Section: Radiodiagnosis.

Original Research Article

ULTRASOUND FINDINGS IN CASES OF DENGUE: A RETROSPECTIVE STUDY

Gorantla Siva Sreenu Pavan[1], V. V. Seetha Pramila[2], A. Parthasarathi[3]

[1]*Junior Resident, Department of Radiodiagnosis, Rajarajeswari Medical College and Hospital, 202 Mysore Road, Bangalore, India.*
[2]*Professor, Department of Radiodiagnosis, Rajarajeswari Medical College and Hospital, 202 Mysore Road, Bangalore, India.*
[3]*Professor and Head, Department of Radiodiagnosis, Rajarajeswari Medical College and Hospital, 202 Mysore Road, Bangalore, India.*

Received *: 15/03/2026*
Received in revised form *: 20/04/2026*
Accepted *: 09/05/2026*

Corresponding Author:
Dr. Gorantla Siva Sreenu Pavan,
Junior Resident, Department of Radiodiagnosis, Rajarajeswari Medical College and Hospital, 202 Mysore Road, Bangalore, India.
Email: gorantlamd@gmail.com

DOI: 10.70034/ijmedph.2026.2.493

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 2986-2992

ABSTRACT

Background: Dengue fever is a common mosquito-borne viral infection in tropical countries and may progress to severe disease due to increased capillary permeability and plasma leakage. Early diagnosis is important for timely management, but clinical features may overlap with other acute febrile illnesses and laboratory confirmation may not always be immediately available. Ultrasonography is a rapid, non-invasive, inexpensive, and widely available imaging modality that can demonstrate features of plasma leakage and visceral involvement in dengue.

Materials and Methods: This hospital-based retrospective radiology study was conducted on 60 patients with confirmed dengue infection who were referred for USG abdomen or USG chest. Data were collected retrospectively from ultrasound reports of dengue patients. The reports were reviewed for gall bladder wall thickening, ascites, pleural effusion, hepatomegaly, splenomegaly, and associated sonographic findings. The presence, frequency, and distribution of ultrasound abnormalities were recorded. Data were entered in Microsoft Excel and analyzed using descriptive statistics. Results were expressed as frequencies and percentages.

Results: Gall bladder wall thickening was the most common ultrasound finding and was observed in 42 patients, accounting for 70.0% of cases. Ascites was present in 30 (50.0%) patients of the study population. The Other Findings were Pleural effusion (41.7%), hepatomegaly (33.3%) and splenomegaly (30%)of cases. Bilateral pleural effusion was seen in 13 patients, right-sided pleural effusion in 10 patients, and isolated left-sided pleural effusion was present in 2 patients. Evidence of plasma leakage in the form of ascites and/or pleural effusion was observed in 37 patients, representing 61.7% of cases.

Conclusion: Ultrasonography is a useful adjunct in the evaluation of dengue fever. Gall bladder wall thickening, splenomegaly, ascites, pleural effusion, and hepatomegaly constitute the principal sonographic findings. In endemic areas, gall bladder wall thickening with or without serosal effusion should raise suspicion of dengue fever when correlated with clinical and laboratory findings.

Keywords: Dengue, Ultrasonography, Gallbladder, Ascites, Pleural Effusion.

INTRODUCTION

Dengue fever is one of the most important mosquito-borne viral infections affecting tropical and subtropical regions, with a steadily increasing global burden.[1] The disease is especially common in urban and semi-urban settings where Aedes aegypti and Aedes albopictus mosquitoes proliferate. Dengue continues to be a major seasonal and epidemic-prone illness in India as well as many other developing countries. Its incidence increases particularly during and after monsoon periods thereby placing a substantial burden on inpatient care facilities. The increasing frequency of dengue outbreaks and its variable clinical presentation makes a high index of suspicion, early recognition and initiation of management a crucial part of management of dengue cases.[2]

Dengue is caused by dengue virus which is a flavivirus having four antigenically distinct serotypes. Dengue Infection may remain asymptomatic or may present as an acute febrile illness which is characterized by fever, headache, retro-orbital pain, myalgia, arthralgia, rash, and abdominal discomfort. In a subset of patients, the disease progresses to severe dengue with plasma leakage, bleeding manifestations, organ involvement, shock, or death. The critical phase of dengue is closely related to increased capillary permeability, which may clinically manifest as hemoconcentration, thrombocytopenia, serosal effusions, ascites, and hemodynamic instability. It can also present with atypical features such as acute pancreatitis.[3] Because the early clinical manifestations overlap with other acute febrile illnesses such as malaria, enteric fever, leptospirosis, viral hepatitis, and other viral fevers, diagnosis based solely on clinical features can be difficult.

Ultrasonography has emerged as a useful adjunctive imaging modality in suspected dengue, particularly in patients with thrombocytopenia, abdominal pain or in cases where there is a strong clinical suspicion of possibility of plasma leakage. Ultrasound is inexpensive, portable, and radiation-free. Moreover, it is also widely available making it especially suitable for use in endemic and resource-limited settings. Previous studies have described several sonographic findings in dengue, including gall bladder wall thickening, ascites, pleural effusion, hepatomegaly, splenomegaly, pericholecystic fluid and occasionally pericardial effusion or pancreatic enlargement. These findings reflect the underlying pathophysiology of vascular permeability and plasma leakage which are central to the development of severe dengue.[4]

Among the sonographic features gall bladder wall thickening has received particular attention as an early and frequently observed imaging finding in dengue fever. It is thought to result from plasma leakage, edema and hypoalbuminemia rather than primary gall bladder disease. The presence of gall bladder wall thickening in a febrile patient with thrombocytopenia particularly during a dengue outbreak therefore may support the clinical suspicion of dengue before serological confirmation is available. Pleural effusion and ascites are also important because they indicate serosal fluid accumulation and may correlate with disease severity. In many cases of dengue right-sided or bilateral pleural effusion is commonly described while isolated left-sided effusion is less frequently reported. Additionally, Splenomegaly and hepatomegaly may occur due to reticuloendothelial activation, hepatic involvement or systemic inflammatory response.[5]

Despite the growing recognition of ultrasonography as a supportive tool in dengue evaluation, there remains a need for institution-based studies documenting the spectrum and frequency of ultrasound findings among confirmed dengue patients, particularly in radiology practice where referrals are often made for abdominal or chest sonography due to clinical deterioration, abdominal symptoms, thrombocytopenia or suspected effusion. Published data vary with respect to the frequency of gall bladder wall thickening, ascites and other imaging abnormalities in patients with dengue possibly due to differences in study population, timing of ultrasound examination and disease severity. The present retrospective study, conducted on 60 dengue patients whose data were collected from ultrasound reports of patients referred for USG abdomen or USG chest intends to evaluate the pattern of sonographic findings in dengue fever. By documenting the relative frequency of abdominal and thoracic ultrasound abnormalities, this study aims to clarify the supportive role of ultrasonography in dengue assessment and contribute radiology-based evidence for early recognition of plasma leakage and disease severity in clinically suspected cases.

MATERIALS AND METHODS

This hospital-based retrospective study was conducted in the Department of Radiodiagnosis among dengue cases who were referred to radiology department for ultrasonographic evaluation. The study included a total of 60 cases of dengue fever. Data was collected retrospectively from ultrasound reports of patients who were sent for USG abdomen or USG chest and who had documented dengue infection. The study population included patients of all age groups and both sexes. Since this was an observational retrospective study based on available radiological records, no intervention was performed as part of the study. A total of 60 eligible laboratory-confirmed dengue cases with available ultrasound reports during the study period were included.

Data was collected retrospectively from hospital records and archived ultrasound reports of patients with laboratory-confirmed dengue infection. Confirmation of dengue was based on documented NS1 antigen positivity, IgM serology, or other accepted laboratory evidence available in the records. Patients were included when they had been referred to the radiology department for USG abdomen, USG chest, or basal pleural screening during abdominal ultrasound. Basic demographic details, available clinical information, and relevant laboratory confirmation were recorded from case files, requisition forms, and hospital information records.

The ultrasound reports were reviewed specifically for radiological findings relevant to dengue. Gall bladder wall thickening, ascites, pleural effusion, hepatomegaly, splenomegaly, pericholecystic fluid, and pericardial effusion were recorded when mentioned in the original report. Gall bladder wall thickening was included only when documented in the report, after excluding obvious alternative causes such as gall stones or features of acute calculous cholecystitis wherever such information was

available. Ascites was recorded when free fluid was described in any peritoneal compartment, and pleural effusion was categorized as right-sided, left-sided, or bilateral according to the report. Hepatomegaly and splenomegaly were recorded according to the measurements or final impression documented by the reporting radiologist.

Statistical analysis was done with the help of statistical software IBM SPSS 23.0. Categorical variables such as gall bladder wall thickening, ascites, pleural effusion, hepatomegaly, and splenomegaly were expressed as frequencies and percentages. Continuous variables such as age were expressed as mean, median, standard deviation, minimum, and maximum values where applicable. The association between selected ultrasound findings, wherever available, was assessed using the chi-square test or Fisher's exact test. A p value of less than 0.05 was considered statistically significant.

Inclusion Criteria

- Patients with laboratory-confirmed dengue infection.
- Patients referred for USG abdomen or USG chest during the study period.
- Patients of all age groups and both sexes.
- Patients whose ultrasound reports were available for review.

Exclusion Criteria

- Patients with negative dengue serology or absence of laboratory confirmation.
- Patients whose ultrasound reports were incomplete or unavailable.
- Patients with known chronic liver disease, congestive cardiac failure, chronic renal failure, nephrotic syndrome, or other systemic illnesses that could independently cause ascites, pleural effusion, or gall bladder wall thickening.
- Patients with known gall bladder pathology such as cholelithiasis or acute calculous cholecystitis.
- Previously treated dengue patients who were asymptomatic at the time of ultrasound evaluation.

RESULTS

The analysis of the gender distribution of the studied cases showed that males formed the larger proportion, with 38 cases (63.3%), while females accounted for 22 cases (36.7%). There was a male preponderance with M:F ratio of 1.7:1. [Figure 1]

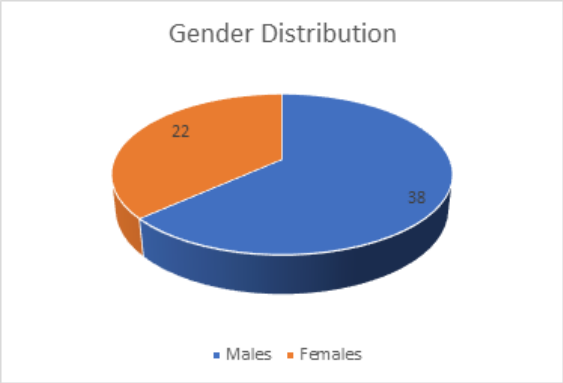

Figure 1: Gender distribution of study population

The analysis of the age distribution of the studied cases showed that the most common age group was 21–30 years, comprising 16 cases (26.7%), followed by 31–40 years with 12 cases (20.0%) and 41–50 years with 10 cases (16.7%). Among males, the highest number of cases was also seen in the 21–30 years age group with 10 cases (26.3%), while among females, the same age group had 6 cases (27.3%). The mean age of the total study population was 37.9 ± 14.2 years, with males having a mean age of 37.6 ± 14.1 years and females 38.5 ± 14.6 years. [Table 1]

Table 1: Gender-wise age distribution of study population

Age group	Male	Female	Total	p value
1–10 years	0	0	0	
11–20 years	4	2	6	
21–30 years	10	6	16	
31–40 years	8	4	12	
41–50 years	6	4	10	0.812
51–60 years	6	3	9	
61–70 years	4	3	7	
Total	38	22	60	
Mean age ± SD	37.6 ± 14.1 years	38.5 ± 14.6 years	37.9 ± 14.2 years	

The analysis of gall bladder wall thickening among the studied cases showed that gall bladder wall thickening was present in the majority of patients, seen in 42 cases (70.0%), while it was absent in 18 cases (30.0%). This indicates that gall bladder wall thickening was a common ultrasonographic finding among dengue patients in the present study. [Table 2]

Table 2: Distribution of gall bladder wall thickening

Gall bladder wall thickening	Number of cases	Percentage
Present	42	70.0%
Absent	18	30.0%
Total	60	100.0%

The analysis of the distribution of ascites according to severity showed that mild ascites was the most common grade, seen in 12 cases (40.0%) among patients with ascites, followed by minimal ascites in 10 cases (33.3%) and moderate ascites in 8 cases (26.7%). This indicates that most patients with ascites had either mild or minimal fluid collection on ultrasonographic evaluation. [Table 3]

Table 3: Distribution of ascites according to severity

Grade of ascites	Number of cases	Percentage among patients with ascites
Minimal ascites	10	33.3%
Mild ascites	12	40.0%
Moderate ascites	8	26.7%
Total	30	100.0%

The analysis of the distribution of major ultrasound findings in dengue patients showed that gall bladder wall thickening was the most common finding, observed in 42 cases (70.0%), followed by ascites in 30 cases (50.0%) and pleural effusion in 25 cases (41.7%). Other important findings included hepatomegaly in 20 cases (33.3%) and splenomegaly in 18 cases (30.0%), while pericholecystic fluid and pericardial effusion were less frequent, seen in 10 cases (16.7%) and 4 cases (6.7%), respectively. [Figure 2]

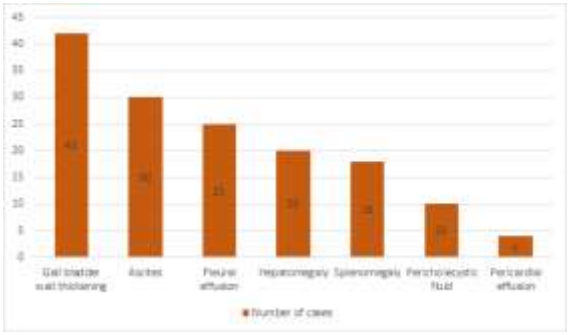

Figure 2: Distribution of major ultrasound findings in dengue patients.

The analysis of the laterality of pleural effusion showed that bilateral pleural effusion was the most common pattern, seen in 13 cases (52.0%) among patients with pleural effusion, followed by right-sided pleural effusion in 10 cases (40.0%). Isolated left-sided pleural effusion was uncommon, observed in only 2 cases (8.0%), indicating that pleural effusion in dengue patients was more frequently bilateral or right-sided. [Figure 3]

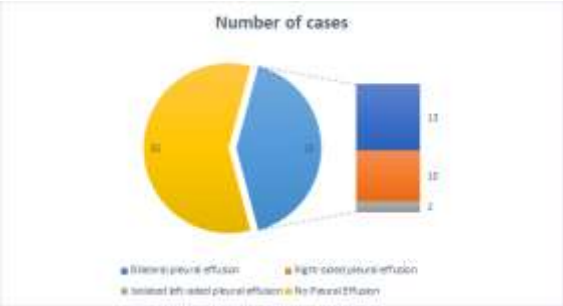

Figure 3: Presence and laterality of pleural effusion in studied cases.

The analysis of the pattern of combined ultrasound findings in the studied cases showed that gall bladder wall thickening with ascites and pleural effusion was the most common pattern, seen in 12 cases (20.0%), followed by gall bladder wall thickening with hepatosplenomegaly with or without fluid collection in 10 cases (16.7%) and gall bladder wall thickening with ascites in 9 cases (15.0%). Gall bladder wall thickening alone and ascites and/or pleural effusion without gall bladder wall thickening were each observed in 8 cases (13.3%), while no significant ultrasound abnormality was found in 5 cases (8.3%). This suggests that combined gall bladder wall thickening with fluid collection was a frequent ultrasound pattern among dengue patients (Table 4, Figure4).

Table 4: Pattern of combined ultrasound findings in studied cases

Combined ultrasound findings	Number of cases	Percentage
No significant ultrasound abnormality	5	8.3%
Gall bladder wall thickening alone	8	13.3%
Gall bladder wall thickening with ascites	9	15.0%
Gall bladder wall thickening with pleural effusion	6	10.0%
Gall bladder wall thickening with ascites and pleural effusion	12	20.0%
Ascites and/or pleural effusion without gall bladder wall thickening	8	13.3%
Gall bladder wall thickening with hepatosplenomegaly with or without fluid collection	10	16.7%
Organomegaly without gall bladder wall thickening or fluid collection	2	3.4%
Total	60	100.0%

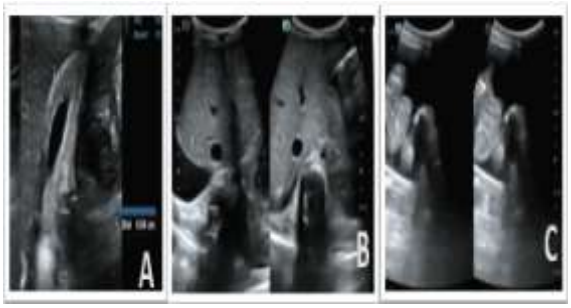

Figure 4: Ultrasonographic findings in a patient with dengue fever showing serositis-related changes. (A) Gall bladder wall edema/thickening (B) Right-sided pleural effusion seen as an anechoic fluid collection above the diaphragm. (C) Ascites demonstrated as free intraperitoneal fluid on abdominal ultrasound.

The analysis of the distribution of solid organ enlargement on ultrasound showed that no hepatosplenomegaly was observed in the majority of cases, accounting for 32 patients (53.3%). Among the positive findings, hepatomegaly only and combined hepatomegaly with splenomegaly were each seen in 10 cases (16.7%), while splenomegaly only was noted in 8 cases (13.3%). This indicates that solid organ enlargement was present in nearly half of the dengue patients, with hepatomegaly and combined hepatosplenomegaly being the more common patterns. [Table 5]

Table 5: Distribution of solid organ enlargement on ultrasound

Solid organ enlargement	Number of cases	Percentage
Hepatomegaly only	10	16.7%
Splenomegaly only	8	13.3%
Both hepatomegaly and splenomegaly	10	16.7%
No hepatosplenomegaly	32	53.3%
Total	60	100.0%

DISCUSSION

In the present retrospective radiology-based study of 60 laboratory-confirmed dengue cases, gall bladder wall thickening was the most frequent ultrasonographic abnormality, being observed in 42 patients (70.0%), followed by ascites in 30 patients (50.0%) and pleural effusion in 25 patients (41.7%). This pattern supports the concept that ultrasonography primarily demonstrates the consequences of capillary permeability and plasma leakage rather than directly diagnosing the viral infection. Venkata Sai reported that gall bladder wall thickening, ascites, pleural effusion, and hepatosplenomegaly were useful ultrasound findings in dengue fever and could support early diagnosis when interpreted with clinical and hematological parameters.[6] Thulkar also documented pleural effusion, gall bladder wall thickening, and ascites among adults with grade III dengue hemorrhagic fever, emphasizing the value of ultrasound in identifying severe dengue-related fluid leakage.[7] In comparison with these studies, the present study showed a high frequency of gall bladder wall thickening, which may be related to the hospital-based radiology referral pattern, as patients were likely referred for ultrasound when abdominal symptoms, thrombocytopenia, or suspected plasma leakage were present. The predominance of gall bladder wall thickening in our study therefore reinforces its importance as a sensitive and easily detectable sonographic marker in clinically suspected dengue, especially in endemic settings.

Ascites was present in half of the patients in the present study, and most cases were minimal or mild, suggesting that ultrasound can identify early or clinically subtle plasma leakage before it becomes obvious on physical examination. Santhosh found that gall bladder wall edema, ascites, and pleural effusion were common sonographic findings in dengue and observed that these abnormalities were more frequent in patients with lower platelet counts.[8] Motla similarly described ascites, pleuro-pericardial effusion, and gall bladder wall edema as useful ultrasound findings for rapid evaluation of dengue patients.[9] The 50.0% frequency of ascites in the present study is comparable with the concept that peritoneal fluid accumulation represents one of the important manifestations of increased vascular permeability in dengue. However, the predominance of minimal and mild ascites in our cases may indicate that many patients were evaluated before progression to more advanced shock or severe fluid accumulation. This has practical clinical relevance because even small-volume ascites, when associated with gall bladder wall thickening or pleural effusion, may alert clinicians to the onset of the critical phase and the need for careful monitoring of hydration, hematocrit, platelet count, and warning signs.

Pleural effusion was detected in 25 patients (41.7%) in the present study, with bilateral effusion being the commonest pattern among those with pleural fluid, followed by right-sided effusion; isolated left-sided effusion was uncommon. Wu highlighted early abdominal sonographic findings in dengue fever and described gall bladder wall thickening, ascites, and pleural effusion as supportive features that may appear during the disease course.[10] Adil reported that gall bladder wall thickening may help in identifying dengue hemorrhagic fever and may serve as a severity marker, particularly when associated with other features of plasma leakage such as ascites and pleural effusion.[11] The predominance of bilateral and right-sided pleural effusion in the present study is consistent with the expected distribution of dengue-related serosal fluid

accumulation. Right-sided fluid may be detected more commonly because of the anatomical relationship of the liver, diaphragm, and right pleural space, while bilateral effusion may reflect more generalized capillary leakage. The relatively low number of isolated left-sided effusions in our study supports the view that such a pattern is less typical in dengue and should prompt consideration of other coexisting causes when clinically indicated. Routine screening of both pleural bases during abdominal ultrasound in dengue patients is therefore advisable.

Solid organ enlargement was another important component of the sonographic spectrum in the present study, with hepatomegaly in 33.3%, splenomegaly in 30.0%, and combined hepatosplenomegaly in 16.7% of cases. Although these findings are less specific than gall bladder wall thickening, ascites, or pleural effusion, they may reflect hepatic involvement, reticuloendothelial activation, and systemic inflammatory response. Setiawan studied gall bladder wall thickening in dengue hemorrhagic fever and demonstrated its association with disease severity, thereby supporting the interpretation of gall bladder edema as a marker of plasma leakage rather than primary biliary disease,[12] Quiroz-Moreno evaluated the clinical utility of ultrasound in identifying dengue hemorrhagic fever and supported the usefulness of sonography for detecting findings suggestive of severe disease.[13] In the present study, organomegaly without gall bladder wall thickening or fluid collection was uncommon, suggesting that isolated hepatomegaly or splenomegaly should be interpreted cautiously. More clinically meaningful patterns were combined abnormalities, especially gall bladder wall thickening with ascites and pleural effusion, which was the most frequent combination. This indicates that a composite ultrasound assessment is more useful than relying on one isolated sign.

The present study supports ultrasonography as a valuable adjunct in the evaluation of dengue, particularly for detecting plasma leakage and helping clinicians assess disease progression. However, it should not be considered a stand-alone diagnostic tool. Parmar reported that ultrasound is not useful as a screening tool to rule out dengue fever, which is relevant to the present study because 8.3% of confirmed cases had no significant ultrasound abnormality.[14] Shah demonstrated ultrasound findings of plasma leakage in dengue fever and emphasized the imaging appearance of pleural effusion, ascites, gall bladder wall thickening, and pericardial effusion in severe disease.[15] Thus, the role of ultrasound is best understood as supportive and prognostic rather than confirmatory. The limitations of the present study include its retrospective design, modest sample size, dependence on archived ultrasound reports, and lack of detailed correlation with platelet count, hematocrit, day of illness, and WHO severity classification. Despite these limitations, the high frequency of gall bladder wall thickening and serosal effusion in this study supports routine sonographic documentation of gall bladder wall thickness, ascites, pleural effusion, hepatomegaly, splenomegaly, pericholecystic fluid, and pericardial effusion in suspected or confirmed dengue cases. Future prospective studies with serial ultrasound and laboratory correlation may better define the temporal evolution and prognostic significance of these findings.

CONCLUSION

Ultrasonography is a useful, rapid, non-invasive imaging modality which can be used in the evaluation of cases with dengue fever. Gall bladder wall thickening was found to be the most common finding followed by ascites, pleural effusion, hepatomegaly and splenomegaly. The presence of ascites or pleural effusion indicates plasma leakage and may help in assessing disease severity and may point towards the possibility of severe dengue. In endemic areas, these sonographic findings when correlated with clinical and laboratory finding can support early diagnosis, monitoring and timely management of cases with dengue fever.

Conflict of Interest: None
Source of Funding: None

REFERENCES

1. Liu SY, Chien TW, Yang TY, Yeh YT, Chou W, Chow JC. A Bibliometric Analysis on Dengue Outbreaks in Tropical and Sub-Tropical Climates Worldwide Since 1950. Int J Environ Res Public Health. 2021 Mar 19;18(6):3197. doi: 10.3390/ijerph18063197. PMID: 33808795; PMCID: PMC8003706.
2. Witte P, Venturini S, Meyer H, Zeller A, Christ M. Dengue Fever—Diagnosis, Risk Stratification, and Treatment. Dtsch Arztebl Int. 2024 Nov 15;121(23):773-778. doi: 10.3238/arztebl.m2024.0175. PMID: 39297280; PMCID: PMC12036110.
3. Rodriguez Sanchez MA, Aguilar Rubio JM, Valenzuela Carvajal L, Rangel Aello F, Aispuro Valenzuela E, et al. Severe pancreatic involvement in severe dengue: simultaneous presentation of acute pancreatitis and diabetic ketoacidosis: a case report. Int J Med Case Rep. 2026;7(1):58-61.
4. Bhatt P, Sabeena SP,Varma M, Arunkumar G. Current Understanding of the Pathogenesis of Dengue Virus Infection. Curr Microbiol. 2021 Jan;78(1):17-32. doi: 10.1007/s00284-020-02284-w. Epub 2020 Nov 24. PMID: 33231723; PMCID: PMC7815537.
5. Wu KL, Changchien CS, Kuo CH, Chiu KW, Lu SN, Kuo CM, Chiu YC, Chou YP, Chuah SK. Early abdominal sonographic findings in patients with dengue fever. J Clin Ultrasound. 2004 Oct;32(8):386-8. doi: 10.1002/jcu.20060. PMID: 15372445.
6. Venkata Sai PM, Dev B, Krishnan R. Role of ultrasound in dengue fever. Br J Radiol. 2005;78(929):416-418. doi:10.1259/bjr/54704044.
7. Thulkar S, Sharma S, Srivastava DN, Sharma SK, Berry M, Pandey RM. Sonographic findings in grade III dengue hemorrhagic fever in adults. J Clin Ultrasound. 2000;28(1):34-37.
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. doi:10.4103/2156-7514.129260.

9. Motla M, Manaktala S, Gupta V, Aggarwal M, Bhoi SK, Aggarwal P, Goel A. Sonographic evidence of ascites, pleura-pericardial effusion and gallbladder wall edema for dengue fever. Prehosp Disaster Med. 2011;26(5):335-341.
10. Wu KL, Changchien CS, Kuo CH, Chiu KW, Lu SN, Kuo CM et al. Early abdominal sonographic findings in patients with dengue fever. J Clin Ultrasound. 2004;32(8):386-388. doi:10.1002/jcu.20060.
11. Adil B, Rabbani A, Ahmed S, Arshad I Sr, Khalid MA. Gall bladder wall thickening in dengue fever: aid in labelling dengue hemorrhagic fever and a marker of severity. Cureus. 2020;12(11):e11331. doi:10.7759/cureus.11331.
12. Setiawan MW, Samsi TK, Pool TN, Sugianto D, Wulur H. Gallbladder wall thickening in dengue hemorrhagic fever: an ultrasonographic study. J Clin Ultrasound. 1995;23(6):357-362. doi:10.1002/jcu.1870230605.
13. Quiroz-Moreno R, Méndez GF, Ovando-Rivera KM. Clinical utility of ultrasound in the identification of dengue hemorrhagic fever. Rev Med Inst Mex Seguro Soc. 2006 May-Jun;44(3):243-8. Spanish. PMID: 16870119.
14. Parmar J, Mohan C, Kumar GP, Vora M. Ultrasound is not useful as a screening tool for dengue fever. Pol J Radiol. 2017;82:693-700. doi:10.12659/PJR.902861.
15. Shah S, Rolfe R, Henostroza G, Seas C. Ultrasound findings of plasma leakage in dengue fever. Am J Trop Med Hyg. 2018;99(6):1362-1363. doi:10.4269/ajtmh.18-0422.