Journal of Communicable Diseases
Volume 57, Issue 4 - 2025, Pg. No. 61-65
Peer Reviewed & Open Access Journal

Research Article

Declining Seroprevalence of Leptospirosis: A Three-Year Trend Analysis from a Tertiary Care Centre

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DOI: https://doi.org/10.24321/0019.5138.202597

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How to cite this article:
Khan M A, Rizwan S. Declining Seroprevalence of Leptospirosis: A Three-Year Trend Analysis from a Tertiary Care Centre. J Commun Dis. 2025;57(4):61-65.

Date of Submission: 2025-09-06
Date of Acceptance: 2025-12-25

A B S T R A C T

Introduction: Leptospirosis is an emerging zoonotic disease of global significance, often underdiagnosed due to nonspecific clinical features and overlap with other endemic febrile illnesses. North India, despite being vulnerable, has limited epidemiological data. This study aimed to determine the seroprevalence, clinical profile, complications, and co-infections of leptospirosis in patients presenting to a tertiary care centre.

Materials and Methods: A total of 500 clinically suspected patients attending the All India Institute of Medical Sciences, New Delhi, between July 2022 and May 2024 were included. Blood samples were tested for anti-Leptospira-specific IgM antibodies using ELISA. Clinical details were assessed using Modified Faine's criteria, and patients were screened for common co-infections, including typhoid, malaria, dengue, and scrub typhus. Data were analysed using STATA software, with $p < 0.05$ considered significant.

Results: 500 suspected cases, 28 (5.6%) were seropositive, while none of the 25 healthy controls tested positive. Males (75%) were more affected than females, with a male-to-female ratio of 3:1. Adults formed the majority (92.9%), with a mean age of 39.8 years. Seasonal clustering was observed, peaking during the monsoon (50%). Fever was universal, followed by jaundice (46.4%), headache (42.9%), and myalgia (39.3%). Renal involvement was the most common complication (28.6%), followed by neurological (14.3%) and pulmonary (10.7%) manifestations. Co-infections were documented in 21.4% of cases, most commonly typhoid.

Conclusion: Leptospirosis remains a clinically significant cause of febrile illness in North India, with seasonal predominance and potential for severe complications. Early diagnosis, heightened clinical suspicion, and preventive measures during monsoon are essential to reduce morbidity.

Keywords: Leptospirosis, Seroprevalence, Clinical profile, Complications, Co-infections, Monsoon

Introduction

Leptospirosis is an anthropozoonotic infection caused by pathogenic Leptospira spp, and has emerged as an important public health problem in India.[1–3] Although primarily considered an occupational disease, environmental contamination renders the general population equally vulnerable.[4] The disease exhibits a wide clinical spectrum, ranging from asymptomatic or subclinical infections to severe, life-threatening manifestations such as pulmonary haemorrhage and Weil's syndrome, posing significant diagnostic and therapeutic challenges.[5]

Typical clinical features include fever, myalgia, headache, conjunctival suffusion, rash, hepatosplenomegaly, haemorrhagic tendencies, renal failure, jaundice, aseptic meningitis, and acute respiratory distress syndrome (ARDS). Importantly, co-infections with endemic pathogens such as typhoid, malaria, scrub typhus, and dengue often complicate the diagnostic scenario, necessitating a high index of suspicion in endemic areas. Clinical diagnosis alone is unreliable; hence, laboratory confirmation plays a pivotal role.

In North India, leptospirosis has been underdiagnosed and underreported due to low awareness, inadequate epidemiological surveillance, and limited diagnostic infrastructure. Conventional methods such as microscopy and culture, though considered standard, are labour-intensive, time-consuming, and require expertise. Molecular techniques, while more sensitive and specific, are costly and resource-intensive, limiting their routine applicability in resource-constrained settings.[6] Serological assays, particularly ELISA, are widely used owing to their high sensitivity and specificity (≈95%) and better cost-effectiveness compared to the microscopic agglutination test (MAT).[6]

Against this backdrop, the present study was undertaken to determine the seroprevalence trends of leptospirosis over a three-year period (2022–2024) at a referral tertiary care hospital in North India.

Materials and Methods

This study included a total of 500 patients with clinically suspected leptospirosis attending the outpatient clinics or admitted to the Departments of Medicine, who were retrospectively analysed over a three-year period from July 2022 to May 2024. The inclusion criteria were based on the guidelines laid down by the International Leptospirosis Society (ILS). Patients with fever lasting more than seven days, accompanied by one or more clinical manifestations such as severe headache, myalgia, conjunctival suffusion, uveitis, arthralgia, rash, hepatosplenomegaly, haemorrhage, renal failure, jaundice, aseptic meningitis, acute respiratory distress syndrome (ARDS), or pulmonary haemorrhage, were included. Clinical details and laboratory findings were recorded using a structured pro forma. Diagnosis of presumptive and possible leptospirosis was further assessed using the modified Faine's criteria.

Collection and Processing of Samples

Approximately 5 ml of venous blood without anticoagulant was collected from all patients during the acute phase under aseptic conditions. Serum was separated following standard laboratory protocols.

Serological Evaluation

Serological testing for anti-Leptospira-specific IgM antibodies was performed using a commercially available ELISA kit (Panbio Diagnostics, Brisbane, Australia) according to the manufacturer's instructions. Serum samples from 25 healthy individuals served as controls.

Screening for Co-infections

Since leptospirosis shares clinical manifestations with other endemic infections, all patients were also screened for common co-infections, including typhoid, malaria, dengue, and scrub typhus. Malaria screening included examination of peripheral blood smears with Giemsa staining, acridine orange staining under UV light, immunochromatographic testing, and quantitative buffy coat (QBC) assay (QBC Diagnostic Inc., Philipsburg, USA). Typhoid detection was carried out using the Widal test. Dengue virus and scrub typhus infections were confirmed serologically using commercial ELISA kits (Dengue Duo Cassette, PanBio, France).

Statistical Analysis

All data were entered and analysed using STATA/SE version 14.0 statistical software (Stata Corp, Texas, USA). Categorical variables were expressed as frequencies and percentages. Results were summarised in tabular form. Statistical significance was assessed using appropriate tests, and p-values < 0.05 were considered significant.

Results

A total of 500 clinically suspected patients were included in the present study. Of these, 28 patients (5.6%) were seropositive for anti-Leptospira-specific IgM antibodies, while none of the 25 healthy controls tested positive. Among the seropositive cases, 21 (75%) were males and 7 (25%) were females, yielding a male-to-female ratio of 3:1. Statistical analysis revealed that males had a significantly higher risk of being seroreactive compared to females ($\chi^2 = 10.9$, $P = 0.001$). The age of seropositive patients ranged from 5 to 82 years, with a mean of 39.8 ± 15.4 years and a median of 38 years. Adults accounted for the majority (26/28; 92.9%), while only 2 (7.1%) were children ≤15 years,

ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202597

showing a significant predominance of adult cases (χ^2 = 25.6, P < 0.001). A clear seasonal trend was observed, with seroprevalence peaking during the monsoon season (June–September) at 14/28 (50%), followed by the pre-monsoon (February–May) at 8/28 (28.6%) and the post-monsoon (October–January) at 6/28 (21.4%). This seasonal clustering highlighted the increased risk of exposure during periods of heavy rainfall and flooding. Based on modified Faine's criteria, a diagnosis of presumptive leptospirosis was made in 21 patients (75%), while 7 patients (25%) fulfilled criteria for possible leptospirosis. Fever was a universal finding (100%), followed by jaundice (46.4%), headache (42.9%), myalgia (39.3%), rash (17.9%), and arthralgia (7.1%). Hepatomegaly was documented in 32.1%, splenomegaly in 21.4%, and haemorrhagic manifestations in 25% of patients. The most frequent complication was renal involvement (28.6%), followed by neurological manifestations (14.3%) such as altered sensorium and meningitis. Pulmonary complications (10.7%) and cardiovascular involvement (3.6%) were less commonly observed. Co-infections were documented in 6 seropositive patients (21.4%). The most frequent was typhoid (n = 3), followed by dengue (n = 2) and scrub typhus (n = 1). No co-infections with malaria were detected in this cohort. Seasonal overlap with monsoon-associated infections appeared to contribute to this clustering.

Table 1.Demographic Characteristics of Seropositive Patients

Parameter	No. of Patients	Percentage (%)
Gender		
Male	21	75.0
Female	7	25.0
Age Group (years)		
≤15	2	7.1
16–40	11	39.3
41–60	10	35.7
>60	5	17.9
Mean ± SD (years)	39.8 ± 15.4	
Median (years)	38	

Table 2.Seasonal Distribution of Leptospira Seropositivity

Season (Months)	Seropositive Cases (n)	Percentage (%)
Monsoon (Jun–Sep)	14	50.0
Pre-monsoon (Feb–May)	8	28.6
Post-monsoon (Oct–Jan)	6	21.4

Table 3.Clinical Manifestations and Complications in Seropositive Patients

Clinical Feature / Complication	No. of Patients	Percentage (%)
Presenting Features		
Fever	28	100.0
Jaundice	13	46.4
Headache	12	42.9
Myalgia	11	39.3
Rash	5	17.9
Arthralgia/arthritis	2	7.1
Hepatomegaly	9	32.1
Splenomegaly	6	21.4
Hemorrhage (any type)	7	25.0

ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202597

Complications		
Renal involvement	8	28.6
Neurological (altered sensorium/meningitis)	4	14.3
Pulmonary involvement	3	10.7
Cardiovascular involvement	1	3.6

Discussion

In our study, 75% of the seropositive patients were males and 25% were females (male-to-female ratio 3:1), with adults forming the majority (92.9%) and a mean age of 39.8 ± 15.4 years. This finding is consistent with Sethi et al. (2003),[7] who reported that 81% of leptospirosis patients in northern India were males, highlighting occupational exposure in agricultural and outdoor settings as a key risk factor. Similarly, Muthusethupathi et al. (1995)[8] in Madras found a male-to-female ratio of 4:1, with most cases in the third and fourth decades of life, further confirming that adult males are disproportionately affected. Chaudhry et al. (2013),[9] in a 10-year AIIMS Delhi study, also observed that the majority of cases were adults aged 20–50 years, with significant male predominance. These parallels suggest that across different parts of India, men of working age consistently represent the highest risk group for leptospiral infection, likely due to greater environmental and occupational exposure. We observed the highest seropositivity during the monsoon season (50%), followed by pre-monsoon (28.6%) and post-monsoon (21.4%). This seasonal pattern has been well documented in India and globally. Shivakumar (2008)[10] reported that the majority of Indian cases occurred during the monsoon due to increased rodent activity and waterlogging. The WHO Brainstorming Meeting (2006)[11] also emphasised monsoon peaks in leptospirosis transmission in South and Southeast Asia. Hinjoy (2014)[12], analysing Thailand's national surveillance data (2003–2012), noted similar monsoon-associated surges, with incidence rates rising sharply in the rainy season. Our findings are also in line with Sohail et al. (2018)[13] from Pakistan, who demonstrated higher seroprevalence in humid, flood-prone areas (12.8%) compared to arid zones (5.2%). Together, these results highlight the influence of climate and seasonality, reinforcing the need for strengthened preventive measures during the monsoon months. In our study, fever was universal (100%), with jaundice (46.4%), headache (42.9%), and myalgia (39.3%) as the leading symptoms. Complications included renal involvement (28.6%), neurological manifestations (14.3%), pulmonary (10.7%), and cardiovascular (3.6%). These findings are comparable with earlier studies. Sethi et al. (2003)[7] reported fever in 100%, jaundice in 41%, and myalgia in 38% of patients in North India, while complications included renal involvement in 29% and neurological in 11%. Muthusethupathi et al. (1995)[8] in Madras found renal complications in 34% and neurological in 11%, very similar to our data. Barua et al. (1999)[14] in northeast India reported renal dysfunction in 30% of cases. Taken together, these studies corroborate our findings that renal involvement remains the most frequent complication, followed by multi-organ dysfunction in severe cases. We observed co-infections in 21.4% of seropositive patients, with typhoid (n = 3) being the most frequent, followed by dengue (n = 2) and scrub typhus (n = 1). No malaria co-infection was detected. Similar findings were reported in earlier Indian studies. Chaudhry et al. (2013)[9], in their 10-year AIIMS Delhi study, found frequent co-infections of leptospirosis with malaria, dengue, and hepatitis E, underscoring diagnostic dilemmas in acute febrile illnesses. Sethi et al. (2003)[7] also highlighted diagnostic challenges due to overlaps with endemic infections like malaria and typhoid. Outside India, Garvey et al. (2014)[15] in Ireland reported leptospira exposures often mimicking other febrile illnesses, although true co-infections were rare. Sohail et al. (2018)[13] in Pakistan reported overlaps with typhoid (7%) and dengue (5%), again reinforcing our observation that coinfections complicate diagnosis in tropical climates. These findings emphasise the importance of simultaneous testing for multiple pathogens during monsoon and post-monsoon seasons in South Asia.

Conclusions

The present study showed a 5.6% seroprevalence of leptospirosis, predominantly affecting adult males with peak incidence during the monsoon season. Fever was universal, and renal involvement emerged as the most common complication. Co-infections with typhoid, dengue, and scrub typhus highlighted diagnostic challenges. Strengthened surveillance, early diagnosis, and preventive measures during high-risk seasons are crucial to reduce morbidity.

Limitations

The study was limited by its single-centre design, which may restrict the generalisability of findings to other regions. The relatively small number of seropositive cases reduced the power for subgroup analyses. Molecular methods such as PCR and gold-standard MAT were not used, which may have led to underestimation of true prevalence. Additionally, as a retrospective analysis, reliance on available clinical records may have introduced reporting bias.

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DOI: https://doi.org/10.24321/0019.5138.202597

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ISSN: 0019-5138
DOI: https://doi.org/10.24321/0019.5138.202597