

LEPTOSPIROSIS: EPIDEMIOLOGY AND PREVENTIVE MEASURES

Assimina Zavitsanou¹, **Fotoula Babatsikou**²

1. PhD, Laboratory of Medical Entomology-Zoology, Department of Public Hygiene, Technological Educational Institute (TEI) of Athens, Greece

2. PhD, M.D, Assistant Professor in Nursing, Laboratory of Epidemiology, Technological Educational Institute (TEI) of Athens, Greece

Abstract

Leptospirosis is probably the world's most widespread zoonosis of global importance. It occurs in both developed and developing countries and large outbreaks have been reported from all over the world. Leptospirosis is now being recognized as a re-emerging infectious disease. Understanding the epidemiology of this infectious disease is a critical step for designing interventions and consequently diminishing the risk of leptospirosis transmission. This article reviews on the epidemiological features of leptospirosis. Moreover, depending on these epidemiological data preventive measures are being suggested.

Keywords: epidemiology, leptospirosis, prevention

Corresponding Author:

Zavitsanou Assimina, MSc, PhD

Department of Public Hygiene

Technological Educational Institute, TEI of Athens

Agiou Spiridona-12210, Egaleo

Tel: 210 2287725, 210-7486382

e-mail: azavits@med.uoa.gr

Introduction

Leptospirosis is a serious zoonotic disease caused by infection with *Leptospira* spp and it is presumed to be the most widespread zoonosis in the world [WHO, 1999a]. Leptospirosis has been identified as a re-emerging infectious disease and this has been demonstrated by the large outbreaks in Nicaragua, Brazil, India, Southeast Asia, Malaysia and in the United States [Meslin 1997; Brandling-Bennett et al., 1996; CDC, 1995; Levett, 1999; Schwartz, 1997; Trevejo et al., 1998; WHO, 2000; CDC, 1998; CDC, 1994; CDC, 2000; Evans et al., 2000]. Leptospirosis is also being described as an emerging disease of the adventure traveler and in such case its transmission is

particularly associated with recreational exposures occurring in water sports [Mumford 1989]. On the other hand, the occurrence of large outbreaks following severe floods has been described in several locations [Epstein et al., 1995; Ko et al., 1999; Zaki et al., 1995; Trevejo et al., 1998; French et al., 1989; Fuortes et al., 1994; Oliveira et al., 1977; Park et al., 1989; es et al., 1969Simo].

In this review the epidemiological features of leptospirosis are being described in detail. Moreover, depending on these epidemiological data specific preventive measures are being suggested in order to reduce the risk of the disease transmission.

Epidemiology

Leptospirosis has a worldwide distribution and is more spread in tropical regions than in temperate countries [Everard, et al., 1993; Ratnam 1994]. This is attributed mainly to longer survival of leptospires in warm and humid environments. Leptospirosis is not limited to developing countries. Retrospective reviews of the disease epidemiology have been reported from Ireland, Denmark and Italy [Pate et al., 2000; Holk et al., 2000; Ciceroni et al., 2000]. A pattern of disease seasonality has been described with a peak incidence occurring in summer or fall in temperate regions and during rainy seasons in warm-climate regions [Levett 2001]. Leptospirosis transmission in humans occurs by direct or indirect contact with urine, blood or tissue from an infected animal containing virulent leptospires [Koutis 2007]. Infection may also arise from bathing or accidental immersion in the fresh water of lakes, rivers or canals contaminated with the urine of the infected livestock that has been previously using the water [Koutis, 2007]. After an incubation period that ranges from 1 to 3 weeks, a phase commences which is marked by fever, chills, headache and severe myalgias and arthralgias [American Public Health Association, 2000]. The great majority of infections remains undetected or misdiagnosed since leptospirosis is a zoonosis of protean and non-specific manifestations [Peter 1982]. Still, in some cases of clinical infections (5-15%) it can cause multi-organ involvement and lead to death [Ko et al., 1999].

Feral and domestic mammals (cattle, pigs and dogs) as well as reptiles and amphibians serve as a source of permanent maintenance hosts or reservoirs for the over 250 known serovars of the genus *Leptospira* [Anon 2003; WHO, 1999b]. Rats and other rodents are the most important sources for human infection [Anon 2003]. This can be confirmed from the fact that several incidences of human and animal leptospirosis in over forty countries were attributed to the rodents. Several rodent species were associated with the disease including *Rattus rattus*, *R. norvegicus*, *Mus musculus*, *Bandicota*

bengalensis, *Bandicota indica*, and others [Gangadhar 1999; Mathias et al., 2002, Koutis 2007]. Other animals such as dogs although vaccinated against *Leptospira* can shed the organism in their urine and this may result in domestic transmission in humans [Feigin et al., 1973]. In this regard, dogs are a significant reservoir for human infection in many tropical countries [Weekes et al., 1997], whereas a lot of documented outbreaks are associated with dogs [Haunz et al., 1952; Barkin 1973; Fraser et al., 1973; Everard et al., 1987]. In general, an infected animal can remain symptom-free and shed infectious organisms in the urine for its entire lifetime [Leonard et al., 1992; Thiermann 1981]. The infected animals transfer the *Leptospirosis* infectious agent to their offspring either in-utero or during neonatal period. Some leptospiral serovars are commonly associated with particular animal reservoirs; thus the prevalence of different leptospiral serovars within a human population depends on the reservoirs present and the serovars they carry [Bharti AR, et al., 2003]. However, no association has been found between infecting serovar and severity or manifestations of clinical symptoms [Merien et al., 1996; Yersin et al., 1998; Levett et al., 2001].

Leptospirosis was thought to be primarily an occupational disease. Miners were the first occupational risk group to be recognized [Buchanan 1927; Inada et al., 1916]. Definitely, occupation is a significant risk factor for humans [Waitkins et al., 1986]. Some occupational high risk groups for leptospirosis that come either in direct or indirect contact with infected animals are reported to be the farmers, veterinarians, abattoir workers, rodent control workers, miners, soldiers, sewer workers, fish farmers, rice field workers, banana farmers, and others [Campagnolo et al., 2000; Chan et al., 1987; Terry et al., 2000; Demers et al., 1985; Buckland et al., 1945; Johnston et al., 1983; Robertson et al., 1981; Padre et al., 1988; Smythe et al., 2000]. However, occupational risk has been significantly decreased since preventive measures have been implemented. In this regard, a high seroprevalence rate (17%) among sewer workers from Scotland has been reported

and this rate has been significantly reduced after the adoption of control rodent programs, the use of protective clothing and the use of detergents which even at low concentrations they inhibit leptospire's survival [Stuart, 1939; Waitkins 1984].

Leptospirosis should be considered a disease of the environment. In this regard, a number of outbreaks have been related to heavy rainfalls in various rural locations including India, Salvador, Nicaraguan, Philippines, Peru, Argentina, [Ko et al., 1999; Trevejo et al., 1998; Easton 1999; Johnson et al., 2004; Vanasco et al., 2002]. Additionally, leptospirosis was documented after the hurricane in Puerto Rico in 1996 [Sanders et al., 1996]. In India and particularly in Orissa leptospirosis was reported following the cyclone in 1999 [Sehgal et al., 2002]. Moreover, there is a significant risk associated with recreational exposures occurring in water sports including swimming, rafting, canoeing, kayaking [Mumford, 1989; Jevon et al., 1986; Shaw, 1992; Reisberg et al., 1997]. For instance, an outbreak of leptospirosis among white-water rafters in Costa Rica was reported in September of 1996 [MMWR, 1997]. Furthermore, an outbreak of leptospirosis among athletes in triathlons in Wisconsin and Illinois has been documented in 1998 [MMWR, 1998]. Additionally, travelers visiting leptospirosis-endemic places continue to bring the disease back home [van Creel, et al., 1994]. In this regard, in 2000 more than 150 athletes participated in EcoChallenge Sabah Expedition Race in Malaysian Borneo contracted leptospirosis. It was presumed that leptospirosis was acquired during swimming in open waters [CDC, 2001]. These athletes presented clinical symptoms of leptospirosis back in their home country. Moreover, many sporadic cases of leptospirosis are associated with activities of daily life; specifically many cases result from barefooted walking in damp environment or gardening with bare hands [Everard, et al., 1992; Douglin et al., 1997]. It should be mentioned that a number of disease outbreaks were associated with drinking of urine-contaminated water [Jorge 1932; Petzetakis 1932].

As mentioned earlier, leptospirosis is not limited to tropical settings and it has first recognized in US inner-city populations [Vinetz, et al., 1996]. Recently, it has been mentioned that leptospirosis has become an urban public health problem as the rural poor population has moved into the cities [Johnson et al., 2004; Ko et al.]. In countries where large demographic shifts have been documented, urban environment has been altered in ways that endemic and epidemic leptospirosis forms are favored. In Brazil for example the intense rural to urban migration in combination with the population growth have resulted in the formation of large urban slums that lack of basic sanitation; this has definitely produced suitable ecological conditions for rodent-borne transmission [Ko et al., 1999]. Urban leptospirosis situation is expected to become more urgent as the world's urban slum population is estimated to dramatically increase in the next 20 years [United Nations, 2003].

An association between prevalence of leptospirosis and gender has been reported in many studies. Particularly, men tend to present much higher incidence or prevalence of the disease than women and this fact was not attributed to more frequent exposure of men [Lecour et al., 1989; Ko et al., 1999; Sasaki et al., 1993; Ciceroni et al., 1995]. However, this association has not been confirmed in other studies [Bertherat et al., 1999; Kim, 1987; Ratnam et al., 1993].

Prevention

Understanding the epidemiological features of leptospirosis is a critical step in designing interventions for diminishing the risk of the disease transmission. At present there are few effective prevention measures for leptospirosis. Currently, there is no human vaccine available against leptospirosis. Human leptospirosis can be controlled by reducing its prevalence in wild and domestic animals. Although little can be done in wild animals, leptospirosis in domestic animals can be controlled through vaccination with inactivated whole cells or an outer membrane preparation [Palaniappan et al., 2007].

Doxycycline (100mg orally per week) is used for chemoprophylaxis but this dose must be reconsidered since its half-life is 18h [Haake et al., 2002]. Although chemoprophylaxis may be feasible for travelers it is impractical for large high risk populations. In addition, persons who travel in leptospirosis-endemic areas should be informed that bathing may be hazardous in rat infected areas [Koutis, 2007]. Since some outbreaks have been associated with drinking of contaminated water, water purification should be implemented. Prevention and control measures should be focused on the infection source [Koutis, 2007]. Rodent-vector control preferably through the use of slow acting rodenticides and improved hygiene may be some of the measures for diminishing the risk of leptospirosis transmission. Occupational hygiene (in sewers, farmers, and other high risk groups) that includes the use of water proof shoes and gloves is fundamental for preventing human leptospirosis [Koutis, 2007]. These occupational groups as well as adventure travelers should also be informed that skin abrasions should not be exposed since they serve as portal of entry for infection. Another control measure that is critical for the disease prevention is the appropriate drainage of wet areas and this is of the most radical means of sanitation. More importantly, policy makers and public health officials should be convinced that addressing the principal conditions of poverty such as poor sanitation could lead to disease elimination; In conclusion, prevention is largely dependent on sanitation measures that are difficult to implement, especially in developing countries.

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