

EARLY DETECTION OF DENGUE FEVER IN CLINICALY SUSPECTED PATIENTS - AN ULTRASOUND STUDY

Dr Dipti A Shah**, Dr. Balasubramanian Vignesh*

*Resident, Department of radiodiagnosis, AMC MET medical college and LG hospital.

**Professor and head of the department , Department of radiodiagnosis, AMC MET medical college, LG hospital, Ahmedabad

ABSTRACT

Background: Dengue is a mosquito-borne infection that in recent years has become a major international public health problem.

Purpose: This study was conducted to assess the sonographic findings in patients with dengue fever.

Methods: A total of 112 patients who were clinically suspected of dengue underwent abdominal sonography on admission at our emergency department. The diagnosis of dengue fever was subsequently confirmed by serology in 86 patients. The study was conducted from September 2016 to January 2017 using LOGIC P5 USG machine at LG hospital, Ahmedabad.

Results: Out of the 86 patients seropositive for dengue, the sonographic feature of thickened gall bladder wall was noted in a total of 53 patients (61%). Gall bladder wall thickening as the only finding was noted in 12 patients (14%). The maximum thickness noted was 6.3mm and the smallest thickness noted was 2.4mm. Average thickness of the gall bladder was 3.4 mm ± 1mm.

Other ultrasound findings such as ascites was noted in 21 patients (24%), splenomegaly in 11 patients (12.7%), and pleural effusion in 23 patients (26%); pleural effusion was either right-sided or bilateral. Pleural effusion as the only finding was noted in 12 patients. In 21 seropositive patients (24%) no significant ultrasound findings were seen. 26 patients were seronegative and showed no significant ultrasound findings.

Conclusion: Abdominal sonography for gall bladder wall thickening 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. Sonographic examinations are useful as an additional diagnostic tool for the prediction of dengue fever. A thickened gallbladder wall is a useful sonographic finding that can help in the detection.

Early detection of dengue has a significant role in reduction of morbidity and mortality with better prognosis.

INTRODUCTION

Dengue is a mosquito-borne infection that in recent years has become a major international public health problem. Dengue fever (DF) is an acute febrile viral disease caused by flavivirus. It occurs in two forms: DF, a milder form of the disease and dengue hemorrhagic fever (DHF), the most severe form.

Dengue has become a major international public health concern in recent years. It is now endemic in more than 100 countries and threatens the health of 40% of the world's population.¹ DF is widely distributed in many countries in Southeast Asia, Central and South America, and the Western Pacific regions. The incidence of DF has increased 30-fold in the last four decades, and more than half the world's population are now threatened with infection from dengue virus (DEN).²

It is estimated that 50 million dengue infections occur each year with 5000000 cases of dengue hemorrhagic fever (DHF) and at least 12000 deaths annually mainly among children ¹. The increase of DF is due to uncontrolled population growth and urbanization in the absence of appropriate water management, global spread of dengue strains via travel and trade and due to erosion of vector control programmes.³

In subtropical countries like India dengue fever is a major cause of morbidity and mortality during the monsoon season. 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.⁴

Dengue viruses are transmitted to humans through the bites of infective female Aedes mosquito. 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.

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. The incubation period of the disease may range from 3 to 14 days. The onset of the disease is recognized by the sudden onset of high fever, retro-orbital pain, thrombocytopenia and haemorrhagic manifestations. Common laboratory findings include pancytopenia, neutropenia, increased haemoconcentration, thrombocytopenia and prolonged bleeding time. These findings are consistent with increased vascular permeability, plasma leakage, abnormalities of haemostasis and protein losing shock syndrome, which commonly occur in DF pathogenesis.

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.

Ultrasonography is a non invasive, safe, low cost dynamic imaging modality which does not utilize ionizing radiation.

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. Although not specific, the sonographic findings in DF are obtained more rapidly than the results of serologic tests.

MATERIALS AND METHODS

The study was a single centred cross-sectional study performed in tertiary care hospital from September 2016 to December 2016.

Patients who were clinically suspected of dengue underwent abdominal sonography on admission at our emergency department. Then they were subjected to serological testing and patients who were proven to be positive for dengue fever by immunological assay for non-structural protein 1(NS1) antigen were included in the study.

The ultrasound of abdomen and chest of the 112 patients was performed. Then the patients were advised 6 hours of fasting to allow better distension of gall bladder (GB) followed by

ultrasound examination by the consultant radiologist the next day. The abdomen and pelvis ultrasonography was done to look for free fluid in the peritoneal cavity, gall bladder wall thickening and pericholecystic collection. The chest ultrasonography was done to look for pleural effusion.

All ultrasound examinations were performed with LOGIC P5 using 10 MHz linear probe and 2.5-5 MHz convex probes.

GB wall thickening was measured by placing the calipers between the two layers of the gall bladder wall. The thickness was measured at the region of maximum wall thickening.^{14,17}

Thoracic scanning was done in supine posture and in sitting posture. Both the pleural spaces were evaluated through an intercostal approach.

Size of the spleen was measured along its long axis from the upper pole to lower pole.^{15,16}

We conducted the study in accordance with all local ethical standards, and oral informed consent to participate was obtained from all patients before their enrollment.

OBSERVATION AND RESULTS

A total of 112 patients were taken in our study. Among them, 60 patients were male and 52 patients were female. 52 patients were under 15 years of age, 39 were between 15 to 30 years and 21 were above 30 years of age.

Out of these 112 patients, 26 patients were seronegative and showed no significant ultrasound findings.

A total of 86 patients were seropositive for dengue. Among them 65 patients had one or more ultrasound findings, as follows.

The maximum gall bladder wall thickness noted was 6.4 mm and the minimum gall bladder wall thickness noted was 2.3 mm. Average thickness of the gall bladder was 3.4 mm \pm 1mm. Out of this, thickened gall bladder wall (>3mm) was noted in a total of 53 patients(61%). Gall bladder wall thickening as the only finding was noted in 12 patients. Along with gall bladder wall thickening, other ultrasound findings such as ascites was noted in 21 patients (24%), splenomegaly in 11 patients (12.7%), and pleural effusion in 23 patients (26%); pleural effusion was either right-sided or bilateral.

Pleural effusion as the only finding was noted in 12 patients.

In 21 sero positive patients (24%) no significant ultrasound findings were seen. Thus Ultrasound findings were negative in 24% of the seropositive patients.

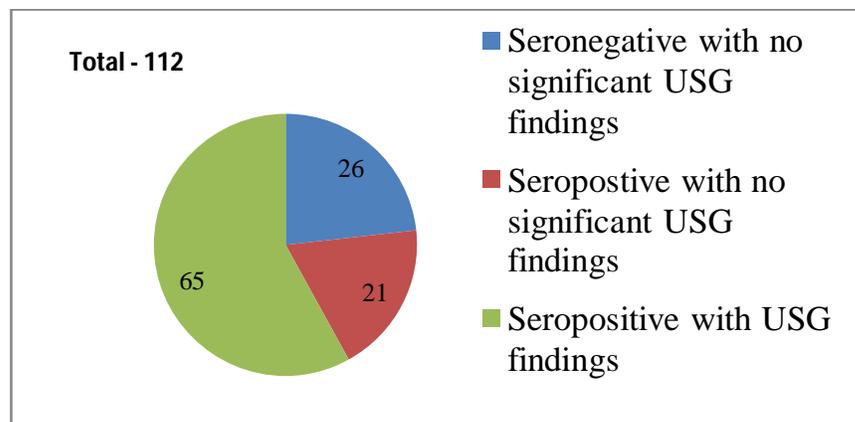


Table 1 -GENDER WISE DISTRIBUTION OF CLINICALLY SUSPECTED PATIENTS FOR DENGUE

	Male	Female	Total	%
Seronegative with no significant USG findings	15	11	26	23
Seropositive with no significant USG findings	13	8	21	18
Seropositive with USG findings	34	31	65	58
Total	62	50	112	

Table 2 - AGE DISTRIBUTION OF PATIENTS CLINICALY SUSPECTED FOR DENGUE

Age group	Male	Female	Total	%
< 15	30	22	52	47
15 – 30	21	18	39	33
30 – 45	7	8	15	14
>45	4	2	6	5
	62	50	112	

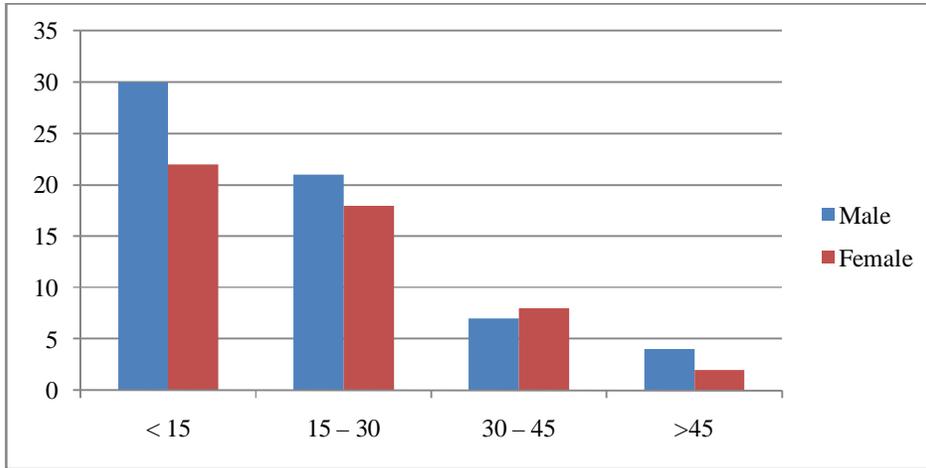


Table 3 - BASED ON USG FINDINGS

USG Findings	Male	Female	Total	Percentage
GB wall thickening as the only finding	7	5	12	14%
GB wall thickening with ascites	9	12	21	24%
GB wall thickening with splenomegaly	7	4	11	12%
GB wall thickening with pleural effusion	6	3	9	11%
	29	24	53	61%

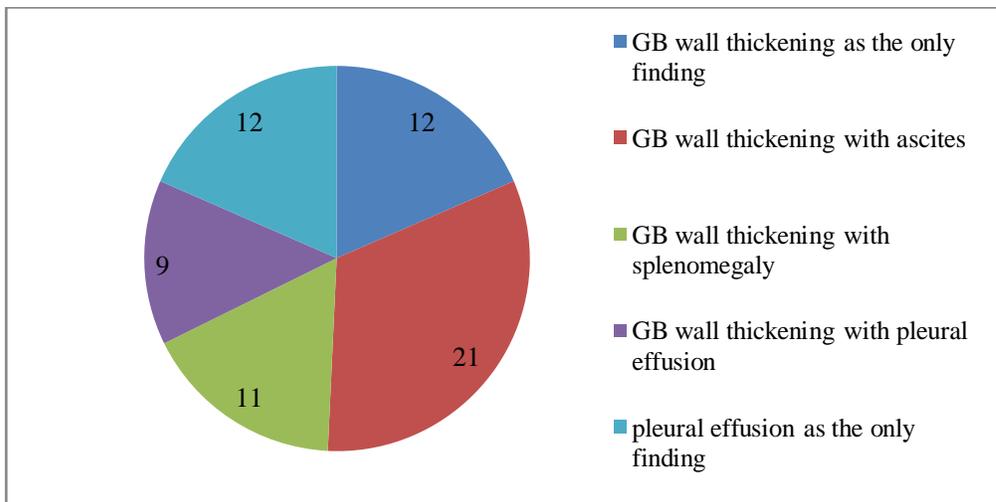


Table 4 – RANGE OF GB WALL THICKNESS.

GB wall thickness range	Male	Female	Total	%
3 – 3.9 mm	15	8	23	43
4 – 4.9 mm	9	9	18	33
>5mm	5	7	12	23

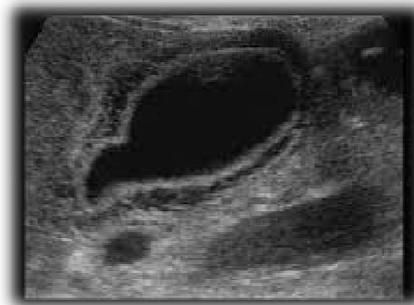
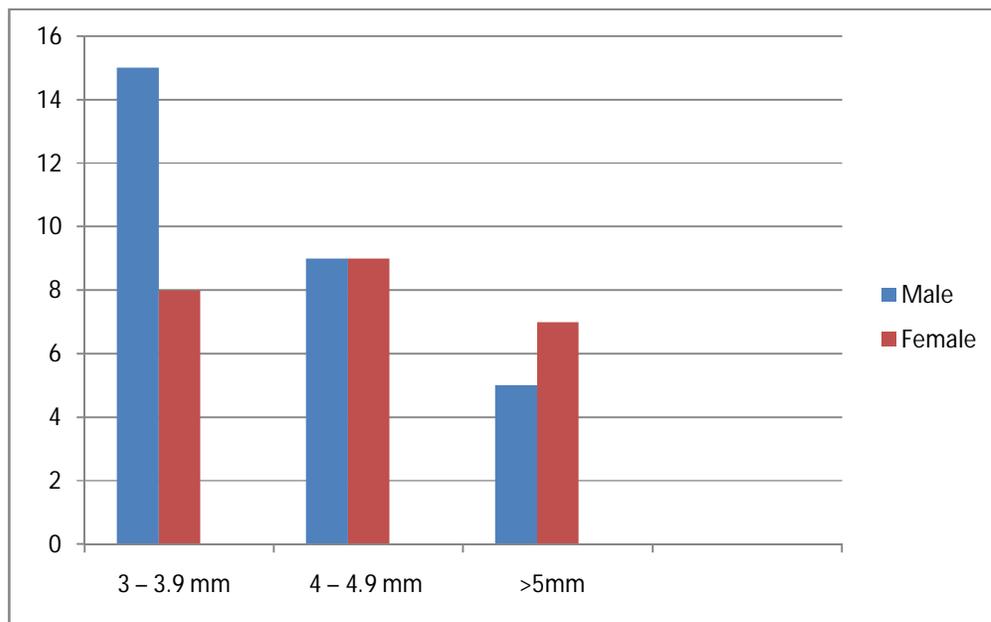




Fig 1,2,3 – Ultrasound images of oedematous gall bladder wall

DISCUSSION

In our study, 61% of the seropositive patients showed gall bladder wall thickening. Hence this was the most persistent finding. Other common findings were pleural effusion and ascites. Along with gall bladder wall thickening, other ultrasound findings such as ascites was noted in 24% , splenomegaly in 12.7%, and pleural effusion in 26%; pleural effusion was either right-sided or bilateral. Pleural effusion as the only finding was noted in 12 patients. In 21 seropositive patients (24%) no significant ultrasound findings were seen.

Our study findings are in accordance with Santhosh et al who concluded in their studies that gall bladder wall thickening being the most frequent finding.⁸

Thulkar et al reported sonographic findings in 40 patients with dengue hemorrhagic fever, including pleural effusion, ascites, and gallbladder wall thickening; splenomegaly was not mentioned.⁵

Setiawan et al states that increased gall bladder thickening associated with increased severity of disease.¹²

Also in the study by Venkata Sai and Krishnan R who concluded that during an epidemic of dengue, presence of thickened gall bladder wall, pleural effusion and ascites strongly favour the diagnosis of dengue fever, similar to our findings.⁷

Tai et al found that sonographic findings of DF were a thickened gallbladder wall, ascites, splenomegaly, and pleural effusion, which were confirmed in our study.²⁰

In another study conducted by Joshi, et al during the epidemic in 1997, right sided pleural effusion was the commonest finding, whereas gall bladder wall thickening was the most frequent finding in ours.¹⁰

In our study there were no isolated left sided pleural effusion. Pleural effusion was either right sided or bilateral. This is in accordance with the findings of the studies conducted by Pramuljo and Harun SR which states that pleural effusion can be found on the right and in bilateral pleural spaces but no isolated left pleural effusion.⁹

Bhamarapravati et al also found edema of the serosa of the gallbladder and ascites in the peritoneal cavity in patients with DF. The main pathophysiologic change in DF is an increased vascular permeability, causing plasma leakage and serous effusion with a high protein content (mostly albumin).¹¹

In studies conducted by Department of Child Health in Indonesia and by Joshi et al in Army Hospital, Delhi Cantt, they had also found abnormal liver parenchyma, which has been

attributed to intraparenchymal and subcapsular haemorrhages.^{9,10} In our study however we could not appreciate any significant change in the echotexture of the liver. None of these studies suggested GB wall thickening as the initial finding in DF (100%) as observed in our study, followed by pleural effusion.

These findings may also occur in other viral infections, enteric fever and leptospirosis, but in other viral infections the historical profile, symptom complex evolution and physical findings do not mimic those of DF. Ultrasound features of enteric fever include splenomegaly, intra-abdominal lymphadenopathy, bowel abnormalities in the form of intramural thickening of the terminal ileum and caecum, renal abnormalities like arteriectasis and perinephric fluid collection in addition to GB wall thickening and polyserositis. Leptospirosis also shows gross abnormalities involving hepatic and renal parenchyma. GB wall thickening also occurs in association with other conditions such as ascites, hypoalbuminaemia, congestive cholecystopathy and in patients with cirrhosis of liver and portal hypertension. It is a very non-specific finding when considered in isolation and is therefore a limitation of this study. Although not specific, the sonographic findings in DF are obtained more rapidly than the results of serologic tests.

Diagnosis can be made early in the course of disease 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

CONCLUSION:

Abdominal ultrasound, being a non invasive, safe, low cost dynamic imaging tool, 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 and tropical areas. Although not specific, the sonographic findings in DF are obtained more rapidly than the results of serologic tests.

Early detection of dengue has a significant role in reduction of morbidity and mortality with better prognosis. Furthermore, diagnosis can be made early in the course of disease compared with other modes of investigation.

Hence during an epidemic of dengue, ultrasound findings of GB wall thickening with or without polyserositis in a febrile patient should suggest the possibility of DF/ DHF. In an area experiencing a DF epidemic, when sonography shows a thickened gallbladder wall, ascites, splenomegaly, and pleural effusion, in a febrile patient with thrombocytopenia, DF should be considered in the differential diagnosis until it is disproven.

REFERENCES

1. Weekly epidemiological record. No. 36, 6th September 2002:300–2.
2. Weekly epidemiological record. No. 6, 8th February 2002:41–3.
3. Weekly epidemiological record No 24, 16th June 2000: 193–6.
4. Health Situation in the South East Asia Region 1994–1997, Regional office for SEAR, New Delhi; WHO (1999).
5. Thulkar S, Sharma S, Srivastava DN, et al. Sonographic findings in grade III dengue hemorrhagic fever in adults. *J Clin Ultrasound* 2000;28:34.
6. Balasubramanian S, Janakiraman L, Kumar SS, Muralinath S, Shivabalan S O. A reappraisal of the criteria to diagnose plasma leakage in dengue haemorrhagic fever. *Indian Pediatr* 2006;43:334-9.
7. Venkata Sai PM, Dev B, Krishnan R. Role of ultrasound in dengue fever. *Br J Radiol* 2005;78:416-8.
8. Santhosh VR, Patil PG, Srinath MG, Kumar A, Jain A, Archana M. Sonography in the diagnosis and assessment of dengue Fever. *J Clin Imaging Sci* 2014;4:14.
9. Pramuljo HS, Harun SR. Ultrasound findings in Dengue haemorrhage fever. *Pediatr Radiol J* 1991;21:100–2.
10. Joshi P, Rathnam VG, Sharma S. USG findings in dengue haemorrhagic fever – our experience in the recent epidemic. *Ind J Radiol Imag* 1997;7:189–92

11. Bhamarapavati N. Pathology of dengue haemorrhagic fever. In: Thongcharoen P. Monograph on dengue/dengue haemorrhagic fever. WHO 1993:72–3
12. Setiawan MW, Samsi TK, Pool TN, et al. Gallbladder wall thickening in dengue hemorrhagic fever: an ultrasonographic study. *J Clin Ultrasound* 1995; 23:357.
13. Srikiatkachorn A, Krautrachue A, Ratanaprakarn W, Wongtapradit L, Nithipanya N, Kalayanaroj S et al. Natural history of plasma leakage in dengue haemorrhagic fever: a serial ultrasonographic study. *Pediatr Infect Dis J*. 2007;26:283–90.
14. Patriquin HB, DiPietro M, Barber FE, Teele RL. Sonography of thickened gallbladder wall: causes in children. *AJR Am J Roentgenol*. 1983; 141:57– 60.
15. Yang CY, Sheen IS, Chanchien CS, et al. The normal sizes of liver, spleen, pancreas, portal vein, common bile duct, splenic vein, and pancreatic duct by using ultrasonography. *Gastroenterol J Taiwan* 1985;2:129.
16. Ishibashi H, Higuchi N, Shimamura R, et al. Sonographic assessment and grading of spleen size. *J Clin Ultrasound* 1991;19:21.
17. Engel JM, Deitch EA, Sikkema W. Gallbladder wall thickness: sonographic accuracy and relation to disease. *AJR Am J Roentgenol* 1980;134:907.
18. Kalayanaroj S, Vaughn DW, Nimmannitya S, et al. Early clinical and laboratory indicators of acute dengue illness. *J Infect Dis* 1997;176:313.
19. McGahan JP, Phillips HE, Cox KL. Sonography of the normal pediatric gallbladder and biliary tract. *Radiology*. 1982;144:873– 875.
20. Tai DI, Kuo CH, Lan CK, et al. Abdominal ultrasonographic features in dengue fever. *Gastroenterol J Taiwan* 1990;7:182.