTRODUCTION

Leptospirosis is a worldwide distribution disease, predominant in tropical and subtropical areas. The infection cycle occurs throughout the year. In temperate climate it occurs more frequently during the rainy season, and in the summer in other sub-humid temperate climate regions. The disease affects man and domestic mammals, wild animals and cold-blooded animals. Human infection is caused by serovars pathogenic to animals, and is considered a zoonosis with a high risk of infection. The disease is spread directly through urine and contact with infected animal tissues to a wide variety of hosts. The infection cycle in nature is transmitted from one animal to another, with humans (with rare exceptions) constituting a dead end of the chain. Human-to-human transmission does not exist [1, 2, 3].

Canine Leptospirosis affects domestic and wild canids; in its clinical form, the infection is generally associated with *Leptospira canicola* and *L.*

*icterohaemorrhagiae*, which produce an acute and febrile course, with a high potential to cause interspecies infection and zoonoses, with signs of liver and kidney disease in most cases of the illness [4]. The etiological agents of canine leptospirosis belong to the *Leptospira interrogans* serogroup, which groups different serovars: *L. canicola*, *L. icterohaemorrhagiae*, *L. bataviae*, *L. copenhageni*, *L. pomona*, *L. medensis*, *L. autumnalis*, *L. grippityphosa* and *L. tarassovi* [5]. The main route of infection is between animal carrier, rodents, contaminated water, urine and aerosols produced during urination. The natural reservoirs of *Leptospira* are wild animals, especially rodents and domestic animals. Infection enters through intact mucous membranes, skin wounds, ingestion of urine and contaminated water [6, 7].

Currently the epidemiology of the disease has had changed in its distribution and associated risk factors in urban and rural environments. It is considered as one of the main re-emerging infectious diseases in several countries [8, 9]. *L. icterohaemorrhagiae* and *L. canicola* are the predominant serovars in dogs, however in recent years there has been an increase in the seroprevalence of *L. grippityphosa* and *L. pomona*, which is why it has been considered a reemerging disease in some countries, possibly due to the migration of wildlife from suburban areas and in the rainforest interface where certain types of serovars predominate [8, 10, 11, 12]. This case study documents a process of acute canine leptospirosis in its icteric form.

## Clinical History

A male French Poodle, 8 years old, with symptoms of dysphagia, polyuria (reddish brown color) was evaluated in medical interconsultation. The owner reported a yellowish coloration of the skin similar to that manifested by an infant at home, attributed to a possible case of human hepatitis B, expressing concern about the infant's health and its possible relationship with the clinical condition of the dog.

Physical examination of the animal revealed marked jaundice (Figure 1), severe dehydration, lumbar and abdominal pain, fever, tachycardia, congestion of the conjunctiva and eyelid mucosa. Laboratory samples

(hematology, clinical biochemistry and EGO) were obtained before hospitalization. The presumptive diagnosis was jaundice of hepatic origin associated with a possible case of canine leptospirosis.

The differential diagnoses were: infectious canine hepatitis (ICH), hepatitis, acute cholecystitis and obstructive jaundice, bacterial meningitis and meningoencephalitis, cytomegalovirus infection and acute renal failure. The animal died two days after admission due to apparent renal failure. The animal was referred for postmortem analysis and samples of liver, kidney, spleen, intestine and lung were collected for histopathological study.



Figure 1. French Poodle patient with yellowish skin coloration.

### **Anatomopathological Study**

Postmortem findings were: marked jaundice of skin, subcutaneous tissue and muscle fascia. Multifocal hemorrhages in subcutaneous tissue. Edema and swelling of explorable lymph nodes. Splenomegaly. Petechial hemorrhages in intestinal loops, liver, kidney and lung.

Presence of yellowish straw ascitic fluid; stomach containing serosanguineous liquid, mucus and scarce food content. Small intestine with

a bloody content. Corticomedullary congestion. In the urinary bladder multifocal petechial hemorrhages were observed, with the presence of reddish brown urine. Soft and friable liver (Figure 2). The macroscopic findings were considered suggestive of acute leptospirosis.

## **Histopathology**

The findings and lesions observed at microscopy were, in the spleen: lymphoid depletion with lymphoblastic activity, abundant amount of macrophages with hemosiderin pigments within the cytoplasm, erythrocyte phagocytosis, nodular lymphoid hyperplasia; in liver: disorganized hepatic cords, hepatocellular necrosis, proliferation of mononuclear phagocytes (Kupffer cells), biliary pigment between hepatic sinusoids and in phagocytic cells; in kidney: focal interstitial nephritis, with diffuse interstitial fibrosis and mononuclear cell infiltration, presence of hyaline casts in renal tubules, and Warthin-Starry stain positive for spirochetes in convoluted tubules; in lung: congestion and pulmonary edema and hemorrhage.

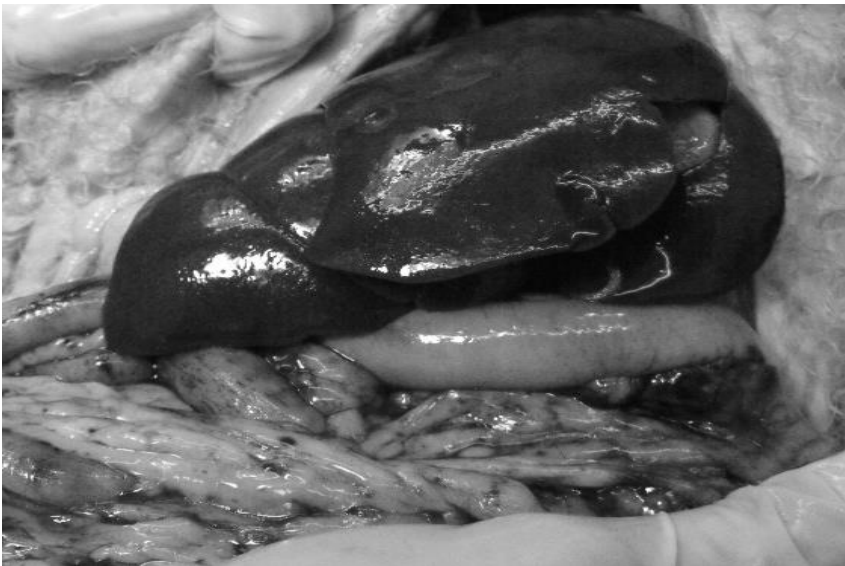


Figure 2. Hepatomegaly and intestinal serosal haemorrhages.

## DISCUSSION AND CONCLUSIONS

In the present case, postmortem findings were similar to those reported in the literature for acute canine leptospirosis. Liver fibrosis may be an obvious lesion, occasionally lesions related to chronic active hepatitis are observed in infection caused by *L. grippotyphosa*, unlike what happens in acute hepatitis caused by *L. icterohaemorrhagiae* [2, 4].

Medical literature reports the most relevant histological lesions in the liver are characterized by disorganization of the hepatic cords, the cytoplasm becomes eosinophilic and granular, and necrosis of hepatocytes. Images of hepatic regeneration with cytomegaly, binucleated nuclei and cell division of hepatocytes may appear. Kupffer cells contain brown pigment and bile canaliculi may be obstructed with bile pigment [13].

The clinical presentation of leptospirosis includes anorexia, vomiting, fever, conjunctival mucosal hyperemia, general weakness and depression, among others. Subsequently, animals may develop hemorrhagic gastroenteritis, myalgia, polyuria, polydipsia, hypothermia, necrotic stomatitis and marked jaundice [13, 14]. A wide variety of these signs were identified on clinical examination at hospital admission of the animal under study. Generally, *L. icterohaemorrhagiae* is associated with a primary liver lesion, while *L. canicola* frequently produces a renal lesion [15, 16].

It is possible that in this case jaundice was caused by *L. icterohaemorrhagiae* without discarding a possible association to a chronic infection by *L. canicola* due to the presence of chronic lesions in the kidney, although also *L. icterohaemorrhagiae* also produces in acute cases nephritis in puppies, with a febrile condition that persists intermittently for up to 2 or 3 days, with hypersensitivity, epistaxis and petechial hemorrhages in mucous membranes [11]. The macroscopic findings at postmortem examination corresponded with those described by Prescott and Zuerner [13] and Speelman [15].

In the different forms of clinical presentation of canine leptospirosis, the heart can be compromised by focal myocarditis, particularly when the icteric form is observed in Weil's syndrome, which has also been described in humans [17].

The signology was associated with severe hepatic dysfunction with predominance of jaundice, in which renal dysfunction, hemodynamic alterations, cardiac and respiratory disorders may also be present. Severe jaundice presents with increased conjugated bilirubin. The clinical findings of the case coincide with those described in the acute form of icteric leptospirosis related to Weil's syndrome [3, 12].

Death in some animals is caused by acute renal and hepatic failure, associated with infection by: *L. canicola*, *L. copenhageni* and *L. icterohaemorrhagiae*. Recently, infection by *L. pomona*, *L. grippotyphosa* and *L. ballum* has been reported in dogs suffering from leptospirosis [4, 18, 19], particularly that caused by *L. copenhageni* which tends to produce acute and fatal jaundice and coagulopathy during the course of disease. Death is associated to renal failure due to acute diffuse nephritis, followed by renal failure (chronic interstitial nephritis and uremic syndrome) [13, 20, 21].

Leptospira can be evidenced by immunohistochemical techniques and special polychromatic silver stain, which allow identifying the presence of the bacterium in sinusoids and hepatic epithelial cells. At the onset of the disease it is also possible to evidence the presence of Leptospira in the proximal convoluted tubules in which there is also hydropic degeneration and necrosis of tubular cells, accompanied by interstitial edema and diffuse infiltration of lymphocytes and plasma cells [12].

In serological studies carried out in street dogs in different Latin American cities, the epidemiological importance of *L. canicola* and *L. icterohaemorrhagiae* serovars as a source of infection for other wild and domestic animals has been pointed out, in addition to the high risk they represent for producing zoonosis, so leptospirosis is considered an occupational disease in veterinarians, farmers and slaughterhouse workers, and caused by the coexistence of owners with animals carrying the disease [8, 18, 19, 22, 23].

It has been reported that serovars such as *L. autumnalis*, *L. grippotyphosa* and *L. bratislava* are also considered to be of clinical importance in the presentation of canine leptospirosis and in other wild mammals, putting human health at risk [5, 20, 21, 23].

## REFERENCES

- [1] Acha, P. and Szyfres B. (1983). *Leptospirosis. Zoonosis y enfermedades transmisibles comunes al hombre y a los animales*. Washington, D.C. OPS. No.503. pp. 112–120.
- [2] Blood, D. C. and Radostits, O. M. (1992). *Medicina Veterinaria*. 7<sup>a</sup> ed. Interamericana-Mc Graw-Hill. México. pp. 816-832.
- [3] Lenik, J., Majmundar, M., Ibarra, G., Saeed, M. and Chaudhari, S. (2020). Unusual Case of Dog Walker with Weil’s Disease. *Am. J. Med.* 133(5):e193-e194.
- [4] McCallum, K. E., Constantino-Casas, F., Cullen, J. M., Warland, J. H., Swales, H., Lingham, N., Kortum, A. J., Sterritt, A. J., Cogan, T. and Watson, P. J. (2019). Hepatic leptospiral infections in dogs without obvious renal involvement. *J. Vet. Intern. Med.* 33(1):141-150.
- [5] Mesina, D. and Campbell, R. (1975). Wild rodents in the transmission of disease to animals and man. *Vet. Bull.* 45:87-96.
- [6] Sepúlveda, M. A., Santiago, D. J. and Preciado, R. F. J. (2002). La rata y el perro importantes vectores de la leptospirosis en explotaciones pecuarias de Ciudad Guzmán, Jalisco. *Rev. Cubana Med. Trop.* 54(1):21-23.
- [7] Latosinski, G. S., Fornazari, F., Babboni, S. D., Caffaro, K., Paes, A. C. and Langoni, H. (2018). Serological and molecular detection of *Leptospira* spp in dogs. *Rev. Soc. Bras. Med. Trop.* 51(3):364-367.
- [8] Lomar, A. V., Diament, D. and Torres, J. R. (2000). Leptospirosis in Latin America. *Infect. Dis. Clin. North. Am.* 14(1):23-39.
- [9] Dorsch, R., Ojeda, J., Salgado, M., Monti, G., Collado, B., Tomckowiack, C., Tejada, C., Müller, A., Eberhard, T., Klaasen, H.L.B.M. and Hartmann, K. (2020). Cats shedding pathogenic *Leptospira* spp.-An underestimated zoonotic risk? *PLoS One.* 15(10):e0239991.
- [10] Cai, H. Y., Horby, G., Key, D. W., Osuch, M. R. and Maxie, M. G. (2002). Preliminary study on differentiation of *Leptospira grippothyphosa* and *Leptospira sejroe* from other common pathogenic



- leptospiral serovars in canine urine by polymerase chain reaction assay. *J. Vet. Diag. Inv.* 14:164-168.
- [11] Farrar, W. E. (1998). Leptospirosis. En: Mandell, Douglas y Bennett. *Enfermedades infecciosas: Principios y práctica*. Panamericana. México. pp 2396-2400. [Leptospirosis. In: Mandell, Douglas and Bennett. *Infectious Diseases: Principles and Practice*]
- [12] Luna, A. M. A., Moles, C. L. P., Gavaldón, R. D., Nava, V. C. and Salazar, G. F. (2008). La leptospirosis canina y su problemática en México. *Rev. Salud Anim.* 30(1):1-11. [Canine leptospirosis and its problems in Mexico]
- [13] Prescott, J. F. (1993). Leptospirosis. In: Gyles CL, Thoen CO. *Pathogenesis of bacterial infections in animals*. Iowa State University Press. Ames, IO. pp. 287-296.
- [14] Rubel, D., Seijo, A., Cernigoi, B., Viale, A. and Wisnivescky, C. (1997). *Leptospira interrogans* en una población canina del Gran Buenos Aires: variables asociadas con la seropositividad. *Rev. Panam. Salud Pública.* 2:102-105.
- [15] Speelman, P. (2005). Leptospirosis. En: Harrison, P. *Principios de medicina interna*. Volumen I. Interamericana. México. pp. 1100-1103. [*Principles of internal medicine.*]
- [16] Reagan, K. L. and Sykes, J. E. (2019). Diagnosis of Canine Leptospirosis. *Vet. Clin. North Am. Small Anim. Pract.* 49(4):719-731.
- [17] Trujillo, S., Martínez, T. J. E. and Mármol, S. A. (1996). Leptospirosis, enfermedad de Weil y falla multiorgánica. *Rev. Cub. Med.* 35(3):7-9.
- [18] Rivera, F. A., De la Peña, M. A., Roa, R. M. A. and Ordoñez, B. M. (1999). Seroprevalencia del leptospirosis en perros callejeros del norte de la ciudad de México. *Vet. Méx.* 30(1):105-107. [Seroprevalence of leptospirosis in stray dogs from the north of Mexico City]
- [19] Carvalho, C. R. and Bethlem, E. P. (2002). Pulmonary complications of leptospirosis. *Clin. Chest. Med.* 23 (2):469-478.
- [20] Corwin, A., Ryan, A., Bloys, W., Thomas, R., Deniega, B. and Watts, D. (1990). A waterborn outbreak of leptospirosis among United States military personnel in Okinawa. *Japan. Int. J. Epidemiol.* 19:743-748.

- [21] Vanasco, N. B., Sequeira, G., Dalla, F. M. L. and Fusco, S. (2000). Descripción de un brote de Leptospirosis en la ciudad de Santa Fe, Argentina marzo–abril de 1998. *Rev. Panam. Salud Publica/Pan. Am. J. Public. Health.* 7(1):35-40. [Description of an outbreak of Leptospirosis in the city of Santa Fe, Argentina, March – April 1998.]
- [22] Rohilla, P., Khurana, R., Kumar, A., Batra, K. and Gupta, R. (2020). Detection of *Leptospira* in urine of apparently healthy dogs by quantitative polymerase chain reaction in Haryana, India. *Vet. World.* 13(11):2411-2415.
- [23] Altheimer, K., Jongwattanapisan, P., Luengyosluechakul, S., Pusoonthornthum, R., Prapasarakul, N., Kurilung, A., Broens, E. M., Wagenaar, J. A., Goris, M. G. A., Ahmed, A. A., Pantchev, N., Reese, S. and Hartmann, K. (2020). *Leptospira* infection and shedding in dogs in Thailand. *BMC Vet. Res.* 16(1):89.