

## Various Prospects of Ultrasonography in the Diagnosis of Dengue Fever

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**ABSTRACT:** The reason for the accompanying exploration is to set up the use of ultrasound as a critical supplement to the clinical and research center profile in the determination of dengue fever and in the forecast of sickness power by relating symbolism with platelet tally. There was additionally investigation of the distinction in sonographic qualities saw in patients from different age classes. It is an examination review. For ultrasound checking of the midsection and chest, 96 patients who were serologically affirmed as having dengue fever among April and August 2012 were alluded and the imaging results were dissected. In 96 cases in seropositive dengue, 64 (66.7 percent) patients had edematous gallbladder (GB) divider thickening, 62 (64.5 percent) patients had ascites, 48 (50 percent) patients had pleural radiation, 17 (17.7 percent) patients had hepatomegaly, 16 (16.7 percent) patients had splenomegaly, and 17 (17.7 percent) patients had customary ultrasound results. The most successive blend of discoveries in all age ranges is edematous GB divider thickening, ascites, and pleural radiation. In 97.8 percent of patients with platelet tallies of under 40,000 alongside ascites (86.9 percent) and pleural emanation (58.6 percent), edematous GB divider thickening was seen. Around 40,000 and 80,000 ascites is more continuous in patients with platelet tallies than edematous thickening of GB dividers. No sporadic sonographic perceptions were prominently seen in patients with a platelet check more noteworthy than 150,000. Sonographic qualities of thickened GB divider, pleural radiation (two-sided or right side), ascites, hepatomegaly, and splenomegaly could unequivocally uphold the analysis of dengue fever, especially during a flare-up, in patients with fever and related side effects. The level of thrombocytopenia had a significant direct association with irregular ultrasound attributes.

**Key words:** Ascites, dengue fever, hepatomegaly, edematous gallbladder wall thickening, pleural effusion, splenomegaly, thrombocytopenia, ultrasound features

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### I. INTRODUCTION

Dengue infection, a flavi infection, is among the broad reasons for fever in jungles. South-east Asia and the Western Pacific represented 70% of the worldwide dengue fever load in 2008. Indonesia, Thailand, Myanmar, Sri Lanka, Bangladesh and India are the nations with an enormous pervasiveness. Dengue is spread by the *Aedes aegypti* mosquito, normally scattered on the planet's tropical and subtropical districts. There are four known serotypes of dengue, albeit more than one serotype of the extraordinary type of dengue fever is set off by contamination. With a fast flare-up of high fever, clinically dengue shows with chills, extraordinary cerebral pains, muscle and joint inconvenience, retro orbital uneasiness and genuine spinal pain. Fever commonly endures 5 days or something like that, occasionally longer than 7 days. One consistent perception is hemorrhagic diathesis and thrombocytopenia with associative stitch fixation.

The dengue pestilence happened in Bengaluru, India, in mid-2012. The objective of this review research was to examine the imaging qualities of the midsection and chest in dengue fever patients, to distinguish whether ultrasound can turn into a noteworthy expansion to the clinical and lab profile in the analysis of dengue fever, and to contrast these discoveries and platelet tallies and infection power across various age gatherings.

#### Dengue infection

There are four separate serotypes of dengue infection, all of which get from the Flaviviridae family and from the Flavivirus gathering. 3,7,8 DENV-1, DENV-2, DENV-3, and DENV-4 serotypes are alluded to, and contamination with every one of the four infections brings about lifetime resilience to that equivalent serotype.4,9,10 Each of the four serotypes has been independently detailed as being answerable for and connected with more genuine dengue scourges.

#### Dengue infection and clinical administration

Dengue is a convoluted issue with a wide assortment of clinical introductions that is every now and again unrecognized or misdiagnosed as most tropical fever-causing diseases.12,13 Most individuals report a

serious rise of fever during the brooding stage that may persevere for 2-7 days which is here and there followed by side effects, for example, myalgia, arthralgia, anorexia, sore throat, headache, which macula. Auxiliary dengue contaminations or particularly harmful strains are two causes that are accepted to be connected with raised seriousness risk.<sup>2,16</sup> In extraordinary circumstances, thrombocytopenia and improved vascular penetrability may add to side effects of hemorrhagic and stun. There is right now no inoculation or interesting antiviral treatment.<sup>10,17,18</sup> But, with opportune case ID and satisfactory clinical mediation, including presentation of intravenous rehydration, the case casualty in outrageous dengue could be under 1%.<sup>11</sup> At present, dengue anticipation depends on solid, negligible vector control strategies because of a lack in adequate treatment.

#### Dengue vector and vector control

*Aedes aegypti* (*A. aegypti*) is the essential arthropod vector for the dengue infection transmission. *Aedes albopictus* (*A. albopictus*), the second, less fruitful vector, benefits from numerous kinds of vertebrates, yet has likewise been discovered to be at risk for some transmission of dengue.<sup>8</sup> Notably, *Aedes* mosquitoes are essentially included during daytime hours, making trouble in vector control.<sup>7,21</sup> *A. Aegypti* mosquitoes are as of now generally circulated all through both the jungles and subtropics.<sup>19</sup> The mosquito is noted for its fruitful 'vector capacity' with a solid human blood liking, moderate protection from the four serotypes of the dengue infection, and emphatically fit to metropolitan life. In standard water tanks or arranged water stockpiling stores, *aegypti* mosquitoes breed in and close homes.<sup>24</sup> Because of this development territory and their little flight capacity, female *A. Aegypti* keeps on enduring in a tamed environment.<sup>19</sup> It is for this reason that people are accepted to be the significant wellspring of dengue transmission across communities.<sup>8</sup> The more extensive anticipation and the board of dengue is fundamentally centered around strategies for vector control. These give strategies and procedures to ecological, natural, and substance vector control management.<sup>19</sup> The objectives of this paper are to analyze the current dengue the study of disease transmission internationally, just as to see its foundations and foundation. Furthermore, we would attempt to develop a portion of the clarifications for future anticipated further extension and increment in dengue.

#### Ultrasonography

In the current report, 34% of patients had ascites, joined by 28% with pericholecystic edema, 12% with reciprocal pleural radiation, 10% with right-sided pleural emission, and hepatomegaly, driven by 5% with splenomegaly. It is likewise recalled that the above ultrasonographic results were firmly corresponded with various types of serologically analyzed dengue, showing that ultrasonography could be successful in coordinating the analysis of dengue fever. The impacts of the current examination don't line up with Chaterjee R et al.<sup>15</sup>'s previous reports.

## II. OBJECTIVE

1. The objective of the following study is to determine the use of ultrasound as an important adjunct to clinical and laboratory profile in diagnosing dengue fever and in predicting the severity of the disease by correlating imaging features with platelet count.

## III. REVIEW OF LITERATURE

- Konus OL (2012) Dengue is a mosquito-borne irresistible illness with a wide local spread over the jungles and subtropics. It is accounted for that right now more than 3.9 billion individuals in at any rate 128 nations overall are in danger of disease with 96 million recorded clinical cases every year. The dengue infection (DENV) is spread by mosquitoes, generally *Ae.*, of the variety *Aedes*. *Aegypti*, yet with *Ae.*, as well. *Ae* and *Albopictus*. Polynesian. DENV is an aspect of the *Flaviviridae* family which likewise contains other huge human microorganisms, for example, West Nile, yellow fever, Zika, Japanese encephalitis and tick-borne encephalitis infections. Four infection serotypes (DENV-1 to DENV-4) have been set up for quite a while, albeit a putative fifth serotype, DENV-5, was as of late portrayed This new subtype was built up during screening probes infection tests got in Malaysia during an episode in 2007.
- G, Celik H, and İşik S. (2016) Infection with DENV may bring about reformist clinical sequelae, verifiably viewed as fluctuating from asymptomatic contamination to dengue fever (DF) and the more genuine appearances of dengue haemorrhagic fever (DHF) and dengue stun condition (DSS) ailment. All the more as of late, the World Health Organization has presented a refreshed characterization that orders fever as follows: (1) dengue; (2) dengue with notice side effects (stomach distress, discontinuous retching, liquid maintenance, mucosal dying, laziness, swollen liver, and expanded platelet hematocrit); and (3) extraordinary (dengue with huge plasma releasing, genuine dying, as well as decreased platelet hematocrit)
- Joshi P, Rathnam (2013) Infections with asymptoms are described by undifferentiated fever with or without rash. In most clinical cases, the first dengue appearance isn't noticeable before steady signs and

manifestations rise. This respite in certainty decreases the chance to make an early and exact clinical conclusion. In correlation there are no reasonable dengue medicines, for example, against viral drugs. All consideration is fundamentally valuable, and there is additionally an extremely significant trouble in giving a precise assessment of the reality of the sickness in a patient as ahead of schedule as could be expected under the circumstances. DF 's most punctual stages are every now and again connected with other febrile tropical issues that can add to ill-advised treatment.

- VG, Sharma S (2014) While as of late, the principal endorsed dengue antibody (DENV-1 to DENV-4 delusion dependent on a 17D spine of yellow fever, recombinant, live lessened tetravalent infection (CYD-TDV; Dengvaxia ®, Sanofi Pasteur)) has been accounted for the use of critical difficulties to immunization adequacy and long haul security in the populace being directed. So this case additionally needs a quick and precise way to deal with determination. Albeit various research facility demonstrative procedures have been being used for quite a long while, each needs to date no technique demonstrating precise, speedy, and financially savvy to its impediments. Along these lines there is a dire need to fortify the administration of dengue. A definitive situation includes the production of exact and quick testing strategies for dengue.
- Current research center techniques for dengue analysis
- Infection detachment
- Infection detachment is known to be the best quality level system of dengue conclusion by Jawetz, Melwick, and Adelberg (2015) Isolation is incredibly viable when examples are acquired in the viraemic cycle, which starts 2-3 days before the inception of fever and proceeds for another 2-3 days. Serum is the essential example choice normally. What's more, other example structures, including semen, fringe blood, cerebrospinal liquid, pleural liquid, and reticuloendothelial tissues, for example, liver, spleen , lymph hubs, kidney, and thymus, are vital Diagnostic helplessness relies upon the circumstance of the example securing, sufficient taking care of, and transport. Since the DENV infection molecule is heat-labile it needs cautious taking care of and ideal appropriation to the research center. An ordinary fridge temperature (~4 ° C) is entirely adequate in the transient when capacity is justified, though the -20 or -70 ° C cooler temperatures are favored for a more drawn out period. In the above circumstance , so as to abstain from defrosting, they ought to be saved.
- Numerous strategies for DENV confinement are available, including immunization of examples into mosquitoes (grown-ups or hatchlings); various societies of in vitro creepy crawlies or mammalian cells; and intra-cerebral infusion into mice.
- MATERIALS AND METHODS
- The exploration was performed at our tertiary consideration office. This review research was acknowledged by our institutional audit board and educated assent was not required. 96 patients who were serologically determined to have dengue fever among April and August 2012 were alluded for stomach and thoracic ultrasound examines and the outcomes were broke down. Both ultrasound tests were directed utilizing 3.5 MHz and 5 MHz tests utilizing a ultrasound framework (GE Voluson 730 Pro model). Gallbladder (GB) divider thickening was determined by embeddings the calipers between the two layers of the foremost divider, which was the unmistakable result in serologically sound circumstances. In either a sitting or recumbent posture, thoracic checking was directed. Through an intercostal system, both pleural spaces were determined. Hepatomegaly was accounted for with liver estimating in excess of 15 cm and spleen estimating in excess of 12 cm was taken with splenomegaly.
- So as to approve the finding, serological investigations were led for dengue, including the non-basic protein-1 (NS-1) Ag and dengue immunoglobulin G/immunoglobulin M assessment. NS-1, which has the least antigenic range, is a firmly dense glycoprotein found in the serum of dengue-contaminated patients.
- Radiologists with at least 5 years of stomach sonography practice led sonography. Filtering was directed just once in light of the fact that there is no distinction between the spectators.
- Reasonability for test size
- As per a report performed by Joshi et al, 66% of patients are relied upon to go through ultrasound pleural emanation. In view of this outcome, with a flat out precision of +10 or-10 and a probability level of P ?? 0.05, it was seen that to get measurable legitimacy, roughly 90 patients were should have been remembered for the example.
- Measurable investigation of information
- Subjective factors, for example, the event of various ultrasonic impacts have been spoken to as rates. The Chi-square assessment of measurable centrality tried the connection of different sonographic qualities with various age gatherings or platelet checks. For measurable importance, P bu 0.05 was respected.
- To assess the age conveyance of imaging highlights in dengue fever, a sum of 96 serologically certain patients were additionally partitioned into four age groupings. Gathering 1 comprised of patients matured 0 to 9 years (16), Group 2 comprised of patients matured 10 to 19 years (17), Group 3 comprised of patients matured 20 to 39 years (43), and Group 4 comprised of patients matured more than 40 years (20).

IV. RESULTS

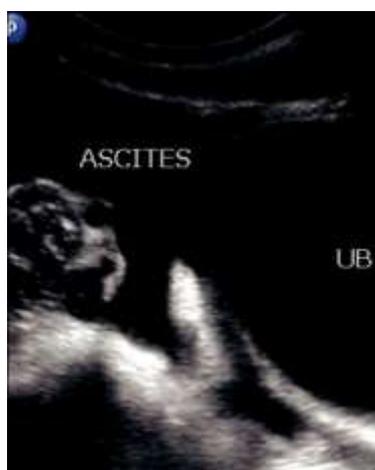
- Of the 96 patients, 64 had GB divider thickening (66.7%) [Figures 1 and 2], 62 had ascites (64.5%) [Figure 3], 25 had two-sided pleural emission (26%), 22 had just right pleural radiation (22.9%) [Figure 4], 1 had just left pleural emanation, 17 had hepatomegaly (17.7%), 16 had splenomegaly (16.7%) and 17 had no serious ultrasonic discoveries (17.7%).
- The significant discoveries with respect to age appropriation of imaging highlights are as per the following:
- In our stud, dengue fever was most ordinarily found in the age gathering of 20-39 years (44.8%)
- GB divider thickening was more normal in Group 1 and Group 4 (75%) than in other age bunches where

**Table 1: Incidence of different sonographic findings in dengue fever**

USG features	Number (%)
Gallbladder wall thickening	64 (66.7)
Pleural effusion	
Bilateral	25 (26)
Only right	22 (22.9)
Only left	1 (1)
Ascites	62 (64.5)
Hepatomegaly	17 (17.7)
Splenomegaly	16 (16.7)
Normal	17 (17.7)
Total number of cases	96



**Figure 1:** 32-year-old male patient with a history of fever with thrombocytopenia, diagnosed with dengue fever. Ultrasound scan of the abdomen shows thickened edematous gallbladder wall.



**Figure 2:** Ultrasound examination reveals mild free fluid in the peritoneal cavity supporting urinary bladder and gallbladder wall thickening and pleural effusion in the 24-year-old male patient with a history of fever diagnosed with dengue fever. Subsequent serology confirmed dengue diagnosis.



**Figure 3:** 28-year-old female patient with a history of fever with thrombocytopenia, diagnosed with dengue fever. Ultrasound shows minimal right-sided pleural effusion.

- As cited less often in the 0-9 year age range (75%) than in other age classes,
- GB wall thickening (75 percent) was more widespread in age group > 40 years than ascites (50 percent);
- Ultrasound characteristics such as GB wall thickening ( $P = 0.701$ ), pleural effusion ( $P = 0.08$ ), ascites ( $P = 0.41$ ), hepatomegaly ( $P = 0.11$ ), and splenomegaly ( $P = 0.11$ ) did not disclose any statistically meaningful cancellation [Table 2 and Graph 1];
- The combination of imaging features observed among the groups was as follows:
- GB wall thickening, ascites and pleural effusion were commonly associated with dengue fever in all age groups
- Splenomegaly and hepatomegaly were seen commonly in the age groups 10-19 years and 20-39 years, respectively [Table 3].

#### **Correlation of imaging features with platelet count**

- GB wall thickening was seen in most of patients whose platelet count was less than 40,000 (97.8%) and more frequently seen in patients whose platelet count was less than 80,000 (87%).
- Ascites (86.9%) and pleural effusion (68.6%) were the other common findings seen in patients whose platelet count was less than 40,000.
- In patients whose platelet count was 40,000-80,000, ascites was more common than GB wall thickening.
- Out of 16 splenomegaly cases, 11 were seen in patients whose platelet count was less than 40,000.
- In five patients whose platelet count was more than 150,000, no abnormal ultrasound findings were detected.
- Decrease in platelet count, (40,000) was associated with the presence of various ultrasound features such as GB wall thickening ( $P < 0.001$ ), pleural effusion ( $P < 0.001$ ), ascites ( $P < 0.001$ ) and splenomegaly ( $P < 0.024$ ). The correlations being statistically significant [Table 4 and Graph 2].

## **V. DISCUSSION**

Dengue fever is the most widespread of all the arthropod-borne viral illnesses. Dengue fever is one of the most common new tropical and subtropical diseases. 1.2 million cases of dengue fever and dengue hemorrhagic fever (DHF) were recorded from 56 countries in a pandemic in 1998. It is projected that 50 million people worldwide get contaminated per year, with 500,000 cases of DHF contaminated and at least 12,000 deaths.

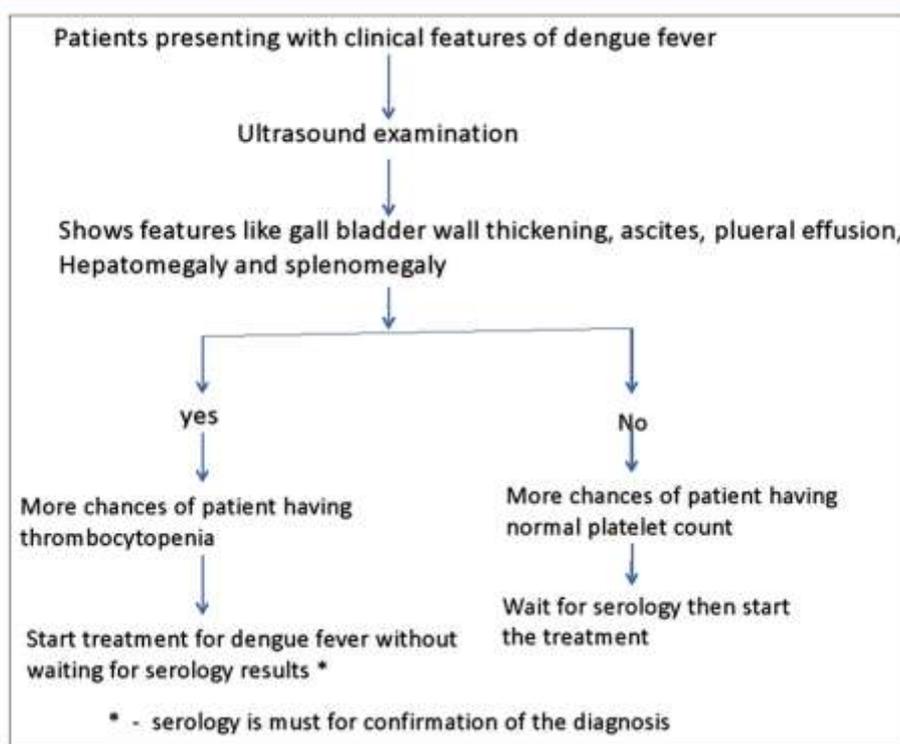


Figure 4: Algorithm.

Table 2: Incidence of sonographic findings in relation to different age groups

USG features	Number of patients (% of total)				P value	Statistical significance
	Group 1 (0-9) yr	Group 2 (12-19) yr	Group 3 (20-39) yr	Group 4 (>40) yr		
Total	16 (16.7)	17 (17.7)	43 (44.8)	20 (20.8)		
Gallbladder wall thickening	12 (75)	11 (64.7)	27 (60.4)	15 (75)	0.701	No
Pleural effusion	11 (68.5)	11 (64.5)	16 (37.2)	10 (50)	0.08	No
Ascites	12 (75)	12 (70.5)	28 (65)	10 (50)	0.41	No
Hepatomegaly	1 (6.2)	2 (11.8)	9 (20.9)	5 (25)	0.11	No
Splenomegaly		3 (17.6)	11 (25.5)	1 (5)	0.11	No
Normal	2 (12.5)	3 (17.6)	10 (23)	2 (10)	0.63	No

Table 3: Combination of sonographic findings seen in different age groups

USG features	Group (years)			
	1 (0-9)	2 (10-19)	3 (20-39)	1 (>40)
GBT+ASC	1	1	7	3
GBT+ASC+PE	9	8	10	3
GBT+ASC+PE+SPM		3	4	
GBT+ASC+PE+SPM+HPM			2	1
GBT+ASC+PE+HPM				3
SPM+HPM			2	1
ASC+PE	1		2	
ASC+SPM			1	

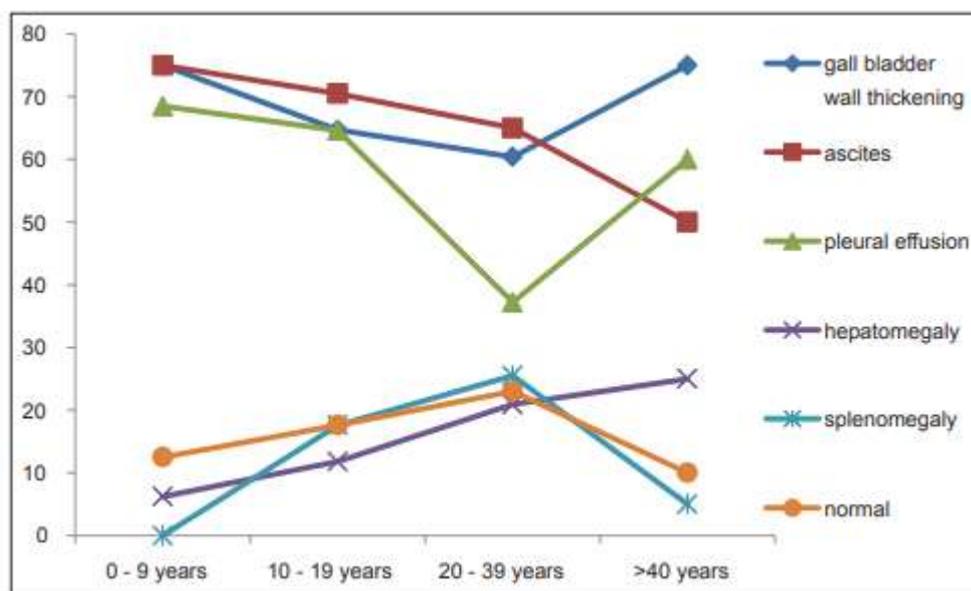
GBT+PE				2
GBT+HPM			1	1
ASC+HPM		1	2	

Bad Handling of Water. Bad water quality is also associated with a lack of public knowledge of mosquito breeding and defense from bites. In 2011-12, dengue was widespread in 23 states. In 2008, there were a total of 12,561 reports and 80 fatalities. Around 15,509 cases and 89 deaths were recorded in 2009. 28,292 cases and 110 deaths were recorded in 2010. 17,273 cases and 112 deaths were recorded in 2011.

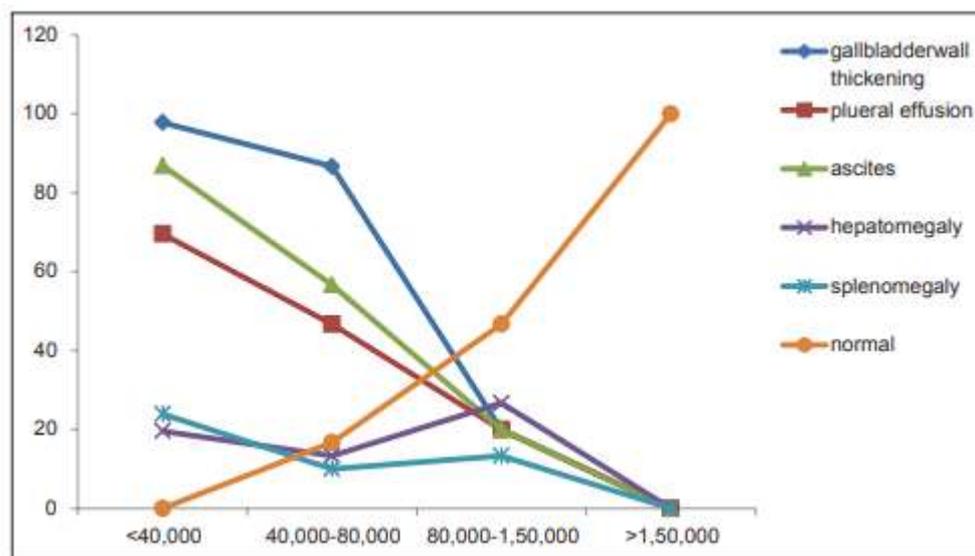
Dengue fever begins during the rainy season as usually there is an excess of vector mosquito reproduction. Dengue cases are most clinically expressed in the post-monsoon season during September to November Traditional dengue fever with a rapid onset of high fever with chills, extreme headache, muscle and joint pain, retro-orbital pain and serious backache. Fever is typically around 5 days long and sometimes longer than 7 days long. Strict

**Table 4: Correlation of sonographic findings with platelet count**

USG features	Number (%)				P value	Statistical significance
	<40,000	40,000–80,000	40,000–80,000	>150,000		
Total number	46 (48)	30 (31.2)	15 (15.6)	5 (5.2)		
Gallbladder wall thickening	45 (97.8)	26 (86.7)	3 (20)	0	<0.001	Yes
Pleural effusion	32 (69.6)	14 (46.7)	3 (20)	0	<0.001	Yes
Ascites	40 (86.9)	17 (56.7)	3 (20)	0	<0.001	Yes
Hepatomegaly	9 (19.6)	4 (13.3)	4 (26.7)	0	0.49	No
Splenomegaly	11 (23.9)	3 (10)	2 (13.3)	0	0.024	Yes
Normal	0	5 (16.7)	7 (46.7)	5 (100)		



**Graph 1:** Graphical representation of various age groups of ultrasound findings. X-axis indicates percentage of ultrasound patients with various traits, y-axis displays patient age category.



**Graph 2:** Graphical depiction of sonographic findings of various platelet counts in patients. The x-axis displays percent of ultrasound patients with various traits, the y-axis indicates platelet count.

Infection of more than one serotype triggers the process of dengue fever when the first infection possibly sensitizes the patient, whereas an immunological tragedy tends to create the second infection with a separate serotype. In treating these patients, early diagnosis of DHF / dengue shock syndrome (DSS) will go a long way and decrease morbidity and mortality, especially in cases of DHF and DSS.

Serology is the mainstay in dengue fever care. By day 5-6 of febrile disease, Hem agglutination suppression antibodies normally present at measurable quantities. Early, milder dengue fever ultrasound observations include GB wall thickening, minimum ascites, pleural effusion, and hepato-splenomegaly. Extreme disease features are synonymous with fluid collection in perirenal and pararenal areas, hepatic and beautiful sub-capsular fluid, pericardial effusion, pancreatic enlargement, and hepato-splenomegaly. A change in the usual liver echo texture can arise due to intraparenchymal and subcapsular hemorrhages. In our research, however, we did not notice any of the monographic features described above, even in extreme types of dengue fever, except hepatosplenomegaly.

GB wall thickening often develops in patients with liver cirrhosis and portal hypertension in combination with other disorders such as ascites, hypoalbuminemia, congestive cholecystopathy. When taken in turn, it is a very non-specific result and is thus a significant limitation of this analysis.

Imaging characteristics of dengue fever such as thickening of the GB surface, ascites, pleural effusion, hepatomegaly and splenomegaly are fairly effective in dengue fever diagnoses. This helps start proper patient care as soon as ultrasound is completed, particularly in centers where there might not be high-end laboratory facilities available for serological confirmation. In the diagnosis of dengue fever, serological examinations are confirmatory, but ultrasound may be of use in the determination of seriousness.

The most common age category affected was 20-40 years in a related survey performed by Joshi et al. during the outbreak in 1997, and right-sided pleural effusion was the most common finding, as in our research [Table 2] In their sample, pleural effusion was the most common finding (66 percent); but in our survey, it was edematous GB wall thickening (66.7 percent). Ascites was shown in just 50 percent of cases in their report; nevertheless, it was seen in 64.5 percent in our report, becoming the second most frequent result. Pleural effusion was observed in 60 per cent of cases in our sample of 96 patients. This is potentially representative of a significant shift in our country's sonographic profile for dengue fever.

The magnitude of the progression of the disorder, which is directly proportional to the amount of platelets, may also be measured by sonography. If a patient displays all dengue fever-related ultrasound signs, the platelet count is expected to be fewer than 40,000 and the patient will need to get a blood transfusion. After a mri test, this helps the prescribing doctor to arrange for blood until platelet count values are available. Also identified in this study is the connection of sonographic findings through age groups.

## VI. CONCLUSION

Conclusion Dengue is now endemic in more than 125 countries globally.<sup>5,31</sup> Reasons for the currently observed and predicted expansion are multifactorial. Climate change, virus progression, and social causes can be involved, such as increasing urbanization, population growth and development, socio-economic influences, as

well as global travel and trade.<sup>23,52</sup> At this point, there is no antiviral therapy or vaccination available for dengue, leaving only early diagnosis and symptomatic fluid resuscitation care necessary for serious case control.

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