Research article

Outbreak Investigation of Leptospirosis in Padaviya, Sri Lanka

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Abstract

Background

Leptospirosis is a neglected tropical disease endemic to Sri Lanka, with outbreaks reported in 2008, 2011 and 2013. This report describes the most recent outbreak of leptospirosis in Padaviya, a rural area in Anuradhapura district, with a focus on clinical presentation and epidemiological deviations from previous outbreaks in the district.

Methods

Two distinct datasets were used for analysis in this study. The first was a retrospective review of records from Padaviya Base Hospital for patients admitted for suspected leptospirosis in December 2014. The second dataset was derived from questionnaires administered to patients admitted to the same hospital between 12 and 15 January 2015 with a suspected diagnosis of leptospirosis.

Results

A total of 19 suspected cases of leptospirosis were reviewed: 14 from admissions in December 2014 and 5 from admissions between 12th and 15th of January 2015. Renal compromise and cardiovascular symptoms were significant characteristics of this particular outbreak, with proteinuria seen in 73.7% of patients, bradycardia in 15.8% and hypotension in 36.8%. In addition, a significant discrepancy was noted between the number of cases identified by hospital staff and the number of cases reported to the regional health authorities.

Conclusion

The most striking feature of this outbreak was the higher prevalence of hypotension and bradycardia in patients, which raises the question of micro geographical distribution of leptospirosis as explained previously in Sri Lanka.

Keywords: Leptospirosis; Padaviya; Outbreak

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Introduction

Leptospirosis is an often underdiagnosed disease endemic to tropical climates, such as Sri Lanka, and spread primarily by contact with contaminated water. In Sri Lanka, rice paddy farmers are most commonly affected, as the spirochete that causes the disease makes its way into the body through skin abrasions or mucous membranes (1). Diagnosis of leptospirosis remains challenging in Sri Lanka, as diagnostic laboratory tests for the disease are not readily available and symptoms can mimic other diseases seen in the area, particularly dengue fever. In Sri Lanka, diagnosis of leptospirosis is mainly clinical, relying on presenting symptoms and only a few basic lab tests.

Outbreaks of leptospirosis have been recorded in both rural and urban areas of Sri Lanka in 2008, 2011 and 2013 (2). There is evidence that an uptick in cases occurs after flooding, with an incidence of up to 37.5/100,000 populations during times of heavy rainfall, in contrast to 11/100,000 population during drier periods (2).

Anuradhapura District and its environs are located in a relatively dry zone of the country. Before 2010, Anuradhapura District was considered a leptospirosis non-endemic area. In 2011, this previously non-endemic area had its first outbreak after flooding (3). In late 2014, Sri Lanka was again affected by heavy rains that impacted primarily the North Central and Eastern Provinces, (4) displacing 900,000 people in 17 districts (5). An increased number of leptospirosis cases with unusual presentations were noted by physicians in the Anuradhapura district (6). However, these cases were not reported in the medical literature. In addition, hospitals are required by law to report cases to the regional epidemiologist in each district, a requirement that is variably fulfilled. The primary intent of this report is to describe the most recent outbreak of leptospirosis in Padaviya, a rural town in the Anuradhapura District, with a focus on clinical presentation and epidemiological deviations from previous outbreaks in the area.

Methods

This study utilized two distinct sets of data; therefore, the methodology differed slightly for each dataset. The first was a retrospective review of records from Padaviya Base Hospital for patients admitted in December 2014 who had a final diagnosis of leptospirosis or were recorded in the medical record as having been managed as a leptospirosis case. Diagnosis of leptospirosis in Padaviya, as noted above, was based mostly on clinical suspicion and the guidelines outlined by the epidemiology unit of Sri Lanka, which are based in part on WHO recommendations (Table 1). Patient symptoms and lab results were recorded based on written report in the bed head ticket (BHTs). Demographic information as well as information on whether the patient was admitted to the ETU (Emergency Treatment Unit), which was being used temporarily to deliver ICU care during this outbreak, was also recorded. As this was a retrospective chart review, all patients in this dataset had already been discharged or transferred; thus screening tests such as ELISA were not done.

Our second dataset comprised of a questionnaire investigation of patients admitted to Padaviya Hospital between 12th and 15th of January 2015 with a suspected diagnosis of leptospirosis (n=5). The inclusion criteria were the same as those outlined above and are described in Figure 1. After identifying these patients using ward records, medical undergraduates from the Rajarata Faculty of Medicine in Anuradhapura completed detailed patient surveys that included questions regarding exposure history, symptoms experienced prior to and during hospitalization, living conditions and socioeconomic status (SES). The medical student data collectors conducted the interviews in Sinhala but recorded data to the questionnaire in English. Each patient then had blood drawn and tested using the ImmuneMed Leptospira Rapid kit (Gangwon-Do, South Korea). The rapid test is an IgM/IgG antigen-antibody (ELISA) assay, with >90% sensitivity and specificity (5). The rapid test cannot identify specific serovars of the bacteria, and as such advanced tests were not available for the current sample of patients, we cannot speculate on any associations between specific serovars and unique clinical presentations seen in this outbreak.

Data was analyzed using SPSS version 19 (IBM, Armonk, NY). We report medians and standard deviations as the measure of central tendency for all linear data. All categorical data are presented as proportions and frequencies.

This study was done as a part of routine outbreak investigation procedure. The study conformed to the Helsinki Declaration and to local legislation. Patients provided oral consent to be interviewed and to have blood samples drawn and analyzed for rapid diagnosis.

Table 1 **Inclusion criteria for suspected cases of leptospirosis**

Inclusion criteria
Presenting complaint: acute febrile illness (fever <5 days) with headache, myalgia and prostration, associated with at least one (1) of the following additional signs/symptoms: a) conjunctional suffusion/hemorrhage b) meningeal irritation c) anuria or oliguria/proteinuria/hematuria d) jaundice e) hemorrhage f) purpuric skin rash g) cardiac arrhythmias or failure
(2) Any febrile patient who is clinically suspected to have leptospirosis, without conforming to surveillance case definitions

Results

The ward admission register indicated that 18 leptospirosis patients were admitted to Padaviya Hospital in December 2014. Of these, only 13 BHTs could be

located. An additional suspected case was found while screening the BHTs of febrile patients, for a total of 14 BHTs to study. During the hospital visit between 12th and 15th of January 2015, we recruited 5 patients (4 male and 1 female) available at that time, falling into our inclusion criteria (3 clinically suspected leptospirosis and 2 clinically suspected viral fever) for full investigation. Four out of these five patients tested positive for leptospirosis.

Median age for the combined data set was 36 years (SD 8 yrs). Of the 19 patients enrolled, 15 (79%) reported exposure to muddy water, a known risk factor for leptospirosis. Median household income was 10,000 Sri Lankan Rupees (LKR) per month (range 8,000 – 30,000 LKR), and most had completed at least 5 years of primary education (range: 0 – 11). The median length of hospitalization for all patients in the sample (n=19) was 4 days (range 2 – 8). ETU care was received by 63% (n=12) of patients, with a median stay of 1.5 days (range 1 – 6) in ETU.

All five patients interviewed in January reported working as farmers. One patient was also a member of the civil forces. Though government policy dictates that doxycycline be provided as prophylaxis to selected members of the population considered to be high-risk by the government, none of the 5 patients interviewed in January 2015 reported receiving prophylaxis. Three patients initially sought care from private practitioners. The remaining (n=2) presented directly to a government hospital for treatment.

Symptom analysis showed that of the entire combined cohort, 94.7% experienced fever at some point during their hospitalization. In addition, 78.9% reported myalgia and 68.4% reported headache. Renal involvement was also a significant characteristic of this particular outbreak, with proteinuria affecting 73.7% (Table 2). We compared these relative frequencies of selected signs and symptoms reported in Padaviya in Dec/Jan of 2014/2015 to those reported in the Agampodi *et al.* study in Anuradhapura 2014 (3) (Figure 1). Cardiovascular symptoms were more prominent in the most recent outbreak, with bradycardia reported in 15.8% and hypotension in 36.8%.

Laboratory Reporting

Table 2 **Urine and blood biochemistry of 19 suspected cases of leptospirosis from Padaviya Dec 2014 /Jan 2015**

Lab test	N (%)
Proteinuria*	14 (74)
Thrombocytopenia**	10 (53)
Elevated ESR***	10 (53)
Elevated Liver Function Tests†	8 (42)
Leukocytosis††	6 (32)
Leukopenia†††	5 (26)
Renal Failure‡	1 (5)

*Any albumin in urine, **Platelets < 150 x 10^3/µL, ***ESR > 20mm/1st hour, †Serum total bilirubin >1.3 mg/L, SGOT > 35 IU/L, or SGPT > 56 IU/L, ††WBC > 10.5 x 10^3/µL, †††WBC < 4.0 x 10^3/µL, ‡Cr >115 µmol/L

Table 2 presents data regarding laboratory testing performed during admission in the full cohort (n=19). The data shown represent unique patients: patients with abnormal lab findings at any point on admission or during hospitalization were counted as one data point, regardless of the number of times that a particular lab value was abnormal.

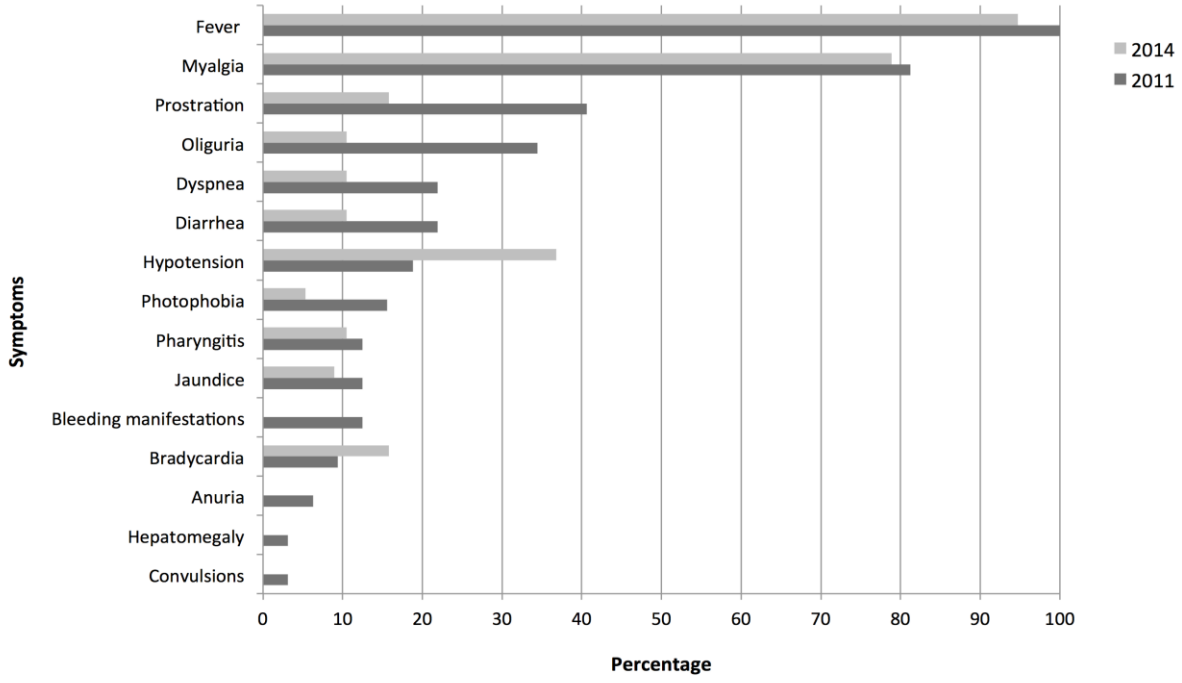

Figure 1 **Comparison of signs/symptoms reported during hospitalization in 2011 (Anuradhapura district) vs. 2014/2015 (Padaviya only)**

Discussion

This is the first published report on leptospirosis in Padaviya. Though the standard microscopic agglutination test (MAT) was not available for case confirmation, clinical and epidemiological data show enough evidence to conclude that the most recent outbreak of febrile illness in Padaviya was due to leptospirosis. It is important to note that even where rapid tests such as the ImmuneMed used in the current study are available, a negative test result does not rule out infection. For example, the negative test result seen in the fifth patient tested in this study could have been the result of an insufficient window for antibody production rather than a reflection of absence of leptospira infection.

The most striking feature of this outbreak was the higher proportion of cases with hypotension and bradycardia. A high proportion of leptospirosis cases with hypotension were previously reported in Thailand in 2002 (7). In a study conducted of that outbreak, the researchers postulated that the high percentage (68%) of hypotension (MAP < 70mmHg) in their cohort of confirmed leptospirosis patients could be explained by systemic vasodilation combined with increased cardiac output and renal vasoconstriction secondary to cytokine release. Patients with hypotension were more likely to have renal compromise in their clinical course as well. One study by Niwattayakul *et al.* recommends early fluid administration to down regulate vasoactive substances and remediate potential kidney damage while preventing fluid overload and pulmonary complications (7).

Though there were 18 suspected cases of leptospirosis at Padaviya Hospital in December 2014, the district level surveillance data showed that no cases of leptospirosis were reported to the regional epidemiologist from Padaviya during the study period. Despite leptospirosis being a mandatory notifiable disease in Sri Lanka, it is clear from this discrepancy that improvements need to be made in leptospirosis case reporting. This fact was previously noted and commented on during the 2011 leptospirosis outbreak. Proper public health surveillance is essential for the early detection, prevention and aversion of infectious disease epidemics therefore high priority should be given to improve case reporting.

Finally, the WHO strongly recommends to implement a rapid test or laboratory confirmation system for suspected cases, as an integral component of effective public health surveillance. Though this would likely be challenging to implement in low-resource areas such as Padaviya, we recommend that health authorities at the district level consider implementing such a system in the future.

Conclusions

We confirmed an outbreak of leptospirosis using rapid point of care diagnostics, which helped in outbreak control and clinical care. Validations of these tools are required to use it in routine settings.

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