Letter to the Editor

An Outbreak of Leptospirosis in Lezhi County, China in 2010 May Possibly Be Linked to Rainfall*

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A total of 26 leptospirosis cases occurred in the outbreak, of whom six died after hospitalization. All 26 patients were clinically diagnosed as leptospirosis. Microscopic agglutination test (MAT) revealed that 13 of 26 patients were affected with laboratory confirmed leptospirosis. Furthermore, MAT data suggested that serogroup Icterohaemorrhagiae were the main pathogens responsible for this outbreak. And the rainfall data suggested that the increased rainfall might be responsible for the leptospirosis outbreak in Lezhi County. This outbreak has reminded us that leptospirosis should not be neglected, especially during flood season, although its incidence rate is low.

Leptospirosis is the most widely spread zoonosis in the world and most commonly found in tropical or sub-tropical regions, especially in developing countries. It is present on all continents except Antarctica, and evidence for the carrier of *Leptospira* species has been found in most mammalian species examined[1-3]. The annual incidence of leptospirosis is estimated to be from 0.1 per 100 000 to 100 per 100 000 individuals. A disease incidence of more than 100 per 100 000 is encountered during outbreaks and in high exposure risk groups[4]. Exposure to contaminated water is the major risk factor for leptospirosis. Flood and heavy rainfall are the main causes of leptospirosis outbreaks. There are also a growing number of reported leptospirosis cases that are associated with outdoor activities related to water, such as swimming, running, canoeing, and water-skiing as a consequence of rising global tourism industry[5]. The typical characteristics of the disease are the sudden onset of headache, pains, prostration, relapse, jaundice, conjunctival suffusion, and petechial haemorrhages[2]. However, leptospirosis usually presents in many nonspecific ways, and the clinical manifestations of leptospirosis in humans and animals range from very mild (fever, meningitis) to very severe and often fatal (kidney, liver, and heart failure). These broad symptoms depend on the infecting serovar and other circumstances. Leptospirosis is a common and widespread zoonotic disease in China, and its outbreaks tend to occur more frequently after heavy rain or flood. Here, we reported an outbreak of leptospirosis in Lezhi County, Sichuan Province, China in 2010 after heavy rainfall.

Lezhi County lies in Southwest of China, which belongs to Ziyang City, Sichuan Province. It governs 25 townships of 628 administrative villages with a population of more than 870 000. Farmers account for 92 percent of its population. Rice is the main crop in this area, though the low precipitation is not suitable for the rice plant. Therefore, local farmers used to collect rainwater in the farm land for rice plant. In harvest season, men and women, old and young all work barefooted in the farm land. *Rattu Norvegicus* and *Apodemos agrarius* are the main wild rats. Pig, cattle, sheep, and dog are the main domestic animals. Lezhi County was one of the leptospirosis endemic areas. The annual number of leptospirosis cases was 48 to 2 011 in the 1980s and 1 to 107 in the 1990s. Local CDC institutions launched vaccination against leptospirosis among the villagers in these areas in May from the beginning of the 21st century.

An outbreak of leptospirosis was reported by the Lezhi County CDC on August 28, 2010. Leptospirosis cases were defined according to the 'Diagnostic Criteria for Leptospirosis' by the Chinese Center for Disease Control and Prevention (CDC)[6]. It classifies leptospirosis cases as laboratory-confirmed, clinically diagnosed or suspected. The final diagnosis should be based on an overall consideration of epidemic history, clinical symptoms and laboratory test results. It is obligatory to report the laboratory-confirmed and clinically diagnosed cases

doi: 10.3967/ bes2014.016

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to the Chinese CDC by employing standardized procedures. The epidemic history is defined as a history of infectious agent exposure, including contact with contaminated water and leptospiral reservoirs, one month before the onset of illness. The clinical symptoms include fever, myalgia, debilitation, conjunctival injection, gastrocnemius tenderness, and enlargement of the lymph nodes. Laboratory criteria for diagnosis include isolation of *Leptospira* from a clinical specimen, nucleic acid detection of *Leptospira* from a clinical specimen, a fourfold or greater increase in a *Leptospira* agglutination titre between acute- and convalescent-phase serum specimens obtained 2 weeks after and studied at the same laboratory, or a *Leptospira* agglutination titre of greater than 400 in one or more serum specimens. A suspected case was defined as one having epidemic history accompanied with one clinical symptom presenting as fever, myalgia or debilitation. A clinically diagnosed case was defined as one under suspicion and having been confirmed with one clinical symptom, which could be conjunctival injection, gastrocnemius tenderness or enlargement of lymph nodes. Lastly, a laboratory-confirmed case was defined as one under suspicion and having been confirmed with positive results from one of the laboratory tests. A total of 26 leptospirosis cases occurred in this outbreak, including 20 male and six female patients. Their ages ranged from 11 to 75, and the average age was 53.5. The onset data spanned a period from August 27 to September 30. All were admitted to the local hospital after a history of fever. Six patients (five males and one female) presenting with typical leptospirosis symptoms died during this outbreak after 1 or 2 days of hospitalization from pulmonary haemorrhage and renal failure. All patients were farmers, with the exception of two students. According to their statements, all worked in the field and came into contact with suspected contaminated water. The average incubation period was 10.2 days. Fever and muscle pain were the common clinical findings amongst these 26 cases, but other clinical symptoms were also present (Table 1). Sera from 26 acute or recovery phase patients were analyzed by MAT test which is the official method to serologically confirm cases of leptospirosis, using 15 Chinese endemic *Leptospira*. The agglutination result was evaluated by dark-field microscopy at 100× magnification. Sera in which 50% of the leptospires were agglutinated were considered positive. When the MAT against the one patient serum showed agglutination with more than two pathogenic *Leptospira*, the highest antibody titer was chosen as final serogroup of pathogenic *Leptospira*. According to this definition, 13 of 26 patients were laboratory-confirmed leptospirosis. Serogroup Icterohaemorrhagiae was the main pathogenic *Leptospira* of this outbreak. All 26 patients were clinically diagnosed leptospirosis. It has been reported that 75 serovars of pathogenic *L. interrogans* and *L. borgpetersenii* have been isolated in China, while the *L. interrogans* serogroup Icterohaemorrhagiae accounts for at least 80% of the leptospirosis cases[7-8]. *L. interrogans* serogroups Grippotyphosa, Autumnalis, Australis, Pomona, and Hebdomaidis are the most commonly isolated strains and *L. borgpetersenii* serogroups Javanica and Bataviae are occasionally isolated strains in this country. According to the data collected by Chinese

Table 1. Summary of the Clinical Manifestations of the Leptospirosis Cases in the 2010 Outbreak in Lezhi County, China

Clinical Manifestation	No. of Cases	Percentage (%)
Fever	26	100.0
Debilitation	25	96.2
Muscle pain	25	96.2
Gastrocnemius muscle tenderness	25	96.2
Conjunctival suffusion	20	76.9
Headache	19	73.1
Leukocytosis	15	57.7
Icteric sclera	13	50.0
Cough	10	38.5
Renal region pain	9	34.6
Lymphadenectasis	8	30.8
Bellyache	7	26.9
Vomiting	7	26.9
Oliguresis	6	23.1
Hemoptysis	4	15.4
Haematuria	4	15.4
Diarrhea	3	11.5
Hepatomegaly	3	11.5
Neck rigidity	3	11.5
Dermatorrhagia	2	7.7
Conscious disturbance	1	3.8
Leukocytopenia	1	3.8
Convulsion	1	3.8
Brudzinski's sign positive	1	3.8

CDC, Serogroups Icterohaemorrhagiae (24.91%) and Australis (34.53%) were the main epidemic pathogenic *leptospira* in the general population in Sichuan Province (unpublished data). And serogroup Icterohaemorrhagiae (94.42%) and Australis (2.30%) were also the main pathogenic *leptospira* isolated from wild and domestic animals in Lezhi County from 1993 to 2001[7]. It is consistent that serogroup Icterohaemorrhagiae is the main pathogenic *Leptospira* responsible for this outbreak.

Lezhi is a southwest county in Sichuan Province, which has some of the highest levels of rainfall from July to September. In August 2010, the rainfall reached 458 mm, which was 2.4 times greater than what was observed in the same period from 2007 to 2009 (Figure 1A). During the period of August 20-22, 2010, the total rainfall reached 310 mm. Accordingly, the leptospirosis cases reached 26 in 2010 while there were only zero to four cases reported during the period from 2007 to 2009. The increase of case number shows a good agreement with the increase of the total precipitation from July to September (Figure 1B). On the basis of the characteristics of the transmission and incubation period of leptospirosis, the heavy rain may have been a direct cause of the leptospirosis outbreak in this area.

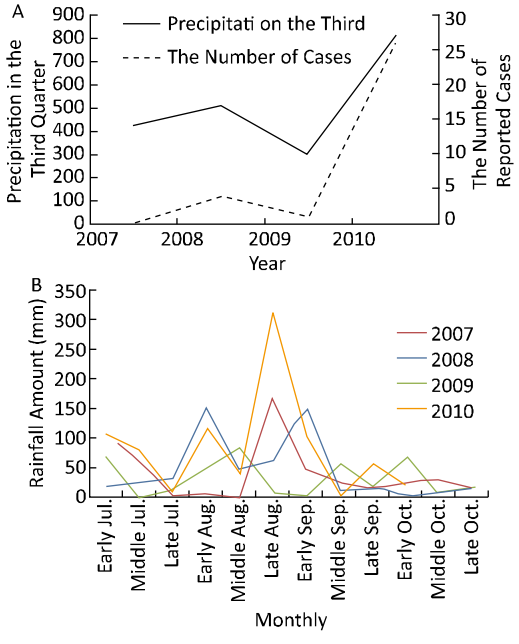

Figure 1. Rainfall in Lezhi Country, Sichuan Province from 2007 to 2010 and the number of leptospirosis cases and the total precipitation in Lezhi County, from July to September between 2007 and 2010. A, Rainfall in Lezhi Country, Sichuan Province from 2007 to 2010. B, The number of leptospirosis cases and the total precipitation in Lezhi County, from July to September between 2007 and 2010.

Leptospirosis is prevalent in China, and the first reported cases appeared in 1937[9]. Leptospirosis was deemed as a notifiable infectious disease in 1955 in China according to the statistics[7]. There were scores of leptospirosis pandemics in the past years, mostly during the 1960s and the 1970s, which posed serious threat to both the lives of the people and their property[7]. Recently, the morbidity and mortality rate has decreased due to the improvement of the living standard, hydraulic engineering and health care services, especially in the last ten years. The outbreak of leptospirosis in Lezhi County, China in 2010 does remind us that leptospirosis should not be neglected, especially during flood season, even though the incidence rate is low.

ACKNOWLEDGEMENTS

The authors are grateful to the Chinese Center for Disease Control and Prevention (CDC), Sichuan Provincial CDC and Lezhi County CDC for their help in collecting the data.

*This study was supported by grants from the National Natural Science Foundation of China (30970125, 81101264, and 81171587).

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Received: August 22, 2013;
Accepted: November 1, 2013

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