Role of ultra sonography (chest and abdomen) in diagnosis and early prediction of severity of dengue fever

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Abstract

Introduction: The diagnosis of Dengue fever is often delayed owing to time taken for availability of serology test results. Ultrasonography (USG) is a cheap, rapid and widely available non-invasive imaging method. Aim of the study was to access the role of ultrasonographic features of thorax and abdomen in diagnosis and early prediction of severity of dengue fever. **Material and Method:** It was aobservational descriptive study, conducted during the period of September 2017 to august 2018 at department of Paediatrics, J. K. Lon Mother and Child Hospital, Government Medical College, Kota. Out of 122 suspected dengue fever cases of age group 2 month to 18 years, 84 children were seropositive for dengue fever, were sent for Ultrasound scan of the abdomen and thorax. **Result:** 59(70.23%) cases were in mild dengue group and 25(29.76%) cases were in severe dengue group. All cases had fever. About 41(57.14%) cases had vomiting, 48(57.14%) had pain abdomen, 54 (64.28%) had Petechiae, 45 (53.57%) had melena. 38 (45.23%) had hepatomegaly, 21 (25%) had splenomegaly and 25 (29.76%) had hypotension. Gall bladder wall edema, ascites, pleural effusion, hepatomegaly, splenomegaly and perinephric edema were present in 67 (79.76%), 52 (61.9%), 43 (51.19%), 51 (60.71%), 27 (32.14%) and 14 (16.66%) in all dengue fever group while 25 (100%), 25 (100%), 21 (84%), 15 (60%), 10 (40%), and 11 (44%) in severe dengue group respectively. 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. **Conclusion:** Ultrasonography is a simple and valuable tool in diagnosing and predicting severity of dengue fever.

Keywords: Dengue fever, Ultrasonography, Platelet count, Gall bladder wall edema

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Introduction

Dengue fever is caused by a single stranded RNA virus of flaviviridae family transmitted by mosquitoes [1]. The countries with high incidences are Indonesia, Thailand, Myanmar, Sri Lanka, Bangladesh and India [2]. There are four known serotypes of dengue, but severe form of dengue fever is caused by infection more than one serotype [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 haemorrhagic 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]. 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 [7].

Ultrasonography (USG) is a cheap, rapid and widely available non-invasive imaging method [7,8]. The ultrasound findings in Dengue fever include gall bladder wall thickening, pericholecystic fluid, minimal ascites, pleural effusion, pericardial effusion and hepatosplenomagely [7].

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

Material and Method

Study Setting: This study was conducted at the department of Paediatrics, J. K. Lon Mother and Child Hospital, Government Medical College, Kota

Type of study: Observational descriptive study

Study period: September 2017 to august 2018

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.

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.

Ethical approval: This study was conducted after getting approval from institutional ethics committee of Government Medical College, Kota

Sample collection: Total 122 cases were enrolled in the study. Children were recruited after taking informed consent from parents or legal guardians.

Serological test NS 1antigen, Dengue IgM and IgG Antibody tests were performed. 84 patients were found serologically positive for dengue, were referred for

Ultrasound scanning of the abdomen and thorax. The ultrasound examination was performed with Sonoscape 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) [9]. Sonography was performed by radiologist and scanning was performed only once so there is on inter observer variation. Gall bladder wall edema, pleural effusion, ascites, splenomegaly, hepatomegaly and perinephric edema were measured by USG.

The children were classified [10] as follows:

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.

Result

Total 122 suspected cases of dengue fever admitted, out of them 84 cases (68.8%) turned out to be dengue serologically positive. Out of 84 cases 5 cases were less than 1 year old, 22 aged 1-5 year, 23 aged 6-10 year and 34 cases were in more than 10-year age group.

Out of 84 cases 51 were male and 33 were female. Out of 84 confirmed cases, 59(70.23%) cases were classified in mild dengue group and 25(29.76%) cases were in severe dengue fever group.

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Table-1: Clinical features among mild and severe dengue group.

S. No.	Clinical feature	Total n = 84 (%)	Mild DF n = 59 (%)	Severe DF n = 25(%)	P value
1	Fever	84 (100)	59 (100)	25(100)	<0.001
2	Vomiting	41(48.80)	24 (40.67)	17 (68)	<0.001
3	Pain abdomen	48 (57.14)	25 (42.37)	23 (92)	<0.001
4	Petechiae	54 (64.28)	35 (59.32)	19 (76)	0.002
5	Melena	45 (53.57)	34 (57.62)	11 (44)	<0.001
6	Splenomegaly	21 (25)	9 (15.25)	12 (48)	<0.001
7	Hepatomegaly	38 (45.23)	23 (38.98)	15 (60)	<0.38
8	CNS involvement	6 (7.14)	1 (1.69)	5 (20)	<0.001
9	Hypotension	25 (29.76)	0 (0)	25 (100)	<0.001

Table-2: USG findings among mild and severe dengue group.

S. No.	USG feature	Total n = 84 (%)	Mild DF n = 59 (%)	Severe DF n = 25(%)	P value
1	Pleural effusion	43 (51.19)	22 (37.28)	21 (84)	<0.001
2	GB Wall edema	67 (79.76)	42 (71.18)	25 (100)	<0.001
3	Ascites	52 (61.90)	27 (45.76)	25 (100)	<0.001
4	Hepatomegaly	51 (60.71)	36 (61.01)	15 (60)	0.42
5	Splenomegaly	27 (32.14)	17 (28.81)	10 (40)	<0.001
6	Perinephric edema	14 (16.66)	3 (5.08)	11 (44)	<0.001

Table-3: Correlation of sonographic finding with platelet count.

USG features	Platelet count (In per µl) - Number (%)			P value
	<40000	40000 – 80000	80000 - 150000	
Total	40 (47.62)	26 (30.95)	18 (21.42)	
GB wall edema	37 (92.50)	24 (92.30)	8 (44.44)	<0.001
Pleural effusion	27 (67.50)	10 (38.46)	5 (27.77)	<0.001
Ascites	37 (92.50)	11 (42.30)	3 (16.66)	<0.001
Hepatomegaly	32 (80)	12 (46.15)	4 (22.22)	0.48
splenomegaly	17 (42.50)	6 (23.07)	3 (16.66)	0.026
Normal	3 (7.50)	2 (7.69)	9 (50.00)	0.56

The clinical features that were present in mild and severe dengue group are given in table 1. USG findings presented in mild and severe dengue group are shown in table 2.

Correlation of sonographic findings with platelet count is shown in table 3. All cases discharged successfully and there was no mortality. 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

Dengue fever constitutes one of the most common arthropod borne viral febrile illness, being endemic in tropical and subtropical countries with outbreaks occurring during monsoon [11] due to increased breeding of mosquito. The severe forms of dengue occur when infection with more than one serotype of virus occurs. The first infection probably sensitises the person and the second serotype induce the immunological response.

The main diagnostic test of dengue fever is serology, but haemagglutination inhibition antibody appears at detectable levels by around day 5-6 of febrile illness and hence to confirm the diagnosis, it would take about 7 days. USG has several advantages, as it is a non-invasive, safe, cost effective imaging modality, readily available and does not have harmful radiation. The increased capillary permeability of dengue fever leading to GB wall edema, ascites, pleural, pericardial effusions and organomegaly could be easily picked up by sonography. So we assessed the use of ultrasonography for early detection of dengue and its severity prediction.

84 cases were serologically confirmed out of 122 suspected dengue cases. 59(70.23%) cases were of mild dengue while 25(29.76%) cases were in severe dengue fever group. The sex distribution is 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 signssimilar to that observed in earlier studies [7, 12, 13]. In our study the most common bleeding manifestation was Petechiae which is different from few studies where hematemesis was commoner [14,15].

The findings of thoracic and abdominal ultrasound were obtained in this study were GB wall thickening, ascites, hepatomegaly, splenomegaly, fluid around the perinephric space (perinephric fluid), and pleural effusion.

GB wall thickening was the most common ultrasonographic finding in the study. GB wall thickening was found in all patients of severe dengue cases. GB wall thickening was found to be significantly associated with the severity of the clinical manifestations of dengue virus infection.

Gall bladder wall thickening also occurs in association with other conditions such as ascites, hypoalbuminemia and congestive cholecystopathy and in patient with cirrhosis of liver and portal hypertension. It is very

nonspecific finding when considered in isolation and is therefore limitation of this study. Other ultra-sonographic findings including ascites, splenomegaly, fluid around the perinephric space (perinephric fluid) and pleural effusion were significantly associated with severity of disease (P<0.001) except Hepatomegaly.

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 [7]. 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%) [16]

In a study done by Williandry M. et al the sonographic findings in pediatric patients including hepatomegaly (39.4%), splenomegaly (6.1%), thickened gallbladder wall (51.5%), ascites (27.3%), perinephric fluid (15.2%) right and bilateral pleural effusion (15.2% and 21.2%). There is significant correlation between the number of findings and the severity of disease in pediatric patients (p < 0.05) [17].

In our study all sonographic findings had significant correlation with severe thrombocytopenia except hepatomegaly, which did not correlate statically (P value = 0.48). So the severity of the course of the disease, which is directly linked to the platelet count, can also be assessed by sonography.

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 edema, ascites and pleural effusion which was seen in all age groups. GB wall edema 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 [18].

Conclusion

Ultrasonographic findings that include GB wall edema, pleural effusion andascites, 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.

What this study adds to existing knowledge: Ultrasonography is a simple and valuable tool in diagnosing and predicting severity of dengue fever.

This means that ultrasonography can help in the diagnosis of dengue fever in patients awaiting their serological reports and it can also give the clinicians idea about the severity of the disease process and thus help in more meticulous management of the patients.

Contributions by Authors

- Data collection done by Dr. Rajendra Singh Gurjar and Dr. Gopikishan Sharma

- Analysis and manuscript preparation done by Dr. Gopikishan Sharma and Dr. Mohit Ajmera

- All research work had been done under the guidance of Dr A L Bairwa

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