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Leptospirosis: Public health perspectives☆

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Abstract

Leptospirosis, caused by a spirochete of genus *Leptospira*, is considered the most widespread zoonosis in the world. It has a global distribution with a higher incidence in the tropics and subtropics, ranging from 10 to 100 human cases per 100,000 individuals. Leptospirosis is considered an “emerging” zoonosis due to increased contact between animals and humans and the resulting human encroachment into wildlife habitat. Climate change and its associated environmental shifts can affect the degree of transmission of leptospirosis. Surveillance for leptospirosis is important for early detection of cases because early treatment is crucial to decrease morbidity and mortality. In June 2012, the Council of State and Territorial Epidemiologists approved reinstatement of leptospirosis as a Nationally Notifiable Condition. Reinstatement of national surveillance will facilitate the assessment of the incidence, geographic distribution, trends, and risk factors associated with human cases and the identification of outbreaks and potential new animal reservoirs.

Keywords

Leptospirosis; Public health; Epidemiology zoonosis; Diagnosis; Vaccines

1. Public health overview

Leptospirosis was first recognized as an occupational disease primarily associated with activities related to agriculture, sewer maintenance, and animal husbandry, and transmitted through contact with urine, water, or soil contaminated by urine from animal reservoirs, such as rodents, dogs, and livestock [1]. Leptospirosis has a global distribution with a higher incidence in the tropics and subtropics ranging from 10 to 100 human cases per 100,000 individuals [2]. Factors associated with endemic leptospirosis include tropical climates, stagnant waters, poor levels of sanitation, occupational or recreational exposure, and proximity of potential mammalian reservoirs to human populations [3]. Epidemics usually occur with flooding events associated with excessive rains or natural disasters such as hurricanes, typhoons, or earthquakes [4–6].

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Leptospirosis is currently considered an emerging zoonosis because the incidence has been documented to be increasing globally [7]. Because transmission of leptospirosis to humans can occur through contact with urine from animal reservoirs or exposure to an environment contaminated with leptospires, factors that increase contact between human and animal populations and their habitats can lead to a greater risk of acquiring leptospirosis, as well as other zoonotic diseases. As human population increase and spread, there is encroachment into wildlife habitat resulting in increased opportunities for human–animal interactions. The wildlife and exotic pet trade facilitates disease transmission through increased contact between animals and persons involved in their acquisition, sale, and purchase [8]. Importation of these animals can also lead to transmission of diseases to domestic livestock, companion animals, and native wildlife. The development of ecotourism introduces travelers to environments where they may be at increased risk of leptospirosis, especially through direct exposure to fresh water and moist soil conditions [9].

Global climate change is also considered a factor contributing to leptospirosis as an emerging disease. Increasing temperatures can lengthen survival of leptospires in the environment and can result in expansion of the habitats of reservoir species into higher elevations and latitudes [10]. Climate fluctuations have also resulted in increased frequency and severity of natural events, such as hurricanes resulting in flooding that can increase the risk for transmission of leptospirosis [11].

In the United States, 100–200 human cases of leptospirosis were reported annually through 1994, when it ceased to be a nationally notifiable disease [12]. However, it remained reportable in 36 states and territories, of which Hawaii, Texas, California, and Puerto Rico have the highest reported incidences. There are indications that incidence is increasing and at-risk populations may be changing. Recent outbreaks in the United States have been associated with participation in adventure races and triathlons involving fresh water events [13,14]. Residents of economically disadvantaged urban inner-city environments where rodent infestations are more likely are potentially at increased risk for leptospirosis [15]. In 2012, the Council of State and Territorial Epidemiologists (CSTE) approved the addition of leptospirosis as a Nationally Notifiable Condition in the United States for 2013. Reinstatement of national surveillance will facilitate the assessment of the incidence, geographic distribution, trends, and risk factors associated with human cases, and the identification of outbreaks and potential new animal reservoirs.

2. Diagnosis and treatment

The diagnosis of leptospirosis continues to present challenges to clinicians, laboratorians, and public health staff. The majority of infections are subclinical or mild, and leptospirosis usually presents as a nonspecific acute febrile illness with similar signs and symptoms to dengue, influenza, and rickettsial diseases [3]. If not diagnosed and treated early, leptospirosis can progress to more severe disease characterized by hepatic, renal or pulmonary dysfunction, or hemorrhagic manifestations. Severe disease manifestations can also occur early in the course of infection as seen in pulmonary hemorrhagic syndrome [6,16]. Laboratory diagnosis currently relies on serology because confirmation of leptospirosis by culture and isolation is difficult due to the fastidious requirements for

growth [3]. The current gold standard is the microscopic agglutination test (MAT). This method, however, relies on the maintenance of panels of *Leptospira* serovars through culture. The process is labor intensive and costly and is therefore limited to leptospirosis reference laboratories. The MAT does not identify the specific infecting group or serovar, and titer results can be difficult to interpret. A high titer is indicative of a current or recent infection, but a low titer on a single sample is inconclusive, especially since antibodies can persist for years. There is a need for diagnostic tests that can be performed locally in areas with limited resources and laboratory capacity. Development and validation of tests for early diagnosis, such as polymerase chain reaction (PCR), can also improve the ability for early detection and initiation of treatment in patients.

Challenges related to prevention and treatment can be addressed in part through the establishment of surveillance for acute febrile illness to facilitate the detection of cases of leptospirosis. Early recognition and treatment of patients have been shown to reduce the duration and severity of illness [16]. Surveillance is also useful for identifying outbreaks early where mass prophylaxis could be considered, especially in areas with high numbers of cases and limited access to health care [17,18]. This strategy, however, can be complicated by the logistics of delivery, compliance issues, and cost of antimicrobials. Vaccination is another strategy for prevention, and vaccines against leptospirosis have been developed regionally for human use, such as in France and China [19,20]. Nevertheless, the feasibility of the development of human vaccines, especially for underserved populations in endemic areas, still remains to be established. Barriers to vaccine development include lack of knowledge of locally circulating serovars, assessment of vaccine safety and efficacy, and cost.

For leptospirosis, the global burden of disease has been difficult to estimate due to lack of reliable epidemiological data from many countries where it is endemic, and lack of economic analyses to assess costs and benefits of available prevention and treatment strategies [21]. The incidence of leptospirosis is believed to be under-reported, most likely due to poor surveillance that relies on adequate laboratory capacity and clinicians' ability to recognize the disease. To better understand the burden of leptospirosis and address issues of prevention and control, the World Health Organization established the Leptospirosis Burden Epidemiology Reference Group (LERG). The LERG is using the disability-adjusted life year (DALY) to quantify the burden. The DALY measures both mortality and disability through the assessment of epidemiological data collected from multiple sources. The information obtained can be used to formulate policy and achieve the goals of identification and implementation of effective prevention and control measures.

3. Conclusions

In summary, many challenges remain for determining the global burden and impact of leptospirosis. These include the lack of established surveillance systems and point-of-care diagnostics at both national and local levels, which limits the ability to detect cases and outbreaks [21]. Long-term studies are needed to evaluate various interventions and targeted control strategies in both endemic and nonendemic areas. Because the epidemiology of leptospirosis has a strong environmental component, the development of statistical models

utilizing climate and topographical data would be beneficial for predicting outbreaks after flooding events and occurrence of natural disasters. Finally, public health entities should coordinate with the veterinary sector to implement surveillance and investigation of outbreaks with the goal of prevention and control as envisioned by the “One Health” concept [22,23].

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