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Ultrasonographic Findings in Children with Dengue Fever-Correlation with Clinical Findings and Investigations: A Study in Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh

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Abstract **Original Research Article**

Introduction: Dengue fever is one of the most important emerging vector-borne viral diseases. There are four serotypes of dengue viruses, each of which is capable of causing self-limiting dengue fever or even life-threatening dengue hemorrhagic fever and dengue shock syndrome. ***Objective*:** To find out Ultrasonographic findings in children with dengue fever-correlation with clinical findings and investigations. ***Material and Methods:*** The aim of this study was to evaluate the clinical and sonographic findings of dengue fever. This cross sectional observational study included 200 serologically confirmed children with dengue fever admitted in the year 2018. The participants were clinically and serologically evaluated against NS1 antigen, IgM and IgG antibody. These patients also underwent USG abdomen and chest within the first week of the illness. ***Results:*** Out of the 200 confirmed dengue cases, 106(53%) cases were males and the remaining 94 (47%) were females. The most common age group was school going children (42%) and adolescents (36%). All the cases had fever (100%). Other features were vomiting in 72%, abdominal pain in 46 %, 67cases (21.5%) had hepatomegaly in 33.5%, hypotension and shock in 23.5%, bradycardia in 13%, and rashes in 10.5%. Investigations revealed thrombocytopenia in 97%, hemoconcentration in 94.5%, leucopenia (< 4000/mm^3) in 63% and raised liver enzymes in 43.5%. The Ultrasonographic findings were hepatomegaly in 38 cases (19%), gall bladder wall thickening in 190(95%) and splenomegaly in 20(10%) of cases. Pleural effusion was noticed in 170 (85%) and 160 cases (80%) had ascites. All the 4 cases who expired had shock and ARDS. ***Conclusion:*** It is concluded that dengue fever should be suspected among children in endemic areas like Bangladesh when they present with fever, vomiting, myalgia, low platelet count with elevated liver enzymes in endemic areas like Bangladesh.

Keywords: Dengue fever (DF), Ultrasonogram (USG), Clinical finding (DF).

INTRODUCTION

Dengue fever is a serious mosquito-borne viral disease which in recent years has become a major international public health concern. It is the most serious viral hemorrhagic fever in the world with an annual incidence of 100 million cases [1]. It is now endemic in more than 100 countries and threatens the health of more than 2500 mil- lion i.e. 40% of the world's population. Nearly 90% of the dengue infections occur in children with risk of dying during a secondary attack is nearly 15- fold higher than that of adults. Its mortality ranges from1-5% treated patients to a maximum of 50% for untreated or inadequately treated patients resulting in at least 12,000 deaths annually mainly among children[2, 3]. Dengue viruses cause symptomatic infections or asymptomatic seroconversion. Symptomatic dengue infection is a systemic and dynamic disease. It has a wide clinical spectrum that includes both severe and non-severe clinical manifestations [4]. Previously WHO had classified the disease as classic dengue, the milder form of the disease and dengue hemorrhagic fever (DHF), the severe form which was further divided into four grades? Changes in the epidemiology of dengue, especially with an increasing number of cases (with and without co-morbidities) and the expansion of dengue into other regions of the world, has led to problems with the use of the existing WHO classification. As there have been

many reports of difficulties in the use of the previous classification which were summarized in a systematic literature review the dengue classification has been revised and is classified as Dengue fever with or without warning signs and Severe Dengue fever [5, 6]. Positive serology (anti dengue antibody) is the mainstay in the diagnosis of DF. But serology takes approximately7 days to give a positive result [7, 8]. The diagnosis of DF is often delayed owing to time taken for availability of serology test results [2]. Ultrasonogram (USG) is a cheap, rapid and widely available non-invasive imaging method [9, 10]. Sonographic findings of dengue fever have been described in several previous literatures. Some authors concluded that during an epidemic the ultrasound findings of gall bladder wall thickening with or without polyserositis in a febrile patient should suggest the possibility of DF [11, 12]. Several studies concluded that Ultrasonogram of the chest and abdomen can be an important adjunct to clinical profile in diagnosis DF and diagnosis can be made early in the course of disease compared with other modes of diagnosis [2]. It can be used as a first-line imaging modality in patients with suspected dengue fever to detect early signs suggestive of the disease prior to obtaining serologic confirmation test results, especially in a dengue fever epidemic area [11]. These findings may also occur in other viral infections and enteric fever but in other viral infections the historical profile, symptom complex evolution and physical findings do not mimic those of dengue fever [2]. The aim of this study was to evaluate ultrasonographic findings of dengue fever which may be useful as an early diagnostic tool.

OBJECTIVE

- To find out ultrasonographic findings in children with dengue fever - correlation with clinical findings and investigations.

MATERIAL AND METHODS

This cross-sectional observational study was carried out in the Department of Radiology and Imaging, Dhaka Shishu (Children) Hospital, Dhaka, Bangladesh. Two hundred children with serologically confirmed dengue fever, admitted in the year 2018, were included in this study. All these patients were clinically and serologically evaluated. All underwent Dengue serology (NS1 antigen/ IgM/ IgG antibody) examination using Bio Line. These patients also underwent USG abdomen and chest within the first week of the illness. The results were tabulated and analyzed.

RESULTS

Out of the 200 confirmed dengue cases, 106(53%) cases were males and the remaining 94 (47%) were females. The most common age group was school going children (42%) and adolescents (36%) (Table & Figure-1). Among age distribution in dengue fever patients 35% under <1-3 yrs. and 3-5 yrs. 15%, 5-10 yrs. 35%, and 10-15> yrs. 15% (Table-2).

Table-1: Sex distribution in dengue fever patients (N=200)

Sex	Frequency	Percentage
Male	106	53%
Female	94	47%

Table-2: Age distribution in dengue fever patients (N=200)

Age distribution	Percentage
<1-3 yrs.	35%
3-5 yrs.	15%
5-10 yrs.	35%
10-15>yrs.	15%

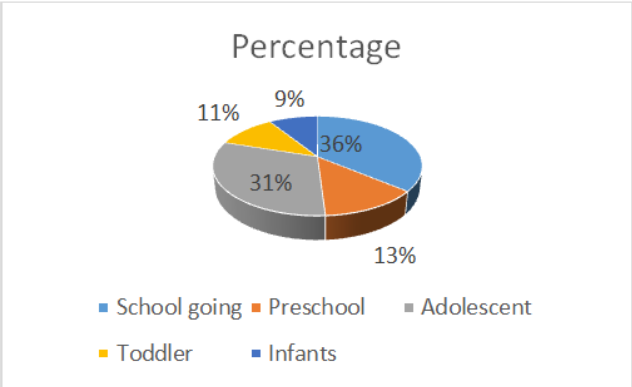

Fig-1: Group distribution in dengue fever patients

Out of the 200 confirmed dengue cases, 106(53%) cases were males and the remaining 94 (47%) were females. The most common age group was school going children (42%) and adolescents (36%) (Figure-1). Among these 200 cases all had fever (100%), 144 (72%) had vomiting, 92(46%) had abdominal pain, 41(20.5%) had hepatomegaly, 21 (10.5%) had rashes, 4(2%) had splenomegaly, 26(13%) had bradycardia and 47(23.5%) developed hypotension and shock (Table-3). Dengue encephalopathy was suspected in view of normal metabolic profile and CSF examination.

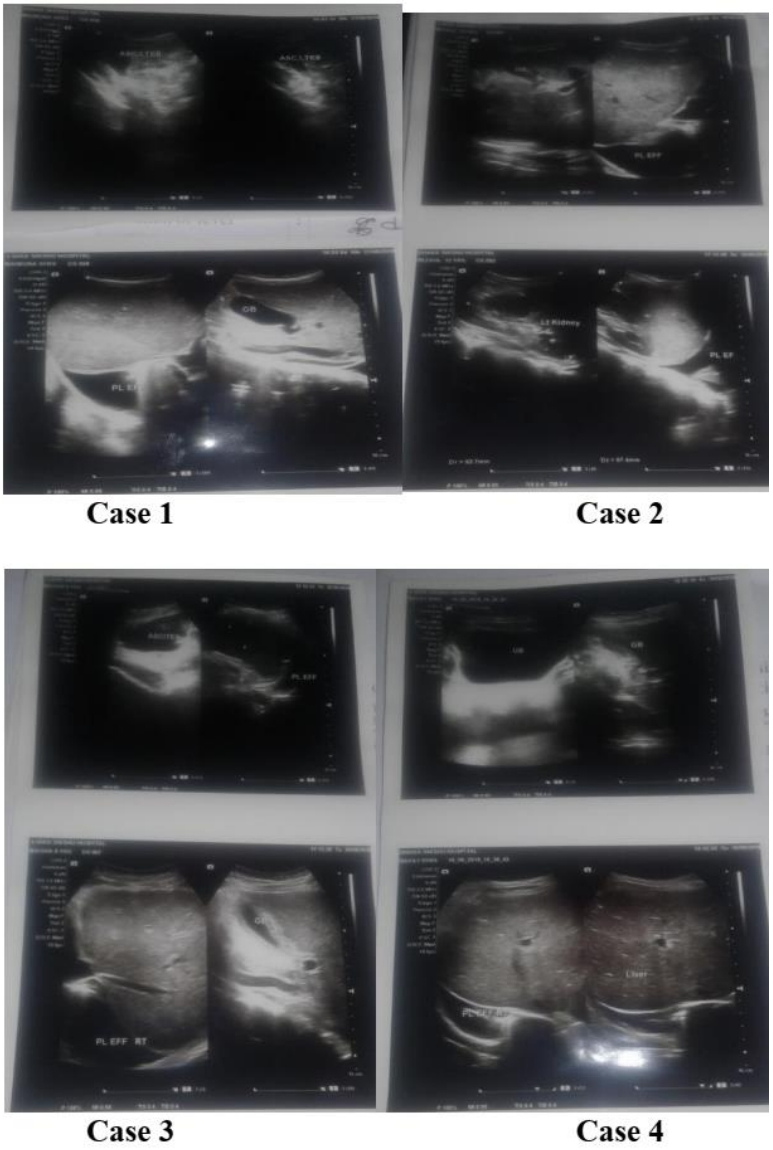

Fig-2: Ultrasonographic findings of Dengue Fever

1-15 years male and female patients with a history of fever diagnosed with dengue fever Ultrasound scan shows moderate free fluid in the peritoneal cavity surrounding urinary bladder and gallbladder wall thickening and pleural effusion. Later serology confirmed diagnosis of dengue **(**Figure-2).

Table-3: Clinical manifestations among dengue cases (N=200)

Clinical manifestations	Number	(%)
Fever	200	(100%)
Vomiting	144	(72%)
Abdominal pain	92	(46%)
Rashes	21	(10.5%)
Hepatomegaly	41	(20.5%)
Hypotension	47	(23.5%)
Bradycardia	26	(13%)
Splenomegaly	4	(2%)

Table-4: Laboratory findings (N=200).

Lab findings	Number	(%)
Thrombocytopenia	194	(97%)
Hem concentration	189	(94.5%)
Leucopenia(<4000/mm^3)	126	(63%)
Raised liver enzymes	83	(41.5%)

Table-5: Ultrasonography findings (N=200).

Ultrasound findings	Number of cases
Hepatomegaly	38 (19%)
Gall bladder wall thickening	190 (95%)
Splenomegaly	20 (10%)
Pleural effusion	170 (85%)
Ascites	160(80%)

Out of these 200 cases 194(97%) had thrombocytopenia, 189(94.5%) had hem concentration, 126(63%) had leucopenia< 4000/mm^3 and 83(41.5%) had raised liver enzymes (Table-4). The

ultrasonographic findings were hepatomegaly in 38 (19%), splenomegaly in 33, gall bladder wall thickening in 190, pleural effusion in 170 and ascites in 160 (Table-5). Out of the 190 cases who developed shock, all had gall bladder wall thickening, moderate to severe ascites and bilateral moderate pleural effusion and 19% had hepatomegaly. In this study all the 4 expired cases had shock and ARDS.

DISCUSSION

Dengue viruses are transmitted to humans through the bites of infective female Aedes mosquito. The incubation period of the disease is 3-14 days. It is an acute febrile viral disease caused by flavivirus having four different serotypes. Dengue has become a major international public health concern in recent years [13]. Hence, it will be useful in the proper management of dengue fever if symptoms, signs and laboratory parameters and sonographic findings associated with the disease are identified early and the clinical severity is known. The main objective of their study was to identify symptoms, signs and investigation findings of dengue fever and the ultrasonographic findings which could help in diagnosis and proper management of cases. The sex distribution is consistent with previous study findings that dengue fever occurs more in male sex. In this study fever and vomiting were the most frequent symptoms and hepatomegaly was the most frequent signs similar to that observed in earlier studies [2, 14, 15]. Our study revealed rashes in 10.5% cases similar to the observation of Ahmed FU *et al*., [16] who noted rashes in 12% of children. In our study the most common bleeding manifestation was petechial followed by hematemesis which is different from few studies where hematemesis was commoner [17, 18]. Headache and retro-orbital pain were not seen in our study as compared to other studies [19] but was similar to a study conducted in Mumbai [20]. The one important laboratory finding is the rise in serum levels of liver enzymes (LFTs) as reported in various studies [11, 21]. The high incidence of vomiting, hepatomegaly and elevated liver enzymes can serve as markers for suspicion of dengue during an epidemic. Subclinical hepatitis may contribute to the abdominal pain and vomiting in these children. Mortality in the present study was 2%. All patients who expired developed hypotension, shock and ARDS. In the study by Anju *et al*., overall mortality was 6%, compared to 3% by Ahmed *et al*., Dengue associated ARDS is associated with a high mortality [16, 17, 22]. In this study 79% cases were positive for NS1 antigen with or without antibodies and the remaining were positive only for antibodies. And it was found that out of the 78 cases (39%) which were positive for NS1 antigen alone, 56 cases (72%) had Ultrasound findings in the form of either hepatomegaly with polyserositis or gall bladder wall thickening. This clearly shows that Ultrasound can be used as an early, non-invasive and economical diagnostic tool. The ultrasound findings in our study showed gall bladder wall thickening in 95% cases whereas as Quiroz-Moreno *et al*., found gallbladder thickening in 86% of the patients, Sai et al in 56% patients, Gonzalez *et al*., in 35.1% [2, 10]. This may be due to serotype of the causative dengue virus, secondary antibody patterns of the patients due to previous exposure to dengue viruses, race of the patients and other factors yet to be known [19]. In our study pleural effusion or ascites was apparent on clinical examination in many of them. But sonography diagnosed all of them. Similarly 17 cases of hepatomegaly and 29 cases of splenomegaly could not be diagnosed by clinical examination but were diagnosed correctly by ultrasonography. So this study clearly demonstrates the importance of abdominal and thoracic solography in the accurate and complete clinical evaluation and management of dengue fever. All the cases which went into hypotension and shock showed gall bladder wall thickening, with moderate to severe pleural effusion and ascites. One study attempted to investigate whether gall bladder wall thickening measured by ultrasonography can be used to predict the onset of severe dengue fever. It is found that a thickness of 5mm is useful as a criterion for identifying DHF patients at high risk of developing hypovolemic shock. This means that ultrasonography can also give the clinicians some idea about the severity of the disease process and thus help in more meticulous management of the patients.

CONCLUSION

It is concluded that dengue fever should be suspected among children in endemic areas like Bangladesh when they present with fever, vomiting, myalgia along with hepatomegaly, low platelet count with elevated liver enzymes in endemic areas like Bangladesh. Abdominal and thoracic sonography can be used as a first-line imaging modality in patients with suspected dengue fever to detect early signs suggestive of the disease prior to obtaining serologic confirmation tests which are costly, invasive and not affordable by all patients.

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