ORIGINAL ARTICLE

CORRELATION OF GALL BLADDER WALL THICKNESS WITH SERUM PLATELETS COUNT AND HAEMATOCRIT LEVELS IN DENGUE NS1 POSITIVE PATIENTS

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Background: Dengue fever, a mosquito-borne viral infection, is characterized by alterations in haematological parameters particularly platelet count and haematocrit levels which serve as indicators of disease severity. Among the radiological evaluations, gallbladder wall thickening is a prominent ultrasonographic finding observed in dengue patients. The objective of this study was to determine the correlation between gallbladder wall thickness and both serum platelet count and haematocrit levels in dengue NS1-positive patients. **Methods:** A total of 110 patients were enrolled in the study. They underwent clinical assessments that included measuring gallbladder wall thickness via ultrasonography performed by trained radiologists, determining serum platelet count using standard haematology analyzers, and assessing haematocrit levels with standardized laboratory techniques. These measurements were taken at consistent intervals on admission and on days 3 and 5. Additionally, an abdominal ultrasound was conducted using portable bedside equipment, and all other clinical and laboratory data were obtained from the patients' electronic records. **Results:** The mean age of the patients was 49.52±8.50 years. Gallbladder wall thickness was less than 3 mm in 50.9% of patients, between 4 and 6 mm in 46.4%, and 7 mm or more in 2.7% of patients. A significant inverse correlation was observed between gallbladder wall thickness and platelet count ($\rho = -0.861$, $p<0.001$), while a strong positive correlation was noted with haematocrit levels ($\rho = 0.873$, $p<0.001$). **Conclusion:** This study concluded that evaluating gallbladder wall thickness in conjunction with serum platelet count and haematocrit levels in dengue fever patients is crucial for predicting disease severity. This approach aids in the management and improves outcomes in dengue-prone areas.

Keywords: Gallbladder wall thickness; Serum platelets; Haematocrit; Dengue

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INTRODUCTION

Dengue fever, a viral infection transmitted by mosquitoes, presents a significant public health issue in tropical and subtropical regions globally.[1] The disease can range from a mild fever to severe forms, such as dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS).[2] Early and accurate diagnosis is vital for effective management and the prevention of complications. Gall bladder wall thickness (GBWT) has become a notable diagnostic parameter, indicating severe form of dengue through its reflection of plasma leakage and increase capillary permeability.[3] Additionally, haematological parameters like serum platelet count and haematocrit levels are critical for monitoring the progression and severity of the disease.[4]

A study conducted at the University of Oxford utilized a map-based approach to estimate the global distribution of dengue fever cases. The findings revealed that India had the highest burden, with approximately 33 million apparent cases and an additional 100 million infections occurring each year.[5] Haematocrit levels, representing the concentration of red blood cells in the blood, are another critical parameter in dengue diagnosis.[6] An elevated haematocrit indicates hemo concentration due to plasma leakage and is a criterion for diagnosing dengue haemorrhagic fever.[7]

A study demonstrated a strong correlation between increasing haematocrit levels and disease severity. Additionally, various studies have explored the individual roles of gallbladder wall thickness (GBWT), serum platelet count, and haematocrit in the diagnosis and management of dengue fever.[8] However, the interactions among these parameters have not been thoroughly investigated. Analysing their correlation could improve the accuracy of clinical evaluations and lead to better management strategies for dengue patients. In Pakistan, numerous studies have consistently identified platelet count and haematocrit levels as critical indicators of dengue severity. For example, a study reported that patients

with severe dengue showed marked thrombocytopenia and haemoconcentration compared to those with mild or moderate forms of the disease. Gallbladder wall thickening (GBWT) has also emerged as a relevant ultrasonographic marker in dengue patients. This study aims to bridge existing knowledge gaps by examining the relationships among these key parameters in dengue NS1-positive patients, thereby enhancing the understanding of dengue diagnostics and patient management[8]. Objective of the study was to determine the correlation of gall bladder wall thickness with serum platelets count and haematocrit in dengue NSI positive patients.

MATERIAL AND METHODS

This study was conducted in the Department of Diagnostic Radiology at the Pakistan Institute of Medical Sciences, Islamabad, after obtaining approval from the hospital's ethical committee. A total of 110 patients meeting the inclusion criteria were enrolled using a consecutive sampling technique. Each patient underwent a comprehensive clinical assessment, which included measurement of gallbladder wall thickness via ultrasonography performed by trained radiologists, determination of serum platelet count using standard haematology analyzers, and assessment of haematocrit levels through standard laboratory methods. These parameters were recorded at consistent intervals on the day of admission, and subsequently on days 3 and 5. Data were analyzed using SPSS version 26.

This study was designed as a cross-sectional investigation utilizing non-probability sampling techniques. It was conducted at the Department of Diagnostic Radiology at the Pakistan Institute of Medical Science, Islamabad, over a period of six months from March 2023 to August 2024. The study included patients who were diagnosed with dengue fever and confirmed positive for the NS1 antigen, with both male and female participants aged between 18 and 65 years. Participants were excluded if they had other viral infections such as hepatitis, influenza, or HIV; bacterial infections like typhoid fever or sepsis; pre-existing haematological disorders (including leukaemia, lymphoma, or myelodysplastic syndromes); chronic liver diseases; or if they were pregnant.

RESULTS

Out of the total patients, 68 (61.8%) were male and 42 (38.2%) were female. The age distribution was as follows: 18 patients (16.4%) were between 18–40 years, 28 patients (25.5%) were between 41–50 years, 62 patients (56.4%) were between 51–60 years, and 2 patients (1.8%) were above 60 years of age. Regarding residence, 68 patients (60.0%) were from urban areas, while 44 patients (40.0%) lived in rural areas.

Gallbladder wall thickness (GBWT) measurements showed that 56 patients (50.9%) had a thickness of less than 3 mm, 51 patients (46.4%) had a thickness between 4–6 mm, and 3 patients (2.7%) had a thickness of 7 mm or more. Spearman's rho correlation analysis demonstrated a significant inverse correlation between GBWT and platelet count ($\rho = -0.861$, $p<0.001$). Additionally, a strong positive correlation was found between GBWT and haematocrit levels ($\rho = 0.873$, $p<0.001$).

Table-1: Characteristics of all the enrolled patients (n=27)

Gender	Frequency	Percentage
Male	68	61.8
Female	42	38.2
Age groups		
18-40 years	18	16.4
41-50 years	28	25.5
51-60 years	62	56.4
>60 years	2	1.8
Gall bladder Thickness		
<3 mm	56	50.9
4-6 mm	51	46.4
≥7 mm	3	2.7

Table-2: Correlation of Gall Bladder Wall Thickness with platelets and hematocrit

Platelets	ρ	-0.861
	p-value	0.000
Haematocrit	P	0.873
	p-value	0.000

(ρ): Correlation Coefficient

DISCUSSION

Dengue is indeed a vector-borne disease caused by the dengue virus, which is transmitted primarily by Aedes mosquitoes, particularly Aedes aegypti and Aedes albopictus.[9] It has become a significant global health problem, leading to recurrent epidemics. Dengue is widespread in more than 100 countries, with a significant presence in Southeast Asia, the Western Pacific, the Americas, Africa, and the Eastern Mediterranean.[10] The World Health Organization (WHO) estimates that there are 50–100 million dengue infections each year globally, resulting in about 500,000 severe cases (dengue hemorrhagic fever) that require hospitalization and cause approximately 20,000 deaths, mainly affecting children.

Our study findings provide critical insights into the relationship between gall bladder wall thickness and two key haematological parameters platelet count and haematocrit levels in Dengue NS1 positive patients. Our study finds a significant

inverse correlation between gall bladder wall thickness and platelet count, with a correlation coefficient (ρ) of -0.861 and a *p*-value of 0.000. This indicates that as gall bladder wall thickness increases, platelet count significantly decreases. This relationship is crucial in the context of dengue fever, where thrombocytopenia (low platelet count) is a common and serious complication. The inverse declining platelet levels potentially preceding severe thrombocytopenia and its associated risks. Similar findings have been noted in the study of Kabra *et al*[11], which emphasize the importance of early detection in managing severe dengue complications. Monitoring gall bladder wall thickness could thus offer a non-invasive method to anticipate and address platelet count drops, improving patient care and intervention strategies, as also supported by research by Setiawan *et al*.[12] In severe dengue cases, monitoring gall bladder wall thickness could provide a non-invasive method to predict and manage drops in platelet count, thereby enhancing patient care and intervention strategies. Conversely, a strong positive correlation was found between gall bladder wall thickness and haematocrit levels, with a correlation coefficient (ρ) of 0.873 and a *p*-value of 0.000.

This positive correlation indicates that as gall bladder wall thickness increases, haematocrit levels also rise significantly. Haematocrit measures the proportion of red blood cells in the blood, and elevated levels often signify hemo concentration, which can result from plasma leakage in severe dengue infections. This relationship suggests that gallbladder wall thickness may act as a marker for hemo concentration and plasma leakage critical factors in the progression of severe dengue, including dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS). Similar observations have been reported by Kabra *et al*.[11], highlighting the utility of gall bladder wall thickness as an indicator of hemo concentration, and by Setiawan et al. reinforcing its role in identifying severe dengue complications.[12] Several other studies also supported our study findings [13-15]. Another study by Sanjay Singh found a statistically significant association between gallbladder thickness and packed cell volume (PCV).[16] The study indicates that using ultrasound to monitor gallbladder wall thickness can be an effective, non-invasive method for evaluating the severity of dengue fever.

This approach offers additional insight into the patient's haematological condition, complementing traditional tests like platelet count and haematocrit levels. Assessing gallbladder wall thickness along with these blood parameters can improve the accuracy of predicting complications such as dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS), leading to better clinical outcomes through early intervention. Therefore, the study advocates for including gallbladder wall thickness measurements in routine ultrasound evaluations for dengue patients, especially those with suspected severe cases, to facilitate early detection and management of potential complications.

CONCLUSION

We concluded that gallbladder wall thickness and haematocrit values are crucial for assessing the severity of dengue fever. This study emphasizes the importance of gallbladder wall thickness in the clinical evaluation of dengue. By correlating this measurement which is non- invasive method with serum platelet count and haematocrit levels, healthcare providers can gain a more comprehensive understanding of the patient's condition, leading to improved management strategies and potentially better outcomes in dengue-endemic areas.

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AUTHORS' CONTRIBUTION

SM, HA, AN: Concept, literature search, write-up. AQ, SH: Data collection, analysis, interpretation, proof reading.

REFERENCES

1. Dehghani R, Kassiri H. A review on epidemiology of dengue viral infection as an emerging disease. Research Journal of Pharmacy and Technology. 2021;14(4):2296-301.
2. Halstead SB. Dengue hemorrhagic fever. CRC Handbook of Viral and Rickettsial Hemorrhagic Fevers: CRC Press; 2019. p. 85-94.
3. Abhijit N. Comparative Study of Ultrasonographic Findings with Clinico Lab Findings in Dengue Fever: Rajiv Gandhi University of Health Sciences (India); 2020.
4. Rai DA, Azad DS, Nautiyal DS, Acharya DS. Correlation between hematological and serological parameters in dengue patients-an analysis of 2022 cases. Trop J Pathol Microbiol. 2019;5(8):547-54.
5. Bhatt S, Gething PW, Brady OJ, Messina JP, Farlow AW, Moyes CL, et al. The global distribution and burden of dengue. Nature. 2013;496(7446):504-7.
6. Jayadas T, Kumanan T, Arasaratnam V, Gajapathy K, Surendran SN. The clinical profile, hematological parameters and liver transaminases of dengue NS1 Ag positive patients admitted to Jaffna Teaching Hospital, Sri Lanka. BMC research notes. 2019;12:1-5.
7. BalasubramanianS,JanakiramanL,Kumar SS,MuralinathS,ShivbalanS.Areappraisalofthe criteria to diagnose plasma leakage in dengue hemorrhagic fever. Indian pediatrics. 2006;43(4):334.
8. Thomas SJ, Endy TP. Critical issues in dengue vaccine development. Current opinion in infectious diseases. 2011;24(5):442-50.
9. MuktarY,TameratN,ShewaferaA.Aedes aegypti as a Vector of

Flavivirus. J Trop Dis. 2016;4(223):2.
10. Guzman A, Istúriz RE. Update on the global spread of dengue. International journal of antimicrobial agents. 2010;36:S40-S2.
11. Kabra S, Jain Y, Pandey R, Singhal T, Tripathi P, Broor S, et al. Dengue haemorrhagic fever in children in the 1996 Delhi epidemic. Transactions of the royal society of tropical medicine and Hygiene. 1999;93(3):294-8.
12. Setiawan MW, Samsi TK, Wulur H, Sugianto D, Pool TN. Epigastric pain and sonographic assessment of the pancreas in dengue hemorrhagic fever. Journal of clinical ultrasound. 1998;26(5):257-9.
13. Khanam M, Ferdoucy SA, Rahat F, Iman K, Hossain RMM, Chowdhury AM. Gallbladder Wall Thickening for Early Detection of Plasma Leakage Among Children with Dengue Fever Admitted in a Tertiary Care Hospital. Bangladesh Journal of Child Health. 2022;46(3):138-43.
14. Moras EC, Raj N, Achappa B, Holla R, Madi D, Mahalingam S. Hyperferritinemia and Gallbladder Wall Oedema as Early Markers of a Severe Dengue Infection in a Developing Nation. 2020.
15. RasoolFK,RasoolAK,Meraj L,BashirF. Ultrasound As An Aid To Diagnosis In Dengue. Journal of Rawalpindi Medical College. 2023;27(1).
16. Singh S, Saxena G, Singh D, Gupta D, ShoaibM,Neelam.Associationofgallbladderwall thickening and haematocrit values with severityin patients of dengue fever. 2022.

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