Section: Pathology

Original Research Article

SEROPREVALENCE OF DENGUE, LEPTOSPIROSIS AND TYPHOID FEVER IN PATIENTS WITH ACUTE FEBRILE ILLNESS IN A TERTIARY CARE HOSPITAL

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Received : 19/03/2026
Received in revised form : 25/04/2026
Accepted : 12/05/2026

Keywords: Acute febrile illness; Dengue; Leptospirosis; Typhoid fever; Chikungunya; Seroprevalence; Tropical infections; Co-infection; ELISA; Widal test

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DOI: 10.47009/jamp.2026.8.3.96

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (3); 531-535

ABSTRACT

Background: Acute febrile illness (AFI) is a significant clinical and public health challenge in tropical regions, where infections such as dengue, leptospirosis and typhoid fever are prevalent. The clinical presentations of these infections often overlap, making early diagnosis and effective management difficult. The study was aimed to determine the seroprevalence of dengue, leptospirosis, and typhoid fever among patients presenting with AFI at a tertiary care hospital in the Andaman & Nicobar Islands, India. **Materials and Methods:** This cross-sectional observational study was conducted over a period of six months. A total of 199 patients presenting with AFI were included in the study. Serological tests - IgM ELISA for dengue, Leptospira and Chikungungya along with Widal test for typhoid fever were performed to identify the causative agents. Data was analyzed using descriptive statistics and the prevalence of each infection was calculated. **Results:** Of the 199 patients, 78.89% tested positive for dengue, 13.07% tested positive for typhoid fever, 9.05% tested positive for leptospirosis and 3.02%for Chikungunya, making dengue the most common infection during this particular period of monsoon in this geographic location.One patient had a co-infection of dengue and leptospirosis, while another tested positive for both dengue and typhoid fever. The study emphasized the substantial impact of these infections and also seasonal impact as well in this region, with dengue emerging as the leading cause of Acute Febrile Illness (AFI) during the monsoon season. **Conclusion:** "In Andaman & Nicobar Islands, leptospirosis is the predominant cause of acute febrile illness, showing higher prevalence year-round. However, in this study dengue was the most common observed infection during the monsoon season, starting from June."Co-infections were observed, emphasizing the need for comprehensive diagnostic strategies in regions with multiple circulating pathogens. Enhanced surveillance and targeted interventions are essential to reduce the public health burden of these diseases.

INTRODUCTION

Acute febrile illness (AFI) remains a major clinical and public health challenge in tropical and subtropical regions of the world.[1] AFI can be caused by a wide spectrum of infectious agents, including viral, bacterial, and parasitic pathogens, which often result in undifferentiated fever presentations. Common diseases such as dengue, leptospirosis, and typhoid fever share overlapping clinical features, making it difficult to distinguish between them based on symptoms alone. Patients often present with non-specific symptoms, including fever, headache, myalgia, and gastrointestinal disturbances, which complicates the process of early diagnosis and effective management.[2,3] Dengue fever, caused by the dengue virus and transmitted primarily by Aedes mosquitoes, is one of the most significant arboviral infections globally, with increasing incidence in South and Southeast Asia. The clinical spectrum of dengue ranges from mild febrile illness to severe forms such as dengue

ISSN (O): 2687-5365; ISSN (P): 2753-6556

hemorrhagic fever (DHF) and dengue shock syndrome (DSS). These severe manifestations can result in significant morbidity and mortality, making dengue a major public health concern in endemic areas. The rapid increase in dengue cases in regions like South Asia highlights the need for better diagnostic and prevention strategies.[3-5] Chikungunya, another important arboviral infection transmitted by Aedes mosquitoes, has also emerged as a significant cause of acute febrile illness in tropical regions. It is characterized by sudden onset of high-grade fever, severe polyarthralgia, myalgia, headache, rash, and fatigue. Although chikungunya is rarely fatal, persistent joint pain and prolonged morbidity can significantly affect quality of life. The clinical overlap of chikungunya with dengue and other febrile illnesses often poses a diagnostic challenge, particularly in endemic settings where these infections co-circulate.[5] Leptospirosis, a zoonotic disease caused by pathogenic Leptospira spp., is widespread in tropical regions, particularly in areas with heavy rainfall and poor sanitation. This disease is often associated with environmental exposure, especially in agricultural and flood-prone areas. Its clinical presentation is diverse, with symptoms ranging from mild febrile illness to severe forms involving renal, hepatic, and pulmonary complications. The overlap of leptospirosis with other febrile illnesses often leads to under-diagnosis, further exacerbating the public health burden.[6] Leptospirosis has been frequently recognized in regions with increased exposure to contaminated water, as in rural and peri-urban communities.[7,8] Typhoid fever, caused by Salmonella enterica serovarTyphi, remains endemic in many developing regions, including India, due to insufficient sanitation and contaminated water. This bacterial infection is characterized by prolonged fever, abdominal pain, and gastrointestinal symptoms. Despite its long-standing endemicity, it continues to contribute significantly to the burden of AFI in regions with inadequate infrastructure.[9] In some areas, typhoid fever often coexists with other infections, complicating the diagnostic process. Timely laboratory confirmation of typhoid fever is crucial for distinguishing it from other causes of fever, particularly in resource-limited settings where misdiagnosis can lead to inappropriate treatments.[4] In settings where multiple infectious agents co-circulate, including dengue, leptospirosis, and enteric fever, the etiological spectrum of AFI becomes even more complex. Co-infections are common in such areas, further complicating clinical management.[10] Various studies have demonstrated the seroprevalence of these diseases in patients presenting with acute fever, revealing how their co-existence can delay proper diagnosis and treatment. A comprehensive understanding of the seroprevalence of these infections is essential for developing targeted diagnostic and therapeutic strategies, especially in regions with overlapping endemic diseases.[5-7] The Andaman & Nicobar Islands, a unique tropical union territory of India, present a distinctive ecological and socio-environmental context that may influence the transmission dynamics of vector-borne and water-associated infections. This archipelago is located in a geographically isolated region with diverse environmental conditions, which could play a role in the epidemiology of diseases such as dengue, leptospirosis, and typhoid fever.[11,12] While studies from mainland India have provided valuable insights into the prevalence and seroepidemiology of these diseases, data from the Andaman & Nicobar Islands remain limited.[13] The islands' unique geographical positioning, varying climate, and limited healthcare infrastructure warrant an in-depth study to determine the burden of these infections among patients with AFI.[14] Understanding the relative contribution of these infections in febrile patients is crucial to inform clinicians about the potential etiology of the illness, optimize diagnostic approaches, and help guide public health interventions in the region. Therefore, the present study aims to determine the seroprevalence of dengue, leptospirosis, chikungunya and typhoid fever among patients presenting with acute febrile illness at a tertiary care hospital in the Andaman & Nicobar Islands.

MATERIALS AND METHODS

Study Design and Setting: This was a cross-sectional observational study conducted at a tertiary care hospital in the Andaman & Nicobar Islands, India. The study was carried out after obtaining the institutional ethical clearance over a period of six months from - June to December 2021.

Study Population: The study enrolled patients from all age groups, both male and female, who presented to the hospital with acute febrile illness (AFI)."A pro-forma for Acute Febrile Illness is filled as a part of routine procedure of the Clinical Microbiology laboratory, where fever less than 7 days and clinical symptoms are documented, and clinical prescriptions are recorded. Based on this information, the necessary tests are performed.The study was approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants / their legal guardians. All patient data were kept confidential, and ethical guidelines as per the Declaration of Helsinki were followed throughout the study.A total of 199 patients were included in the study during the study period."

Laboratory Investigations

1. **Dengue Diagnosis**:
   - Serological testing for dengue was performed using IgM Enzyme linked Immunosorbent Assay (ELISA) to detect recent infection.
2. **Leptospirosis Diagnosis**:
   - Diagnosis was confirmed through serology (Leptospira IgM ELISA), which detects

ISSN (O): 2687-5365; ISSN (P): 2753-6556

antibodies produced against Leptospira species during acute infection.

3. **Typhoid Fever Diagnosis**:
   - Diagnosis of typhoid fever was based on Widal test (detecting O and H antibodies to Salmonella Typhi).
4. **ChikungunyaDiagnosis**:
   - Serological testing for Chikungunya was performed using commercial ELISA kits to detect recent infection.

Statistical Analysis: Data were analyzed using SPSS version 25 (IBM, Armonk, NY, USA). Descriptive statistics were used to calculate frequencies, percentages, and measures of central tendency (mean, median) for the demographic and clinical variables.

RESULTS

A total of 199 participants were included in the study during the study period, with a diverse distribution across various age groups. The largest group consisted of individuals aged 1-19 years, comprising 44.72% (89/199) of the study population. This was followed by the 20-39 years age group, which accounted for 36.18% (72/199). The remaining age groups included 40-59 years (13.07%, 26/199), 60-79 years (5.53%, 11/199), and 80-99 years (0.50%, 1/199). The mean age of the participants was calculated to be 24.07 ± 18.18 years, with a range of 84 years (from 1 to 85 years), reflecting the diversity in age groups. The median age was 21.0 years, with an interquartile range (IQR) of 8.0-33.5 years [Table 1]. In terms of gender distribution, 54.77% (109/199) of the participants were female, while 45.23% (90/199) were male [Table 2]. Upon analyzing the dengue status, it was found that 78.89% (157/199) of the participants tested positive for dengue, indicating a high prevalence of this infection during this particular season among patients presenting with AFI. Only 21.11% (42/199) tested negative for dengue. Notably, there were two patients who had co-infections, one with dengue and leptospirosis and another with dengue and typhoid fever. These findings highlight the potential for overlapping infections and underscore the complexity of diagnosing AFI in such cases [Table 3]. Regarding leptospirosis, 9.05% (18/199) of the participants tested positive for the disease, while the majority, 90.95% (181/199), tested negative [Table 4]. Among the positive cases, one patient tested positive for both dengue and leptospirosis, demonstrating the possibility of co-infection, which can complicate diagnosis and treatment. In the case of chikungunya, only 3.52% (7/199) of the participants tested positive, while 96.48% (192/199) were negative [Table 5]. This suggests that Chikungunya remains less prevalent as compared to dengue in the study population. Lastly, considering the serology of typhoid fever, caused by Salmonella enteric serovar Typhi, the antibodies was detected in 13.07% (27/199) of the participants, while 86.93% (172/199) tested negative. One patient was found to have a co-infection of dengue and typhoid, further emphasizing the occurrence of multiple infections in the same patient. This highlights the importance of considering differential diagnoses in AFI cases [Table 6].

Table 1: Age Distribution in the Study Population

Age Interval	Count	Percentage (%)
1-19	89	44.72
20-39	72	36.18
40-59	26	13.07
60-79	11	5.53
80-99	1	0.50
Total	199	100.00
Mean ± SD	24.07 ± 18.18	
Range	84.0	
Median (25th-75th percentile)	21.0 (8.0 - 33.5)	

Table 2: Gender Distribution in the Study Population

Gender	Count	Percentage (%)
Female	109	54.77
Male	90	45.23
Total	**199**	**100.00**

Table 3: Dengue Distribution in the Study Population

Dengue Status	Count	Percentage (%)
Positive	157	78.89
Nil	42	21.11
Total	199	100.00

Table 4: LeptospiraDistribution in the Study Population

Status	Count	Percentage (%)
Nil	181	90.95
Positive	18	9.05
Total	199	100.00

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 5: Chikungunya Distribution in the Study Population

Status	Count	Percentage (%)
Nil	192	96.48
Positive	7	3.52
Total	199	100.00

Table 6: Typhoid Distribution in the Study Population

Status	Count	Percentage (%)
Nil	172	86.93
Positive	27	13.07
Total	199	100.00

DISCUSSION

The majority of participants in this study were from the 1-19 years (44.72%) and 20-39 years (36.18%) age groups. This is consistent with findings by Tripathi et al. (2008), who reported a high incidence of dengue among children and young adults in Uttar Pradesh,[15] and Gunasekaran et al. (2011), where 70% of cases were in individuals aged 10-30 years in Chennai.[16] These studies, including ours, highlight the significant burden of dengue in younger populations, emphasizing the need for youth-targeted interventions. Dengue is observed in the Andaman & Nicobar Islands, with frequent outbreaks, likely driven by the favourable conditions for mosquito breeding. Leptospirosis is endemic here, with a distinct clinical presentation, including pulmonary hemorrhage, requiring specialized management.In our study, 54.77% of participants were female, and 45.23% were male, which aligns with the findings of Gunasekaran et al. (2011), who reported 53.2% female cases and 46.8% male cases in Chennai.[16]

Dengue fever was the most prevalent infection in our study, with 78.89% (157/199) of participants testing positive for dengue. This result is notably higher than the 20.9% seropositivity reported by Tripathi et al. (2008) in Uttar Pradesh, India, who found dengue to be a major cause of AFI but with a lower prevalence.[15]Gunasekaran et al. (2011) reported 43.0% dengue seropositivity in a study from Chennai, which, although lower than our findings, indicates that dengue transmission is widespread across India.[16] The variation in prevalence rates can be attributed to differences in geographical factors, such as climatic conditions, mosquito density, and vector control measures. The increased number of dengue virus infections in our study may be attributed to the monsoon season, which occurs from June to September. Additionally, other factors such as urbanization and increased population densities of the vector during the monsoon season may contribute to this rise in cases. The higher prevalence observed in the Andaman & Nicobar Islands (78.89%) indicates that dengue is consistently prevalent in this region, with ongoing transmission and frequent outbreaks due to favourable mosquito habitats during monsoon season. Leptospirosis was observed in 9.05% (18/199) of the patients in our study. Leptospirosis was observed in 9.05% (18/199) of the patients in our study. This result is similar to the prevalence observed in studies from other tropical regions. For instance, Dhanashree et al. (2021) reported a seroprevalence of 8.5% for leptospirosis in Mangalore, India among patients with AFI.[5] In a broader context, Gunasekaran et al. (2011) found that leptospirosis accounted for 4.2% of AFI cases in Chennai.[16] Our study's co-infection finding of one patient with both dengue and leptospirosis further highlights the potential for multiple infections to present with overlapping clinical features.Chikungunya was the least prevalent infection in our study, with only 3.52% of participants testing positive. This is consistent with Gunasekaran et al. (2011), who reported 2.5% of patients in Chennai testing positive for chikungunya, compared to higher rates of dengue seropositivity.[16] The low prevalence of chikungunya in our study may be attributed to sporadic outbreaks of chikungunya, in contrast to the more frequent and widespread dengue transmission in the region. As reported by Monath and Tsai (1997), chikungunya typically exhibits epidemic patterns with intermittent outbreaks, which may explain its lower prevalence compared to dengue in our cohort.[17] Typhoid fever was detected in 13.07% (27/199) of the participants in this study, reflecting its ongoing relevance in regions with inadequate sanitation. This result aligns with Parry et al. (1999), who reported 13% prevalence of typhoid fever in Vietnam, which is consistent with findings from other developing countries where enteric fever remains a major public health issue.[18] In India, Shyamala (2012) found 8.6% of patients testing positive for typhoid fever in a tertiary care setting, further emphasizing that typhoid fever continues to be endemic despite the rise of other infections like dengue and leptospirosis.[19] The 13.07% prevalence in our study highlights the persistent burden of enteric fever in areas with limited access to clean water and improper sanitation, and it reinforces the need for better sanitation measures to control typhoid transmission. The study found co-infections in two cases: dengue and leptospirosis in one patient, and dengue and typhoid in another. This is consistent with Tripathi et al. (2008), who highlighted co-infections in tropical regions with multiple circulating pathogens.[15] These co-infections add diagnostic

ISSN (O): 2687-5365; ISSN (P): 2753-6556

challenges and emphasize the need for thorough differential diagnosis and treatment.

Limitations of the Study: "This study was conducted at a single tertiary care hospital, which limits its generalizability. The reliance on serological tests for diagnosing dengue, leptospirosis, and typhoid fever, which have known limitations in sensitivity and specificity, may affect the accuracy of the results. Additionally, the absence of confirmatory blood cultures and the Microscopic Agglutination Test (MAT), along with the small number of co-infection cases, limits the ability to draw definitive conclusions. The cross-sectional design also restricts the ability to establish causal relationships between the infections and AFI. Furthermore, the study was conducted over a period of only six months."

CONCLUSION

In the Andaman & Nicobar Islands, leptospirosis is the most common cause of acute febrile illness throughout the year, while dengue infections show seasonal variations. Typhoid fever is also prevalent in this region. This highlights the need for region-specific surveillance and diagnostic strategies.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556