Original Research Article

An outbreak investigation of dengue in medical students and health care workers in a tertiary care hospital, Pune

Namrata D Mule[1], Sangita C Shelke[2], Muralidhar P Tambe[1], Malangori A Parande [1],*, Rupali N Baviskar[1], Ganesh R Jagadale,, Minal B Hatnapure[1], Priyanka H Salunke[1]

[1]*Dept. of Community Medicine, BJ Government Medical College, Pune, Maharashtra, India*
[2]*Dept. of Community Medicine, Government Medical College, Pune, Maharashtra, India*

A B S T R A C T

Background: Dengue is fast emerging mosquito borne viral disease. There was sudden outbreak of dengue cases among Medical students and Health Care Workers in tertiary care hospital from September to November 2019. Therefore, outbreak investigation carried out and corrective actions taken to halt the outbreak. Study Objectives are to investigate outbreak of dengue cases in medical students and Health Care Workers and to take corrective actions to halt the outbreak.

Material and Methods: The outbreak investigations of Dengue cases was done as 28 cases were admitted which includes medical students and Health Care Workers in tertiary care hospital from September to November 2019. A thorough search for breeding sites of Aedes mosquito was done in premises of hospital, college and residential area. 5 teams were made consisting of Sanitary Inspector, interns, resident doctors and lecturer. House to house surveys were done for container index in Resident quarters and employees quarters. Health education on prevention of dengue was given to Medical students and Health Care Workers including interns, resident doctors, undergraduate students. Antilarval measures like abating, fogging and spraying of oildone.

Results: The mean age was 27.2 years, ranged for 14-68 years. Males 15(53.5%) and Females 13(46.4%). Out of 28,12(42.8%) Undergraduate students, 9(32.1%) Resident doctors and 7(25%) employees. 22(78.5%) NS-1positivecases and 16(57.1%) IgM dengue positive cases. The most common symptom found in this was fever (100%). Thrombocytopenia was most common abnormal laboratory finding which was present in 22(79%) patients out of 28 patients. Out of 22 patients having thrombocytopenia, platelet transfusion was done to 4 patients. Mean duration of stay in the hospital was 4 days.

Conclusion: With the corrective measures taken, no new case of dengue was notified in November 2019 among Medical Students and Health Care Workers.

1. Introduction

Dengue is one of the most rapidly spreading mosquito borne viral disease and is endemic in many countries in the tropical and subtropical regions of the world.[1] In the first report of the World Health Organization(WHO) on Neglected Tropical Diseases (NTDs), dengue was listed as one of the NTDs by the WHO.[2] Globally 390 million dengue virus infections per year of which 96 million manifest clinically. In India, there were 136422 cases and 132 deaths due to Dengue in 2019 while in Maharashtra there were 12374 cases and 25 deaths.[3]

* *Corresponding author.*
  E-mail address: drparandemalan@gmail.com (M. A. Parande).

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.[4] Anti dengue IgM detection using enzyme linked immunosorbent assay (ELISA) represents one of the most important advances and has become an invaluable tool for routine dengue diagnosis.[5] Specifically, MAC ELISA (IgM antibody capture ELISA) diagnosis is based on detecting dengue specific IgM.[6]

This was a tertiary health care center catering to whole of the Western Maharashtra area. Around 150-200 postgraduate students and 250 undergraduate students were admitting to this Institute per year. Increased no. of dengue fever cases were reported among the medical students and health care workers of this Institute in the month of September to November 2019 which warranted this outbreak investigation. There were total 94 medical students and Health Care Workers found positive for dengue.

So the present study planned to investigate outbreak of dengue cases in medical students and Health Care Workers in a Tertiary Care Hospital.

2. Study Objectives

1. To investigate outbreak of dengue cases in medical students and Health Care Workers in Tertiary Care Hospital.
2. To take corrective actions to halt the outbreak.

3. Materials and Methods

Outbreak was investigated by comparing the dengue positive cases of year 2019 with the previous year's data. There were 7-8 cases in the month of September 2018, 3-4 cases in the month of October 2018. But there were 94 dengue positive cases seen from September 2019 to November 2019 among the medical students and health care workers. Hence the outbreak of dengue was confirmed. Outbreak investigation was done among medical students and Health Care Workers working in a Sassoon general Hospital suffering from dengue fever from September 2019 to November 2019.

Medical students and Health Care Workers who were tested positively for NS-1 Antigen and IgM were included in the study while patients other than medical students and Health Care Workers were excluded. Records were reviewed and information on the date of onset, sociodemographic characteristics, serological reports for confirmed dengue cases from September to November 2019 was collected.

3.1. Teams for outbreak investigation

1. Total 5 teams were made to investigate the outbreak of dengue fever. The premise of Sassoon general hospital was equally distributed among these 5 teams.

2. Each team consisted of Sanitary Inspector, Interns, residents and lecturer of Community Medicine department.
3. Surveys for searching of breeding sites of mosquitoes are usually done monthly by such teams.
4. Despite of this, one day training of all teams was done in Department of Community Medicine. As per this distribution each team conducted a thorough search for breeding sites and looked for Aedes aegypti larvae. Aedes larvae were identified by visual inspection of their appearance and movement in water.[7]
5. Open spaces in the premise was checked for any water collection.
6. House to house surveys was conducted in undergraduate hostel, Residents Quarters and Employee Quarters for calculating Container Index.

Environmental survey was also done. In that, sanitation practices of the residents, their water storing habits, mosquito breeding sites, and drainage system was observed.

3.2. Operational definitions

3.2.1. Suspect dengue case

Any case of fever of 2 days or more with two or more of any of the following: headache, retro-orbital pain, myalgia, arthralgia, rash, hemorrhagic manifestations, and leukopenia.[7]

3.2.2. Confirmed dengue case

Any suspect dengue case with one or more of the following: positive monoclonal IgM antibody capture-ELISA (MAC-ELISA) test in a serum specimen from the late acute or convalescent phase, or positive NS1 ELISA test in acute phase.[7]

3.3. Ethical considerations

Permission of Institute Ethical Committee (IEC) was taken. Ethic's Committee no. is BJGMC/IEC//Pharmac/ND-0720109-110 dated 24/09/2019. Full confidentiality of respondent's information was kept and information was used only for research purpose.

3.4. Statistical analysis

Data was collected and entered in Microsoft Excel. It was analyzed using OpenEpi info. Epidemic curve was formed with number of cases. Spot map was drawn to see the clustering of cases in the area. Qualitative data was analyzed using Chi square test. Odds ratio (OR) with confidence interval (CI) was calculated. Qualitative data was analyzed by calculating mean, standard deviation. P value < 0.05 was taken as significant.

4. Results

Finding of cases was done by reporting the patients who had fever, joint pain.

Tracking of the cases were done to avoid the repetition of cases.

Total 94 Health Care Workers were positive for dengue. Of which 28 were admitted in the hospital and 66 were treated on OPD basis.

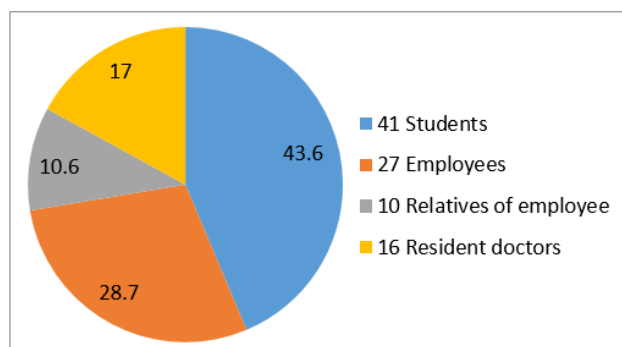Out of total 94 Health Care workers, majority 41(43.6%) were students. (Figure 1)

Fig. 1: Distribution of dengue cases among health careworkers

Out of 28 admitted cases, 12(42.8%) were Undergraduate students, 9(32.1%) were Resident doctors and 7(25%) were employees.
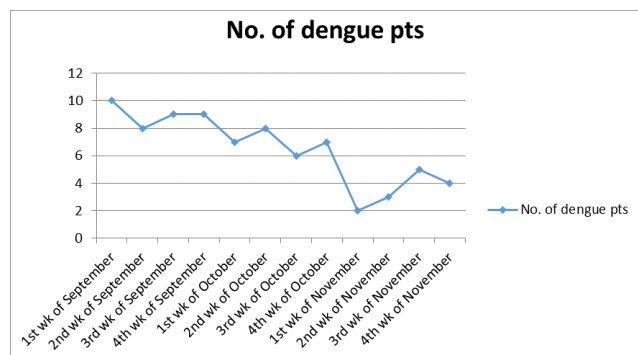

Fig. 2: Week wise distribution of no. of dengue cases among Health Care Workers in a Tertiary Care Hospital in month of September to November 2019

Maximum number of cases were observed during the month of September 2019. (Figure 2)

The mean age was 27.2+ 10.2 years, ranged for 7-68 years. In present study most common age group was between 18-30 years. There is no significant difference between age groups(p=0.34). Males were 52 (55.3%) and Females were 42 (44.6%) (Table 1). There is no significant difference between male and female(p=0.8).

Most common serology test which was positive was NS-1 in 37.2%, IgM was positive in 31.9% and mixed positivity (NS1 & IgM) was present in 30.8% (Table 2)

The most common symptom found in the study was fever (100%) following headache (97%), myalgia (97%), arthralgia (80%) (Table 3)

Thrombocytopenia was most common abnormal laboratory finding which was present in 22(79%) patients out of admitted 28 patients. Leucopenia was observed in 15 patients, HCV (>45%) among 4 patients, Hb (<10 gm%) in 2 patients and 2 patients had S.Creatinine (>1.2 mg%) (Table 4)

Out of 22 patients having thrombocytopenia, platelet transfusion was done to 4 patients.

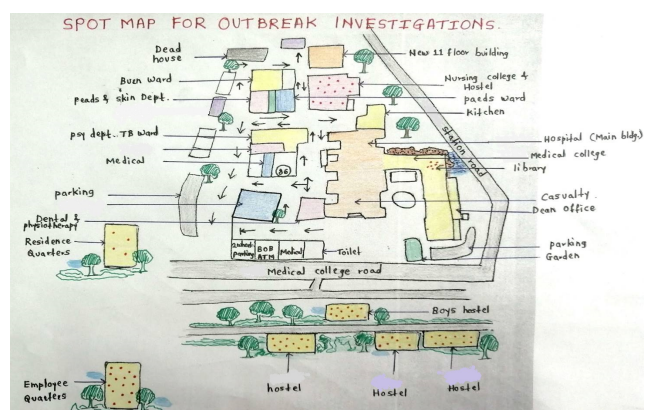Mean duration of stay in the hospital was 4 days.

Fig. 3: Spot map of cases of dengue fever

In the Spot map(Figure 3), Dengue cases were marked as red dots and clustering of cases were seen near the sites of breeding of Aedes larvae.

4.1. Container index

All the hostels, premises, resident quarters, employee quarters, UG hostels were actively searched for Aedes larvae. Among 13 sites, total 260 containers were examined and 72 containers were positive for Aedes larvae giving container index of 27.2%; highest index around the Hospital garden, employee quarters and the college library premises.

Containment measures taken to halt the outbreak-

1. Total 5 outbreak investigation teams were utilized for outbreak investigation and control measures.
2. During this procedure, the members from respective teams inspected the allotted area for search of any artificial breeding sites such as tyres, plastic materials, earthen pots, overhead tanks and water coolers for mosquito breeding sites.
3. Apart from that, water collection sites were also searched.
4. Anti-larval measures were taken in the form of abating using Temephos and spraying of mineral oil.

Table 1: Age and sexwise distribution of patients

Variable	Admitted n=28(%)	OPD n=66(%)	Total n=94(%)	P value
Age in years				
< 18	1 (3.5)	6 (9)	7 (7.4)	
18-30	23 (82.1)	42 (63.6)	65 (69.1)	0.34
31-50	3 (10.7)	15 (22.7)	18 (19.1)	
>50	1 (3.5)	3 (4.5)	4 (4.2)	
Sex				
Males	15(53.5)	37(56)	52(55.3)	
Females	13(46.4)	29(43.9)	42(44.6)	0.8
Total	28	66	94(100)	

Table 2: Serological findings of medical students and health care workers suffering from dengue in a tertiary care hospital

	Admitted n=28(%)	OPD n=66(%)	Total n=94(%)
NS-1 positive	12(42.8%)	23(34.8%)	35(37.2%)
IgM Dengue	6(21.4%)	24(36.3%)	30(31.9%)
Mixed	10(35.7%)	19(28.7%)	29(30.8%)
Total	28	66	94

Table 3: Symptoms of dengue cases

Symptoms	No. of patients
Fever	94 (100%)
Headache	91 (97%)
Retro orbital pain	19 (20%)
Myalgia	91(97%)
Arthralgia	75(80%)
Rash	8 (9%)
Petechiae/Ecchymoses/Purpura	4(4%)
Bleeding from any site	4(4%)
Vomitting	46(49%)
Abdominal pain	6(7%)

Table 4: Abnormal laboratory findings in admitted dengue patients

Laboratory findings	No. of patients
Hb (<10 gm%)	2(7%)
Leucopenia (<4000/ul)	15(56%)
Thrombocytopenia (<0.1 lac/ul)	22 (79%)
Haematocrit (>45%)	4 (14%)
PT (>14 sec)	1 (4%)
aPTT (>40 sec)	1(4%)
INR (>1.2)	1(4%)
S.creatinine (>1.2 mg%)	2 (8%)

5. Anti-adult measures were taken in the form of fogging using Deltamethrin (5ml in 1 lt.of diesel)
6. House to house survey was done. Health education sessions were conducted to spread the health awareness among students, employees and doctors. All were advised to use mosquito nets. All the health care workers were asked to wear full sleeve shirts, socks, and covered footwear during day time and also to apply mosquito repellent cream
7. Dry day was initiated and maintained where in there should not be storage of water in any containers for 1 day in a week. All the containers should be washed thoroughly and kept upside down.
8. Even after taking all these corrective actions, mosquito nuisance was still present. The whole area was again reinvestigated. Mosquitoes and their breeding sites were found in hostel toilets. Then fogging was done in all the toilets.

The maximum number of dengue cases were found during the month of September 2019 to November 2019. The last case of dengue was reported in Mid-November. After taking all the corrective actions the cases drops down and the

dengue outbreak was declared as end of outbreak.

5. Discussion

Total 94 Health Care Workers were positive for dengue from the month of September 2019 to November 2019. Maximum number of cases were observed during the month of September. There was an increase in the number of samples received in the post monsoon period (September to November).[8] Investigations were done to confirm the outbreak of dengue. Whole area of hospital, college, hostels, resident and employee quarters were distributed among various teams. Thorough search for breeding sites was done. Anti-larval and Anti-adult measures were taken to control the outbreak.The age group in this study was 14 to 68 years while age group in another study was 21 to 30 years.[9] Also age group commonly affected in another study was 21 to 30 years.[10] Cases were slightly more in males than females. This observation was similar to study conducted by Bhaswati Bandyopandhyay et al.[11] However the study conducted by Sourav Goswami et al.[9] showed that female population suffered more than male.

There were 35(37.2%) NS-1 positive cases and 30(31.9%) IgM dengue positive cases, while 29(30.8%) cases were having both NS-1 and IgM dengue positivity. In one study 26 (56.52%) cases tested positive for NS1 antigen, 11 (23.91%) cases were positive for IgM and 9(19.57%) were positive for both NS1 antigen and IgM.[12] Thrombocytopenia was observed in the present study in 22(79%) but the study done in south India showed leukopenia among most of the cases.[9] Another study done in South India shows leukopenia was observed among 39 (84.78%) cases.[12]

6. Conclusion

There was sudden increase of dengue cases among medical students and health care workers from September 2019. Therefore outbreak investigation was done in all the premise of Tertiary care hospital including resident's quarters, employee's quarters, college area and hostels. House to house surveys were done for searching of breeding places of Aedes mosquito. Water collection sites were also looked. Anti-larval measures were taken in the form of abating using Temephos and spraying of mineral oil. Anti-adult measures were taken in the form of fogging using Deltamethrin (5ml in 1lt. of diesel).

Health education was given to all students, doctors and employees. The breeding sites were observed and proper action were taken. This outbreak has shown that dengue fever can present as a sudden explosive outbreak under appropriate epidemiological setting, especially at an institutional set up. Breeding places of Aedes mosquito can be missed unless looked for in a systematic way. Because dengue fever is known to exhibit severe complications, sometimes culminating in fatalities, all such outbreaks should be prevented and promptly controlled.

7. Recommendations

1. Continuous on sight monitoring of breeding sites should be done.
2. Personal protection in the form of mosquito repellents, use of bed nets should be used.
3. Insecticide spraying should be done in post rainy season.

8. Source of Funding

Nil.

9. Conflicts of Interest

There are no conflicts of interest.

References

1. World Health Organization, Tropical Disease Research. Dengue: Guidelines for Diagnosis, Treatment, Prevention and control. France: World Health Organization; 2009; 2009. Available from: https://apps.who.int/iris/handle/10665/44188.
2. World Health Organization. First Report on Neglected Tropical Diseases: Working to Overcome the Global Impact of Neglected Tropical Diseases. Geneva: World Health Organization; 2010. Available from: https://apps.who.int/iris/handle/10665/44440.
3. WHO, "Dengue and severe dengue," World Health Organization, 2019. Available from: https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue.
4. Gubler DJ. Dengue and dengue hemorrhagic fever. *Clin Microbiol Rev*. 1998;11(3):480–96.
5. Hati AK. Studies on dengue and dengue haemorrhagic fever(DHF) in West Bengal State, India. *J Commun Dis*. 2006;38(2):124–9.
6. Vaughn DW, Green S, Kalayanarooj S, Innis BL, Nimmannitya S, Suntayakorn S, et al. Dengue viremia titer, antibody response pattern, and virus serotype correlate with dissease severity". *J Infect Dis*. 2000;181(1):2–9. doi:10.1086/315215.
7. Biswas DK, Bhunia R, Basu M. Dengue fever in a rural area of West Bengal, India, 2012: An outbreak investigation. *WHO South East Asia J Public*. 2014;3(1):46–50.
8. Gupta E, Dar L, Kapoor G, Broor S. The changing epidemiology of dengue in Delhi, India. *Virol J*. 2006;13:92. doi:10.1186/1743-422X-3-92.
9. Goswami S, Jha A, Siven SP, Mundra A, Gupta SS, Dambhare D, et al. Outbreak investigation and containment measures of dengue fever in rural Wardha: A field epidemiological study. *Int J Adv Med Health Res*. 2019;6(1):32.
10. Mishra R, Kumar P. A Report on Outbreak investigation of Dengue in Bihar in 2015. *J Med Sci Crit Res*. 2016;4(11):13557–68. doi:10.18535/jmscr/v4i11.08.
11. Bandyopadhyay B, Bhattacharyya I, Adhikary S, Konar J, Dawar N, Sarkar J, et al. A Comprehensive Study on the 2012 Dengue Fever Outbreak in Kolkata, India. 2013;doi:10.5402/2013/207580.
12. Bhattacharyya A. Epidemiological investigation and containment measures of a dengue fever outbreak in an institutional set up in South India. *Int J Med Sci Public Health*. 2016;5(5):915–9.

Author biography

Namrata D Mule, Senior Resident

Sangita C Shelke, Associate Professor

Muralidhar P Tambe, Professor and Head

Malangori A Parande, Associate Professor https://orcid.org/0000-0003-1332-3434

Rupali N Baviskar, Junior Resident III

Ganesh R Jagadale,, Junior Resident III

Minal B Hatnapure, Junior Resident III

Priyanka H Salunke, Junior Resident III