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RESEARCH ARTICLE

DENGUE FEVER IN CHILDREN: ROLE OF ULTRASONOGRAPHY.

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Abstract

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-limited dengue fever or even life-threatening dengue haemorrhagic fever and dengue shock syndrome. The aim of this study was to evaluate the role of sonographic findings as early diagnostic modality in children with dengue fever.

Materials & Methods: This cross-sectional observational study was carried out in the department of pediatrics of a tertiary care hospital. A total of 88 patients who were clinically and serologically (NS1 antigen/ IgM/ IgG antibody) diagnosed as dengue positive were included in this study. These patients also underwent USG abdomen and chest within the first week of the illness.

Results: Out of the 88 confirmed dengue cases, 56 (63.6%) cases were males. All the cases had fever (100%). Other clinical symptoms were vomiting in 64.8%, abdominal pain in 62.5%, bodyache 53.4%, Shock in 28.4%, headache in 48.9% and rashes in 23.9%. The USG findings were hepatomegaly (39.8%), gall bladder thickening (53.4%), splenomegaly (20.5%), pleural effusion (38.6%) and ascites (30.7%). Overall 65 (73.8%) out of 88 cases had one of the positive findings in ultrasonography.

Conclusion: Ultrasonography can be used as a first-line imaging modality in all patients with suspected dengue fever to detect early signs suggestive of the disease.

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Introduction:-

Dengue fever is an acute febrile infectious disease in subtropical and tropical areas that is progressively making its way from being "one of the great neglected diseases of mankind" [1] towards being acknowledged as one of the world's major infectious diseases [2]. In the last 50 years, incidence of dengue has increased 30-fold with increasing geographic expansion to new countries and from urban to rural settings. An estimated 50 million dengue infections occur annually and approximately 2.5 billion people live in dengue endemic countries [3].

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The etiologic agents include all four serotypes which belong to the genus *Flavivirus* in the family *Flaviviridae*. The principle vector is mosquito, *Aedes Aegypti*, which breeds largely indoors in clean waters mainly in artificial water containers, and feeds on humans in daytime [4].

The clinical manifestations of dengue vary with the age and immunity of the patient. It can present as 1) In apparent infection 2) non-specific febrile illness, 3) classic dengue fever, 4) dengue hemorrhagic fever, 5) Dengue shock syndrome (DSS) and 6) encephalopathy and fulminant liver failure [5,6].

Guzman et al. studied to show that most cases present as classic dengue fever (DF) with high fever, retro-orbital pain, severe myalgia/arthralgia, and rash. However, in some cases, illness progresses to life-threatening dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS), characterized by vascular leakage leading to hypovolemic shock and a case fatality rate up to 5% [7,8].

Hammond et al. [9] studied to show that preschool children and infants have rather more often nonspecific febrile illnesses while preadolescent children often develop fever and moreover younger children with DHF are known to experience more severe clinical outcome (e.g. higher case fatality ratio) than adults.

Early identification of patients at risk of developing severe dengue is critical to provide timely supportive care, which can reduce the risk of mortality to < 1% [10]. Distinguishing dengue from other febrile illnesses (OFIs) early in illness is challenging, since symptoms are non-specific and common to other febrile illnesses such as malaria, leptospirosis, rickettsiosis, and typhoid fever in dengue-endemic countries [11].

Positive serology (anti dengue antibody) is the mainstay in the diagnosis of DF. But serology takes approximately 7 days to give a positive result [12,13]. The diagnosis of DF is often delayed owing to time taken for availability of serology test results [14]. Ultrasonography (USG) is a cheap, rapid and widely available non-invasive imaging method [15,16]. Some authors concluded findings of hepatomegaly, pericholecystic edema, thickened gall bladder, ascites, pleural effusion (right sided/ both) and splenomegaly are early and significant markers of dengue, which can be confirmed by serology later on [17,18]. Several studies concluded that ultrasonography 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 [14]. 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 [17].

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 [14]. Thus, the aim of present study was to evaluate the sonographic findings of dengue fever which may be useful as an early diagnostic tool.

Materials and Methods:-

Study Type & Area:-

A prospective observational study was conducted at Department of Paediatrics of a tertiary care centre during July 2014 to August 2016.

Inclusion Criteria:-

1. Patient between the age group of 0 – 18 years.
2. Patients with confirmed diagnosis of dengue fever (positive test for NS1 antigen/IgM dengue/IgG dengue).

Exclusion Criteria:-

1. Patient with serological test negative for dengue.
2. Patients having fever of more than 2 weeks duration.

Sample Size:-

Consecutive type of non-probability sampling was used for the selection of study subjects. A total of 88 diagnosed pediatric patients of Dengue fever admitted in our hospital were taken for study after informed consent from parents.

Study Methodology:-

All patients were admitted and treated as indoor patients. On admission, detailed history and complete physical examination findings were recorded. The vitals (temperature, pulse, respiration, blood pressure) of the patients were recorded on admission and thereafter till discharge. In all patients, complete blood count and serological tests for dengue (NS1 antigen/ IgM dengue/ IgG dengue) were carried out depending on duration of fever on presentation.

Following laboratory investigations were done in all patients on admission:-

1. Dengue NS1 antigen test/ IgM dengue antibody/ IgG dengue antibody- depending on duration of fever on presentation. All the three tests will be done by the ELISA (enzyme linked immunosorbant assay) technique.
2. Complete blood count (CBC) including platelet count.
3. Coagulation Profile
4. USG abdomen

Other investigations like liver function test, renal function test, S. electrolyte, X-ray chest/abdomen, blood culture, peripheral smear for malarial parasite were performed based on the clinical presentation.

Based on the investigation results, patients were classified into 3 categories as per WHO guidelines: Dengue fever, Dengue Hemorrhagic fever and Dengue shock syndrome. All patients will be treated as per WHO guidelines- Dengue guidelines for diagnosis, treatment, prevention and control [19].

Results:-

Out of the 88 confirmed dengue cases, 56 (63.6%) were males while 32 (36.4%) were females. Fever was present in all the cases, while other features were: vomiting (64.8%), abdominal pain (62.5%), bodyache (53.4%), shock (28.4%), headache (48.9%) and rashes (23.9%) (Table 1). Investigations revealed thrombocytopenia in 78.4%, hemoconcentration in 48.9%, raised liver enzymes in 68.2% while raised creatinine levels in 2.3% patients (Table 2). The ultrasonographic findings showed hepatomegaly in 35 (39.8%) cases, gall bladder thickening in 47 (53.4%) cases, splenomegaly in 18 (20.5%) cases, pleural effusion in 34 (38.6%) cases while ascites was seen in 27 (30.7%) cases (Table 3). Overall 65 (73.8%) out of 88 cases had one of the positive findings in ultrasonography. Final Diagnosis of Dengue was given in 15.9% cases while diagnosis of dengue with warning signs and severe dengue was given in 55.7% and 28.4% cases respectively (Table 4). Out of total 88 patients, 2 (2.27%) patients expired who were suffering from severe dengue.

Table 1:- Distribution of patients according to presenting complaints.

Presenting Complaints	N	%
Fever	88	100%
Headache	43	48.9%
Bodyache	47	53.4%
Rash	21	23.9%
Vomiting	57	64.8%
Abdominal Pain	55	62.5%
Shock	25	28.4%

Table 2:- Distribution of patients according to laboratory findings.

Lab Findings	N	%
Thrombocytopenia	69	78.4%
Hemoconcentration	43	48.9%
Raised Liver Enzymes	60	68.2%
S. Creatinine (> 1.2 mg%)	2	2.3%

Table 3:- Distribution of patients according to sonographic findings.

USG Findings	N	%
Hepatomegaly	35	39.8%
GB wall Thickening	47	53.4%
Splenomegaly	18	20.5%
Pleural Effusion	34	38.6%
Ascites	27	30.7%

Table 4:- Distribution of patients as per Final Diagnosis.

Diagnosis	N	%
Dengue	14	15.9%
Dengue with warning signs	49	55.7%
Severe Dengue	25	28.4%
Total	88	100.0%

Discussion:-

Dengue has become a major international public health concern in recent years [20]. It is emerging as one of the most important mosquito borne diseases in India. *Aedes aegypti* mosquitoes that transmit the disease breed in man-made containers such as tanks, pitchers, discarded containers etc. in which water has stagnated for over a week. Thus, the success of control measures have become a reflection of sanitation and hygienic practices achieved. The cases of dengue peak in the monsoon season in most parts of the country but have become perennial in the southern states and Gujarat [21,22].

Dengue has myriad clinical manifestations with unpredictable evolution and outcome. The disease typically begins with an acute febrile phase lasting 2-7 days and is accompanied by flushing, generalized body ache, myalgia, arthralgia and headache. Increased capillary permeability reflected by progressive increase in hematocrit heralds the beginning of critical phase at around 3-7 days of illness. Severe hemorrhagic manifestations and shock secondary to plasma leakage may occur at this stage. Leukopenia and declining platelet counts are also seen preceding this stage [23]. Serological diagnosis is confirmatory of dengue and includes direct methods such as virus isolation and NS1 antigen detection and indirect methods such as IgM and IgG antibody detection [24]. As serological diagnosis is not available in most of the places in a resource scarce country like India, sonography has an increasingly important role. Sonography is a readily available and cost-effective method for the diagnosis, which impacts the management of patients of dengue. The aim of present study was thus to evaluate the role of sonographic findings as early diagnostic modality in children with dengue fever.

In present study, male predominance was seen with 63.6% male cases to 36.4% females with male to female ratio of 1.74:1. In a study by Hema M et al. [25], the sex ratio of male to female was 1.32: 1, while in that of Srinivasa et al. [26], it was 1.13:1. The sex distribution is also consistent with previous study findings that dengue fever occurs more in male sex [22,24,27].

In present study, fever was present in all the cases, while other features were: vomiting (64.8%), abdominal pain (62.5%), bodyache(53.4%), shock (28.4%), headache (48.9%) and rashes (23.9%). In the study by Srinivas et al. [26], fever and vomiting were the most frequent symptoms. Similar observation was also seen in earlier studies [14,28,29]. Srinivasa also observed rashes in 10.5% cases while Ahmed FU et al [30] noted rashes in 12% of children.

We also observe thrombocytopenia in 78.4% cases while hemoconcentration and raised liver enzymes were observed in 48.9% and 68.2% cases respectively. In the study by Mittal Hema et al. [25], thrombocytopenia and hepatic enzyme derangement was present in 92.6% and 60% of the cases respectively. In the study by Narayanan M. et al. [31], serum SGPT levels were elevated in 59.7% of the total patients in whom the test was performed. Serum SGPT levels were elevated in 65% of DF, 63.6% of DHF and 66% of DSS patients. In the study by Aggarwal Anju et al. [32], serum SGPT levels were elevated in 57% of the patients in whom the test was performed.

The ultrasonographic findings showed hepatomegaly in 35(39.8%) cases, gall bladder thickening in 47(53.4%) cases, splenomegaly in 18 (20.5%) cases, pleural effusion in 34(38.6%) cases while ascites was seen in 27(30.7%) cases. Overall 65 (73.8%) out of 88 cases had one of the positive finding in ultrasonography. This clearly shows that Ultrasound can be used as an early, non-invasive and economical diagnostic tool.

In the study by srinivasa et al. [26], 72% of the cases had ultrasound findings in the form of either hepatomegaly or gall bladder wall thickening. The ultrasound findings showed gall bladder wall thickening in 30.5%. In a study by Quiroz-Moreno et al. [33] gallbladder thickening was seen in 86% of the patients, Sai et al. [14] observed in 56% patients while Thulkar et al. in 35.1% [34]. Setiwan et al. 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 [35].

In our study pleural effusion or ascites was apparent on clinical examination in some of the cases. But sonography helped in diagnosing all of them. Similarly 15 cases of hepatomegaly and 11 cases of splenomegaly could not be diagnosed by clinical examination but were diagnosed correctly by ultrasonography. So this study clearly demonstrates the importance of ultrasonography in the accurate and complete clinical evaluation 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.

Conclusion:-

Abdominal USG should be used as a first-line imaging modality in all patients with suspected dengue fever to detect early signs suggestive of the disease along with obtaining serologic confirmation tests.

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