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Original Research Article

To Evaluate the Sonographic Findings in Children with Dengue Fever (DF) and to Determine its Role in Predicting the Severity of the Disease

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Abstract

Aim: The aim of the present study was to evaluate the sonographic findings in children with dengue fever (DF) and to determine its role in predicting the severity of the disease.

Material & Methods: The retrospective study was done in the Upgraded Department of Paediatrics, Patna Medical College and Hospital, Patna, Bihar, India from November 2013 to October 2014 Serological test NS 1antigen, Dengue IgM and IgG Antibody tests were performed. 70 patients were found serologically positive for dengue, were referred for Ultrasound scanning of the abdomen and thorax.

Results: Out of 70 cases 42 were male and 28 were female. Out of 70 cases 4 cases were less than 1 year old, 20 aged 1-5 year, 22 aged 6-10 year and 24 cases were in more than 10-year age group. Out of 70 confirmed cases, 50 cases were classified in mild dengue group and 20 cases were in severe dengue fever group. All cases had fever. About 34 (48.57%) cases had vomiting, 40 (57.14%) had pain abdomen, 45 (64.28%) had Petechiae, 37 (52.85%) had melena. 32 (45.71%) had hepatomegaly, 18 (25.71%) had splenomegaly and 21 (30%) had hypotension. Gall bladder wall oedema, ascites, pleural effusion, hepatomegaly, splenomegaly and perinephric oedema were present in 55 (78.57%), 40 (57.14%), 36 (51.42%), 42 (60%), 22 (32.42%) and 11 (15.71%) in all dengue fever group while 20 (100%), 20 (100%), 17 (85%), 12 (60%), 8 (40%), and 9 (45%) in severe dengue group respectively.

Conclusion: Sonographic features of thickened GB wall, pleural effusion (bilateral or right side), ascites, hepatomegaly and splenomegaly should strongly favour the diagnosis of dengue fever in patients presenting with fever and associated symptoms, particularly during an epidemic. The degree of thrombocytopenia showed a significant direct relationship to abnormal ultrasound features.

Keywords: Ascites, Dengue Fever, Hepatomegaly, Oedematous Gallbladder Wall Thickening, Pleural Effusion, Splenomegaly, Thrombocytopenia, Ultrasound Features

Introduction

One of the common causes of fever in the tropics is dengue virus, a flava virus. Dengue is endemic in more than 100 countries, which are included in the world health organization (WHO) regions of the world. [1] Dengue is deemed second in importance to malaria, the WHO counts Dengue as one of sixteen neglected tropical diseases. [2,3] Dengue fever is caused by a single stranded RNA virus of Flaviviridae family transmitted by mosquitoes. [4]

There are four known serotypes of dengue, but severe form of dengue fever is caused by infection by more than one serotype. [5] 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. [6] Clinically dengue manifests with sudden onset of high fever with chills, intense headache, muscle and joint pain, retro‑orbital pain and severe backache. Fever usually lasts for about 5 days, rarely for more than 7 days. [7] Haemorrhagic diathesis and thrombocytopenia with concurrent hem-concentration are a constant finding. [8]

DHF can lead to increased vascular permeability resulting in leakage of plasma with manifestations

such as pleural effusion and ascites. In DHF can occur enlarged abdominal organs such as hepatomegaly, splenomegaly and an enlarged pancreas. The diagnosis of DF is often delayed owing to time taken for availability of serology test results. [9] Ultrasonography (USG) is a cheap, rapid and widely available non-invasive imaging method. [9,10] The ultrasound findings in Dengue fever include gall bladder wall thickening, pericholecystic fluid, minimal ascites, pleural effusion, pericardial effusion and hepatosplenomegaly. [9] Ultrasonography (USG) is a cheap, rapid and widely available non-invasive imaging method. [11,12] The ultrasound findings in Dengue fever include gall bladder wall thickening, pericholecystic fluid, minimal ascites, pleural effusion, pericardial effusion and hepatosplenomagely. [11] In pandemic situations like the current Covid- 19(Corona virus disease19) crisis, the feasibility of a non-invasive and relatively simple investigation like USG as an adjunct for early detection and an indication of disease severity can be useful for time management and ultimately reduction in mortality due to dengue.

Hence the purpose of this study was to access the role of ultrasonographic features of thorax and abdomen in diagnosis and early prediction of severity of dengue fever.

Materials & Methods

The retrospective study was done in the Upgraded Department of Paediatrics, Patna Medical College and Hospital, Patna, Bihar, India from November 2013 to October 2014. Serological test NS 1antigen, Dengue IgM and IgG Antibody tests were performed. 70 patients were found serologically positive for dengue, were referred for Ultrasound scanning of the abdomen and thorax.

Inclusion criteria: All children of age group 2 month to 18 years with suspected dengue fever, having fever more than 3days and thrombocytopenia were included in the study. [12]

Exclusion criteria: Children of less than 2 month, who were positive for meningitis, malaria, enteric fever and of chronic liver disease, were excluded from our study.

The ultrasound examination was performed with Sono scape ultrasound machine using 3.5MHz and5MHz probes. Ultrasound scan of the abdomen and pelvis was performed six hours after fasting in order to attain better distension of gall bladder (GB). [13] Sonography was performed by radiologist and scanning was performed only once so there is on inter observer variation. Gall bladder wall oedema, pleural effusion, ascites, splenomegaly, hepatomegaly and perinephric oedema were measured by USG.

The children were classified as follows:[14]

1. DF-Fever of 2-7 days with two or more of following- Headache, myalgia, arthralgia, retro orbital pain leukopenia, thrombocytopenia and no evidence of plasma leakage.

2. DHF 1: Above criteria plus positive tourniquet test and evidence of plasma leakage. platelet count

<100,000/cu.mm and Hct rise more than 20% over baseline.

3. DHF II: Above plus evidence of spontaneous bleeding in skin or other organs & abdominal pain.

4. DHF III(DSS): Above plus circulatory failure(weak rapid pulse, narrow pulse pressure, hypotension) DHF IV(DSS): Profound shock with undetectable blood pressure or pulse DF, DHF I and DHF II were categorized as mild dengue while, DHF III (DSS) and DHF IV (DSS) were categorized as severe dengue.

Statistical Analysis: Data obtained was tabulated using version 21 of the statistical package for social science (SPSS published SPSS Inc.). Qualitative variables were expressed as percentages. Association of various variables were assessed through chi square test and ANNOVA. P value less than 0.05 was considered for statistical significance.

Results

Table 1: Demographic data

Gender	N%
Male	42 (60)
Female	28 (40)
Age groups	
Less than 1 year	4 (5.71)
1-5 years	20 (28.57)
6-10 years	22 (31.42)
More than 10 years	24 (34.28)

Out of 70 cases 42 were male and 28 were female. Out of 70 cases 4 cases were less than 1 year old, 20 aged 1-5 year, 22 aged 6-10 year and 24 cases were in more than 10-year age group.

Table 2: Clinical features among mild and severe dengue group

Clinical features	Total n = 70 (%)	Mild DF n = 50 (%)	Severe DF n = 20(%)	P value
Fever	70 (100)	50 (100)	20 (100)	<0.001
Vomiting	34 (48.57)	20 (40)	14 (70)	<0.001
Pain abdomen	40 (57.14)	22 (44)	19 (95)	<0.001
Petechiae	45 (64.28)	30 (60)	15 (75)	0.002
Melena	37 (52.85)	28 (56)	9 (45)	<0.001
Splenomegaly	18 (25.71)	8 (16)	9 (45)	<0.001
Hepatomegaly	32 (45.71)	19 (38)	12 (60)	<0.38
CNS involvement	5 (7.14)	2 (2)	4 (20)	<0.001
Hypotension	21 (30)	0 (0)	20 (100)	<0.001

Out of 70 confirmed cases, 50 cases were classified in mild dengue group and 20 cases were in severe dengue fever group. All cases had fever. About 34 (48.57%) cases had vomiting, 40 (57.14%) had pain abdomen, 45 (64.28%) had Petechiae, 37 (52.85%) had melena. 32 (45.71%) had hepatomegaly, 18 (25.71%) had splenomegaly and 21 (30%) had hypotension.

Table 3: USG findings among mild and severe dengue group

USG feature	Total n = 70 (%)	Mild DF n = 50 (%)	Severe DF n = 20 (%)	P value
Pleural effusion	36 (51.42)	18 (36)	17 (85)	<0.001
GB Wall edema	55 (78.57)	36 (72)	20 (100)	<0.001
Ascites	40 (57.14)	23 (46)	20 (100)	<0.001
Hepatomegaly	42 (60)	30 (60)	12 (60)	0.42
Splenomegaly	22 (31.42)	14 (28)	8 (40)	<0.001
Perinephric edema	11 (15.71)	3 (6)	9 (45)	<0.001

Gall bladder wall oedema, ascites, pleural effusion, hepatomegaly, splenomegaly and perinephric oedema were present in 55 (78.57%), 40 (57.14%), 36 (51.42%), 42 (60%), 22 (32.42%) and 11 (15.71%) in all dengue fever group while 20 (100%), 20 (100%), 17 (85%), 12 (60%), 8 (40%), and 9 (45%) in severe dengue group respectively.

Table 4: Correlation of sonographic finding with platelet count

USG features	Platelet count (In per µl) - Number (%)			P value
	<40000	40000 – 80000	80000 - 150000	
Total	34 (48.57)	15 (30)	4 (20)	
GB wall edema	65 (92.85)	46 (92)	9 (45)	<0.001
Pleural effusion	46 (65.71)	19 (38)	5 (25)	<0.001
Ascites	65 (92.85)	21 (42)	3 (15)	<0.001
Hepatomegaly	56 (80)	23 (46)	4 (20)	0.48
splenomegaly	29 (41.42)	11 (22)	3 (15)	0.026
Normal	5 (7.14)	4 (8)	10 (50)	0.56

All sonographic features had more significant association with severe dengue group (p <0.001) except hepatomegaly. All sonographic features had significant correlation (P value < 0.001) with severe thrombocytopenia except hepatomegaly.

Discussion

As per the World Health Organization (WHO), dengue has shown a 30-fold increase globally over the past five decades. Approximately, 50-100 million new infections are estimated to occur annually in more than 100 endemic countries. Every year, hundreds of thousands of severe cases arise resulting in approximately 20,000 deaths. Although the definitive diagnosis of dengue fever (DF) is serological (demonstration of immunoglobulin M [IgM] specific antibodies), the diagnosis of dengue haemorrhagic fever (DHF) is made clinically based on the diagnostic criteria proposed by WHO. [15] There are difficulties in following the WHO criteria in recognizing plasma leakage for diagnosis of DHF. Haemoconcentration (>20%) is usually diagnosed retrospectively and also requires repeated sampling, while hypoproteinaemia can be an infrequent

finding. [16] Radiographic investigations even though detect effusions, it often requires multiple films to demonstrate the ongoing collections in the pleural cavity which increases the risk of radiation exposure, but ultrasound can detect even smaller amount of pleural effusion and ascites in children with transient plasma leakage and it is highly sensitive. Gallbladder wall thickening (GBWT), i.e., honeycomb pattern on ultrasonography (USG), is the most specific sign that may help in diagnosis and in prognosis of severe dengue infection. [17] USG has been shown to be a useful tool in predicting severe dengue infection at early stage of illness. [18]

Out of 70 cases 42 were male and 28 were female. Out of 70 cases 4 cases were less than 1 year old, 20 aged 1-5 year, 22 aged 6-10 year and 24 cases were in more than 10-year age group. Out of 70 confirmed cases, 50 cases were classified in mild dengue group and 20 cases were in severe dengue fever group. All cases had fever. About 34 (48.57%) cases had vomiting, 40 (57.14%) had pain abdomen, 45 (64.28%) had Petechiae, 37 (52.85%) had melena. 32 (45.71%) had hepatomegaly, 18 (25.71%) had splenomegaly and 21 (30%) had hypotension. The sex distribution was consistent with previous study findings that dengue fever occurs more in male sex. In this study fever was the most frequent symptoms and hepatomegaly was the most frequent signs similar to that observed in earlier studies. [19,20] In our study the most common bleeding manifestation was Petechiae which is different from few studies where hematemesis was commoner. [21,22]

Gall bladder wall oedema, ascites, pleural effusion, hepatomegaly, splenomegaly and perinephric oedema were present in 55 (78.57%), 40 (57.14%), 36 (51.42%), 42 (60%), 22 (32.42%) and 11 (15.71%) in all dengue fever group while 20 (100%), 20 (100%), 17 (85%), 12 (60%), 8 (40%), and 9 (45%) in severe dengue group respectively. Venkata S et al had studied 88 children belonging to the age group of two-nine years, who were serologically positive for dengue. In their study it was demonstrated that gallbladder wall thickening was seen in100% of the patients when ultrasonography was performed between the second and seventh day of fever onset. This was followed by pleural effusion. [23] Sudhir Sachar et al had done a study on 20 patients with dengue fever, which was confirmed with platelet count and serologic tests. USG features included thickened GB wall in all (100%) patients, ascites was seen in 15 patients (75%), splenomegaly was present in 8 patients (40%), and pleural effusion in 14 patients (70%). [24]

All sonographic features had more significant association with severe dengue group ($p < 0.001$) except hepatomegaly. All sonographic features had significant correlation (P value < 0.001) with severe thrombocytopenia except hepatomegaly. In the study conducted by V. R. Santhosh et al, 96 seropositive dengue patients were examined with ultrasonography. It was found that 64 (66.7%) patients had GB wall thickening, 62 (64.5%) patients had ascites, 48 (50%) patients showed pleural effusion, 17 (17.7%) patients showed hepatomegaly, 16 (16.7%) patients had splenomegaly and in 17 (17.7%) patients ultrasound findings were normal. The most common combination of findings was GB wall oedema, ascites and pleural effusion which was seen in all age groups. GB wall oedema was seen in 97.8% of patients whose platelet count was less than 40,000 followed by ascites (86.9%) and pleural effusion (58.6%). No abnormal sonographic finding was seen in patients whose platelet counts were more than 150,000. [25]

Conclusion

Ultrasonographic findings that include GB wall oedema, pleural effusion and ascites, are an important ancillary tool in favour of early diagnosis of dengue fever in a patient who presents with fever and thrombocytopenia. Ultrasound also helps substantially in estimating the severity of the disease. The degree of thrombocytopenia showed a significant direct relationship to abnormal ultrasound features.

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