OPEN ACCESS

Saudi Journal of Medical and Pharmaceutical Sciences
Abbreviated Key Title: Saudi J Med Pharm Sci
ISSN 2413-4929 (Print) | ISSN 2413-4910 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article **Paediatrics**

The Clinical and Biochemical Profiles and Outcomes of Dengue Fever and Dengue Hemorrhagic Fever in Children During a Dengue Outbreak in 2022 at a Tertiary Care Hospital in Bangladesh

Dr. Md. Al Mamun Hossain[1*], Dr. Pandora Glory[2], Dr. Mst. Hasna Hena[3], Dr Farzana Kabir[4], Dr Afroza Sultana[5], Dr. Zannat-ul- Sarmin[6], Dr. Afroza Islam Shuma[7]

[1]Assistant Professor (Paediatrics) OSD, Department of Neonatology, Dhaka Medical College Hospital, Dhaka Bangladesh
[2]Registrar, Department of neonatology, Dhaka Medical college Hospital. Dhaka, Bangladesh
[3]Junior Consultant (Paediatrics) Department of Paediatric Neurology & Development, Dhaka Medical College Hospital, Dhaka, Bangladesh
[4]Consultant Paediatrics, OSD, BSMMU, Dhaka, Bangladesh
[5]Registrar, Paediatrics, Dhaka Medical College Hospital, Dhaka, Bangladesh
[6]Registrar, Department of Nephrology, Dhaka Medical College Hospital, Dhaka Bangladesh
[7]Assistant Professor, Neonatology, Dhaka Medical College, Dhaka, Bangladesh

DOI: https://doi.org/10.36348/sjmps.2024.v10i11.004 | **Received:** 26.09.2024 | **Accepted:** 31.10.2024 | **Published:** 12.11.2024

***Corresponding author:** Dr. Md. Al Mamun Hossain
Assistant Professor (Paediatrics) OSD, Department of Neonatology, Dhaka Medical College Hospital, Dhaka Bangladesh

Abstract

Background: In 2022 the current dengue outbreak is unusual in its nature and seasonality. The changing pattern of presentation among pediatric age group is alarming to us. Shock and plasma leakage has been more prevalent in younger patients in recent outbreak. The study's objective was to compare the clinical, biochemical features, and outcomes of dengue fever and dengue hemorrhagic fever among children. ***Objective:*** The study's objective was to compare the clinical, biochemical features, and outcomes of dengue fever and dengue hemorrhagic fever among children. ***Method:*** This was a prospective longitudinal study. carried out in the department of Pediatrics in Dhaka Medical College Hospital, Dhaka, Bangladesh. Data was collected from previous record. Total 350 confirmed dengue patient, with the age limit of 1 month to 12 years, admitted in Dhaka Medical College Hospital within January to December 2022, fulfilling the inclusion and exclusion criteria were included in this study. ***Results:*** In our study among 350 dengue infected child, we found 133 (38%) patients as dengue fever and 217 (62%) patient got dengue hemorrhagic fever. In our study among 350 patient 322 patients has dengue NS1 antigen test positive. There is no significant variation between DF and DHF. 117 patients have Anti-dengue IgM antibody positive, and 28 patients has Anti-dengue IgG antibody positive. And 152 patients got both Anti-dengue IgM antibody and Anti-dengue IgG antibody positive. That means they got secondary infection. In the hematological findings high hematocrit level, leucopenia, thrombocytopenia is significantly associated with dengue hemorrhagic fever in contrast to dengue fever. Death was found in 2 patients. The two case of death was diagnosed as dengue shock syndrome. Hemorrhage contributes to dengue morbidity and mortality. ***Conclusion:*** Dengue hemorrhagic fever was found as more to be the leading cause of severity or mortality. Skin rash, vomiting, GIT symptoms were more common in dengue hemorrhagic fever. High hematocrit level, leucopenia, thrombocytopenia is significantly associated with dengue hemorrhagic fever in contrast to dengue fever. So, if we can do proper follow up and investigation from the very beginning of diagnosis, management will be more specific, and mortality can be reduced.

Keywords: Dengue fever, dengue hemorrhagic fever, dengue shock syndrome, childhood dengue infection.

INTRODUCTION

Dengue fever (DF) is an arthropod-borne viral disease that affects more than 100 million cases worldwide [1, 11]. The clinical manifestations may present as mild febrile illness (DF) to severe hemorrhagic fever (DHF) and Dengue Shock Syndrome (DSS) [4,16]. Dengue fever is associated with fever,

arthralgia, myalgia, retro-orbital pain, and rash. Dengue cases also present with hemorrhagic manifestation (sub-conjunctival hemorrhage, petechiae, epistaxis, etc.) with or without shock. Dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) are more serious and can be fatal [18, 23]. The first official outbreak of dengue in Bangladesh was reported in 2000 with 5551 dengue cases and 93 reported deaths [22]. In 2022 a surge of cases started in June. Currently, all eight divisions in the country are reporting cases and deaths. This is the second-largest outbreak since 2000, with the largest having occurred in 2019. The current dengue outbreak is unusual in its scale and seasonality [1]. The prevalence of (DF) in tropical and subtropical zones are increasing day by day. Age distribution has been rising and more cases have been reported among the pediatric age group. DF is usually self-limiting disease where death is uncommon. But the changing pattern of presentation among pediatric age group is alarming to us. A variation in the clinical manifestations can be noted over the decade since the first outbreak [5,6,7,12,14]. For example the outbreak of 2000 and 2002 were characterized by high-grade fever with typical purpuric rash, break-bone body ache, and thrombocytopenia [13,14], on the other hand in 2010 [12]. and 2018 [6]. outbreaks, predominant manifestations were fever, gastrointestinal symptoms and bleeding manifestation with normal platelet counts. The majority of fatalities in dengue infection during epidemics occur in children [43,44]. Previously elder person has been reported to be a risk factor for mortality with DF or DHF as the co-morbidities are associated with ageing and their waning immunity [13,19]. Though shock and plasma leakage has been more prevalent in younger patients [1, 20]. This article discusses the impact of dengue fever and dengue hemorrhagic fever in children.

MATERIALS & METHODS

This was a prospective longitudinal study carried out in the department of Pediatrics in Dhaka Medical College Hospital, Dhaka, Bangladesh. The study was done after obtaining ethical clearance from the Ethical Review Committee.

This was a prospective longitudinal study carried out in the department of Pediatrics in Dhaka Medical College Hospital, Dhaka, Bangladesh. The study was done after obtaining ethical clearance from the Ethical Review Committee.

This study was done in department of Pediatrics in Dhaka Medical College Hospital, Dhaka, Bangladesh in the period of June to November 2022.Study population was all the confirmed dengue patient admitted in department of Pediatrics Dhaka Medical College Hospital within this period fulfilling the inclusion and exclusion criteria.

Inclusion criteria:

Child age from 1month to 12 years with NS1 antigen positive or Positive dengue IgM antibody with or without positive dengue IgG antibody.

Exclusion criteria:

Both dengue NS1 and IgM negative or only Dengue IgG positive. Expanded dengue syndrome. Dengue fever is associated with chronic disease like - congenital heart disease, chronic kidney disease, chronic liver disease, malignancy, severe acute malnutrition, epilepsy etc.

According to National guideline for clinical management for dengue syndrome 4th edition, 2018 (revised) dengue fever can be defined as the onset of fever is sudden with a sharp rise in temperature and is frequently associated with a flushed face and headache. Occasionally, chills accompany the sudden rise in temperature. The following features are usually observed: Retro-orbital pain on eye movement or pressure on eye, photophobia, backache and pain in the muscles and joints/bones. The other common symptoms include anorexia and altered taste sensation, constipation, colicky pain and abdominal tenderness. DHF is characterized by the acute onset of high fever and is associated with signs and symptoms similar to DF. Critical phase with plasma leakage is the hallmark of DHF. There is a tendency to develop hypovolemic shock (dengue shock syndrome) due to plasma leakage. A structured questionnaire was used for data collection. After fulfilling the inclusion and exclusion criteria informed written consent was taken from parents. Finally total 380 children were enrolled in this study. Children with the age limit of 1 month to 12 years, confirmed dengue case were included in this study irrespective of sex, & ethnicity. Detail history regarding Dengue infection and thorough clinical examinations were done accordingly. Dengue cases were defined and classified according to National guideline for clinical management for dengue syndrome 4th edition, 2018 (revised). Patients were categorized into the following three classes- dengue fever (DF, including classical dengue and dengue with unusual hemorrhage), dengue hemorrhagic fever (DHF with or without shock), and expanded dengue syndrome (EDS). Primary infection was defined as having positive IgM antibody and negative IgG antibody or having an IgM:IgG ratio of >1.8 at day 7 after the onset of illness. However, having a negative IgM and positive IgG test or an IgM:IgG ratio of 1.8 was considered secondary infection. (Ref-guideline) After getting proper history and clinical findings appropriate management was given according to the protocol for Dengue management for children. Blood draw was obtained for investigation of complete blood count, S. bilirubin, ALT and AST. Data were processed, compiled and analyzed with Statistical Package for Social Science (SPSS) version 23.0. Data were presented in number, percentage and tables.

RESULTS

Table-I: Demographic profile of study population (N-350)

Variable	Total N-350	DF N-133 (38%)	DHF (With or without shock) N-217 (62%)	p value
Sex				
Male	165	77(58%)	88 (40%)	0.021
Female	185	56 (42%)	129(59%)	0.035
Residence				
Rural	35	28	7	0.000
Semi urban	140	91	49	0.590
Urban	175	14	161	0.001
Traveling to endemic zone	70	35	35	0.021
Associated co-Infection	82	42	40	0.182

Table-2: Clinical profile of study population (N-350)

Variable	Total N-350	DF N-133 (38%)	DHF (With or without shock) N-217 (62%)	p value
Fever	350 (100 %)	133 (100 %)	217 (100 %)	
Duration of fever (Day)		4.89	5.30	0.072
Headache	153	77	75	0.01
Myaleia	133	56	77	0.215
Retro orbital pain	63	35	28	0.002
MyaJeia	133	56	77	0.215
Letha.I1!V	56	35	21	0.01
Arthralgia	70	37	33	0.021
Pallor	72	21	51	0.123
Jaundice	14	7	7	0.345
Skin Rash	168	119	49	0.000
GIT Symptoms				
Vomiting	168	49	119	0 .0 01
Abdominal pain	49	35	14	0.021
Diarrhea	49	7	42	0.123
Ascites	7	0	7	0.345
Hepatomegaly	124	21	103	0.002
Unconsciousness	14	0	14	0.019
Convulsion	16	7	9	0.345
Respiratory symptom	294	133	161	0.002
Urine out				
Normal	231	133	98	0.001
Low	119	0	119	
Pulse <60/min	175	126	49	0.002
Low Pulse volume	189	14	175	0 .006
Shock	168	0	168	0.001

Table 3: Hematological profile of stud population (N- 350)

Variable	Total N-350	DF N-133 (38%)	DHF (With or without shock N-217 (62%)	P value
NS1 antigen Positive	322	126	196	0.140
Anti-dengue IgM antibody Positive	317	ll9	198	0.507
Anti-dengue IgG antibody Positive	28	7	21	0.140
Hematocrit >48 (raised hematocrio	192	78	184	<0.004
Leucopenia (4 x 10^3 cells /µL)	266	84	182	<0.001
Thrombocytopenia (150 x103cells/µL)	260	50	210	<0.001
ALT	220	80	140	<0.001
AST	273	77	196	<0.001

Table-4: Outcome of the dengue infected children (N-350)

Variable	Total N-350	DF N-133 (38%)	DHF (With or without shock). N-217 (62%)	P value
Complete recovery	341	133	208	0.011
Recovery with complication	7	0	7	0.004
Death	2	0	2	0.005

DISCUSSION

In this study 62% patient presented as DHF. This disease pattern markedly differs from other studies conducted in Bangladesh, where most of the affected children developed DF. Dengue shock syndrome is more common in our study. This may be due to changing pattern of dengue infection in this outbreak or may be Dhaka medical college hospital is a tertiary care hospital and critical patients are referred from different area of Bangladesh.

We noted typical clinical presentations of dengue in our study participants with fever, myalgia (in the form of either backache and diffuse pain), headache, rash, vomiting and shock. Fever is present in all patients. Previous reports from Bangladesh in 2018 [24,25] and from Papua New Guinea in 2016 [26] reported lower frequency of such symptoms. However, a study from Indonesia that included children with dengue between 2009 to 2013 reported a similar prevalence of symptoms [27]. Intriguingly, during the 2000 outbreak in Dhaka city, the pattern of clinical picture was remarkably like our findings [24,25]. A plasma leakage was present in a significantly higher proportion in the DSS group [8]. A significantly higher proportion of children with DHF had hepatomegaly compared to DF fever patients found in another study [29]. Bleeding manifestations including petechiae, epistaxis and menorrhagia have been observed frequently in adults with DF or DHF, although upper gastro-intestinal (GI) bleeding is the most common type of severe haemorrhage [30].

It is well-established that secondary infection by a different virus strain can lead to severe dengue through antibody-dependent enhancement [20]. In 2022 it was the second outbreak of dengue. The 1st largest outbreak of dengue fever was found in 2019. This may be the cause of more chance to develop secondary infection and more chance to develop shock in this pandemic.

In our study among 350 patient 322 patients has dengue NS1 antigen test positive. There is no significant variation between DF and DHF. 117 patients have Anti-dengue IgM antibody Positive, and 28 patients has Anti-dengue IgG antibody Positive. And 152 patients got both Anti-dengue IgM antibody and Anti-dengue IgG antibody Positive. That means they got secondary infection. In the hematological findings high hematocrit level, leucopenia, thrombocytopenia is significantly associated with dengue hemorrhagic fever in contrast to dengue fever. Increased liver enzymes [alanine aminotransferase (ALT) and aspartate aminotransferase (AST)] have been found in children during dengue infection, indicating liver involvement [31,32].

If we consider the outcome of our study population then we found excellent outcome. Among 350 patients 341 patient recovered without any complication. Only 7 patients got found complication. More unusual manifestations of dengue infection are severe internal hemorrhage, cardiomyopathy, cardiac arrhythmias, acute respiratory distress syndrome (ARDS), rhabdomyolysis, pancreatitis, appendicitis, co-infection with other tropical diseases, and neurological phenomena such as altered consciousness, seizures and coma owing to encephalitis and encephalopathy [33]. Neurological manifestations secondary to dengue infection were ascribed to non-specific complications such as myelitis, optic neuritis, polyradiculopathy or neuropathy [37, 38]. Possible causes of dengue encephalopathy include hypotension, cerebral oedema, focal hemorrhage, hyponatremia and fulminant hepatic failure [34,38,40]. However, a recently documented possibility is dengue invasion of the nervous system [40,41]. Death was found in 2 patients. The two case of death was diagnosed as dengue shock syndrome leading to expanded dengue syndrome. Hemorrhage contributes to dengue morbidity and mortality, especially during the severe thrombocytopenia and toxic hemorrhagic stage (3–5 days after illness onset) [30].

CONCLUSION

Dengue hemorrhagic fever was found as more to be the leading cause of severity or mortality. Skin rash, vomiting, GIT symptoms were more common in dengue hemorrhagic fever. High hematocrit level, leucopenia, thrombocytopenia is significantly associated with dengue hemorrhagic fever in contrast to dengue fever. So, if we can do proper follow up and investigation from the very beginning of diagnosis, management will be more specific, and mortality can be reduced.

REFERENCES

1. Agarwal, R., Kapoor, S., Nagar, R., Misra, A., Tandon, R., Mathur, A., ... & Chaturvedi, U. C. (1999). A clinical study of the patients with dengue hemorrhagic fever during the epidemic of 1996 at Lucknow, India. *Southeast Asian journal of tropical medicine and public health*, *30*(4), 735-740.
2. Anuradha, S., Singh, N. P., Rizvi, S. N., Agarwal, S. K., Gur, R., & Mathur, M. D. (1998). The 1996 outbreak of dengue hemorrhagic fever in Delhi, India. *The Southeast Asian Journal of Tropical Medicine and Public Health*, *29*(3), 503-506.

3. Akram, A. (2019). Alarming turn of dengue fever in Dhaka city in 2019. *Bangladesh Journal of Infectious Diseases*, *6*(1), 1.
4. Azad, D. A. K., Ferdousic, D. S., & Islam, Q. T. (2018). National guideline for clinical management of dengue syndrome. *Dhaka: Government of the People's Republic of Bangladesh*.
5. Islam, M. A., Ahmed, M. U., Begum, N., Chowdhury, N. A., Khan, A. H., del Carmen Parquet, M., ... & Morita, K. (2006). Molecular characterization and clinical evaluation of dengue outbreak in 2002 in Bangladesh. *Japanese journal of infectious diseases*, *59*(2), 85-91.
6. Amin, M. R., Islam, M. R., Bhuiyya, M., Hasan, M. J., Islam, M. S., & Islam, F. Clinical study on paradigm shift of dengue syndrome in Bangladesh-2018. *Unpubl Work*.
7. Arif, K. M., Mohammed, F. R., Nur, Z., Shams, M. Z., Alam, M. B., Uddin, M. J., & Ahasan, H. N. (2009). Clinical profile and outcome of dengue hemorrhagic fever in a Tertiary Care Hospital in Dhaka. *Journal of Medicine*, *10*(1), 12-15.
8. Biswas, R., Mohammed, F. R., Sengupta, P., Ahmed, H. S., Rahman, M. M., Sarker, M. A. S., & Nazimuddin, M. (2014). Dengue NS1 antigen: a tool in early detection of dengue virus infection. *Journal of Medicine*, *15*(1), 28.
9. DGHS: Director General of Health Services. Daily daily status report. 2021. https://dghs.gov.bd/index.php/bd/home/ 5200-daily-dengue-status-report.
10. Kouri, G., & Guzman, M. (2003). Dengue and dengue hemorrhagic fever in the Americas: lessons and challenge. *Journal of Clinical Virology*, *27*(1), 1-13.
11. Islam, M. A., Ahmed, M. U., Begum, N., Chowdhury, N. A., Khan, A. H., del Carmen Parquet, M., ... & Morita, K. (2006). Molecular characterization and clinical evaluation of dengue outbreak in 2002 in Bangladesh. *Japanese journal of infectious diseases*, *59*(2), 85-91.
12. Islam, Q. T., Basher, A., & Amin, R. (2012). Dengue: a practical experience of medical professionals in hospital. *Journal of Medicine*, *13*(2), 160.
13. Lee, I. K., Liu, J. W., & Yang, K. D. (2005). Clinical characteristics and risk factors for concurrent bacteremia in adults with dengue hemorrhagic fever. *American Journal of Tropical Medicine and Hygiene*, *72*(2), 221-226.
14. Mohammad, H., Sarkar, D. N., Amin, M. R., Basher, A., & Ahmed, T. (2011). Clinical profile and outcome of patients with dengue syndrome in hospital care. *Journal of Medicine*, *12*(2), 131-138.
15. NEWS DESK. Bangladesh dengue cases top 1,000, down dramatically from 2019. 2020. http://outbreaknewstoday.com/bangladesh-denguecases-top-1000-down-dramatically-from-2019/.
16. Pervin, M., Tabassum, S., Kumar Sil, B., & Islam, M. N. (2003). Isolation and Serotyping of Dengue Viruses by Mosquito Inoculation and Cell Culture Technique: An Experience in Bangladesh.
17. Pervin, M., Tabassum, S., Kumar Sil, B., & Islam, M. N. (2003). Isolation and Serotyping of Dengue Viruses by Mosquito Inoculation and Cell Culture Technique: An Experience in Bangladesh.
18. Pancharoen, C., Kulwichit, W., Tantawichien, T., Thisyakorn, U., & Thisyakorn, C. (2002). Dengue infection: a global concern. *Journal of the Medical Association of Thailand= Chotmaihet thangphaet*, *85*, S25-33.
19. Rigau-Pérez, J. G., & Laufer, M. K. (2006). Dengue-related deaths in Puerto Rico, 1992–1996: diagnosis and clinical alarm signals. *Clinical infectious diseases*, *42*(9), 1241-1246.
20. Rongrungruang, Y., & Leelarasamee, A. (2001). Characteristics and outcomes of adult patients with symptomatic dengue virus infections.
21. Rahman, M., Rahman, K., Siddque, A. K., Shoma, S., Kamal, A. H. M., Ali, K. S., ... & Breiman, R. F. (2002). First outbreak of dengue hemorrhagic fever, Bangladesh. *Emerging infectious diseases*, *8*(7), 738.
22. Sharmin, S., Viennet, E., Glass, K., & Harley, D. (2015). The emergence of dengue in Bangladesh: epidemiology, challenges and future disease risk. *Transactions of The Royal Society of Tropical Medicine and Hygiene*, *109*(10), 619-627.
23. World Health Organization. Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control. Geneva, Switzerland: WHO, 2009.. J Clin Virol. 2003;27:1–13.
24. Afroze, S., Shakur, S., Wahab, A., & Shakur, S. (2019). Clinical profile of dengue and predictors of its severity among children. *Am J Pediatr*, *5*(4), 219-23.
25. Shultana, K., Rahman, A. Z. M. M., Al Baki, A., Khan, M. S. I., Deb, B., Chowdhury, D., ... & Haque, M. M. (2019). Dengue infection in children: clinical profile and outcome in Dhaka City. *Am J Pediatr*, *5*(3), 111. https://doi.org/10.11648/j.ajp.20190503.16
26. Pulsan, F., Sobi, K., Anga, G., Vince, J., & Duke, T. (2020). An outbreak of dengue fever in children in the National Capital District of Papua New Guinea in 2016. *Paediatrics and International Child Health*, *40*(3), 177-180. https://doi.org/10.1080/20469047.2020.1756106 PMID: 32330106
27. Karyanti, M. R., Uiterwaal, C. S., Hadinegoro, S. R., Jansen, M. A., Heesterbeek, J. H., Hoes, A. W., & Bruijning-Verhagen, P. (2021). Clinical course and management of dengue in children admitted to hospital; A 5 years prospective cohort study in Jakarta, Indonesia. *The Pediatric infectious disease journal*. https://doi.org/10.1097/INF.0000000000002479 PMID: 31738330

28. Ahmed, F. U., Mahmood, C. B., Sharma, J. D., Hoque, S. M., Zaman, R., & Hasan, M. S. (2001). Dengue and Dengue Haemorrhagic Fever in children during the 2000 outbreak in Chittagong, Bangladesh.
29. Ramabhatta, S., Palaniappan, S., Hanumantharayappa, N., & Begum, S. V. (2017). The clinical and serological profile of pediatric dengue. *The Indian Journal of Pediatrics*, *84*, 897-901. https://doi.org/10.1007/s12098-017-2423-0 PMID: 28887788
30. Srikiatkhachorn, A., Krautrachue, A., Ratanaprakarn, W., Wongtapradit, L., Nithipanya, N., Kalayanarooj, S., ... & Green, S. (2007). Natural history of plasma leakage in dengue hemorrhagic fever: a serial ultrasonographic study. *The Pediatric infectious disease journal*, *26*(4), 283-290.
31. Kalayanarooj, S., Rimal, H. S., Andjaparidze, A., Vatcharasaevee, V., Nisalak, A., Jarman, R. G., ... & Gibbons, R. V. (2007). Clinical intervention and molecular characteristics of a dengue hemorrhagic fever outbreak in Timor Leste, 2005. *American Journal of Tropical Medicine and Hygiene*, *77*(3), 534.
32. Kurane, I., Innis, B. L., Nimmannitya, S., Nisalak, A., Rothman, A. L., Livingston, P. G., ... & Ennis, F. A. (1990). Human immune responses to dengue viruses. *The Southeast Asian journal of tropical medicine and public health*, *21*(4), 658-662.
33. Thakare, J., Walhekar, B., & Banerjee, K. (1996). Hemorrhagic manifestations and encephalopathy in case of dengue in India. *Southeast Asian journal of tropical medicine and public health*, *27*, 471-475.
34. Solomon, T., Dung, N. M., Vaughn, D. W., Kneen, R., Raengsakulrach, B., Loan, H. T., ... & White, N. J. (2000). Neurological manifestations of dengue infection. *The Lancet*, *355*(9209), 1053-1059.
35. Davis, J. S., & Bourke, P. (2004). Rhabdomyolysis associated with dengue virus infection. *Clinical Infectious Diseases*, *38*(10), e109-e111.
36. Promphan, W., Sopontammarak, S., Pruekprasert, P., Kajornwattanakul, W., & Kongpattanayothin, A. (2004). Dengue myocarditis. *Southeast Asian J Trop Med Public Health*, *35*(3), 611-3.
37. Chanthamat, N., & Sathirapanya, P. (2010). Acute transverse myelitis associated with dengue viral infection. *The journal of spinal cord medicine*, *33*(4), 425-427.
38. Misra, U. K., Kalita, J., Syam, U. K., & Dhole, T. N. (2006). Neurological manifestations of dengue virus infection. *Journal of the neurological sciences*, *244*(1-2), 117-122.
39. García-Rivera, E. J., & Rigau-Pérez, J. G. (2002). Encephalitis and dengue. *Lancet*, *360*(9328), 261.
40. Chokephaibulkit, K., Kankirawatana, P., Apintanapong, S., Pongthapisit, V., Yoksan, S., Kositanont, U., & Puthavathana, P. (2001). Viral etiologies of encephalitis in Thai children. *The Pediatric infectious disease journal*, *20*(2), 216-218.
41. Lum, L. C., Lam, S. K., Choy, Y. S., George, R., & Harun, F. (1996). Dengue encephalitis: a true entity?. *The American journal of tropical medicine and hygiene*, *54*(3), 256-259.
42. Tantawichien, T. (2012). Dengue fever and dengue haemorrhagic fever in adolescents and adults. *Paediatrics and international child health*, *32*(sup1), 22-27.
43. Hasan, M. J., Tabassum, T., Sharif, M., Khan, M. A. S., Bipasha, A. R., Basher, A., ... & Amin, M. R. (2021). Comparison of clinical manifestation of dengue fever in Bangladesh: an observation over a decade. *BMC infectious diseases*, *21*, 1-10.