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Leptospirosis: An Emerging Yet Neglected Occupational Zoonosis of Global Public Health Concern

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Abstract

Zoonoses caused by multiple etiological agents can occur in sporadic and epidemic form, resulting in high morbidity and mortality both in humans and animals. Leptospirosis is an important occupational zoonotic disease of global significance, particularly in tropical and subtropical countries of the world. Globally, leptospirosis is responsible for around 1 million cases and 60,000 deaths in humans every year. Several animals, including rodents, serve as the reservoirs, and animal urine acts as a source of infection. Humans can acquire infection by direct contact of the skin with moist soil, water, and vegetation contaminated with the urine of infected animals. The disease presents an occupational risk to the animal handlers, sugar cane growers, rice field workers, dairy farmers, sanitation staff, veterinarians, abattoir workers, garbage collectors, butchers, etc. Leptospirosis is characterized by a wide range of clinical symptoms, such as fever, conjunctivitis, nephritis, jaundice, and pneumonia. Clinical diagnosis should be supported by various standard laboratory techniques. Doxycycline can be used for prophylaxis in the high-risk groups. Preventive measures include occupational protection, environmental sanitation, rodent control, animal vaccination, robust surveillance, targeted chemoprophylaxis, and public education. The One Health approach, encompassing experts from human, animal, and environmental areas, is imperative for the control of this enigmatic zoonosis.

Keywords

Leptospirosis; Occupational hazards; Public Health; Reservoirs; Rodents; Water; Zoonosis

1. Introduction

Zoonoses are infectious diseases that are naturally transmitted between vertebrate animals and humans, and are caused by several etiologic agents, such as viruses, bacteria, fungi, protozoa, helminths, and ectoparasites [1]. These diseases have serious implications for human and animal health, and are reported from developing and developed countries of the world [1]. Transmission of zoonoses involves many modes, including inhalation, ingestion, direct contact, bite of animals, blood transfusion, and bite of arthropods like mosquitoes, mites, ticks, etc. [1]. Leptospirosis, an emerging and re-emerging bacterial anthropozoonosis, is known with several synonyms, such as Canicola fever, Haemorrhagic jaundice, Mud fever, Swamp fever, Swineherd's disease, Weil's disease [1]. Anthropozoonosis is an infectious disease that is transmitted from animals to humans [1]. The recorded history of disease goes back to the year 1886, when Weil for the first time recognized it as spirochetal jaundice [2]. However, Stimson in 1907 noticed slender spirochetes in the silver-stained sections of the kidney of a human patient who died due to jaundice [2]. Leptospirosis is caused by pathogenic *Leptospira*, which is a thin, helical, motile, and obligate aerobic spirochaete

[1]. Weil's disease, characterized by jaundice, bleeding, and kidney failure, is a classical form of leptospirosis [3]. Disease can occur in sporadic as well as in epidemic forms, causing high morbidity and mortality [4]. Outbreaks of leptospirosis are usually noticed after the rainy seasons. People who work in agriculture, animal husbandry, and sanitary occupations have a higher risk of acquiring the infection. Rodents serve as the chief reservoir of *Leptospira* [4]. It is mentioned that pathogenic *Leptospira* survive for long periods in the convoluted tubules of the kidneys of the natural hosts, multiply, and then shed in the urine that may serve as a source of infection to the people who come in contact with it [2]. There are various modes of disease transmission, including direct and indirect contact. Diagnosis can be confirmed by isolation of the pathogen from clinical specimens, employing immunological and molecular tests [1, 5]. The microscopic agglutination test (MAT) is considered the gold standard for the diagnosis of leptospirosis [6]. Immunization of high-risk groups is practiced in some countries like China, Italy, and Russia [7]. Antibiotics, including penicillin, erythromycin, tetracycline, and streptomycin, are used to treat patients [1]. Doxycycline is recommended as a drug of choice for prophylaxis [2]. The present communication delineates the etiology, clinical spectrum, epidemiology, diagnosis, treatment, prevention, and control of leptospirosis.

2. Etiology

The disease is caused by pathogenic *Leptospira*, i.e., *L. interrogans*, which has about 22 serogroups having over 200 serotypes. The organism belongs to the genus *Leptospira*, family *Leptospiraceae*, and order *Leptospirales*. Leptospires are thin, delicate, motile, flexible, helical rods that are susceptible to heat as killed at 30 °C in 10 minutes. The organisms are aerobic and microaerophilic, which can be grown in several media in the laboratory [1, 2]. Moisture plays a vital role in the survival of organisms in the environment. They can remain viable in moist conditions at pH 6-8 to 8.0 for days [1].

3. Host and Transmission

The natural infection has been described in humans, and also in a wide variety of animal species, such as buffalo, camel, cat, cattle, deer, dog, fox, goat, horse, pig, rodent, sea lion, and sheep [1].

Humans can acquire the infection by direct contact with diseased animals and infected tissues. Contact of the skin with moist soil, water, and vegetation contaminated with the urine of infected animals can result in infection. Infection can also occur during bathing in animal urine-contaminated water, such as canals, ponds, streams, ditches, etc. *Leptospira* can penetrate the skin, mucous membranes through abrasion, injury, cuts, etc. [1].

4. Clinical Spectrum

4.1 Humans

The incubation period is usually 10 days with a range of 4 to 20 days [7]. The clinical manifestations may vary from a mild febrile illness to severe disease [7]. The patients exhibit a variety of symptoms, such as high fever, nausea, vomiting, abdominal cramps, headache, arthritis, conjunctivitis, hepatitis, jaundice, anaemia, albuminuria, nephritis, epistaxis, bronchitis, pneumonia, and meningitis. Death occurs due to acute renal failure [1].

4.2 Animals

The affected animals show anorexia, fever, dyspnea, conjunctivitis, petechial haemorrhages on the mucosa, anaemia, jaundice, hemoglobinuria, nephritis, diarrhea, polyuria, stillbirth, abortion, placentitis, hypogalactia, mastitis, drop in milk production, meningitis, rapid dehydration, and death [1]. Periodic ophthalmia is observed in horses [1].

5. Epidemiology

Leptospirosis is a highly infectious zoonotic disease that is particularly reported from the poor-resource countries of the world [8]. It is an enigmatic zoonosis, which is important from a public health and economic point of view. The distribution of the most common serotypes, their reservoirs, and distribution is shown in Table 1. Disease caused by serogroups like Canicola and Icterohemorrhagiae, is global in distribution, whereas Grippotyphosa is prevalent in Africa, Europe, South East Asia, and the USA [2]. Children more frequently acquire the infection from dogs as compared to adults [2]. The number of leptospirosis cases was higher in tropical regions as compared to temperate zones because the organisms can survive longer in warm and humid conditions. Currently, around one million cases and 60,000 deaths are attributed each year due to leptospirosis worldwide [9]. It is an occupational zoonosis affecting agriculture farmers, abattoir employees, livestock handlers, sewer workers, rodent catchers, veterinarians, military personnel, and kennel attendants [1, 4, 5]. Among several occupationally exposed groups, agricultural workers have a high risk of getting the infection due to their exposure to contaminated water and wet soil [5]. Certain activities like swimming, hunting, hiking, gardening, and fishing can also pose risks to *Leptospira* infections in humans [7, 9]. Many species of animals, such as rats, field mice, dogs, cattle, and pigs, serve as reservoirs for serogroups, like Icterohemorrhagiae, Grippotyphosa, Canicola, Hardjo, and Pomona, respectively [2]. It is pertinent to mention that one ml of urine from animal carriers can excrete up to 100 million organisms, thus contaminating the environment [2]. Rodents can excrete *Leptospira* organisms in the urine for a long time [7]. The risk of *Leptospira* infection often increases after a flood or hurricane when people come in contact with contaminated water or soil [9]. It has been mentioned that serovars of *Leptospira* have the potential to infect over 160 species of mammals [10].

Leptospirosis has been described in many nations of the world, including India [9, 11, 12]. The disease is endemic in India. and several outbreaks of leptospirosis have been reported from many States like Gujarat, Orrisa, Tamil Nadu, Kerala, West Bengal, Andaman and Nicobar Islands, Karnataka, and Maharashtra [13]. The disease presents a major public health problem that occurs at the animal–human–environment ecosystem interface, and hence, the One Health approach is imperative for its control [4].

Table 1. Common serogroups, their animal reservoirs, and distribution

Sr. No.	Name of serogroups	Animal reservoirs	Distribution
1	Bataviae	Rat	Africa, Europe, Southeast Asia
2	Canicola	Dog	Worldwide
3	Grippotyphosa	Field mice	Africa, Europe, Southeast Asia, USA
4	Hardjo	Cattle	New Zealand, UK, USA
5	Hebdomadis	Field mice	Europe, Japan, USA
6	Icterohemorragiae	Rat	Worldwide
7	Pomona	Pig	Australia, Europe, Indonesia, the Middle East

6. Diagnosis

Several laboratory methods, such as examination of freshly voided urine by dark field microscopy for demonstration of organisms, direct detection of leptospires in clinical specimens with Giemsa, silver impregnation, and immunoperoxidase techniques, immunological tests like compliment fixation (CFT), enzyme linked immunosorbent assay (ELISA), and microscopic agglutination (MAT), DNA hybridization for the demonstration of leptospires in body fluids, isolation of organism from blood, CSF during acute phase and urine after 7 days on media, such as EMJH (Ellinghausen, Mc Cullough, Johnson, Harris) containing bovine serum albumin, Fletcher's, Korthop's, and Stuart's, and inoculation of clinical specimen into Guinea pig or hamster are helpful to confirm the diagnosis of disease [1]. Among several media, EMJH is more commonly used to isolate *Leptospira*. It has been stated that MAT is the most commonly used reference and gold standard serological test for confirming the diagnosis of leptospirosis [6]. Polymerase chain reaction (PCR) is a molecular tool that is considered highly sensitive and specific to detect up to ten leptospires per milliliter of urine specimen [5]. Sehgal and co-investigators [14] reported that the LEPTO Dipstick test is a fast and simple test, which can be employed to make serodiagnosis in patients suffering from acute infection. Leptospirosis should be differentiated from several diseases, such as brucellosis, yellow fever, malaria, influenza, borreliosis, dengue, typhoid fever, pneumonia, and hepatitis [15, 16].

7. Treatment

A number of antibiotics, including erythromycin, penicillin, streptomycin, and tetracycline, are used to treat acute illness. In addition, ampicillin, amoxicillin, ceftriaxone, and doxycycline are also recommended [9]. Dihydrostreptomycin is suggested for carriers [1]. In serious cases, penicillin should be given intravenously (1 to 2 million units six hourly) for one week [2]. In order to avoid a reaction to penicillin, it is advised that sensitivity to penicillin should be checked before its administration. Doxycycline given orally in the dosage of 200 mg once a week is recommended for prophylaxis [2]. It is pertinent to mention that early treatment with antibiotics may help to prevent severe illness in patients (CDC, 2025). If the treatment is not undertaken by a severely affected patient, fatality may reach up to 40 % [15].

8. Prevention and Control

Leptospirosis is a tropical zoonosis of global public health concern affecting both sexes and all age groups [17]. It is recognized as an emerging disease of travellers [18]. The total elimination of leptospirosis seems difficult, as many species of domestic and wild animals act as reservoirs of pathogenic *Leptospira*. Several measures, such as prevention of environmental contamination by animal excreta, rodent control in human habitation and agriculture fields, provision of protective clothing to occupational workers, avoiding to enter pigsties or cowsheds in bare feet, covering blisters, cuts, scratches with waterproof plasters during the work, thorough washing of the hands after handling an infected animal, avoid swimming in contaminated water, proper disinfection of swimming pool with chlorine, kennel with cresol and agriculture field with copper sulphate, maintenance of hygienic conditions in the yard, pen, shed, and kennel, mechanization of agriculture, identification of potentially contaminated water, treatment of asymptomatic carrier and shedder in dogs, regular immunization of animals, chemoprophylaxis of high-risk groups, and health education to various occupational groups about the source of infection, mode of transmission, severity of disease, and environmental hygiene can certainly reduce the prevalence and incidence of this life-threatening zoonosis [1].

9. Conclusion

Leptospirosis is primarily an animal disease that can cause life-threatening infection in humans. It is a widely prevalent neglected zoonosis that occurs in sporadic as well as epidemic form, affecting both sexes and all age groups. Many wild and domestic animals can carry the pathogenic *Leptospira*, which are spread through the urine of infected animals. Large epidemics have been observed after heavy rainfalls and floods. Early correct diagnosis and prompt treatment are highly imperative to mitigate the sufferings of the patients. There is a need to implement the One Health approach linking experts from various fields, such as medical, veterinary, environmental, including wildlife, for the control of leptospirosis. Further research work on the development of a safe, potent, and low-cost vaccine having several commonly prevalent serogroups of *Leptospira* to immunize humans as well as animals will be rewarding.

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