

Short Communication

Verbal autopsy of probable leptospirosis deaths in a tertiary care centre in North Kerala

Deepthi Sumitha Rajagopal*, Jayasree Anandabhavan Kumaran

Department of Community Medicine, Government Medical College, Pariyaram, Kannur, Kerala, India

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*Correspondence:

Dr. Deepthi Sumitha Rajagopal,

E-mail: drdeepthisr@gmail.com

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ABSTRACT

Leptospirosis is a significant zoonosis in India, especially in southern regions, where it causes substantial morbidity and mortality. Verbal autopsy is a structured interview used to determine probable cause of death from caregivers or next of kin. Objectives were to identify factors associated with fatality among probable leptospirosis patients admitted to a tertiary centre in North Kerala. A hospital-based descriptive study was conducted at Government Medical College Kannur. Twelve probable leptospirosis deaths reported between January and December 2024 were included. Case records and telephonic interviews with relatives were used to collect data on disease course. Mean age of the deceased was 49.88 ± 11.6 years, with male predominance (75%) and most being agricultural workers (58.3%). Chronic alcoholism was present in 50%, while 91.7% had no prior comorbidities. Common features were fever (100%), myalgia (58.3%), and reduced urine output (41.7%). Liver derangement occurred in all cases and renal impairment in 66.7%. Mean patient delay was 2.1 days; diagnostic and treatment delays were 0.9 days each. Although doxycycline prophylaxis was issued to 50%, none had taken it. Sepsis/ multiorgan dysfunction syndrome (MODS) (58.3%) and cardiac complications (41.7%) were leading causes of death. Most fatalities occurred in the economically productive age group (40-60 years). Deaths happened despite early diagnosis, treatment, and few pre-existing comorbidities, suggesting rapid progression to multi-organ failure. High occupational exposure among agricultural workers, chronic alcoholism, and poor prophylaxis adherence were present. These findings suggest the need for improved public health awareness and preventive strategies for high-risk populations.

Keywords: Leptospirosis, Verbal autopsy, North Kerala

INTRODUCTION

Leptospirosis is a zoonotic disease caused by several serotypes of *Leptospira* (spirochaetes). These are excreted in the urine of wild and domestic animals especially rodents like rats, mice, cattles, pigs etc. Humans acquire the disease by contact with an environment contaminated by urine and faeces of carrier. Incubation period is usually 10 days, with a range of 4 to 20 days. The disease manifestations ranges in severity from a mild febrile illness to severe, sometimes fatal disease with liver and kidney involvement. Clinical types of the disease include anicteric and icteric leptospirosis. Weil's disease is one of

the many manifestations of human leptospirosis.¹ Outbreaks of leptospirosis have been increasing in India for the past three decades. The positivity rate for the disease is notable in the southern part of India at 25.6%, followed by 8.3%, 3.5%, 3.1%, and 3.3% in northern, western, eastern and central India, respectively.² Globally, leptospirosis was estimated to cause 1.03 million cases and 58,900 deaths each year. These estimates place leptospirosis as a leading zoonotic cause of morbidity and mortality.³ While the overall mortality rate for uncomplicated cases is low, severe forms carry a substantial burden. Weil syndrome, characterized by jaundice and renal failure, has a case-fatality rate of 5-

15%. The most severe manifestation, leptospirosis pulmonary hemorrhage syndrome (LPHS) carries a mortality rate exceeding 50%.

Factors associated with leptospirosis mortality were older age and delayed antibiotic therapy.⁴ Prevention of leptospirosis mainly involves avoiding exposure to contaminated water, especially during floods. Use protective gear such as boots and gloves if exposure is unavoidable, ensure safe drinking water, maintain rodent control and chemoprophylaxis with doxycycline might be effective in preventing clinical disease.⁵ Verbal autopsy is a structured interview with the caregivers or next of kin of the deceased that can be used to determine the most likely cause of death where no physician can ascertain the dead.⁶

Despite early diagnosis, treatment, and prophylactic measures, fatalities still occur, suggesting the presence of contributory clinical, behavioural, and healthcare-related factors. Verbal autopsy can provide an understanding of disease progression, delays in care, complications, and preventive practices among deceased patients. The findings of this study may help strengthen preventive strategies, improve awareness regarding prophylaxis, and reduce mortality among high-risk populations.

Objective of the study were to identify the factors associated with fatality among probable leptospirosis patients admitted to a tertiary care centre in North Kerala.

METHODS

A hospital-based descriptive study was conducted at Government Medical College Kannur in North Kerala. A total of 12 deaths reported between January 2024 and December 2024 were included in the study.

Inclusion criteria

All probable leptospirosis deaths reported at Government Medical College, Kannur, between January and December 2024 were included in the study.

Exclusion criteria

There were no exclusion criteria, as all probable leptospirosis deaths during the study period were included in the study.

Ethical considerations

The study was conducted after obtaining departmental ethical approval and permission from the Head of the Department, Department of Community Medicine, Government Medical College, Kannur. Confidentiality of patient information was maintained throughout the study and verbal consent was obtained from the relatives before telephonic interviews.

Operational definitions

Probable leptospirosis

A person having acute febrile illness with headache, myalgia, and prostration, with an associated history of exposure to infected animals or an environment contaminated with animal urine, along with one or more of the following features: calf muscle tenderness, conjunctival suffusion, anuria/oliguria, jaundice, haemorrhagic manifestations, vomiting, abdominal pain, or diarrhoea.⁷

Patient interval

Patient delay was defined as the time interval between symptom onset and first healthcare consultation.⁸ A delay exceeding 5 days was considered clinically significant, as severe complications of leptospirosis commonly develop within 5-7 days of illness.

Diagnostic delay

The time interval between first consultation with a healthcare provider and diagnosis.⁸ A delay exceeding 24 hours was considered clinically significant due to the rapidly progressive nature of leptospirosis.

Treatment delay

The time interval between diagnosis and initiation of treatment.⁸ A delay exceeding 24 hours was considered clinically significant considering the importance of early treatment in leptospirosis.

Data collection and analysis

Data were collected from case records of the patients. Details regarding the course of disease were obtained from relatives of the deceased through telephonic interviews using a semi-structured questionnaire.

The collected data were entered in Microsoft excel and analysed using appropriate statistical methods. Descriptive statistics such as frequencies and percentages were used to summarise the findings.

RESULTS

A total of 12 probable leptospirosis deaths reported at Government Medical College Kannur during the period January 2024 to December 2024 were included in the study. The mean age of the deceased was 49.8 ± 11.6 years, ranging from 29 to 64 years.

Out of the 12 probable leptospirosis deaths, the mean age was 49.8 ± 11.6 years. A significant male preponderance (75%) was observed. The 40-60 years age group was most affected (58.3%) indicating high mortality among the economically productive population. Occupationally,

agriculture workers constituted the majority (58.3%). 6 out of 12 (50%) were chronic alcoholics. In majority of the cases (91.7%) comorbidities were absent with only one patient having a history of LRTI, chronic obstructive pulmonary disease (COPD) and coronary artery disease (CAD).

Occupation of others include skilled/self-employed, unskilled labourers, and unemployed/dependent individuals. The single patient with comorbidities had a history of lower respiratory tract infection (LRTI), COPD, and CAD.

Out of the probable leptospirosis deaths, patient delay was absent (≤ 5 days) in the majority of cases (10) while clinically significant patient delay (> 5 days) was observed in only one case. As one patient was destitute, didn't get his details on this. The mean patient delay was 2.1 ± 1.7 days. As one patient was destitute, detailed history regarding delay could not be obtained. Out of the 12 probable leptospirosis deaths, diagnostic delay was absent (≤ 1 day) in the majority of cases (10), while clinically significant diagnostic delay (> 1 day) was observed in two cases. The mean diagnostic delay was 0.9 ± 1.7 days.

Out of the 12 probable leptospirosis deaths, treatment delay was absent (≤ 1 day) in the majority of cases (10), while clinically significant treatment delay (> 1 day) was observed in 2 cases.

The mean treatment delay was 0.9 ± 1.7 days.

Out of the 12 probable leptospirosis deaths, fever was the predominant presenting symptom and was observed in all cases (100%). Myalgia was reported in 58.3% of the cases, while reduced urine output was noted in 41.7%. Gastrointestinal manifestations such as loose stools and vomiting were present in 33.3% of cases each.

Yellowish discolouration and breathlessness were observed in 25% of the patients. Doxycycline prophylaxis had been given to 50% of the patients. However, none had taken prophylaxis.

Laboratory abnormalities were commonly observed among the probable leptospirosis deaths. Liver function derangement was present in all cases (100%), whereas renal function derangement was observed in 66.7% of the patients.

Table 1: Baseline characteristics of probable leptospirosis deaths, (n=12).

Variables	Category	N	Percentage (%)
Gender	Male	9	75
	Female	3	25
Age (in years)	<40	2	16.7
	40-60	7	58.3
	>60	3	25
Occupation	Agriculture worker	7	58.3
	Homemakers	2	16.7
	Others	3	25
Chronic alcoholism	Present	6	50
	Absent	6	50
Comorbidities	Present	1	8.3
	Absent	11	91.7

Table 2: Patient delay among probable leptospirosis deaths, (n=11).

Variables	Category	N	Percentage (%)
Patient delay	Delay absent (≤ 5 days)	10	90.9
	Delay present (> 5 days)	1	9.1

Table 3: Diagnostic delay among probable leptospirosis deaths, (n=12).

Variables	Category	N	Percentage (%)
Diagnostic delay	Delay absent (≤ 1 day)	10	83.3
	Delay present (> 1 day)	2	16.7

Table 4: Treatment delay among probable leptospirosis deaths, (n=12).

Variables	Category	N	Percentage (%)
Treatment delay	Delay absent (≤ 1 day)	10	83.3
	Delay present (> 1 day)	2	16.7

Table 5: Distribution of clinical features and doxycycline prophylaxis among probable leptospirosis deaths.

Clinical features	N	Percentage (%)
Fever	12	100
Myalgia	7	58.3
Yellowish discolouration	3	25
Reduced urine output	5	41.7
Loose stools	4	33.3
Vomiting	4	33.3
Breathlessness	3	25
Doxycycline prophylaxis given	6	50
Doxycycline prophylaxis taken	None	None

Table 6: Laboratory abnormalities among probable leptospirosis deaths.

Laboratory abnormality	N	Percentage (%)
Liver function derangement	12	100
Renal function derangement	8	66.7

Table 7: Distribution of primary causes of death among probable leptospirosis deaths.

Variables	Categorisation	N	Percentage (%)
Primary cause of death	Sepsis/septic shock/MODS	7	58.3
	Cardiac (Myocarditis/arrest/shock)	5	41.7
	Hepatorenal syndrome	2	16.7
	Acute kidney injury	2	16.7
	Respiratory failure/ARDS	3	25

Multiple causes of death were present in some patients.

Among the 12 probable leptospirosis deaths, sepsis/septic shock with MODS was identified as the leading cause of death, accounting for 58.3% of cases. Cardiac complications, including myocarditis, cardiac arrest, and cardiogenic shock, were documented in 41.7% of cases. Respiratory failure/ARDS contributed to 25% of deaths, whereas hepatorenal syndrome and acute kidney injury were each reported in 16.7% of cases. In general, fatal outcomes were frequently associated with complications involving multiple organ systems.

DISCUSSION

In this study, most deaths occurred in middle-aged adults (mean 49.8±11.6 years) with 58.3% aged 40-60 years, indicating that fatalities were more in the economically productive age group.

The findings reveal a significant male preponderance (75%) and majority of deaths in the economically productive age group (40-60 years), who accounted for 58.3% of the cases. This demographic trend is likely linked to occupational exposure, as agriculture workers constituted the majority (58.3%) of the deceased. Given that leptospirosis is a zoonotic disease transmitted through environment contaminated with animal urine, these workers are at high risk due to their frequent contact with soil and water during their daily activities.

A significant finding is that half of the patients (50%) were chronic alcoholics. This may have contributed to the 100% incidence of liver function derangement found in our laboratory results. The occurrence of mortality in 11 patients without any known prior medical illness suggests that the circulating strains may have been highly virulent, with affected individuals showing rapid progression to systemic failure despite having no comorbidities.

An important finding of this study is the absence of significant delays in seeking and receiving care. Most patients (90.9%) sought medical attention within 5 days of symptom onset, with a mean patient delay of only 2.1 days. Furthermore, diagnostic and treatment delays were minimal, with 83.3% of cases receiving a diagnosis and initiating treatment within 24 hours of their first consultation. The fact that mortality occurred despite this rapid clinical response suggests that the cases may have been characterized by high virulence or that the transition from mild febrile illness to severe multi-organ failure can occur more rapidly than the conventional 5-7-day window.

Fever was the common presenting symptom (100%) followed by myalgia (58.3%) and reduced urine output (41.7%). Laboratory data further shows that the severity of these cases, with 100% of the deceased exhibiting liver function derangement and 66.7% showing renal impairment. These findings are in accordance with the known progression of severe leptospirosis (Weil's

disease) which frequently involves hepatic and renal systems.

One of the most significant findings is the total failure of prophylaxis adherence. While 50% of the patients had been issued doxycycline prophylaxis, none of them (0%) actually took the medication. This indicates a major public health challenge despite the availability of preventive measures; there is a significant gap in health awareness or perceived risk among high-risk groups like agricultural workers.

The verbal autopsy data indicates that sepsis and septic shock with MODS was the leading cause of death (58.3%). Cardiac complications (41.7%) including myocarditis and cardiogenic shock and respiratory failure and ARDS (25%) were also major contributors. The involvement of multiple organ systems in these fatal outcomes shows the systemic nature of the infection and the need for intensive monitoring of cardiac and respiratory parameters alongside renal and hepatic functions.

CONCLUSION

This study has assessed the reported 12 probable leptospirosis deaths in a tertiary care centre in Northern Kerala during 2024. The majority were middle-aged male agricultural workers indicating high occupational exposure to contaminated environments. Half of them were chronic alcoholics. Although most patients sought care and received a diagnosis in a timely manner, illness frequently progressed rapidly to multisystem organ failure even in the 11 patients who had no prior comorbidities. Only one patient had a documented medical history of LRTI, COPD, and CAD. Sepsis and cardiac complications were the predominant immediate causes of death. None of the patients reported taking the doxycycline prophylaxis that had been offered. These findings suggest that high pathogen virulence, rapid progression, and limited public health awareness contributed to fatal outcomes even when delays in access to care were minimal. These findings suggest the need for improved public health awareness regarding leptospirosis among high-risk populations, particularly agricultural workers. Strengthening community education on early symptom recognition, use of doxycycline prophylaxis, personal protective measures and early healthcare seeking behaviour may help to reduce leptospirosis related mortality. Enhanced surveillance and early identification of severe cases are also essential to prevent rapid progression and fatal complications.

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