Original Research Article

Clinico-epidemiological study of dengue cases in a tertiary care hospital, Guwahati, Assam, India

Lalit Mohan Bhardwaj, Swapnav Borthakur*, P. C. Bhattacharyya

Department of Medicine, Down Town Hospital, Guwahati, Assam, India

Received: 21 August 2017
Accepted: 19 September 2017

*Correspondence:
Dr. Swapnav Borthakur,
E-mail: dr.lalitmohan7@gmail.com

ABSTRACT

Background: Dengue fever (DF) is a common mosquito borne disease caused by dengue virus and is transmitted by Aedes mosquito. It is one of the major public health problems in India. A large-scale outbreak of dengue fever occurred in 2016 involving several districts of Assam. Here we report our experience with Dengue cases. The present study was aimed to assess clinical and epidemiological aspects of dengue cases presenting in down town hospital, Guwahati, Assam.
Methods: A record based retrospective study conducted in our centre. Total 880 fever cases, fulfilling WHO criteria for dengue suspicion were included in our study. Required data from the entire laboratory confirmed cases from 1st January to 31st December 2016 were collected from MRD (medical record department) and analysed. Epidemiological data were compared with previous year's available data from 1st January to 31st December 2015.
Results: The number of dengue cases in 2016 clearly outnumbered the dengue cases in past years. Most of the cases were in the age group 20-50 years with a male preponderance. The outbreak occurred during the months of August-November indicating increased vector transmission in the monsoon and post monsoon periods. Average days of hospital stay were 6 days.
Conclusions: Measures can be taken both at personal and government level to reduce morbidity and mortality from dengue particularly during the monsoon period.

Keywords: Dengue fever, Dengue cases in Guwahati, Dengue outbreak 2016

INTRODUCTION

Dengue viruses (DV) belong to the family *Flaviviridae*, and there are four serotypes of the virus referred to as DV-1, DV-2, DV-3, and DV-4. DV is a positive-stranded encapsulated RNA virus and is composed of three structural protein genes, which encode the nucleocapsid or core (C) protein, a membrane-associated (M) protein, an enveloped (E) glycoprotein, and seven non-structural (NS) proteins. It is transmitted mainly by Aedes aegypti mosquito and also by Ae. albopictus. All four serotypes can cause the full spectrum of disease from a subclinical infection to a mild self-limiting disease, the dengue fever (DF); a severe disease that may be fatal, the dengue haemorrhagic fever/dengue shock syndrome (DHF/DSS).

Dengue is the most common and widespread arboviral infection in the world today. It is an increasingly prevalent tropical arbovirus infection with significant morbidity and mortality.[1] Dengue infection has been known to be endemic in India for over two centuries as a benign and self-limited disease.

In India, the first epidemic of clinical dengue-like illness was recorded in Madras in 1780 and first virologically proved epidemic of DF occurred in Calcutta and Eastern

Coast of India in 1963-1964.[2] Dengue virus was isolated in Japan in 1943 by inoculation of serum of patients in suckling mice and at Calcutta in 1944 from serum samples of US soldiers.[3,4] The dengue haemorrhagic fever (DHF) started simmering in various parts of India since 1988.[5] The major outbreak of DF/DHF was reported in Delhi and neighboring states in 1996. Data for the last 10 years reveal maximum number of cases due to DF/DHF were reported in the year 1996 (16,000) while the next increase was noted in 2003 (21,000).[6] The rural spread of the vector is relatively recent occurrence associated with the development of rural water supply schemes, improved transport system, scarcity of water and life style changes.[7] Another study in Faisalabad, Pakistan showed that there are various other factors also found to be associated with DF like excessive travelling, travelling during epidemic, and presence of disease in the family or neighbouring houses, people living near watery areas, immunocompromised persons and low level of awareness.[8]

Dengue in state of Assam and capital city of Guwahati

Dengue arbovirus has recently emerged as a major public health concern with increased morbidity in Assam.[9] Entomological survey carried out in different time periods reveals the prevalence of potential dengue vectors in this region.[10] A comprehensive entomological surveys conducted during 2004-2005 in the seven states of northeast region of India revealed that the region is rich in known dengue vectors, viz. Aedes aegypti and Aedes albopictus.[11]

Table 1: Dengue case details and death since 2010 in Assam.*

Year	Case	Death
2010	237	2
2011	0	0
2012	1058	5
2013	4526	2
2014	27	0
2015	1076	1
2016	6157	4

*As per record of National Vector Borne Disease Control Program, Directorate General of Health Services, Ministry of Health and Family Welfare Dengue case details and death since 2010 in Assam.

It was in 2010 that for the first time 237 dengue cases and 2 deaths confirmed to be due to dengue were recorded in Assam state.

In the following years except in 2011, there was manifold increase in dengue cases.[12] For each year, of the total confirmed cases, majority (69%-91%) were recorded in Guwahati, the capital city of Assam, during the post-monsoon months in September to December. Guwahati is the largest and fast-growing metropolis and

gateway of northeast India. Over the past decade, there has been an increase in urbanization, deforestation, massive developmental activities, rapid population movement and increased air connectivity between Guwahati and other metropolitan cities resulting in increased receptivity for mosquito breeding and possible importation and spread of dengue virus through the human host in the region.

The disease is currently spreading to semi-urban areas of other districts of Assam supported by serological evidence for circulating dengue virus serotypes.[11] Given the reported regional abundance of disease vectors and case incidence in city areas, Aedes Aegypti is held the most probable mosquito vector transmitting dengue virus, and recently has been incriminated for circulating dengue virus-2 serotype. With the available data for prevalence of disease vectors and case incidence, there is a strong possibility of local transmission happening evidence by listing of cases without any travel history.[12,13]

Despite a large number of cases being reported every year in Guwahati, not much of literature is available on the clinico-epidemiological profile of cases of DF. The present study is aimed to assess the incidence, signs, symptoms and epidemiological characteristics of cases of DF in a tertiary care hospital in Guwahati, Assam. The aim and objective of this work to Study clinico-epidemiological features, seasonal variations and outcome of dengue cases presenting in down town hospital, Guwahati, Assam.

METHODS

A record based retrospective study conducted in down town hospital, Guwahati, Assam; a premier multi-disciplinary tertiary care super specialty hospital and referral center for North-Eastern India and neighboring countries. All required data were collected from MRD and analyzed from all the laboratory confirmed cases during 1st January to 31st December 2016. The epidemiological data were collected from those who attended the down town hospital for fever. Dengue fever patients typically develop sudden onset of high-grade fever.

Hence, fever cases of all age groups and either sex attending the down town hospital were selected as per WHO criteria (An acute febrile illness with ≥ 2 of the following manifestations: headache, retro-orbital pain, myalgia, arthralgia, rash, and haemorrhagic manifestation).

Total 880 patients were included after considering eligibility criteria during the study period. Detection of at least one component (NS1, IgM, or IgG) was positive for serodiagnosis. A screening test was done by RICT (rapid immunochromatographic card test) strictly following manufacturers protocol (AlereTM SD Dengue Duo); all positive cases were further confirmed in GMCH

laboratory by MAC ELISA test prepared by the National Institute of Virology Pune. Out of these 880 suspected dengue cases, 226 cases were found positive for dengue in screening test. 99 patients were managed OPD basis and remaining 127 were admitted following WHO-2009 admission criteria for dengue.

Out of total 127 RICT screen positive cases, 123 cases were confirmed by MAC ELISA. A detailed study was done on indoor patients by collecting data from MRD.

Ethical clearance was obtained from Institutional Ethical Committee. Statistical analysis was done by using frequency, percentages, median, range, chi-square for linear trend after entering data in Microsoft Excel 2010 and SPSS version 19.

RESULTS

All suspected cases of dengue fever according to WHO criteria who presented to our hospital in outdoor as well as indoor were tested for dengue serology. Out of total 486 outdoor patients, 99 came out dengue RICT positive and Out of total 394 indoor suspected cases of dengue, 127 patients came out to be positive during the period of 1st January 2016 to 17th December 2016.

Figure 1 reveal that only 13.47% of the fever cases were due to dengue fever in the year 2015. But in 2016, the numbers escalated steeply to 25.68%. As the outbreak of dengue mainly occurred in the months of August to November of 2016, Table 2 show the monthly distribution of the cases.

Table 2: Month-wise distribution of dengue cases in 2015 and 2016.

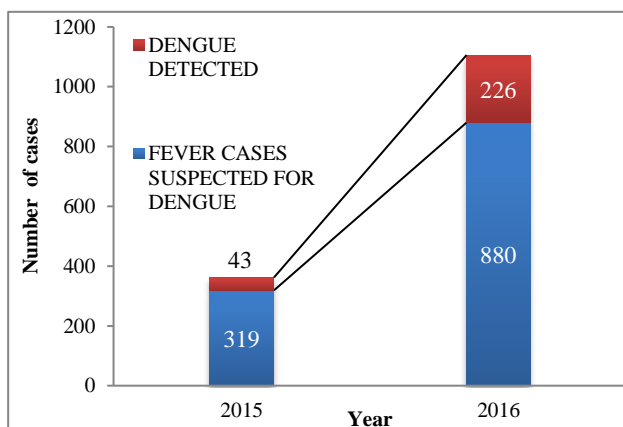| Month	2015		2016	
	Total		Total	
	Suspected for dengue	Dengue detected	Suspected for dengue	Dengue detected
Jan	7	0	16	0
Feb	4	0	19	2
March	8	0	13	0
April	12	0	12	0
May	7	0	18	3
June	16	1	51	6
July	37	3	73	17
Aug	19	3	162	51
Sep	61	11	158	42
Oct	63	9	166	52
Nov	55	12	138	43
Dec	30	4	54	10
Total	319	43	880	226

Figure 1: Year-wise case distribution of dengue.

District wise distribution of 105 dengue cases is given in Figure 2. Eighteen patients, who visited to the endemic area but residing outside Assam are not mentioned in map. Although dengue cases were presented to our hospital from 18 districts of Assam, clearly Kamrup was the worst affected, and it alone shared 52.84% of the dengue cases.

Most cases have no history of travel. Indeed, 18 patient's residents of other states of India and other countries who visited Assam developed Dengue fever. The 12th south Asian game was held in Guwahati during 2016 and one of the players of other country developed dengue fever. He was successfully treated in our centre. Six patients had one of their family members, who also suffered from recent dengue infection.

Figure 3 shows the distribution of the dengue cases in various age groups in either sex. It clearly reveals that the highest number of cases belonged to the age group 20-50 yrs. and males clearly outnumbered the females.

72.38% dengue cases were from 9 Urban Agglomerations and only 27.62% cases were from rural area.

Table 3: Distribution of dengue cases among the rural and urban population.

Area	Total number of cases	% cases
Urban	76	72.38
Rural	29	27.62

Fever was the most common symptom present in almost 100% cases, followed by headache 85.36%, myalgia 81.30%, nausea and vomiting 61.78% and joint pain 52.03% in our study (Figure 5). Among haemorrhagic manifestations, petechiae and gum bleed were most common. Few patients developed hematemesis, melena, and per-vaginal bleed.

Table 4: Distribution of dengue cases as per laboratory parameters.

Laboratory parameters	Number of cases (%)
Ns1ag	105 (85.36)
IGM	25 (20.32)
Igg	11 (8.94)
Both ns1ag and IGM	17 (13.82)
Both IGM and IGG	2 (1.62)
Leukopenia(<4000/cumm)	63 (51.21)
Thrombocytopenia (<1.5 lac)	87 (70.73)
AST and ALT >3fold rise	21 (17.07)

Majority of cases presented in the first week of fever and had Ns1Ag positive (85.36%). Common laboratory alteration among dengue cases viz. leukopenia, thrombocytopenia and marked elevation in AST and ALT were observed in the frequency of 51.21%, 70.73%, and 17.07% respectively.

Table 5: Platelet count in dengue cases.

Platelet count(/cumm)	Number of cases (%)
≥1.5 lac	36 (29.26)
1 lac – 1.49 lac	24 (19.51)
70000 – 99000	20 (16.26)
50000 – 69000	15 (12.19)
30000 – 49000	13 (10.59)
10000 – 29000	14 (11.38)
<10000	1 (0.81)

Only 1 case had platelet count <10000/cumm and majority of patient had platelet count out of danger zone. Platelet count in detail is mentioned in table 5. Seven cases (5.69%) required platelet transfusion and 4 cases (3.25%) required blood transfusion.

The majority of the cases were of dengue fever (70.07%) followed by dengue haemorrhagic fever (23.62%), 2 patients developed DHF with shock (Table 6).

Out of 880 patients of study population, no one died. Case fatality rates were calculated from available data and mentioned in Table 7.

Average days of hospital stay were 6 days (SD = 2.02).

Few atypical cases

Renal failure and Pyelonephritis in Dengue

A 58-year's old lady suffering from dengue fever was hospitalized due to abdominal pain and bilateral renal angle tenderness. Her serum creatinine level started rising and urine routine examination revealed 20-25 pus cells. Her total WBC count was 7400/cumm; platelet count = 150000/cumm; creatinine = 1.93 mg/dl. CT-scan abdomen revealed bilateral pyelonephritis. Urine culture did not reveal any growth. Acute kidney injury (AKI) and pyelonephritis were managed conservatively with renal supportive medications and levofloxacin antibiotic, on discharge day her serum creatinine level was within normal limits. AKI is frequently observed in dengue cases, but data regarding pyelonephritis and AKI in dengue cases are limited and studies are ongoing in this regard.[14]

Table 6: Distribution of dengue cases according to diagnosis.

Diagnosis	Number of cases	% of cases
UF	6	4.72
DF	89	70.07
DHF	30	23.62
DHF with shock	2	1.57
Total	127	100

Table 7: Case fatality rates of dengue cases.

	Dengue cases	Death	Case fatality rate (%)
India	129166	245	0.18
Assam	6157	4	0.06
Present study group	226	0	0.0

A Complicated Case of Dengue Encephalitis

A 23-year's old male patient, discharged from our hospital after treatment of dengue fever was again readmitted for altered sensorium and seizure activity on next day of discharge. There was no past history of seizure activity and radio-imaging brain was also within normal limits. EEG revealed diffuse slow wave pattern. He also developed AKI. Peripheral blood smear revealed schistocytes. Platelet count was 32000/cumm. Total count 12000/cumm, AST=241u/l, ALT=145 u/l and serum creatinine level was 4.9 mg/dl. He also had hematemesis. Serum ammonia was normal. He was managed conservatively and discharged with normal serum creatinine level, and in a fully oriented state. Dengue

encephalitis is a known rare complication reported earlier in literature, but development of AKI in dengue encephalitis is very rare.[15]

Haemorrhagic transformation of ovarian cyst: A new differential diagnosis in unilateral abdominal pain among female Dengue cases.
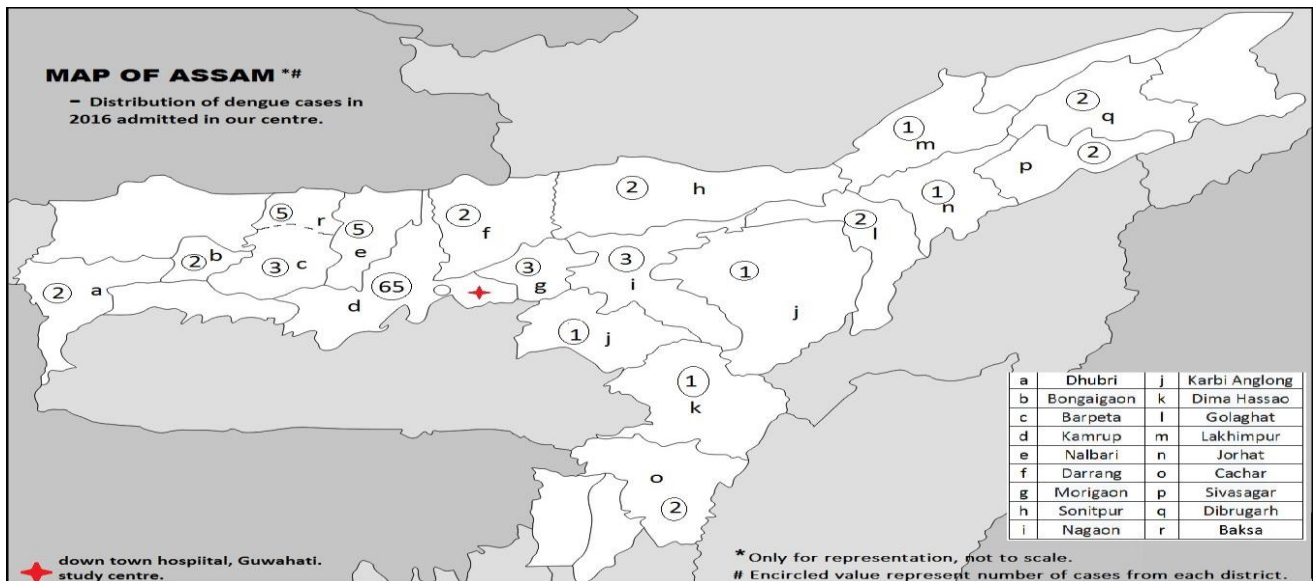

Figure 2: Distribution of dengue cases in 2016 admitted in our centre.

1st case-25 years old lady had right lower quadrant abdominal pain and gum bleed, her platelet count and INR levels were 68000/cumm and 1.38, respectively. SGOT and SGPT were 86 and 71u/l. haemoglobin level was 12.5mg/dl and total count was 3700/cumm. She had a history of right corpus luteal cyst measuring 40x40x35 mm detected 2months back by ultrasound abdomen. On repeat ultrasound abdomen, right haemorrhagic ovarian cyst measuring 42x40x35mm was detected.

2nd case-33 years old lady had right lower quadrant abdominal pain, her platelet count and INR levels were 24000/cumm and 1.19, respectively. SGOT and SGPT were 340 and 220 u/l. serum creatinine were 0.64mg/dl and total count was 6600 /cumm. She had a follicular ovarian cyst in her right ovary measuring 35x30x30mm as indicated by ultrasound report dated 6 months back. On repeat ultrasound abdomen, right haemorrhagic ovarian cyst measuring 32x30x25 mm was detected.

3rd case-38 years old lady had left lower quadrant abdominal pain, her platelet count and INR levels were 14000/cumm and 0.99, respectively. SGOT and SGPT were 36 and 22u/l. haemoglobin 7.3 mg/dl and total count was 2300/cumm. She had a history of left follicular ovarian cyst. On ultrasound abdomen, left haemorrhagic ovarian cyst measuring 48 x 42 x 40 mm was detected. All cases were managed conservatively and discharged without any further complications.

Dengue patient may bleed internally from any pre-existing trauma/ peptic ulcers/IM injection sites.[13] Among the dengue cases those patients who have bleeding manifestations either have associated thrombocytopenia or coagulopathy. An ovarian cyst can turn into haemorrhagic cyst on occasions such as patients on anticoagulation therapy, thrombocytopenia, and ITP.[16,17] In literature, such cases have not been reported so far. However, this complication is explainable, and their occurrence cannot be negated. Considering these facts, it will be prudent to consider haemorrhage in ovarian cyst as a potential complication of dengue.
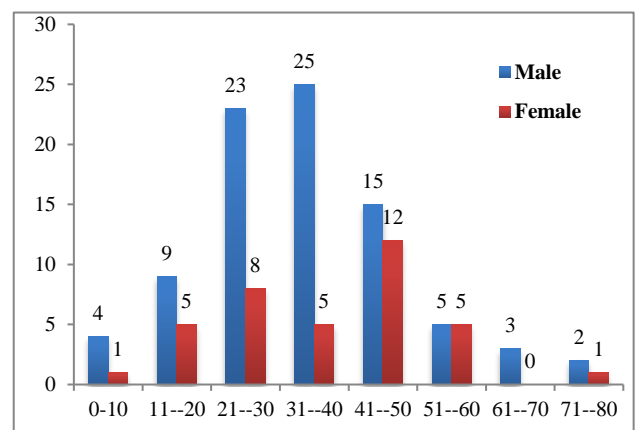

Figure 3: Age and sex distribution of dengue cases.

Ophthalmological manifestation in dengue cases

A 32-year's old male patient presented with fever since, 3 days and blurred vision. Ns1Ag was positive further confirmed by MAC ELISA. His blood sugar was normal. He also had conjunctival injection and retro-orbital pain. His total WBC count was 1900/cumm, platelet count=20000/cumm and packed cell volume=51.0%. On ophthalmological examination- retinal oedema was detected, fundus was normal. Radio-imaging of brain was within normal limits. He was managed conservatively; his vision improved gradually and discharged after 7 days of hospitalization. Ophthalmologic manifestation is not uncommon and in recent year many such reports been published.[18]
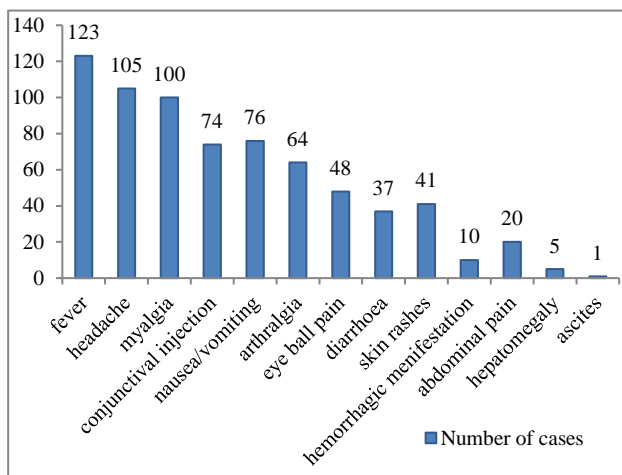

Figure 4: Clinical manifestations of dengue cases.

A 19-year's old young girl admitted with history of fever, loose stools, headache and double vision since last 2 days. She was detected dengue Ns1Ag positive. She had horizontal binocular diplopia. Hess diplopia charting was done which revealed left lateral rectus underaction. Fundus was normal and there was retinal oedema. MRI brain was within normal limits. Her platelet count was 96000/cumm. She was managed conservatively. Her double vision improved by day 6 of fever onset. She was discharged with no untoward event. Isolated sixth cranial nerve palsy is very rare among dengue cases and only few such cases have been reported till now.[19] All these cases were benign in nature and self-limiting.

Out of 123 dengue confirmed cases, 14 patients had fatty liver detected by ultrasound abdomen. Among these 14 cases, average level of ALT and AST were found 157.64 u/l and 205.35 u/l, respectively. These patients with >3-fold rise in AST and ALT also reported a significant loss of appetite, nausea, and vomiting. Elevation in liver enzyme is very common among dengue cases; various studies reported 63-97% dengue cases with raised AST level.[20] Significant increase in liver enzyme is obvious with prior poor liver status, but studies are sparse in this regard.

Patients with past history of acid peptic disease, peptic ulcers and gastric erosions have reported episodes of melena and abdominal pain. Such findings are expected complication of dengue fever with thrombocytopenia. These findings can give insight to clinicians while managing dengue cases. We managed all such cases with sucralfate oral suspension.

Two MAC ELISA confirmed dengue cases have shown cross reactivity with Enterocheck card test (IgM antibodies against the outer membrane protein (OMP) of the Salmonella typhi). Widal test and blood cultures were negative. Cross reactivity of thyphidot test with dengue fever cases without co-existing infection is increasing concern among clinician. One such study is recently being published and reported similar association. Until these findings can be further evaluated, clinicians should be cautious in interpreting Enterocheck test and have a high index of suspicion of dengue in endemic areas.[21]

DISCUSSION

Dengue is emerging as a major public health problem in India. It is one of the major public health threats in North East. Dengue cases are comparatively more this year as we found only 13.47% of the fever cases were due to dengue fever in the year 2015. But in 2016, the numbers escalated steeply to 25.68%. Male patients of age group 20-50 years were affected more in our study as compared to the study by S. Saini in Maharashtra and Ritu karoli in north India.[22,23] The highest number of cases was reported in the months of August-November. Monsoon and post monsoon season is favoured as seen with last two years data. Probable reason behind it may be due to heavy rainfall and flood which occurred in the months of July and august. Most of cases were reported from metropolitan city and urban agglomerations. A probable explanation for this may be more mosquito breeding areas, better healthcare facility, timely reporting.

Present outbreak was of a large magnitude but was comparatively less severe. Among the most frequent presentations of dengue infection, fever is number one followed by headache, myalgia, conjunctival injection, nausea/vomiting and arthralgia. The relatively fewer common clinical features were haemorrhagic manifestations, rash, and eyeball pain. One of the warning sign in dengue infection is abdominal pain. Few female patients complaining abdominal pain, on further evaluation found to have haemorrhage in ovarian cyst. Further studies are required to assess nature and complications as ovarian cysts are frequently associated with infertility. Dengue fever exacerbated chronic conditions and may lead to complication and delayed recovery. We have observed more gastrointestinal bleed in patient with past history of peptic ulcers. Patients with fatty liver had more rise in AST and ALT levels. These findings can help clinician to expect the possible disease course and potential complications.

Average days of hospital stay were 6 days in our study which cost significant amount of expenditure. In India, dengue cases are highly underreported. According to a study by US and Indian researchers, 24 actual dengue cases were found to be 282 times the reported number per year. The report also finds that dengue costs the emerging economic power at least $1.1bn each year in medical and other expenses. These reports also indicate that response toward control of dengue infection at our public and government level is very inadequate, causing unnecessary suffering locally and undermining global attempts to restrict the spread of the virus.

These findings indicate that Assam is a hyperendemic zone for dengue virus. Attention is therefore required for effective vector control measures. The distribution of stray cases throughout the year points to the perennial transmission of dengue virus. As, during epidemic and nonepidemic years, dengue infections are mostly seen in post monsoon season, hence preventive measures should be in full swing at the very onset of the monsoons.

The present study has the limitations that are inherent to any record-based study and these include a likelihood of many manifestations having been missed in the case sheets. Due to time constraints and non-availability of records, few sociodemographic variables like occupation, mosquito breeding areas could not be studied which could be considered as a limitation of the study.

CONCLUSION

The present study highlights the importance of dengue fever to the clinician in the area of epidemiology, its varied manifestations, complications, and outcome of the disease with no specific antiviral therapy or vaccination available in our country, mortality from dengue fever can only be prevented by its early diagnosis and timely management.

ACKNOWLEDGEMENTS

REFERENCES

1. Murray NE, Quam MB, Wilder-Smith A. Epidemiology of dengue: past, present and future prospects. Clinical epidemiology. 2013;5:299.
2. Sarkar JK, Chatterjee SN, Chakravarty SK. Haemorrhagic fever in Calcutta: some epidemiological observations. The Indian journal of medical research. 1964;52:651.
3. Kimura R, Hotta S, Studies on dengue fever (IV) on inoculation of dengue virus into mice. Nippon Igaku. 1944;3379:629-33.
4. Sabin AB, Schlensinger MC, Production of immunity to dengue with virus modified by propagation in mice. Science. 1945:101:640-2.
5. Kabra SK, Verma IC, Arora NK et al. Dengue hemorrhagic fever in children in Delhi. Bull world Health Organ. 1992:70:105-8.
6. Vaddadi Srinivas, Vaddadi Radha Srinivas, Dengue fever: A review article. J Evolution of Medic and Dental Sci. 2015;4(29):5048-5058.
7. Park K.: Park's Textbook of Preventive and Social Medicine. 22nd Ed. Jabalpur. Banarasidas Bhanot. 2013:224-32.
8. Nasreen S, Arshad M, Ashraf M, Raza A, Bahar-e-Mustafa. The epidemiology of Dengue fever in district Faisalabad, Pakistan. Int J Sci Res Publications. 2015;5(3):1-6.
9. Dev V, Khaund K, Tewari GG, Dengue vectors in urban and suburban Assam, India entomological observations. WHO South-East Asia J Public Health. 2014;3:51-9.
10. Dutta P, Khan SA, Sarma C, et al. Distribution of potential Dengue vectors in Major Township along the national highway and trunk road Northeast India. Southeast Asi J Tropical Medic and Public Health. 1998;29(1):173-6.
11. Dutta P, Mahanta J, Potential vectors of Dengue and the profile of Dengue in the Northeastern Region of India: An EpidemiologicalPerspectives. WHO Dengue Bulletin. 2006;30:234-42.
12. Dev V, Mahanta N, Baruah BK, Dengue and emerging arboviral infection in Assam, Northeast India. Tropical Biomedicine. 2015;32(4):796-9.
13. Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control: New Edition. Geneva: World Health Organization; 2009. 4, Laboratory Diagnosis and Diagnostic Tests. Available from: https://www.ncbi.nlm.nih.gov/books/NBK143156/.
14. Oliveira, J. F. P., and Burdmann, E. A. Dengue-associated acute kidney injury. Cli Kid J. 2015;8(6):681-5
15. Madi D, Achappa B, Ramapuram JT, Chowta N, Laxman M, Mahalingam S. Dengue encephalitis–A rare manifestation of dengue fever. Asia Paci J Tropical Biomed. 2014;4:S70-2.
16. Wilbur AC, Goldstein LD, Prywitch BA. Hemorrhagic ovarian cysts in patients on anticoagulation therapy: CT findings. J Compu Assist Tomogr. 1993;17:623-5.
17. Baidya J. L, Chakraborty J, Ray J, Pradhan M. Thrombocytopenia & Ruptured Corpus Luteal CYST: A Deadly Combination: A Case Report. J Evo of Medic and Dental Sci. 2015;4(55):9674-6.
18. Chan DP, Teoh SC, Tan CS, Nah GK, Rajagopalan R, Prabhakaragupta MK, et al. Eye Institute Dengue-Related Ophthalmic Complications Workgroup. Ophthalmic complications of dengue. Emerging infectious diseases. 2006;12(2):285.

19. Mishra A, Shukla S, Aggarwal S, Chaudhary B. Lateral rectus palsy in a case of dengue fever. Medical Journal, Armed Forces India. 2015;71(Suppl 1):S101-3.
20. Samanta J, Sharma V. Dengue and its effects on liver. Wo J Clinic Cases: WJCC. 2015;3(2):125.
21. Bhatti AB, Ali F, Satti SA. Cross-reactivity of rapid Salmonella Typhi IgM immunoassay in dengue fever without co-existing infection. Cureus. 2015;7(12).
22. Saini S, Kinikar AG, Deorukhkar S, Bhalerao D, Roushani SB. Epidemiology and seropositivity of dengue fever cases in a rural tertiary care hospital of western Maharashtra, India. Int J Bio Med Res. 2013;4(7):473-7.
23. Ritu Karoli, Jalees Fatima, Zeba Siddiqi et al. Clinical profile of dengue infection at a teaching hospital in North India. J Infect Dev Ctr. 2012;6(7):551-4.
24. Shepard DS, Halasa YA, Tyagi BK, Adhish SV, Nandan D, Karthiga KS, et al. Economic and disease burden of dengue illness in India. Am J Trop Med Hyg. 2014;91(6):1235-42.