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Sociodemographic profile, clinical presentations, environmental factors, and laboratory parameters of dengue patients: A retrospective study from Mizoram, India

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ABSTRACT

Background: Mizoram is one of the states in India with high cases of dengue for the year 2022. There is very limited data regarding the sociodemographic profile, clinical presentation, environmental factors, and laboratory parameters and outcome of infection of dengue patients in Mizoram. **Aims and Objectives:** The present study was aimed to study factors and the proportion of patients getting admitted with dengue fever (DF), DF with warning signs and severe dengue. **Materials and Methods:** The data collected retrospectively from the medical records of the patients admitted in three private hospitals and two governmental hospitals during the time period from July to November 2022. Descriptive analysis was carried out and categorical outcomes were compared between study groups using Chi-square/Fisher's Exact test. Mean values were compared between study groups using ANOVA (>2 groups). $P<0.05$ was considered statistically significant. **Results:** Out of 189 patients, 103 (54.50%) were male and majority were aged >14 years 166 (87.83%). Mean age was 42.08. Majority 157 (83.07%) belonged to urban population. DF were 137 (72.49%), severe dengue 10 (5.29%), and with warning signs of severe dengue 42 (22.22%). Most common symptoms observed were fever 181 (95.77%) followed by myalgia 95 (50.26%). Severe dengue was reported more among females 7 (70%), DF was more common among males 71 (51.82%) ($P=0.041$). DF was more common in patients from urban 113 (82.48%) versus rural 24 (17.52%) ($P<0.001$). Mortality was 1.59%. **Conclusion:** Health education and integrated vector control measures need to be intensified to prevent future dengue outbreaks in Mizoram.

Key words: Severe dengue; Urban; Stagnant outdoor water collection; Integrated vector control

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INTRODUCTION

Dengue is one of the most important mosquito-borne viral diseases and can be caused by any one of the four dengue virus serotypes (DENV1-4) of the genus Flavivirus.[1] Dengue virus is a non-segmented, positive-sense, single-stranded, and enveloped RNA virus, transmitted mainly by the bite of *Aedes aegypti*, a tropical and subtropical mosquito species that inhabits mostly in urban areas in proximity to houses.[2] It breeds in small bodies of fresh water, most commonly in various containers found around homes.[3] It is estimated that 390 million DENV infections occur every

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year,[4] and it is endemic in more than 100 countries across the Americas, East Mediterranean, Western Pacific, Africa, South-East Asia, and Europe.[5] Dengue infection in humans results from four (DEN-1, DEN-2, DEN-3, and DEN-4) of *Flavivirus* genus. As per the WHO 1997 classification, symptomatic dengue virus infection has been classified into dengue fever (DF), dengue hemorrhagic fever, and dengue shock syndrome. The revised WHO classification of 2009 categorizes dengue patients according to different levels of severity as dengue without warning signs, dengue with warning signs (abdominal pain, persistent vomiting, fluid accumulation, mucosal bleeding, lethargy, liver enlargement, and increasing hematocrit with decreasing platelets), and severe dengue.[6-9]

Today, dengue is the most important mosquito-borne, human viral disease in terms of both the number of cases, and the number of deaths. Therefore, dengue is considered a major global health threat by the World Health Organization.[10] The Indian subcontinent is mainly affected by DENV2 and DENV3 serotypes. All four virus serotypes cause similar illness, but severe and fatal hemorrhagic disease is more often associated with DENV2 and DENV3 infections.[11] In India, the first epidemic of clinical dengue-like illness was recorded in Madras (now Chennai) in 1780 and the first virologically proved epidemic of DF occurred in Calcutta (now Kolkata) and Eastern Coast of India in 1963–1964.[12] In the northeast region (NER) of India, serological survey conducted during 1963 revealed dengue activity in the Lohit district of Arunachal Pradesh and Darrang district of Assam.[13,14]

Subsequently, another report of dengue (DENV-2) in Assam and Nagaland appeared during the nineties.[15,16] During 2009–2011, a study carried out by Dutta et al., reported that 143 laboratory confirmed cases belonging to Assam (82), Meghalaya (35), Nagaland (15), Manipur (8), and AP (3).[17,18] The state of Mizoram is a part of the Indo-Burma biodiversity hotspot in the eastern Himalayan range with an average annual rainfall of 2100–3500 mm, temperature ranging from 11°C to 29°C and is in the moist tropical to subtropical climatic zone, which is an ideal breeding ground for vector mosquitoes.[19]

At present, Mizoram is facing a major Dengue Outbreak in the year 2022. There is an alarming increase in cases of Dengue in 2022, nearly 859 cases reported so far the year 2022. Aizawl district reported the highest at 773, followed by Lunglei district in south Mizoram at 31. Mamit district in the western part of the state bordering Tripura and Bangladesh reported 21 incidences of the disease.[20] A comprehensive study involving the sociodemographic profile, clinical symptoms, environmental factors, coinfections, and laboratory parameters of dengue infection has not been studied in Mizoram. Hence, we wanted to study the sociodemographic profile, clinical profile, environmental factors, coinfection profile, laboratory parameters, and outcome of the dengue patients getting admitted in hospitals in Mizoram and also wanted to study the proportion of patients getting admitted with DF, DF with and without warning signs of severe dengue and severe dengue.

Aims and objectives

The present study was aimed to study the risk factors and the proportion of patients getting admitted with dengue fever (DF), DF with warning signs and severe dengue.

MATERIALS AND METHODS

The data were collected retrospectively from the medical records of the patients admitted in three private hospitals and two governmental hospitals during the time period from July to November 2022. The data regarding sociodemography, symptoms at the time of admission, clinical manifestations, laboratory investigation reports, mosquito prevention measures followed, environmental factors, and patient outcome were collected from the medical records. The study was cleared by the Institutional Ethical Committee of Zoram Medical College, Mizoram, India. Informed written consent was waived because the study was a retrospective data analysis.

Serum samples from patients presenting with acute febrile illness and clinical features consistent with DF were tested for dengue using NS-1 antigen and/or immunoglobulin (Ig) M and IgG antibody against dengue virus by ELISA test kits produced by the National Institute of Virology (Arbovirus Diagnostic NIV, Pune, Maharashtra, India). The tests were carried out following the manufacturer instructions.

Statistical analysis

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. Non-normally distributed quantitative variables were summarized by median and interquartile range. All quantitative variables were checked for normal distribution within each category of explanatory variable using visual inspection of histograms and normality Q-Q plots. Shapiro–Wilk test was also conducted to assess normal distribution. Shapiro–Wilk test $P>0.05$ was considered as normal distribution. Categorical outcomes were compared between study groups using Chi-square test/Fisher's Exact test (If the overall sample size was <20 or if the expected number in any one of the cells is <5, Fisher's exact test was used).

For normally distributed quantitative parameters, the mean values were compared between study groups using ANOVA (>2 groups). P<0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis. IBM SPSS version 22 was used for statistical analysis.

RESULTS

Table 1 shows the baseline parameters of the study population. The mean age of the study population was 42.08 years, majority belong to male population (54.50%), urban (83.07%), admitted in the month of November (48.15%), and 27.51% of the family members were also positive.

Table 2 shows the details such as number of coinfection reported, risk factors associated with acquisition of dengue, diagnostic blood tests done, classification of dengue based on 2009 WHO guidelines, and patient outcome.

Table 3 shows the baseline mean values of systolic blood pressure, diastolic blood pressure, mean duration of symptoms in days, and other laboratory parameters.

Table 1: Descriptive analysis of baseline parameters in the study population (n=189)

Baseline parameters	Summary n (%)
Age [Mean±SD (min-max)]	42.08±21.8 (0.8–93)
Age group	
≤14 years	23 (12.17)
>14 years	166 (87.83)
Gender	
Male	103 (54.50)
Female	86 (45.50)
Rural/urban	
Rural	32 (16.93)
Urban	157 (83.07)
Month of admission	
July	2 (1.06)
August	13 (6.88)
September	27 (14.29)
October	56 (29.63)
November	91 (48.15)
Symptoms at the time of admission	
Fever	181 (95.77)
Arthralgia	23 (12.17)
Headache	93 (49.21)
Myalgia	95 (50.26)
Rash	54 (28.57)
Hemorrhagic manifestations	
Bleeding gum	3 (1.6)
Epistaxis	4 (2.13)
Malena	8 (4.26)
Hematuria	4 (2.13
Hematemesis	1 (0.53)
Other clinical symptoms	
Cough	26 (13.76)
Diarrhea	40 (21.16)
Abdominal pain	54 (28.57)
Vomiting	44 (23.28)
Nausea	55 (29.1)
Ascites	14 (7.41)
Pleural effusion	26 (13.76)
Weakness	80 (42.33)
Hepatomegaly	33 (17.46)
Dizziness	15 (7.94)
Family member positive	52 (2751)

Table 2: Descriptive analysis of coinfections, diagnostic tests, severity of dengue diagnosis, and outcome of patients

Coinfections identified	N(%)
Typhi dot positive	6 (3.17%)
Scrub typhus positive	11 (5.82%)
Malarial parasite –ICT	1 (0.53%)
Risk factors associated with dengue infection	
Mosquito net usage	
Yes	121 (64.02%)
No	68 (35.98%)
Indoor or outdoor water collection	
Yes	70 (37.04%)
No	119 (81.96%)
Animal breeding	
Yes	63 (33.33%)
No	126 (66.67%)
Hunting/sleeping in forest	
Yes	28 (14.81%)
No	161 (85.19%)
Diagnostic blood tests	
NS1 Ag	113 (59.79%)
IG M	88 (46.56%)
IG G	20 (10.58%)
Dengue case classification based on the WHO 2009 criteria	
Dengue fever	137 (72.49%)
Severe dengue	10 (5.29%)
Warning signs	42 (22.22%)
Patient outcome	
Alive	186 (98.41%)
Expired	3 (1.59%)

Table 3: Descriptive analysis of baseline parameters in the study population (n=189)

Baseline parameters	[Mean±SD (minimum–maximum)]
SBP	111.66±16.83 (74–170)
DBP	73.59±11.81 (40–108)
Duration of symptoms (days)	4.84±3.7 (1–30)
Hb	12.59±1.76 (7–17)
Platelet Count	125387.83±88961.91(6000–430000)
TLC	6851.8±5637.64 (1400–41800)
PCV	39.1±7.57 (21–79)
AST	85.74±112.78 (13–1150)
ALT	74.77±127.6 (13–1350)
Urea	33.49±23.45 (8–210)
Creatinine	0.96±0.77 (0.1–6.1)

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, Hb: Hemoglobin, TLC: Total leukocyte count, PCV: Packed cell volume, AST: Aspartate aminotransferase, ALT: Alanine transaminase

Table 4 shows the comparison of age group, gender, and location of study population across different types of DF.

Table 5 shows the comparison of coinfections, diagnostic tests, course of stay in the hospital, and family members positive across different types of dengue diagnosis.

DISCUSSION

In the present study, majority of the study population were male (54.50%). This was comparable with another study done by Dhungana et al.,[21] which also showed that 51.29% were male. The present study also showed that majority admission of dengue patients happened in the month of November (48.15%). In Mizoram, the rainy season generally start from the month of April, it then rains heavily from May to September and lasts till late October. Hence, it is understandable that water logging and breeding places for mosquito happen during and after the rainy season. Similarly, a study done by Dhungana et al.,[21] also showed that majority of cases got admitted in the month of September (44.38%). Another study done by Poudyal et al.,[22] also showed that the admissions were more in the months of September 192 (59.4%) and October 101 (31.2%).

In the present study, the most common symptoms were fever (72.49%), and the findings were similar with other studies done by Dhungana et al.,[21] and Mahato et al.,[23] The present study showed that majority of the patients were from urban locations (83.07%), this was comparable and similar to a study done by Chew et al.,[24] in Malaysia, which also showed higher dengue cases among those living in urban locations as compared to rural locations.

The present study found that majority of the cases had DF (72.49%), followed by DF with warning signs (22.22%) and severe dengue in 5.29% of cases admitted in hospitals. This was comparable with another study done by Prattay et al.,[25] which observed that majority were DF (90.77%) and dengue hemorrhagic fever was reported in 5.95%. The severe form of dengue is very less when compared with other forms of dengue probably due to the better scientific

Table 4: Comparison of baseline characteristics across diagnosis (n=189)

Parameter	Diagnosis			Chi-square	P-value
	Dengue fever (n=137) (%)	Warning signs (n=42) (%)	Severe dengue (n=10) (%)		
Age group					
≤14 years	18 (13.14)	4 (9.52)	1 (10)	0.439	0.803
>14 years	119 (86.86)	38 (90.48)	9 (90)		
Gender					
Male	71 (51.82)	29 (69.05)	3 (30)	6.400	0.041
Female	66 (48.18)	13 (30.95)	7 (70)		
Rural/urban					
Rural	24 (17.52)	0 (0)	4 (40)	140.96	<0.001
Urban	113 (82.48)	4 (9.52)	6 (60)		

Table 5: Comparison of parameters across diagnosis (n=189)

Parameters	Diagnosis			Chi-square	P-value
	Dengue fever (n=137) (%)	Warning signs (n=42) (%)	Severe dengue (n=10) (%)		
Typhi dot	6 (4.38)	0 (0)	0 (0)	*	*
Scrub typhus	6 (4.38)	2 (4.76)	3 (30)	11.271	0.004
Malarial parasite – ICT	1 (0.73)	0 (0)	0 (0)	*	*
Mosquito net usage	94 (68.61)	22 (52.38)	5 (50)	4.578	0.101
Mosquito repellent	64 (46.72)	16 (38.1)	3 (30)	1.800	0.407
Indoor water collection	13 (9.49)	3 (7.14)	0 (0)	*	*
Stagnant outdoor water	42 (30.66)	10 (23.81)	2 (20)	1.119	0.572
Animal breed	48 (35.04)	11 (26.19)	4 (40)	1.343	0.511
Hunting sleeping in forest	22 (16.06)	3 (7.14)	3 (30)	3.954	0.138
NS 1 antigen	83 (60.58)	23 (54.76)	7 (70)	0.911	0.634
IG M	61 (44.53)	23 (54.76)	4 (40)	1.536	0.464
IG G	13 (9.49)	6 (14.29)	1 (10)	0.785	0.675
Course of stay					
Alive	137 (100)	42 (100)	7 (70)	*	*
Expired	0 (0)	0 (0)	3 (30)		
Family member positive	36 (26.28)	12 (28.57)	4 (40)	0.910	0.634

*No statistical test was applied – due to o subjects in the cells

understanding of the disease and better availability to monitor and treat the patients in the modern era.

A meta-analysis done with 233 studies by Ganeshkumar et al.,[9] showed that the pooled estimate of case fatality ratio was 2.6%. The present study also showed a less mortality of 1.59%. Again, the low case fatality rate could be attributed to better availability of treatment and good quality of patient care.

Mizoram has reported a very high number of dengue cases in the year 2022. The dengue is caused by *A. aegypti* or *Aedes albopictus* which are anthrophilic mosquito and indoor mosquito, so the COVID-19 pandemic and lock down could also have been the reason for increase in number of dengue cases in the year 2022.[26]

Limitations of the study

The Present study was done including data only from three private hospitals and two government hospitals. Hence the limitations of the study is that the study results may not represent the true epidemiological distribution of Dengue for the whole state of Mizoram.

CONCLUSION

The present study concluded that the majority were admitted with DF (72.49%) followed by DF with warning signs (22.22%). Furthermore, most cases got admitted during the months from August to November. Proper environmental modifications to be undertaken so that water logging can be prevented. Integrated vector control should be started well in advance during the rainy season. Furthermore, by virtue of proper, health education in the community regarding the usage of mosquito nets and other forms of household vector control to be intensified and in turn the case load of dengue can be reduced in future.

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REFERENCES

1. Yong YK, Thayan R, Chong HT, Tan CT and Sekaran SD. Rapid detection and serotyping of dengue virus by multiplex RT-PCR and real-time SYBR green RT-PCR. Singapore Med J. 2007;48(7):662-668.
2. WHO-TDR. Dengue: Guidelines for Diagnosis, Treatment, Prevention, and Control-New Edition. Geneva, Switzerland: World Health Organisation; 2009. Available from: https://www.who.int/publications/i/item/9789241547871 [Last accessed on 2023 Jan 25].
3. World Health Organization. Global Strategy for Dengue Prevention and Control 2012-2020. World Health Organization; 2012. p. 1-43. Available from: https://www.apps.who.int/iris/bitstream/handle/10665/75303/9789241504034_eng.pdf [Last accessed on 2023 Feb 07].
4. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, et al. The global distribution and burden of dengue. Nature. 2013;496(7446):504-507.
https://doi.org/10.1038/nature12060
5. Kyle J and Harris E. Global spread and persistence of dengue. Annu Rev Microbiol. 2008;62:71-92.
https://doi.org/10.1146/annurev.micro.62.081307.163005
6. Centers for Disease Control and Prevention. Dengue. Available from: https://www.cdc.gov/dengue/index.html [Last accessed on 2023 Jan 07].
7. World Health Organization. Dengue Hemorrhagic Fever: Diagnosis, Treatment and Control; 1997. Available from: https://www.apps.who.int/iris/bitstream/handle/10665/41988/9241542098_rus.pdf [Last accessed on 2023 Jan 07].
8. Barniol J, Gaczkowski R, Barbato EV, da Cunha RV, Salgado D, Martínez E, et al. Usefulness and applicability of the revised dengue case classification by disease: Multi-centre study in 18 countries. BMC Infect Dis. 2011;11:106.
https://doi.org/10.1186/1471-2334-11-106
9. Ganeshkumar P, Murhekar MV, Poornima V, Saravanakumar V, Sukumaran K, Anandaselvasankar A, et al. Dengue infection in India: A systematic review and meta-analysis. PLoS Negl Trop Dis. 2018;12(7):e0006618.
https://doi.org/10.1371/journal.pntd.0006618
10. Dinkar A and Singh J. Dengue infection in North India: An experience of a tertiary care center from 2012 to 2017. Ci Ji Yi Xue Za Zhi. 2019;32(1):36-40.
https://doi.org/10.4103/tcmj.tcmj_161_18
11. Dash PK, Parida MM, Saxena P, Kumar M, Rai A, Pasha ST, et al. Emergence and continued circulation of dengue-2 (genotype IV) virus strains in northern India. J Med Virol. 2004;74(2):314-322.
12. Gupta N, Srivastava S, Jain A and Chaturvedi UC. Dengue in India. Indian J Med Res. 2012;136(3):373-390.
13. Rodrigues FM and Dandawate CN. Arthropod-borne viruses in north-eastern India: a serological survey of Arunachal Pradesh and northern Assam. Indian J Med Res. 1977;65(4):453-465.
14. Dutta P and Mahanta J. Potential vectors of dengue and the profile of dengue in the north-eastern region of India: An epidemiological perspective. Dengue Bull. 2006;30:234-242.
15. Barua HC and Mahanta J. Serological evidence of Den2 activity in Assam and Nagaland. J Commun Dis. 1996;28(1):56-58.
16. Sankari T, Hoti SL, Singh TB and Shanmugavel J. Outbreak of dengue serotype-2 (DENV-2) of Cambodian origin in Manipur, India-association with meteorological factors. Indian J Med Res. 2012;136:649-655.
17. Dutta P, Khan SA, Borah J and Mahanta J. Demographic and clinical features of patients with Dengue in Northeastern Region of India: A retrospective cross-sectional study during 2009-2011. J Virol Microbiol. 2012;11:786298.
18. Khan SA, Dutta P, Topno R, Soni M and Mahanta J. Dengue Outbreak in a Hilly State of Arunachal Pradesh in Northeast India. ScientificWorldJournal. 2014;2014:584093.
https://doi.org/10.1155/2014/584093
19. Vanlalruia K, Senthilkumar N and Gurusubramanian G. Diversity and abundance of mosquito species in relation to their larval habitats in Mizoram, North Eastern Himalayan region. Acta

Trop. 2014;137:1-18.

https://doi.org/10.1016/j.actatropica.2014.04.026

20. Outlook. Health Tips. Dengue Ingection High in Mizoram this Year. Available from: https://www.outlookindia.com/national/dengue-infection-high-in-mizoram-this-year-news-237275 [Last accessed on 2023 Feb 25].
21. Dhungana D, Banstola B and Banjara M. Admitted dengue cases among the adult dengue positive cases in a tertiary care centre: A descriptive cross-sectional study. JNMA J Nepal Med Assoc. 2022;60(253):781-784.

    https://doi.org/10.31729/jnma.7675
22. Poudyal S, Subba HK and Sharma K. Admitted Cases of dengue fever among dengue positive cases in a tertiary care hospital: A descriptive cross-sectional study. JNMA J Nepal Med Assoc. 2021;59(244):1272-1276.

    https://doi.org/10.31729/jnma.5307
23. Mahato AK, Shrestha N, Gharti SB and Shah M. Typhoid Fever among patients diagnosed with dengue in a tertiary care centre: A descriptive cross-sectional study. JNMA J Nepal Med Assoc. 2022;60(252):714-717.

    https://doi.org/10.31729/jnma.7624
24. Chew CH, Woon YL, Amin F, Adnan TH, Wahab AH, Ahmad ZE, et al. Rural-urban comparisons of dengue seroprevalence in Malaysia. BMC Public Health. 2016;16(1):824.

    https://doi.org/10.1186/s12889-016-3496-9
25. Prattay KM, Sarkar MR, Shafiullah AZ, Islam MS, Raihan SZ and Sharmin N. A retrospective study on the socio-demographic factors and clinical parameters of dengue disease and their effects on the clinical course and recovery of the patients in a tertiary care hospital of Bangladesh. PLoS Negl Trop Dis. 2022;16(4):e0010297.

    https://doi.org/10.1371/journal.pntd.0010297
26. Mashudi DN, Ahmad N and Said SM. Level of dengue preventive practices and associated factors in a Malaysian residential area during the COVID-19 pandemic: A cross-sectional study. PLoS One. 2022;17(4):e0267899.

    https://doi.org/10.1371/journal.pone.0267899

Authors' Contributions:
ZV- Concept and design of the study, coordination, review of literature, data collection, prepared first draft of manuscript; **LS-** Concept of study, Interpreted the results, data collection, manuscript preparation and revision; **JLT-** Concept, data collection and manuscript preparation; **DL-** Concept, study design, data collection, review of the manuscript, co-ordination and revision; **Z-** Concept, study design, data collection, review of manuscript. **LH-** Concept, data collection, review of manuscript; **GSA-** Manuscript preparation, review of literature, co-ordination, submission and revision of manuscript.

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