Bangladesh Journal of Infectious Diseases

Incidence and Pattern of Clinical Dengue Cases among Travelers and Non-Travelers in a District of Bangladesh

Syed Abdul Kader[1], Sonia Afrin Rob[2]

[1]Assistant Professor, Department of Endocrinology, Sher-E-Bangla Medical College, Barishal, Bangladesh; [2]Lecturer, Department of Dental Pharmacology, Marks Dental College, Dhaka, Bangladesh

Abstract

Background: Expansion of Dengue fever caused by a mosquito borne arbovirus to new countries and, from urban to rural settings constitutes an important health problem in the world including Bangladesh. **Objective:** This study was conducted to evaluate spread of clinical Dengue to previously non-endemic Barisal district and get an idea of how recent this spread is by comparing proportions of non-travelers and travelers to an endemic area among the admitted patients. **Methodology:** The incidence of dengue infection in Barisal division with and without travel history to known endemic area was investigated in the current cross sectional study from a conveniently selected sample of patients admitted to the medicine department of Sher-e-Bangla medical College Hospital form Barisal district from July 15, through August, to September 15, 2019. Clinical and laboratory data were collected by attending doctors and checked by investigators. The primary diagnostic tool was NS1 antigen detected by SD Bioline Dengue NS1 Ag Test Kit. Data entry and analysis was done by SPSS version 24.0 software. **Result:** A total number of sample size was 212 admitted patents of whom 138(65.1%) were male, 74 (34.9 %) were female,116 (54.7%) of patients traveled to a known endemic zone, 96 (45.3%) did not; 206 (97.2%) were NS1 positive, 4 (1.9%) were IgM positive, 2 (0.9%) were IgM positive and IgG positive; Of travelling 116 patients, 92(79.3%) were male, 24(20.7%) were female, of travelling 96 patients 46(47.9%) were male, 50(52.1%) were female. p-value was <0.001. **Conclusion:** The study concluded that Dengue is becoming endemic in previously non-endemic zones like greater Barisal, though travelers still holds the major share of disease burden. Male preponderance in traveling to endemic zone was statistically significant. [*Bangladesh Journal of Infectious Diseases, June 2020;7(1):3-7*]

Keywords: Dengue fever; *Aedes aegypti*; serotype; NS1 antigen.

Introduction

Dengue is a disease caused by an arbovirus, which has four related virus serotypes[1]. It is the most important arthropod transmitted human viral disease, most rapidly spreading mosquito-borne viral disease in the world[2]. In the 50 years from the mid-twentieth century to the beginning of the twenty-first century, incidence has increased 30-folds with increasing geographic expansion to new countries and, in the present decade, from urban to rural settings constituting an important health problem in the world including Bangladesh[3]. Dengue is a systemic and dynamic infectious disease which may be asymptomatic or present itself with a broad clinical spectrum. After the incubation period (4 to 10 days), the illness begins abruptly and is followed by three phases—febrile, critical, and recovery. Principles of case classification can help to identify patients at risk of developing severe dengue and the requirement of hospital care[4].

Globally, reporting on dengue cases shows cyclical variation with high epidemic years and non-epidemic years[5]. Dengue often presents in the form of large outbreaks. There is, however, also a seasonality of dengue, with outbreaks occurring in different periods of the year. This seasonality is determined by peak transmission of the disease, influenced by characteristics of host, vector, agent and environment. These relationships determine the endemic level in an area. Temperatures in the range of 25 C ± 5 C, relative humidity around 80% and innumerable small water collections result high transmission[6].

Only nine countries had experienced severe dengue epidemics before 1970 [7]. Today, the disease is endemic in more than 100 countries throughout the globe[8]. The actual numbers of dengue cases are underreported and many cases are misclassified. World Health Organization estimate indicates that 390 million dengue infections occur every year (95% credible interval 284–528 million), of which 96 million (67–136 million) manifest clinically (with any severity of disease) [9]. A study, of the prevalence of dengue (2012), estimates that 3.9 billion people in 128 countries are at risk of infection with dengue viruses[4].

In Bangladesh the first epidemic of dengue hemorrhagic fever occurred in mid-2000 when 5,551 dengue infections were reported from Dhaka, Chittagong, and Khulna cities, occurring mainly among adults[10]. Among the reported cases, 4,385 (62.4%) were dengue fever (DF) infections, and 1,186 (37.6%) cases were dengue hemorrhagic fever (DHF). The case-fatality rate (CFR) was 1.7%, with 93 reported deaths[11]. *Aedes aegypti* was identified as the main vector responsible for the epidemic, and *Aedes albopictus* was identified as a potential vector in Chittagong[12]. According to WHO, the worst outbreak occurred in 2002, with 6,232 cases and 58 deaths[13,14]. The prevalent serotypes of dengue until 2000 in Bangladesh were DENV1, DENV2, and DENV3, with the highest number of reported cases attributed to DENV-3 [14,15]. A similar situation can be seen in other countries, such as India and Sri Lanka, where DENV-3 has been reported most of the time in DF/DHF-related illnesses[16]. Over the last 10-15 years, dengue fever and dengue hemorrhagic fever has become a leading cause of hospitalization among children in South East Asian Regions[12].

Aedes aegypti and *Aedes albopictus* are the two most important vectors of dengue. *Aedes aegypti* is highly domesticated and strongly anthropophilic. *Aedes albopictus,* an aggressive feeder, can take the blood required for each gonotropic cycle in one bite. They usually reside in the urban peripheries, prefers natural larval habitats like tree holes, latex collecting cups, leaf axils, bamboo stumps, coconut shells, however, breeding has been reported recently in domestic habitats. The eggs of Aedes mosquito can remain viable in dry condition for more than a year, emerge within 24 hours after contact with water making control of dengue difficult.

The female *Aedes* mosquito takes a blood meal from a person during the acute febrile (viremic) phase of dengue, after an extrinsic incubation period of 8 to 10 days, can bite and infect another person. Dengue begins after an intrinsic incubation period of 4 to 7 days. There is also evidence of vertical transmission of dengue virus[17]. The monsoon (June-July) and post-monsoon (August-October) in Bangladesh is peak time to develop dengue. During 2015 to 2017, in the pre-monsoon season, the dengue cases were reported to be more than seven times higher compared to the previous 14 years[18]. The findings closely correlate with high density of larva and pupa of the dengue vectors in the environment on pre-monsoon *Aedes* vector survey.

In one study, climate changes, such as average rainfall, humidity, and temperature, after 2014, and rapid unplanned urbanization were the strong predictors of an imbalance in the existing ecology

that has led to increase in dengue cases in 2016 and the emergence of the Chikungunya virus for the first time in Bangladesh in 2017[19]. The seasonal prevalence of Dengue had been in restricted in Dhaka and surrounding areas. But the recent years have seen significant increase in the incidence of clinical Dengue far away from Dhaka.

Methodology

This was a hospital-based, cross-sectional study. Sample was taken from the male and female patients with clinical features of Dengue and Dengue Haemorhagic fever with any of Dengue antigen or antibody positivity admitted to the medicine department of Sher-E-Bangla Medical College Hospital, Barisal, Bangladesh from July 15, 2019 through the whole month of August to September 15, 2019. The patients selected for this study came from Barisal district. Sample was selected by convenience sampling technique. A venous blood specimen of 3 mL was collected from all the consenting participants. The serum was separated mostly at the Sher-E-Bangla Medical College Hospital laboratory facility located on the first floor of the hospital where for detecting NS1 antigen, SD Bioline Dengue NS1 Ag Test Kit imported from South Korea was used if presentation was within first five days of symptoms; however, Dengue IgM and IgG antibodies detection was done if presentation was after five days of symptoms onset, if not already done appropriately**.** Data were collected in a pre-prepared tabulated form by the attending doctors after performing interview, physical examination and laboratory investigation on the patients during their hospital stay. Collected data were checked and rechecked by the investigators to eliminate mistakes. Computer data entry and analysis were done using SPSS version 24.0 software. Frequency and percentage were used to present descriptive summary of the findings; chi-square test was done for analysis. No physical or psychological risk was associated with the study. Permission of the authority and informed consent of the participants were taken before conducting the study.

Results

The incidence of dengue infection in Barisal district with and without travel history to a known endemic area has been investigated in the current study. The total sample size was 212. Among the patients 138 (65.1%) were male, 74 (34.9 %) were female. Male: Female ratio was 1.9: 1 (Table 1).

Table 1: Distribution of Dengue Patients by Sex (n=212)

Gender	Frequency	Percent
Male	138	65.1
Female	74	34.9
Total	**212**	**100.0**
Male: Female ratio	1.9: 1	

The distribution of dengue patients by travel to known endemic zone was recorded. Among the patients 116 (54.7%) traveled to a known endemic zone, 96 (45.3%) did not travel to a known endemic zone (Table 2).

Table 2: Distribution of Dengue Patients by Travel to Known Endemic Zone (n=212)

Travel to known endemic zone	Frequency	Percent
Yes	116	54.7
No	96	45.3
Total	**212**	**100.0**

The distribution of dengue patients by diagnostic criteria was recorded. Among the patients 206 (97.2%) were NS1 positive, 4(1.9%) were IgM positive, 2(0.9%) cases were IgM and IgG positive (Table 3).

Table 3: Distribution of Dengue Patients by Diagnostic Criteria (n=212)

Diagnostic Criteria	Frequency	Percent
NS1 positive	206	97.2
IgM positive	4	1.9
IgM & IgG positive	2	0.9
Total	**212**	**100.0**

Figure I shows distribution of dengue patients by platelet count available on admission. Platelet count was available in 63(63.6%) patients, not available in in 36(36.4%) patients who presented documents on admission.

Table 4: Association of Travel Frequency in Endemic Zone with Sex Distribution (n=212)

Travel endemic zone	Male	Female	P value
Yes	92(79.3%)	24(20.7%)	
No	46(47.9%)	50(52.1%)	<0.001*
Total	138(65.1%)	74(34.9%)	

Chi-square test was done, *significant

The number of patients with platelet count 100000/cmm or below defining dengue haemorrhagic fever was 29(46%) among the patients with available platelet count.
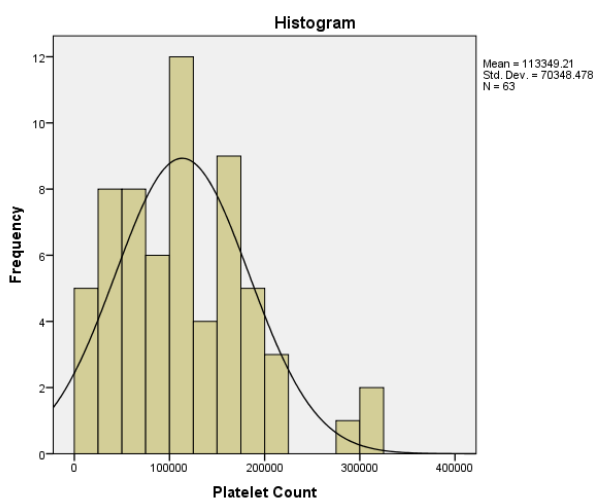

Figure I: Distribution of dengue patients by platelet count available on admission (n=63)

The association of travel frequency in endemic zone with sex distribution was recorded. Among the patients 116 traveled to endemic zone, of them 92(79.3%) were male, 24(20.7%) were female. The remaining 96 patients did not travel to endemic zone, of them 46(47.9%) were male, 50(52.1%) were female. p-value was <0.001. Male preponderance in traveling to endemic zone was statistically significant (Table 4).

Discussion

The incidence of dengue infection in Barisal division with and without travel history to known endemic area has been investigated in the current study. The total sample size was 212. Among the patients 138 (65.1%) were male, 74 (34.9 %) were female. Male: Female ratio was 1.9: 1.

In this study 116(54.7%) patients traveled to a known endemic zone, 96(45.3%) cases did not travel to a known endemic zone. In a survey conducted in India distribution of Dengue was found to heterogenous[5]. In Bangladesh Dengue was previously endemic in Dhaka and surrounding area, in the current study more than half of the patients had history of travel to an endemic zone.

Among the patients 206(97.2%) were NS1 positive, 4(1.9%) were IgM positive, 2(0.9%) were both IgM positive and IgG positive.

In this study, platelet count was available in 63(63.6%) patients, not available in 36(36.4%) patients who presented documents on admission. The number of patients with platelet count 100000/cmm or below defining Dengue Haemorrhagic fever was 29(46%) cases among the patients with available platelet count which far exceeds, proportionately, previous widely accepted estimates[6].

In the study 116 patients traveled to endemic zone, of them 92(79.3%) cases were male, 24(20.7%) cases were female. The remaining 96 patients did not travel to endemic zone, of them 46(47.9%) cases were male, 50(52.1%) cases were female. p-value was <0.001. Male preponderance in traveling to endemic zone was statistically significant.

Conclusion

Dengue is a systemic and dynamic infectious disease which may be asymptomatic or present itself with a broad clinical spectrum. Expansion of this disease caused by a mosquito borne arbovirus to new countries and, from urban to rural settings constitutes an important health problem in the world including Bangladesh. This study concluded that Dengue is becoming endemic in previously non-endemic zones like Barisal district, though travelers still holds the major share of disease burden. Male preponderance in traveling to endemic zone was statistically significant. In the coming years larger studies should be conducted to determine the new endemic zones in the country where adequate resources should be allocated to enhance preparedness.

Reference

1. Bäck AT, Lundkvist A. Dengue viruses - an overview. Infect Ecol Epidemiol 2013 Aug 30;3
2. MV Murhekar, Kamaraj P, Kumar MS, Khan SA, Allam RR, Barde P, et al. Burden of dengue infection in India, 2017: a cross-sectional population based serosurvey. Lancet Glob Health 2019;7: e1065–73
3. Phillips ML. Dengue reborn: widespread resurgence of a resilient vector. Environ Health Perspect. 2008;116(9):A382-8
4. National Malaria Elimination & Aedes Transmitted Disease Control Program Disease Control Unit Directorate General of Health Services. National Guideline for Clinical Management of Dengue Syndrome 4th Edition. National Malaria Elimination & Aedes Transmitted Disease Control Program Disease Control Unit Directorate General of Health Services, Mohakhali, Dhaka, 2018.
5. Morales I, Salje H, Saha S, Gurley ES. Seasonal Distribution and Climatic Correlates of Dengue Disease in Dhaka, Bangladesh. Am J Trop Med Hyg. 2016;94(6):1359-61
6. Campbell KM, Lin CD, Iamsirithaworn S, Scott TW. The complex relationship between weather and dengue virus

transmission in Thailand. Am J Trop Med Hyg. 2013;89(6):1066-1080

7. Murray NE, Quam MB, Wilder-Smith A. Epidemiology of dengue: past, present and future prospects. Clin Epidemiol. 2013;5:299-309

8. Guo C, Zhou Z, Wen Z, Liu Y, Zeng C, Xiao D, Ou M, Han Y, Huang S, Liu D, Ye X, Zou X, Wu J, Wang H, Zeng EY, Jing C, Yang G. Global Epidemiology of Dengue Outbreaks in 1990-2015: A Systematic Review and Meta-Analysis. Front Cell Infect Microbiol. 2017;7:317

9. Guzman MG, Vázquez S, Kouri G. Dengue: where are we today? Malays J Med Sci. 2009;16(3):4-11

10. Rahman M, Rahman K, Siddque AK, Shoma S, Kamal AH, Ali KS, Nisaluk A, Breiman RF. First outbreak of dengue hemorrhagic fever, Bangladesh. Emerg Infect Dis. 2002;8(7):738-40

11. Sharmin S, Viennet E, Kathryn G, David H. The emergence of dengue in Bangladesh: Epidemiology, challenges and future disease risk. Transactions of the Royal Society of Tropical Medicine and Hygiene. 2015;109

12. Mahmood B, Mahmood S. Emergence of Dengue in Bangladesh a major international public health concern in recent years. Environmental Research. 2011; 2. 35-41

13. Banu S, Hu W, Hurst C, Guo Y, Islam MZ, Tong S . Space-time clusters of dengue fever in Bangladesh .Tropical Medicine and International Health. 2012;17(9):1086–91

14. Muraduzzaman AKM, Alam AN, Sultana S, Siddiqua M, Khan MH, Akram A, et al. Circulating dengue virus serotypes in Bangladesh from 2013 to 2016. Virus disease. 2018;29(3):303-307

15. Shirin T, Muraduzzaman AKM, Alam AN, Sultana S, Siddiqua M, Khan MH, et al. Largest dengue outbreak of the decade with high fatality may be due to reemergence of DEN-3 serotype in Dhaka, Bangladesh, necessitating immediate public health attention. New Microbes New Infect. 2019;29:100511

16. Messer WB, Gubler DJ, Harris E, Sivananthan K, de Silva AM. Emergence and global spread of a dengue serotype 3, subtype III virus. Emerg Infect Dis. 2003;9(7):800-9

17. World Health Organization (WHO) and the Special Programme for Research and Training in Tropical Diseases (TDR). Dengue: guidelines for diagnosis, treatment, prevention and control -- New edition. A joint publication of the World Health Organization (WHO) and the Special Programme for Research and Training in Tropical Diseases (TDR). 2009.

18. Control Room, DGHS. Trend analysis of reported dengue cases and deaths by years from public and private health facilities. Control Room, DGHS, 2000–2017

19. Mutsuddy P, Tahmina S, Shamsuzzaman AKM, Kaisar SMG, Khan MNA. Dengue Situation in Bangladesh: An Epidemiological Shift in terms of Morbidity and Mortality. Canadian Journal of Infectious Diseases and Medical Microbiology. Volume 2019, Article ID 3516284, 12 pages.