



GALLBLADDER WALL THICKENING IN DENGUE FEVER: A RADIOLOGICAL MARKER FOR DENGUE SEVERITY

Radio-Diagnosis

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ABSTRACT

Introduction: Dengue fever has become a significant public health issue due to its increasing prevalence in recent years. Gall bladder wall thickening (GBWT) is frequently observed in dengue fever cases, yet there is limited research exploring the different patterns of GBWT and their role in predicting disease severity. **Methodology and Significant Findings:** This study includes 150 patients with 80 seropositive patients at JJM Medical College Hospital, with patients showing gall bladder wall thickening. Four distinct GBWT patterns were observed: a uniform echogenic pattern, striated or tram-track pattern, asymmetric pattern, and a honeycomb pattern. The findings indicated that uniform echogenic thickening was more common in dengue fever without warning signs, while the striated/tram-track and honeycomb patterns were more associated with severe dengue fever. Serial ultrasound examinations performed every alternate day demonstrated changes in GBWT patterns, correlating with the progression of the disease. **Conclusion:** The study identified four distinct patterns of gall bladder wall thickening. The uniform echogenic pattern was more prevalent in dengue fever without warning signs, while the honeycomb pattern was primarily seen in severe dengue fever. Serial ultrasound imaging can be a useful tool for monitoring the disease's progression and predicting its severity.

KEYWORDS

Dengue fever, Dengue hemorrhagic fever, Gall bladder wall thickness, Ultrasound, Severity markers.

INTRODUCTION

Dengue fever (DF) has become a significant public health issue, with a rise in cases over recent years. The clinical presentations of DF have become more varied in recent epidemics, leading to delays in timely diagnosis and treatment. Gall bladder wall thickening (GBWT) is commonly observed in DF, and some recent studies have highlighted the importance of ultrasound in assessing patients at risk of progressing to the critical phase by measuring GBWT. While a few patterns of GBWT have been described, there is a lack of research focused on the clinical significance of these patterns in relation to the severity of DF. The literature regarding the various patterns of GBWT and their potential role in predicting disease severity is limited.

Aims and Objectives

The primary aim of this study was to investigate the patterns of GBWT in DF. The secondary aim was to evaluate the clinical significance of these GBWT patterns in predicting the severity and prognosis of DF. This study includes 150 patients and conducted with 80 seropositive dengue patients at JJM Medical College Hospital, Davangere.

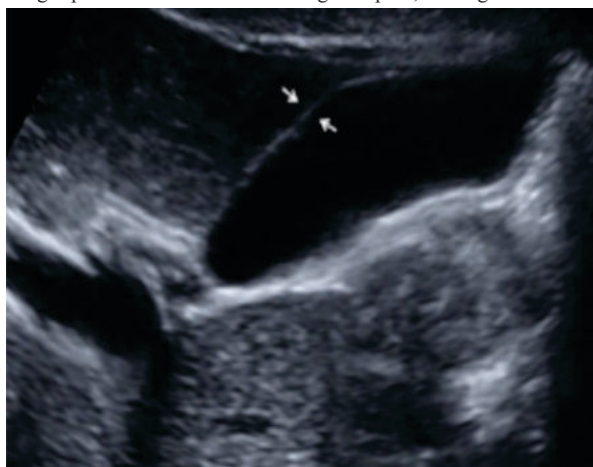


Figure 1: The thickness of the gallbladder wall is measured along the long axis of the ultrasound beam in an area where the gallbladder is contiguous with the liver.

MATERIALS AND METHODS

A total of 150 patients suspected of having Dengue Fever (DF) were

referred to the radiology department of JJM Medical College Hospital between January 2024 and June 2024 for ultrasound examination. Among them, 80 patients were confirmed as seropositive cases of DF and were included in the study.

The clinical manifestations of these patients included fever, frontal headache, retroocular pain, muscle and joint pain, nausea, vomiting, rash, leukopenia, and thrombocytopenia. The diagnosis of DF was confirmed through NS1 antigen tests or Dengue IgM/IgG antibody tests.

Abdominal ultrasound was performed using LOGIQ P10 with a 3-5 MHz curved array transducer and a wide bandwidth (4 to 12 MHz) linear probe for pediatric patients. To ensure optimal visualization of the gall bladder (GB), all patients underwent abdominal ultrasound after a fasting period of 4 hours. Ultrasound examinations were conducted by a single radiologist, with serial ultrasounds performed every alternate day until clinical improvement was noted.

Gall bladder wall thickening (GBWT) was considered significant if the thickness was ≥ 3 mm, measured between the two layers of the anterior wall using calipers. The pattern of GBWT was evaluated and correlated with the severity of the disease. The severity of the disease was categorized into three levels: DF without warning signs, DF with warning signs, and severe DF, based on the WHO's 2009 guidelines for dengue case classification.

Informed Consent

All adult participants, as well as the parents or guardians of pediatric participants, provided written informed consent for their involvement in the study.

Statistical Analysis

Type of Study: Prospective observational study

Statistical Methods: Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 17.0. Continuous variables are presented as mean $\pm$ standard deviation (SD) or as median if the data was not normally distributed. Categorical variables are expressed as frequencies and percentages.

To compare normally distributed continuous variables between groups, the Student's t-test was used. For nominal categorical data, the Chi-square test or Fisher's exact test was applied, as appropriate. A p-value of less than 0.05 was considered statistically significant for all tests.



Figure 2:Ultrasound appearance of uniform echogenic wall thickening(calipers).

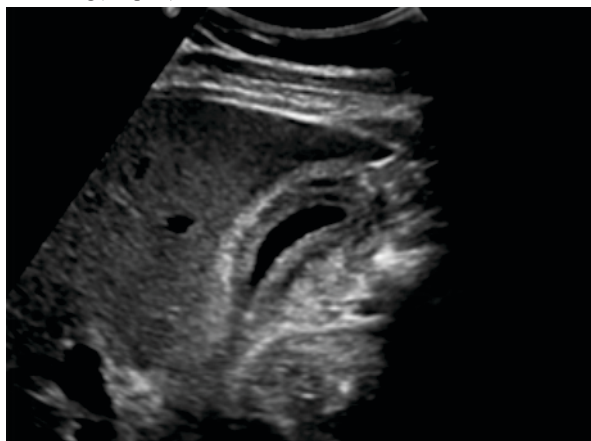


Figure 3: Ultrasound appearance of a striated pattern (multiple linear hypoechoic layers separated by parallel echogenic layers).

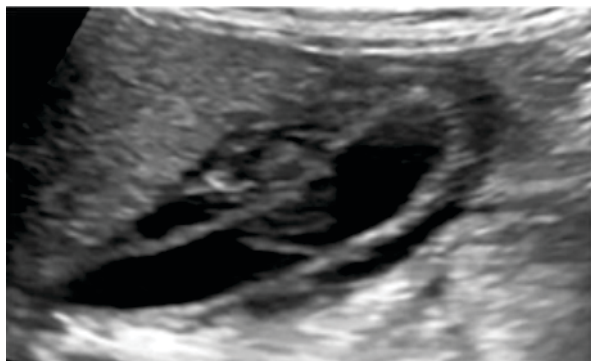


Figure 4: Ultrasound appearance of an asymmetric pattern (echogenic tissue projecting into the gall bladder lumen).

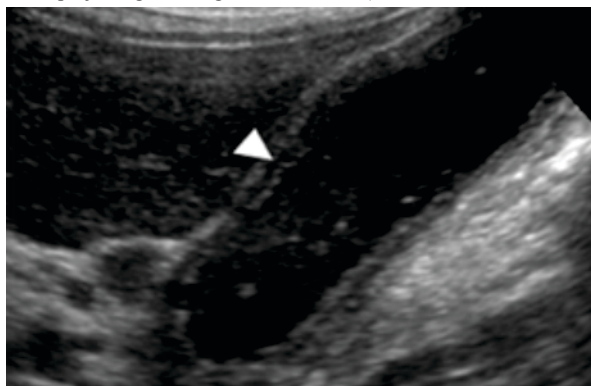


Figure 5: Ultrasound appearance of a tram track pattern (central hypoechoic zone separated by two echogenic layers).



Figure 5: Ultrasound appearance of a honeycomb pattern (multiple hypoechoic layers separated by multiple echogenic layers).Note is also made of coarse liver and ascites

OBSERVATIONS AND RESULTS

A total of 150 suspected cases of dengue fever (DF) were referred to the radiology department for ultrasound examination at JJM Hospital. Among these, 80 patients (53 males [66.25%] and 27 females [33.75%]) were serologically confirmed as positive for DF and included in the study. The mean age of the patients was 32.28 ± 15.0 years, with 19 (20.4%) pediatric patients. Out of the 80 seropositive patients, 40 (50%) were classified as having DF without warning signs, 24 (30%) had DF with warning signs, and 16 (20%) were diagnosed with severe DF.

A gall bladder wall thickness (GBWT) greater than 3 mm was considered abnormal, and GBWT was detected in 54 patients at the time of presentation. The study found a significant correlation between GBWT and the severity of DF. The mean GB wall thickness was 3.32 mm in DF without warning signs, 4.95 mm in DF with warning signs, and 8.80 mm in severe DF. Statistical analysis showed that the mean difference was significant with a p-value < 0.05 .

Four distinct patterns of GBWT were observed in the study. These were:

1. Uniform Echogenic Pattern – a smooth, uniform echogenic layer.
2. Striated or Tram Track Pattern – multiple linear hypoechoic layers separated by parallel echogenic layers.
3. Asymmetric Pattern – asymmetric echogenic tissue projecting into the gall bladder lumen.
4. Honeycombing Pattern – multiple hypoechoic layers separated by echogenic layers.

A significant statistical relationship ($p < 0.05$) was found between the patterns of GBWT and the severity of DF. The uniform echogenic pattern was most commonly found in DF without warning signs, while the honeycombing pattern was primarily associated with severe DF.

Table 1: Findings of Gall Bladder Wall Thickening Patterns in Different Dengue Categories.

Gall Bladder Wall Thickening Pattern	Dengue Fever Without Warning Signs	Dengue Fever With Warning Signs	Severe Dengue Fever
Uniform Echogenic Pattern	69.23% (28 patients)	28.20% (11 patients)	2.5% (1 patient)
Striated or Tram Track Pattern	18.18% (7 patients)	45.45% (11 patients)	36.36% (6 patients)
Asymmetric Pattern	0% (0 patients)	50% (8 patients)	50% (8 patients)
Honeycombing Pattern	0% (0 patients)	4.76% (1 patient)	95.24% (21 patients)

These findings underline the association between gall bladder wall thickening patterns and the severity of dengue fever, with the honeycombing pattern being particularly indicative of severe cases.

DISCUSSION

Dengue fever (DF) is an acute viral illness transmitted by mosquitoes and caused by one of four virus serotypes: DEN-1, DEN-2, DEN-3, and DEN-4. DF is endemic in Southeast Asia, where frequent outbreaks have been reported, leading to significant morbidity and

mortality in recent years. The illness can range from mild to severe, presenting with symptoms such as fever, headache, retroocular pain, muscle and joint pain, nausea, vomiting, and rash. In more severe cases, it can progress to hemorrhagic manifestations and shock syndrome. Laboratory findings commonly include neutropenia, lymphocytosis, elevated liver enzymes, and thrombocytopenia.

The diagnosis of DF is confirmed through serologic tests or antibody detection; however, these results may not be available promptly. Therefore, additional diagnostic tools are necessary for early detection, and ultrasound has emerged as an important tool in evaluating DF. One of the common ultrasound findings is gall bladder wall thickening (GBWT), which can vary in appearance.

In this study conducted at JJM Hospital, four distinct patterns of GBWT were observed in 80 seropositive patients diagnosed with DF. The patterns included:

1. Uniform echogenic pattern
2. Striated/tram track pattern
3. Asymmetric pattern
4. Honeycomb pattern

Previous studies, such as Oliveira GA et al., have reported these patterns, associating them with plasma leakage in severe DF. Specifically, the honeycomb pattern has been linked to dengue hemorrhagic fever (DHF). In this study, the honeycomb pattern was predominantly observed in patients with severe DF, while it was absent in those with DF without warning signs. The findings suggest that GBWT is more pronounced in severe DF, while patients with DF without warning signs exhibit normal or uniform thickening of the gall bladder wall.

Interestingly, the study also observed changes in the pattern of GBWT during the course of the disease. Clinically improving patients showed a shift from the honeycomb pattern (seen during the severe phase of DF) to a normal or uniform echogenic wall pattern by the 7th day of illness. In contrast, patients who deteriorated clinically displayed a progression from a uniform echogenic wall in the early stages of DF without warning signs to a honeycomb pattern as the disease progressed to severe DF.

The study's findings highlight the importance of ultrasound as a diagnostic and prognostic tool in DF. The patterns of GBWT, especially the honeycomb pattern, appear to correlate with disease severity and clinical progression, making ultrasound a valuable tool in monitoring patients with DF. The change in GBWT pattern during the course of illness may help in predicting the clinical course and severity of the disease.

CONCLUSION

This study identified four distinct patterns of gall bladder wall thickening (GBWT) in patients with dengue fever (DF). The normal gall bladder wall and the uniform echogenic pattern were more commonly observed in patients with DF without warning signs and those with warning signs, while the honeycomb pattern was predominantly seen in cases of severe dengue fever. These patterns represent a spectrum of GBWT, with normal or uniform echogenic thickening in mild DF and the honeycomb pattern in more severe cases. Recognizing these patterns can be valuable in assessing the severity of the disease. Additionally, any change in the pattern of GBWT on follow-up ultrasound—from a honeycomb pattern to a uniform or normal wall thickening, or vice versa—can indicate clinical improvement or worsening of the condition.

Summary

Dengue fever is a prevalent viral infection with a wide range of clinical manifestations and varying degrees of severity. Gall bladder wall thickening is a common ultrasound finding in dengue fever. This study revealed four distinct patterns of GBWT in DF patients, with the uniform echogenic pattern being more frequent in DF without warning signs and the honeycomb pattern being more common in severe cases. The study concluded that these GBWT patterns can serve as a useful diagnostic tool to gauge the severity of dengue fever. Moreover, monitoring changes in these patterns through serial ultrasounds could help predict the patient's prognosis and guide clinical decision-making.

Limitations

Patterns of GBWT cannot be studied in patients with a history of

cholecystectomy or gall blad

Conflict of Interest

The authors declare that they have no conflict of interest.

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