

Original Research Article

Role of ultrasonography in diagnosing dengue shock syndrome in patients presenting with symptoms of acute abdominal pain

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Received: 21 June 2025

Accepted: 14 July 2025

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ABSTRACT

Background: Dengue shock syndrome (DSS) can present with acute abdominal symptoms, often mimicking surgical emergencies such as appendicitis, particularly in pediatric patients. Early and accurate differentiation is crucial to avoid unnecessary interventions. This study aimed to evaluate the role of ultrasonography (USG) in diagnosing DSS among children presenting with acute abdominal pain.

Methods: This cross-sectional study was conducted in the Department of Radiology, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh, from November 2022 to November 2024. This study included 82 pediatric patients who tested negative for the rapid NS1 antigen test and presented with acute abdominal symptoms suggestive of appendicitis.

Results: The most common age group was 7–11 years (37.80%) and males comprised 58.54% of the study population. Abdominal pain was universally present (100%), followed by fever (95.12%) and vomiting (65.85%). DSS was confirmed in 35 patients (42.68%). Key ultrasonographic findings included free peritoneal fluid (54.88%), thickened bowel wall (52.44%), inflamed appendix (50%), collapsed IVC (42.68%) and gallbladder wall thickening (36.59%). Laboratory abnormalities such as thrombocytopenia (58.54%) and leukopenia (47.56%) were common in DSS cases. USG showed strong diagnostic performance with a sensitivity (88.6%), specificity (85.1%), PPV (81.6%) and NPV (90.9%). The overall diagnostic accuracy of USG for DSS was 86.6%.

Conclusions: Ultrasonography is a valuable, non-invasive diagnostic tool with high sensitivity and specificity in identifying dengue shock syndrome among pediatric patients presenting with acute abdominal pain. Incorporating USG into the diagnostic approach can aid in early recognition of DSS, minimize misdiagnosis and prevent unnecessary surgical interventions.

Keywords: Acute abdominal pain, Dengue shock syndrome, Diagnostic accuracy, Ultrasonography

INTRODUCTION

Dengue fever has emerged as the most common flavivirus infection globally, posing a significant public health challenge, particularly in tropical and developing regions.¹ The dengue virus, a single-stranded RNA virus

belonging to the Flaviviridae family, is primarily transmitted by the *Aedes aegypti* mosquito.² Over recent decades, the global incidence of dengue has increased markedly. According to the World Health Organization, approximately half of the world's population is now at risk of infection.³ It is estimated that 2.5 billion people worldwide live in areas where dengue is endemic. Each

year, more than 50 million cases of dengue infection are reported, with approximately 500,000 cases progressing to severe forms such as dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS), particularly affecting the pediatric population.⁴ Currently, there is no specific antiviral therapy available for the treatment of acute dengue infection.^{5,6}

Clinically, dengue illness progresses through three phases: febrile, critical and recovery. Complications typically arise during the critical and recovery phases.⁷ The disease usually begins with a sudden high-grade fever following the bite of an infected *Aedes* mosquito.⁸ There are four major dengue virus serotypes (DEN1-DEN4), each providing lifelong immunity only to the specific serotype encountered. All serotypes are transmitted between humans by *Aedes aegypti* and *Aedes albopictus* mosquitoes.¹

Dengue virus infection can range from asymptomatic cases to classical dengue fever (DF) and severe forms, including DHF and DSS. Clinical manifestations often appear within 3-4 days post-exposure and include fever, malaise, headache, myalgia, abdominal pain, nausea and vomiting.⁹

Abdominal pain is a frequently reported symptom in both DF and its severe forms, with intense abdominal pain being strongly associated with DHF.¹⁰ Such presentations may mimic a variety of surgical emergencies, including acute appendicitis, cholecystitis and pancreatitis.¹¹⁻¹³ In several cases, however, no surgical cause is identified. Therefore, prompt recognition of dengue-related features in patients with symptoms mimicking acute surgical conditions is critical to prevent unnecessary procedures, such as non-therapeutic appendectomies.

In this context, ultrasonography (USG) has gained attention as a valuable diagnostic adjunct during dengue outbreaks. As a non-invasive, widely available and cost-effective imaging modality, ultrasonography can supplement clinical and laboratory findings. Specific USG features suggestive of dengue include gallbladder wall thickening with pericholecystic fluid, pleural effusion, ascites, hepatomegaly, splenomegaly and pericardial effusion.¹⁴ Early identification of plasma leakage is crucial for improving the prognosis in DHF and DSS. Ultrasonography, with its high sensitivity in detecting early ascites, gallbladder wall edema and pleural effusion, serves as an essential tool for detecting early plasma leakage.¹⁵

Additionally, serial ultrasonographic assessments are more effective in detecting plasma leakage than conventional laboratory markers like hematocrit or albumin levels, particularly in predicting progression to DSS. Given the nonspecific nature of these symptoms and their overlap with other clinical conditions, particularly surgical emergencies, accurate and timely

diagnosis is essential to avoid unnecessary interventions and improve outcomes.

Therefore, the present study aimed to evaluate the role of ultrasonography in the diagnosis of dengue shock syndrome (DSS) in pediatric patients presenting with acute abdominal pain.

METHODS

This cross-sectional study was conducted in the Department of Radiology, Bangladesh Shishu Hospital and Institute, Dhaka, Bangladesh, from November 2022 to November 2024. In this study, a total of 82 pediatric patients aged 6 months to 16 years, who tested negative for the rapid NS1 antigen test and presented with acute abdominal symptoms suggestive of appendicitis, were included during the study period.

These were the following criteria for eligibility as study participants:

Inclusion criteria

Children aged 6 months to 16 years. Children with presentation with acute abdominal pain suspected to be surgical in origin (e.g., suspected appendicitis). Children underwent abdominal ultrasonography and routine laboratory investigations. Children who had complete clinical follow-up and laboratory workup to confirm the final diagnosis (DSS).

Exclusion criteria

Children with known chronic gastrointestinal, hepatobiliary or hematologic disorders. Children with incomplete laboratory reports or missing ultrasound/laboratory reports. Children whose parents didn't consent to participate in the study.

Data collection procedure

Informed written consent was obtained after an explanation of the study procedure. All enrolled patients underwent a comprehensive clinical assessment, including detailed history taking, physical examination and monitoring of vital signs. Ultrasound was promptly performed as an early diagnostic tool to guide clinical assessment and support timely identification of dengue-related complications. Standard laboratory investigations were performed for all patients. These included a complete blood count (CBC), with specific focus on platelet count, white blood cell counts and hematocrit levels, liver function tests (ALT and AST) and dengue serology comprising IgM antibodies where appropriate.

Ultrasonographic evaluation

Each patient also underwent abdominal ultrasonography conducted by an experienced radiologist using high-

frequency linear and convex transducers. The ultrasonographic evaluation assessed for the presence of free fluid in the peritoneal cavity, bowel wall thickening, appendiceal diameter and the diameter of the inferior vena cava (IVC) to identify collapse, an indirect marker of hypovolemia. Additional parameters evaluated included gallbladder wall thickening, hepatomegaly and pleural effusion. All ultrasonographic findings were documented in a structured proforma. A diagnosis of suspected Dengue Shock Syndrome (DSS) on USG was based on the presence of findings such as free peritoneal fluid, collapsed IVC, gallbladder wall thickening and/or pleural effusion, in conjunction with compatible clinical and laboratory features.

Diagnostic confirmation

Final diagnoses were established by integrating clinical progression, laboratory results and ultrasonographic findings. In cases of diagnostic uncertainty, further confirmation was obtained through consultation with relevant specialists.

Data analysis

All data were recorded systematically in a pre-formatted data collection form. The qualitative data were expressed as a frequency distribution and a percentage. The data were analyzed using standard diagnostic accuracy metrics. The diagnostic performance of ultrasonography for detecting DSS was evaluated in terms of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and overall diagnostic accuracy. Statistical analysis was performed by using SPSS 22 (Statistical Package for Social Sciences) for Windows version 10. This study was approved by the Ethical Review Committee of Bangladesh Shishu Hospital and Institute.

RESULTS

Table 1 presents the demographic profile of the 82 pediatric patients included in the study. The largest group of patients (37.80%) fell into the 7-11 years age range, followed by 32.93% in the 2-6 years age group. Only 10.98% were under 2 years old and 18.29% were in the 12-16 years category. Regarding gender distribution, males were predominant (58.54%), while females made up 41.46%.

Table 2 outlines the clinical symptoms presented by the study population. Abdominal pain was universally reported (100%), which was the primary symptom prompting clinical evaluation. Fever was present in 95.12% of patients, followed by nausea or vomiting in 65.85%. Hypotension and signs of shock, critical indicators for DSS, were identified in 42.68% of the patients. Additionally, a rash was observed in 10.98% of cases. Table 3 presents the ultrasonographic (USG) findings among the 82 pediatric patients who presented

with symptoms of appendicitis. Notably, free fluid in peritoneal cavity was the most frequently observed abnormality, detected in 54.88% of patients. This nonspecific finding may be associated with both intra-abdominal inflammation and plasma leakage in Dengue Shock Syndrome (DSS). A thickened bowel wall was present in 52.44% of cases, followed by an inflamed appendix was visualized in 41 patients (50%).

Importantly, collapsed inferior vena cava (IVC), a suggestive indicator of DSS, was identified in 42.68% of patients. Additional findings included gallbladder wall thickening in 36.59%, hepatomegaly (23.17%) and pleural effusion (18.29%).



Figure 1: Sonographic findings of free fluid in the peritoneal cavity of a 6 months old male.

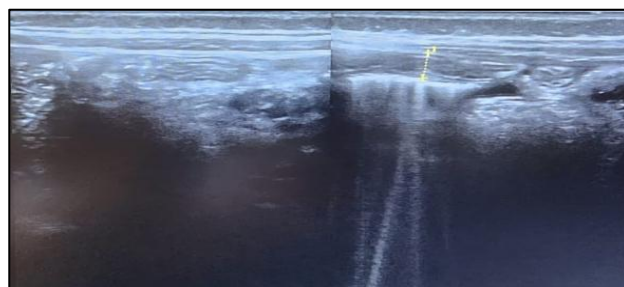


Figure 2: An inflamed appendix of a 6 months old male.

Table 4 shows that the most frequent laboratory finding was thrombocytopenia (platelet count $<100,000/\text{mm}^3$), seen in 58.54% of cases. White blood cell count $<4000/\text{mm}^3$ was found in 47.56% of the patients. Additionally, hematocrit greater than 45% was observed in 46.34% of patients. Elevated liver enzymes were also notable: ALT was elevated in 37.80% and AST in 35.37%. Furthermore, IgM dengue antibodies were detected in 39.02% of cases.

Table 5 summarizes the final diagnoses of the 82 pediatric patients after thorough evaluation using ultrasonographic and laboratory investigations. The most prevalent condition was DSS, confirmed in 35 cases (42.68%). Acute appendicitis was ultimately diagnosed in

18 patients (21.95%), followed by acute cholecystitis, which was found in 15 patients (18.29%). Acute hepatitis was diagnosed in 8 patients (9.76%) and ascites was noted in 6 cases (7.32%).

Table 6 presents the cross-tabulation of ultrasonographic findings with confirmed DSS diagnoses. Out of the 35 patients confirmed with DSS, 31 (88.6%) showed positive ultrasonographic features suggestive of DSS, while only 4 (11.4%) were USG-negative. Conversely, among the 47 patients without DSS, 40 (85.1%) had negative USG findings, while 7 (14.9%) showed false-positive features.

Table 7 shows the diagnostic accuracy metrics of ultrasonography in identifying DSS. The sensitivity of

USG was 88.6%, the specificity was 85.1%, the positive predictive value (PPV) stood at 81.6% and the negative predictive value (NPV) was 90.9%. The overall diagnostic accuracy of ultrasonography in detecting DSS was 86.6%. These findings underscore the reliability of ultrasonography as a non-invasive, rapid and effective diagnostic tool for evaluating suspected DSS in pediatric patients presenting with acute abdominal symptoms. Table 8 presents the distribution of study patients according to the type of management received. The majority of patients (42.68%) diagnosed with DSS received medical intervention and recovered from acute abdominal pain without the need for surgery. Surgical intervention alone was performed in 29 patients (35.37%), while 18 patients (21.95%) received a combination of surgical and conservative treatment.

Table 1: Demographic characteristics of the study population (n=82).

Variable	Frequency (N)	%
Age group (in years)		
<2	9	10.98
2-6	27	32.93
7-11	31	37.80
12-16	15	18.29
Gender		
Male	48	58.54
Female	34	41.46

Table 2: Clinical symptoms on presentation in study patients (n=82).

Clinical symptom	Frequency (N)	%
Abdominal pain	82	100.00
Fever	78	95.12
Nausea/vomiting	54	65.85
Rash	9	10.98
Hypotension/shock signs	35	42.68

Table 3: Ultrasonographic findings of study patients (n=82).

USG Finding	Frequency (N)	%
Free fluid in peritoneal cavity	45	54.88
Thickened bowel wall	43	52.44
Inflamed appendix	41	50.00
Collapsed IVC (suggestive of DSS)	35	42.68
Gallbladder wall thickening	30	36.59
Hepatomegaly	19	23.17
Pleural effusion	15	18.29

Table 4: Laboratory findings in study population (n=82).

Laboratory Parameter	Frequency (N)	%
Thrombocytopenia (<100,000/mm³)	48	58.54
WBC count (<4000/mm³)	39	47.56
Hematocrit (Elevated Hct >45%)	38	46.34
Elevated ALT	31	37.80
Elevated AST	29	35.37
Positive IgM dengue	32	39.02

Table 5: Final diagnosis based on ultrasonographic and laboratory findings (n=82).

Diagnosis	Frequency (N)	%
Acute appendicitis	18	21.95
Dengue Shock Syndrome (confirmed)	35	42.68
Acute cholecystitis	15	18.29
Acute hepatitis	8	9.76
Ascites	6	7.32

Table 6: Ultrasonographic accuracy in detecting dengue shock syndrome (n=82).

USG finding	DSS confirmed (n=35)	No DSS (n=47)	Total (n=82)
USG Positive for DSS	31	7	38
USG Negative for DSS	4	40	44
Total	35	47	82

Table 7: Diagnostic accuracy metrics of ultrasonography.

Metric	Value
Sensitivity	88.6%
Specificity	85.1%
Positive predictive value (PPV)	81.6%
Negative predictive value (NPV)	90.9%
Overall Accuracy	86.6%

Table 8: Distribution of study patients by management.

Management	Frequency (N)	%
Surgical intervention	29	35.37
Surgical+ conservative treatment	18	21.95
Medical treatment for DSS	35	42.68

DISCUSSION

In this study, the majority of pediatric patients presenting with dengue fever and acute abdominal pain were in the 7-11 years age group (37.80%) and males outnumbered females, accounting for 58.54% of the sample. While previous literature suggests a near 1:1 male-to-female ratio in dengue infections, studies focusing on dengue patients presenting with acute abdominal symptoms have noted a higher frequency among females.^{1,16} Consistent with our findings, a study by Islam et al, also observed a significantly higher prevalence of dengue in males (89.9%) compared to females (10%).¹⁵

Abdominal pain is a commonly reported symptom in dengue fever, with varying degrees of severity.⁹ It may be specific, localized to certain quadrants or non-specific and diffuse.¹⁷ In some cases, the pain mimics acute surgical conditions, such as appendicitis, cholecystitis or pancreatitis, potentially leading to diagnostic dilemmas and unnecessary surgical interventions.^{11,18} However, it is also notable that in many instances of severe abdominal pain, no definitive underlying cause can be identified.¹⁹ In our study, abdominal pain was a presenting complaint in all patients (100%), which is consistent with our

inclusion criteria focusing on individuals with acute abdominal presentations. Comparable findings were reported by Gupta et al, where 32.9% of patients presented with acute abdomen and by Shabbir et al, who found similar presentations in 32% of cases.^{19,20} However, a markedly lower frequency (4.15%) was observed in a Sri Lankan cohort studied by Weerakoon in 2009.²¹

Ultrasonographic findings in our study revealed that free fluid in peritoneal cavity was the most prevalent abnormality (54.88%), followed by thickened bowel wall (52.44%) and inflamed appendix (50%). Notably, collapsed IVC was found in 42.68% of patients. Additional features included gallbladder wall thickening (36.59%), hepatomegaly (23.17%) and pleural effusion (18.29%). These findings are in line with previous reports by Bashir et al, who documented ascites, pleural effusion and hepatosplenomegaly as common sonographic features among hospitalized dengue patients.⁸

Similar results were observed in studies conducted by Osam S. Abdo et al and Jitendra Parmar et al, where ultrasonographic evidence of plasma leakage, including gallbladder wall thickening, ascites, pleural effusion,

hepatomegaly and splenomegaly, was frequently reported among patients with severe dengue. These findings support the growing consensus that abdominal ultrasonography is an effective modality for early detection of plasma leakage in dengue.^{14,22}

In terms of final diagnoses, acute appendicitis was confirmed in 21.95% of our patients. However, differentiating true appendicitis from dengue-induced pseudo-appendicitis can be clinically challenging. In one illustrative case from Gupta et al, a patient presented with classic signs of appendicitis, including right iliac fossa pain and localized tenderness.²⁰ USG confirmed an inflamed appendix; however, the patient was later diagnosed with dengue fever based on thrombocytopenia and recovered with supportive care, without surgical intervention. This mirrors previous findings where dengue mimicked acute appendicitis both clinically and radiologically, yet lacked histological evidence of bacterial infection.^{13,23-25}

Acute hepatitis was diagnosed in 9.76% of our patients and has also been recognized as a common atypical manifestation in prior studies, including by Nimmagadda et al and by Gupta et al.^{26,20} Hepatomegaly, although frequently observed, does not always correlate with disease severity.²⁷ Acute cholecystitis, found in 18.29% of our cases, is believed to result from gallbladder wall edema due to plasma leakage. Although acalculous cholecystitis is relatively rare in dengue fever, it has been described in the literature.¹² The diagnosis relies on both clinical and sonographic criteria. Importantly, gallbladder wall thickening generally resolves with the natural course of the disease and does not typically require surgical intervention.²⁸⁻³¹

Acute pancreatitis, though rare, is another known complication of severe dengue. Its pathogenesis is not entirely understood but may involve direct viral invasion, ischemic injury secondary to shock or immune-mediated mechanisms.³² In this study, DSS was confirmed in 42.68% of cases and was often the underlying cause of the acute abdominal presentation. These findings align with those of Premaratna et al, who reported 12 cases of dengue mimicking appendicitis, most of whom had leukopenia and thrombocytopenia, key clues to dengue diagnosis during epidemics.³³

A recent review of 357 dengue patients revealed that 12.04% presented with acute abdominal pain with signs of peritonitis, while 10.64% had no abdominal pain.¹ The exact mechanism behind the acute abdominal pain in dengue remains unclear. Hypotheses include mesenteric lymphadenitis, serous effusions, plasma leakage and lymphocytic infiltration, all of which may lead to inflammatory changes mimicking true surgical emergencies.^{16,34} Shamim et al also highlighted that patient with abdominal pain often had complications like DHF or DSS, emphasizing the importance of recognizing these presentations to avoid unnecessary surgical

interventions.¹ Ultimately, although abdominal pain is common in dengue fever, it may also be the primary presenting symptom. Such patients may present to medical, surgical, gastroenterology or emergency departments. Failure to promptly recognize dengue-related causes of abdominal pain can lead to unnecessary surgeries, delayed treatment and increased morbidity. Therefore, ultrasonography, supported by laboratory findings (e.g., thrombocytopenia, leukopenia), is crucial in differentiating dengue-related abdominal pain from true surgical emergencies.

This single-center study was conducted at a tertiary pediatric hospital, which may limit the generalizability of the findings to other populations or healthcare settings. Additionally, the study focused only on diagnosis and recovery outcomes, without evaluating prognosis, treatment stages or treatment-related complications. There is scope for further studies with long-term follow-up to address these aspects.

CONCLUSION

This study emphasizes the significant role of ultrasonography in diagnosing Dengue Shock Syndrome (DSS) among pediatric patients presenting with acute abdominal pain, a clinical scenario that often mimics surgical emergencies such as acute appendicitis. Ultrasonographic features like collapsed IVC, free peritoneal fluid, gallbladder wall thickening and pleural effusion have proven highly suggestive of DSS and can effectively differentiate it from other abdominal pathologies.

With a sensitivity of 88.6%, specificity of 85.1% and an overall diagnostic accuracy of 86.6%, ultrasonography proved to be a highly reliable, non-invasive diagnostic modality in resource-limited, dengue-endemic settings. When used alongside laboratory markers such as thrombocytopenia, hemo-concentration and positive dengue serology, it enables clinicians to make timely and accurate diagnoses, reducing the risk of unnecessary surgical interventions and improving patient outcomes.

Recommendations

Further multi-centre studies, including adult populations, are needed to integrate ultrasonography and laboratory parameters for the early detection of DSS.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Shamim M. Frequency, pattern and management of acute abdomen in dengue fever in Karachi, Pakistan. *Asian J Surg.* 2010;33(3):107-13.

2. Joob B, Wiwanitkit V. Zika virus infection and dengue: A new problem in diagnosis in a dengue-endemic area. *Ann Trop Med Public Health.* 2015;8(4):145.
3. World Health Organization. Dengue and Severe Dengue. Geneva: WHO. 2017. Available at: <http://www.who.int/mediacentre/factsheets>. Accessed on 21 March 2025.
4. Guzman MG, Halstead SB, Artsob H, Buchy P, Farrar J, Gubler DJ, et al. Dengue: a continuing global threat. *Nat Rev Microbiol.* 2010;8(12):7-16.
5. Pothapregada S, Kamalakannan B, Thulasingham M. Clinical profile of atypical manifestations of dengue fever. *Indian J Pediatr.* 2016;83(6):493-9.
6. Tavares MdA, João GAP, Bastos MS, Gimaque JBL, Almeida ACG, Ngo TT, et al. Clinical relevance of gallbladder wall thickening for dengue severity: A cross-sectional study. *PLoS One.* 2019;14(8):218939.
7. Fernando S, Wijewickrama A, Gomes L, Punchihewa CT, Madusanka S, Dissanayake H, et al. Patterns and causes of liver involvement in acute dengue infection. *BMC Infect Dis.* 2016;16(1):1-9.
8. Bashir Z, Kamran AU, Saeed H, Nazir R, Patras S, Mehmood K, et al. Ultrasound findings in dengue fever: A single center study. *Pak J Med Health Sci.* 2022;16(4):756.
9. Murray NEA, Quam MB, Wilder-Smith A. Epidemiology of dengue: past, present and future prospects. *Clin Epidemiol.* 2013;5:299-309.
10. Casali CG, Pereira MR, Santos LM, Passos MN, Fortes Bde P, Ortiz Valencia LI, et al. The epidemic of dengue and hemorrhagic dengue fever in the city of Rio de Janeiro, 2001/2002. *Rev Soc Bras Med Trop.* 2004;37(4):296-9.
11. Shashirekha CA, Sreeramulu PN, Ravikiran HR, Katti P. Surgical presentations with abdominal pain in dengue fever. *Int Surg J.* 2016;3:754-6.
12. Kuna A, Wroczynska A, Gajewski M, Felczak-Korzybska I, Nahorski WL. A case of acalculous cholecystitis in the course of dengue fever in a traveller returned from Brazil. *Int Marit Health.* 2016;67(1):38-41.
13. McFarlane MEC, Plummer JM, Leake PA, Powell L, Chand LV, Chung S, et al. Dengue fever mimicking acute appendicitis: A case report. *Int J Surg Case Rep.* 2013;4(11):1032-4.
14. Gul H, Ahmed A, Idrees M, Rehman N, Asghar M. Sonographic findings in patients with dengue hemorrhagic fever. *Khyber J Med Sci.* 2018;11(2):250.
15. Islam M, Afsar R, Ali A, Naqvi FH. Role of ultrasound for the diagnosis of complications of dengue fever in Gujrat. *Med Sci J Adv Res.* 2022;3(3):75-80.
16. Khor BS, Liu JW, Lee IK, Yang KD. Dengue hemorrhagic fever patients with acute abdomen: clinical experience of 14 cases. *Am J Trop Med Hyg.* 2006;74(5):901-4.
17. Khanna S, Vij JC, Kumar A, Singal D, Tandon R. Etiology of abdominal pain in dengue fever. *Dengue Bull.* 2005;29:85-9.
18. Jayasundara B, Perera L, de Silva A. Dengue fever may mislead the surgeons when it presents as an acute abdomen. *Asian Pac J Trop Med.* 2017;10(1):15-9.
19. Shabbier B, Qadir H, Shafi F, Mahboob F. Acute abdominal pain in dengue fever. *Pak J Med Health Sci.* 2012;6:155-8.
20. Gupta BK, Nehara HR, Parmar S, Meena SL, Gajraj S, Gupta J. Acute abdomen presentation in dengue fever during recent outbreak. *J Acute Dis.* 2017;6(5):198-204.
21. Weerakoon KGAD, Chandrasekaram S, Jayabahu JPSNK, Gunasena S, Kularatne SAM. Acute abdominal pain in dengue hemorrhagic fever: A study in Sri Lanka, 2009. *Dengue Bull.* 2009;33:70-4.
22. Parmar JP, Mohan C, Vora M. Patterns of gall bladder wall thickening in dengue fever: a mirror of the severity of disease. *Ultrasound Int Open.* 2017;3(2):76-81.
23. Kumarasena L, Piranavan P, Bandara S, Pubudu WPG, Jayasundara B, de Silva A. A case of dengue fever with acute appendicitis: Not dengue fever mimicking appendicitis. *Sri Lanka J Surg.* 2014;32(3):33-5.
24. Nee LY, Keong BCM. Appendicular mass complicating acute appendicitis in a patient with dengue fever. *Med J Malaysia.* 2016;71(2):83-4.
25. Vagholkar K, Mirani J, Jain U. Abdominal manifestations of dengue. *J Med Sci Clin Res.* 2014;2(12):3159-62.
26. Nimmagadda SS, Mahabala C, Boloora A, Raghuram PM, Nayak AU. Atypical manifestations of dengue fever (DF) - Where do we stand today? *J Clin Diagn Res.* 2014;8(1):71-3.
27. Mourão MPG, Lacerda MVG, Bastos MS, Cláudio B, Albuquerque BC, Alecrim WD. Dengue hemorrhagic fever and acute hepatitis: A case report. *Braz J Infect Dis.* 2004;8(6):461-4.
28. Nasim A. Dengue fever presenting as acute acalculous cholecystitis. *J Coll Physicians Surg Pak.* 2009;19(8):531-3.
29. 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;32:386-8.
30. Koh FH, Misli H, Chong VH. Acute acalculous cholecystitis secondary to dengue fever. *Brunei Int Med J.* 2011;7(1):45-9.
31. Sreeramulu PN, Shashirekha CA, Pawan Katti. Incidence and management of acalculus cholecystitis in dengue fever-A retrospective study. *Int J Biol Adv Res.* 2014;5(9):422-4.
32. Durbesula AT, Usham G, Meriga RK, Venkatakrishnan T, Karnati R. A rare combination in dengue fever: Acute pancreatitis with normal

enzyme levels. *Int J Med Health Sci*. 2016;5(1):57-60.

33. Premaratna R, Bailey MS, Ratnasena BG, de Silva HJ. Dengue fever mimicking acute appendicitis. *Trans R Soc Trop Med Hyg*. 2007;101(7):683-5.
34. Wu KL, Changchien CS, Kuo CM, Chuah SK, Lu SN, Eng HL, et al. Dengue fever with acute acalculous cholecystitis. *Am J Trop Med Hyg*. 2003;68(6):657-60.

Cite this article as: Monowara M, Sadiya S, Biswas I, Ahmed A, Islam MMZ. Role of ultrasonography in diagnosing dengue shock syndrome in patients presenting with symptoms of acute abdominal pain. *Int J Contemp Pediatr* 2025;12:1330-7.