

A Study on Role of Ultrasonography in the Diagnosis of Dengue Fever

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Abstract

Background: Dengue Fever is an acute mosquito transmitted viral infection caused by one of the 4 serotypes of the genus flavivirus which has become a major international public health problem. The diagnosis of DF is often delayed owing to time taken for availability of serology test results. Moreover, this test is expensive and not widely available. Ultrasonography (USG) is a cheap, rapid and widely available non-invasive imaging method. In recent years several studies concluded that Ultrasonography of the chest and abdomen can be an important adjunct to clinical profile in diagnosis of DF and diagnosis can be made early in the course of the disease compared with other modes of diagnosis. The aim of the study is to demonstrate the ultrasound findings of dengue fever and also evaluate the specificity of gall bladder findings in dengue fever. **Subjects and Methods:** We conducted a prospective study in Govt Medical College & Hospital, Srikakulam and Konaseema Institute of Medical Sciences, Amalapuram, A.P. Study included 50 patients referred to the department of Radio-Diagnosis and Imaging for Ultrasonography with clinical suspicion of dengue fever, during a period of July 2018 to December 2019. USG of the abdomen, pelvis and chest was performed in all cases and findings were noted. Dengue serology was performed later and all the ultrasound findings were correlated with dengue serology. **Results:** In our study of 50 patients all the patients studied were diagnosed with dengue fever based on dengue serology. In our study, 100% of our patients diagnosed with DF (by dengue serology) showed gall bladder wall thickening, 88% showed splenomegaly, 44% showed ascites. Pleural effusion was present in 30% of which 66.66% of pleural effusion was bilateral and the rest 33.33% was right sided. Isolated left sided pleural effusion was not found in our study. Hepatomegaly was present in 28% of our patients. In our study mortality and complications from dengue fever were not seen. **Conclusion:** Ultrasound findings in dengue fever are gall bladder wall thickening, splenomegaly, ascites, pleural effusion and hepatomegaly. In an area where DF is an epidemic, when Ultrasonography shows gall bladder wall thickening in a febrile patient with thrombocytopenia DF should be suggested. On Ultrasonography, when there is gall bladder wall thickening, splenomegaly, ascites, and pleural effusion in a febrile patient with thrombocytopenia in a DF epidemic area a diagnosis of DF should be considered in a differential diagnosis until proved otherwise.

Keywords: Dengue Fever, Gall Bladder, Ascites, Splenomegaly, Hepatomegaly

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Introduction

Dengue Fever is an acute mosquito-transmitted viral infection caused by 1 of 4 virus serotypes (DEN-1, DEN-2, DEN-3, and DEN-4) of the genus Flavivirus. It is the most common arboviral disease in the world. [1] Dengue fever (DF) has been known for more than a century in the tropical areas of South East Asia and the Western Pacific regions. [2] A significant increase in the incidence of this infectious disease has taken place in the last 20 years and Dengue has become a major international public health concern in recent years. In 1998, it was deemed to be the most important tropical mosquito-transmitted infectious disease, surpassed only by malaria. [3]

It is now endemic in more than 100 countries and threatens the health of more than 2500 million i.e. 40% of the world's population. It is estimated that 10 million classic dengue infections occur each year with 500,000 cases of Dengue Hemorrhagic Fever. Its mortality ranges from 1-5% of treated patients to a maximum of 50% for untreated or poorly treated patients resulting in at least 12,000 deaths annually mainly among children. [4]

The disease occurs in two forms: classic dengue, the milder form of the disease and Dengue Hemorrhagic Fever (DHF), the severe form. The severity of this disease falls into four grades. Grade I, which is milder, is characterized by fever, general symptoms and positive tourniquet test and severe Grade IV

which shows shock and non-detectable artery pressure. In all phases, there is thrombocytopenia and haemoconcentration. Since there is no other tests that can be used to diagnose the condition with a reasonable degree of accuracy and reliability, the diagnosis of DF is based on clinical appearance in combination with serology. Positive serology (anti dengue antibody) is the mainstay in the diagnosis of DF.^[5] But serology takes approximately 7 days to give a positive result.^[6] The diagnosis of DF is often delayed owing to time taken for availability of serology test results. Moreover, this test is expensive and not widely available. Ultrasonography (USG) is a cheap, rapid and widely available non- invasive imaging method. In recent years several studies concluded that ultrasonography of the chest and abdomen can be an important adjunct to clinical profile in diagnosis of DF and diagnosis can be made early in the course of the disease compared with other modes of diagnosis.^[3] It can be used as a first-line imaging modality in patients with suspected DF to detect early signs suggestive of the disease prior to obtaining serologic confirmation test results, especially in a DF epidemic area.^[7]

Sonographic findings of DF have been described in several 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/DHF.^[4] The reported changes vary according to the severity of each case. According to the previous studies ultrasound findings in milder form include pleural effusion, ascites, gall bladder wall thickening, hepatomegaly, splenomegaly, pancreatic enlargement, pericholecystic fluid and pericardial effusion. Severe form of the disease is characterized by fluid collection in the perirenal and pararenal region, hepatic and splenic subcapsular fluid collections, pericardial effusion, pleural effusions, ascites, gallbladder wall thickening, hepatomegaly, splenomegaly, hepatic intraparenchymal haemorrhages, and pancreatic enlargement.^[3,4,7]

Objectives

To demonstrate the ultrasound findings of dengue fever.

To evaluate the specificity of gall bladder findings in dengue fever.

Subjects and Methods

Source of data

The study was conducted at Konaseema Institute of Medical Sciences, Amalapuram & Govt Medical College & Hospital, Srikakulam, A.P. between July 2018-December 2019. 50 patients with clinical suspicion of DF referred to the Department Of Radio-diagnosis for Ultrasonography of abdomen and thorax were included in this study.

Method of collection of data

Prospective study of 50 patients.

Inclusion criteria

- Patients with signs and symptoms of DF such as fever, headache, myalgia, rashes, nausea, vomiting and abdominal pain.
- Patients of viral fever with thrombocytopenia.
- AGE GROUPS: all age groups
- SEX: Any

Exclusion criteria

- Patients in whom dengue serology was negative.
- Patients treated previously, for DF and currently asymptomatic.

Equipment and protocol

Ultrasonography of the abdomen was performed after 4-6hrs of fasting for better distention and visualisation of the gall bladder on USG machines Philips clear VUE 360, GE Logic F8. Gall bladder wall thickening was measured by placing the callipers between the two layers of anterior gall bladder wall. In all the cases gall bladder was assessed for wall thickening as well as for pericholecystic fluid collection and for presence of calculi. Gall bladder was imaged from the portal vein to fundus with transverse images obtained at representative images. Splenic and liver size was measured along the long axis from dome to the tip in a sagittal plane and the measurement of spleen more than 12cms and liver more than 15.5cms were considered as splenomegaly and hepatomegaly respectively. We examined the hepatorenal pouch and retrovesicular area in a supine position for ascites.

Thoracic Ultrasonography was done in supine or sitting position with assessment of both the pleural spaces in the entire posterior and lateral thorax. To detect pleural effusion, longitudinal scans of the right hemithorax at the midclavicular and the midaxillary line and a transverse scan of the right upper abdominal quadrant were performed in the supine position.

Dengue serology was performed on all suspected cases of DF and only those patients positive for DF were included in the study.

Study design

Hospital based prospective study

Method of Statistical Analysis

Excel software was used to analyze the statistical data.

Results

In our study, the highest number of cases was in the age group of 21-30yrs. The mean age was 37.7yrs. The youngest patient was 12 yrs and the oldest being 70yrs. [Table 2]

Table 1: Age Distribution

Age	Frequency	Percent
1-10 yrs	0	0
11-20 yrs	5	10
21-30 yrs	13	26
31-40 yrs	10	20
41-50 yrs	08	16
51-60 yrs	8	16
61-70 yrs	6	12

Table 2: Mean Age of the patients

N	Mean	Media	SD	Min	Max
50	37.7	35	14.023	13	70

Table 3: Gender frequency

Gender	Frequency	Percent
Male	32	64
Female	18	36
Total	50	100

Table 4: Distribution of study population according to clinical history

Clinical History	Frequency	Percent
Fever	50	100
Myalgia	46	92
Headache	10	20
Retro-Orbital Pain	5	10
Vomiting	5	10
Abdominal Pain	3	6

Table 5: Distribution of rashes in study population

Rashes	Frequency	Percent
Present	30	60
Absent	20	40
Total	50	100

In our study of 50 cases, 32(64%) were males and 18(36%) were females. [Table 3]

Among 50 cases, all (100%) had fever and myalgia was present in 92%. [Table 4]

Rashes were present in 60% of our cases. [Table 6]

In our study all the patients tested positive for dengue serology had gall bladder wall thickening, followed by ascites (44%) and pleural effusion (30%). [Table 7]

Table 6: Ultrasonography findings of study population.

Ultrasound Findings	Frequency	Percent
Gall Bladder Wall Thickening (GBWT)	50	100
Ascites	22	44
Pleural Effusion	15	30
Hepatomegaly	14	28
Splenomegaly	44	88

Table 7: Distribution of grades of ascites.

Ascites	Frequency	Percent
Moderate	14	63.3
Mild	5	22.72
Minimal	3	13.63

Table 8: Distribution of pleural effusion among patients

Pleural Effusion	Frequency	Percent
Bilateral	10	66.66
Right Sided	5	33.33

Table 9: diagnosis

Diagnosis	Frequency	Percent
DF	36	72
DHF	14	28

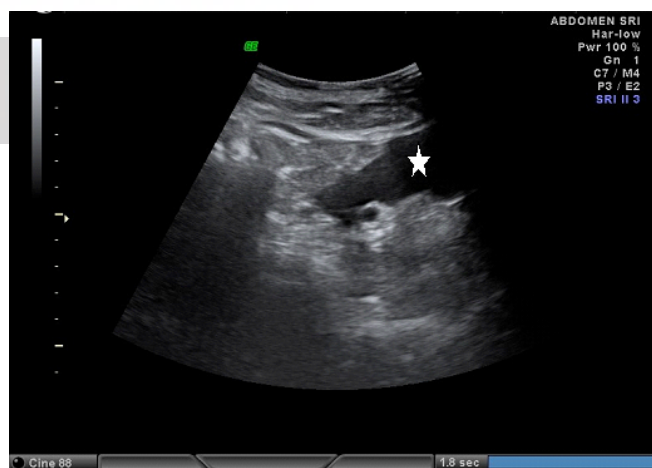


Figure 1: grey scale USG image of the pelvis showing anechoic free fluid in the pelvis suggestive of ascites.

Among 50 patients, ascites was present in 44% of our cases of which Moderate ascites was present in 63.63% of cases who had ascites. [Table 8]

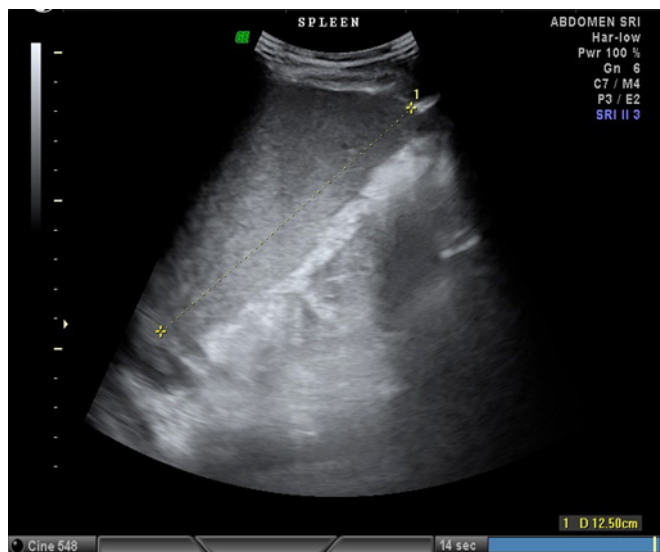


Figure 2: Grey scale USG image showing spleen measuring 12.5cms suggestive of splenomegaly.

In our study population of 50 patients, pleural effusion was present in 15(30%) of our cases, among whom 66.66% was bilateral and 33.33% was right sided. Isolated left sided pleural effusion was not present in our study. [Table 9]

In our study, DF was diagnosed in 72 percent of our cases and the rest 28 percent as DHF. [Table 10]

Discussion

Dengue is an acute febrile viral disease caused by flavivirus which occurs in two forms: DF, which is the milder form of the disease and the most severe DHF. Dengue has become a major international public health concern in recent years. DF is increasing due to uncontrolled population growth and improper urbanization in the absence of appropriate water management, global spread of dengue strains via travel and due to erosion of vector control programmes. In India the problem is even more acute because since 1963, more than 50 outbreaks have been reported by the National Institute of Communicable diseases, New Delhi.

Common laboratory findings include pancytopenia, neutropenia, increased haemoconcentration, thrombocytopenia and prolonged bleeding time. Serology is the mainstay in the diagnosis of DF. Haemagglutination inhibition antibodies usually appear at detectable level by day 5 to 6 of febrile illness. The diagnosis of DF is often delayed owing to time taken for availability of results. A diagnostic test that can quickly detect endothelial damage and facilitate immediate treatment is not currently available and the serological test needs paired serum samples with an interval of at least 7 days. Ultrasound can

be used to detect small amounts of transudate in serous cavities in patients suspected of having DHF in endemic regions. Although not specific, the sonographic findings in DF are obtained more rapidly than the results of serologic tests. The early sonographic findings of DF have rarely been reported in the literature.

The aim of our study was to evaluate the ultrasound findings in DF, to find whether ultrasound of the abdomen is an important adjunct to clinical and laboratory profile in diagnosing DF and further if ultrasound is useful in predicting the severity of the disease.

Mia MW et al,^[8] conducted study on 100 patients as a part of clinical and sonological evaluation of DF and among these, 58% were males and 42% were females. In our study of 50 patients who were diagnosed as DF, 32(64%) were male and 18(36%) were females. In our study DF was more common in males as compared to females which correlates with the study of Mia MW et al.^[8] These findings are also consistent with findings of Venkat Sai M et al^[4] that DF occurs more in male sex than females.

Keng Liang Wu^[1] conducted study on 65 patients for early abdominal sonographic findings in patients with DF, of whom 36 were women and 29 were male. In their study they found DF more common in females than male which was the opposite in our case study.

Mia MW et al,^[8] conducted study on 100 patients as a part of clinical and sonological evaluation of DF and among these patients age ranged between 6-67 years. In Keng Liang Wu et al^[1] study of 65 patients the age ranged from 18-76 years with a mean age of 49 years as compared to our study the age range was from 12 to 70 years with a mean age of 37.7 years and DF was more prevalent in the age group between 21-30 years.

In Keng-Liang Wu et al,^[1] study on 65 patients, All 65 patients had fever. Thirty-three patients had skin rash, 35 had myalgia. Thirty-three patients had abdominal discomfort, and 24 patients experienced diarrhea. In Melani W. Setiawan et al,^[9] study on 148 patients. The clinical features included fever in 148 (100%), abdominal pain in 109 (74%). Fever was also the main presenting complaint which was present in 100% of our study population, followed by myalgia (92%), retroorbital pain (10%), vomiting (10%) and pain abdomen (6%). In Mia MW et al,^[8] study fever was the most common clinical manifestation followed by nausea/vomiting and musculoskeletal pain. Rashes were present in 30 (60%) of our study patients.

Skin rashes were present in 55% of our study patients which was also the case in a study performed by Keng-Liang Wu et al,^[1] study on 65 patients where Thirty-three patients had a skin rash.

The most common Ultrasonography feature in our study was gall bladder wall thickening which was present in all our study

population making it 100% which correlated with other studies conducted by P M Venkata Sai Et al,^[4] where gall bladder wall thickening was present in all of the dengue sero-positive cases. Thickened gall bladder wall was also the most common feature in studies conducted by Keng-Liang Wu et al, Melani W. Setiawan and Mia MW et al.^[1,8,9]

The other features were Ascites which was present in 44% of our patients followed by pleural effusion in 30%, splenomegaly in 88% and hepatomegaly in 28%.

In Melani W. Setiawan study,^[9] Pleural effusion was found in 22/73 (30%) of the cases. The pleural effusion was bilateral in 63/148 (43%), right-sided in 30/148 (20%), but never only on the left side as compared to our study Pleural effusion was present in 30% and it was bilateral in and right sided in . left sided pleural effusion was not present in our study showing a good correlation between the two studies.

The above sonographic findings are not diagnostic of DF. Thickening of the gall bladder wall is also found in acute cholecystitis and some nonbiliary disorders namely hepatic cirrhosis, viral hepatitis, chronic congestive cardiac failure, chronic renal failure and hypoalbuminaemia. However, since gall bladder wall thickening was present in 100% of our cases it can be used as a supportive evidence to diagnose dengue fever prior to obtaining serological test which takes up to 7days to confirm dengue fever. Studies done by P M Venkata Sai Et al,^[4] concluded that diagnosis of DF can be made early in the course of disease based on Ultrasonography compared with other modes of diagnosis. During an epidemic the ultrasound findings of GB wall thickening with or without polyserositis in a febrile patient should suggest the possibility of DF/DHF.

Mortality and other complications from DF were not seen in our study probably due to early diagnosis and prompt treatment of DF and also milder form of the disease.

Conclusion

Ultrasound findings in dengue fever are gall bladder wall thickening, splenomegaly, ascites, pleural effusion and hepatomegaly. In an area where DF is an epidemic, when Ultrasonography shows gall bladder wall thickening in a febrile patient with thrombocytopenia DF should be suggested on Ultrasonography, when there is gall bladder wall thickening, splenomegaly, ascites, and pleural effusion in a febrile patient with thrombocytopenia in a DF epidemic area a diagnosis of DF should be considered in a differential diagnosis until proved otherwise.

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