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Analysis of the Relationship between the Severity of Dengue Fever and the Thickness of the Gallbladder Wall in a Tertiary Care Hospital, Kerala

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ABSTRACT
Background: This study investigated the correlation between gallbladder wall thickness and dengue fever severity to enable early prediction of fatal outcomes and facilitate timely interventions to mitigate severe consequences.
Methods: This prospective observational study was conducted at Amala Institute of Medical Sciences, a tertiary-care hospital, Thrissur, Kerala, India, from October 2023 to November 2024. The study included patients aged >18 who presented with dengue clinical features and received serological confirmation.
Results: Most dengue cases without warning signs (55.7%) were in the 50–60 age range. Gall bladder walls were thicker than 5 mm in most severe dengue cases (64.3%). It was discovered that there was a highly significant association between dengue severity and gall bladder wall thickness, meaning that the more severe the dengue, the thicker the gall bladder.
Conclusions: This study concludes that ultrasonographic measurement of gallbladder wall thickness (GBWT) offers a valuable tool for early predicting patients' dengue hemorrhagic fever (DHF) severity. We recommend the inclusion of GBWT (Gallbladder wall thickness) as an admission criterion during DHF epidemics.

Key-words: Dengue fever, Dengue shock syndrome, Gallbladder wall thickness, Outcome, Severity

INTRODUCTION

Dengue fever, a mosquito-borne viral illness, has become a significant global health concern, affecting millions worldwide. The disease's severity spectrum ranges from mild febrile illness to life-threatening complications, including dengue shock syndrome (DSS) [1,2].

DSS, characterized by severe plasma leakage, hemorrhaging, and organ impairment, accounts for substantial morbidity and mortality, particularly in tropical and subtropical regions. As the world grapples with the escalating burden of dengue, elucidating the complex interplay between the virus, host, and environment has become imperative. This knowledge gap underscores the need for comprehensive research to unravel the pathophysiological mechanisms underlying DSS [3,4].

A study is proposed to investigate the correlation between gallbladder wall thickness and dengue fever severity. Dengue fever outbreaks have been recorded globally across tropical, subtropical, and temperate zones for the past three centuries. DHF is a leading cause of mortality and severe illness in Asian countries. The mortality rate may reach 5%, with DHF fatalities exceeding 20% in some instances [5-10].

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MATERIALS AND METHODS

This prospective observational study was conducted at Amala Institute of Medical Sciences, a tertiary care hospital in Thrissur, Kerala, India, from October 2023 to November 2024.

Study Population- Adult participants (≥18 years) with serologically confirmed dengue fever and associated clinical manifestations were included in the study.

Exclusion criteria- Patients with other inflammatory conditions were excluded.

Inclusion Criteria- Adult participants aged more than 18 yrs with serologically confirmed dengue fever and associated clinical manifestations were included in the study.

Clinical Assessment
- ❖ A comprehensive clinical assessment was performed, including:
- ❖ Detailed medical history to identify symptoms
- ❖ Documentation of vital signs and physical examination findings (general and systemic) upon admission

Laboratory analyses, comprising
- ❖ Hematocrit
- ❖ Daily platelet counts
- ❖ Abdominal ultrasonography for gallbladder wall edema
- ❖ Other relevant parameters

Statistical Analysis- Data for this study were managed using Microsoft Excel for organization and descriptive statistics, while SPSS 25 was used for analyses. Categorical variables were described using proportions and percentages, and associations were assessed with Chi-square tests. ANOVA compared means across groups, and t-tests analyzed pairwise differences. Statistical significance was set at $p<0.05$.

**Ethics and Consent-** All subjects gave informed consent, and the Institutional Ethics Committee approved the study.

RESULTS

In a cohort of 280 patients, males (n=156) constituted a larger proportion than females (n=124), exhibiting a male-to-female ratio of 1.2:1 (Fig. 1). The 50–60-year age group was the most prevalent, including 100 cases, followed by the 40–50-year age group (80 cases) and the 18–30-year age group (50 cases), (Table 1). 30-40-year group with 30 cases,60-70 years with 15 cases and 70-90 years with 5 cases.

Table 1: Age-wise distribution

Age groups	No. of cases	Percentage (%)
18-30	50	17.85
30-40	30	10.71
40-50	80	28.57
50-60	100	35.7
60-70	15	5.35
70-90	05	1.78
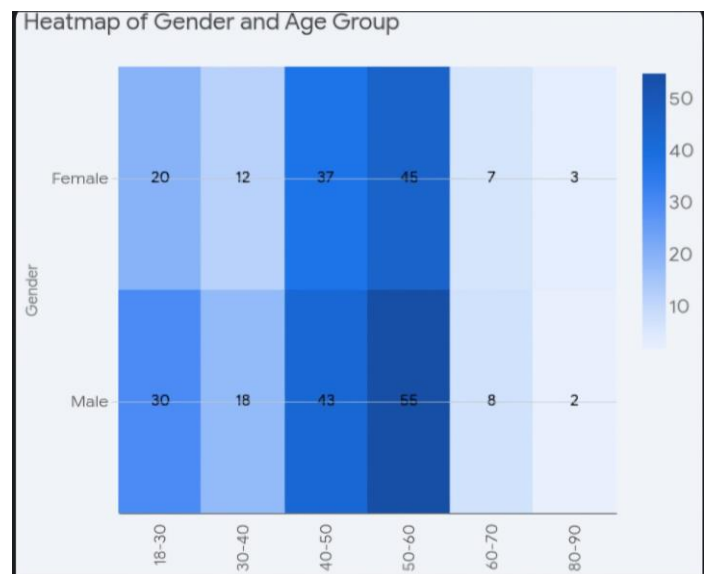
Fig. 1: Heatmap of gender and age group

Comparative analysis of dengue cases based on WHO classification (Table 2) reveals that the most significant proportion (55.6%) exhibited no warning signs. This was followed by 24.2% of cases presenting warning signs and 20% classified as severe dengue.

The most prevalent clinical features observed in this study were fever (92%), myalgia/arthralgia (60.55%), conjunctival congestion (60%), retro-orbital pain (54%), exanthem/rash (40%), and abdominal pain (30.8%). Additional findings included melena (12.2% and persistent vomiting (35%). Petechiae were present in

27.9% of cases, with mucosal bleeding observed in 23.2%.

This study reveals that platelet counts on admission ranged from 80,000 to 100,000/cumm, with a mean of 80,900.4±24,198.7 (SD)/cumm. By day three, the mean decreased to 56,705.3±19,501.8 (SD)/cumm; by day six, it increased to 111,982.8±31,673 (SD)/cumm.

Table 2: Classification of dengue cases as per WHO

Type	No. of Cases	Percentage
Dengue fever without warning signs	156	55.6
Dengue fever with warning signs	68	24.2
Severe dengue	56	20

Gallbladder wall thickness measurements revealed that 40% of cases exhibited a thickness between 1.0 and 2.0 mm, while 25.7% showed a thickness between 2.1 and 3.0 mm. Eighteen cases presented with gallbladder wall thickness exceeding 5.0 mm. Regarding severity correlation, among 28 severe dengue cases, 18 (64.3%) exhibited gallbladder wall thickness greater than 5.0 mm; only one case each of dengue fever with warning signs and dengue fever without warning signs showed a thickness exceeding this threshold (Table 3). There was a statistically significant correlation between dengue severity and gallbladder wall thickness (p<0.000001), meaning that the more severe the dengue, the thicker the gallbladder wall.

Table 3: Association between severity of dengue and gallbladder thickness

Severity of dengue	Gallbladder thickness <5mm	Gallbladder thickness >5mm	
Dengue fever without warning signs	154	2	156
Dengue fever with warning signs	66	2	68

Severe dengue	20	36	56
Total	240	40	280

The study reveals that 92.1% of patients were discharged satisfactorily, highlighting positive outcomes for most cases. However, there were 11 recorded mortalities, underscoring the potential risks and complexities associated with the treatment. These findings emphasize the importance of identifying factors that could further improve patient outcomes and reduce mortality rates (Table 4).

Table 4: Outcomes for most cases

Outcome	No. of cases	Percentage
Discharged	258	92%
Death	22	8%

A substantial percentage (63.6%) of these mortalities demonstrated gallbladder wall thickness exceeding 5 mm, compared to only 10% of discharged patients. Statistical analysis revealed a highly significant correlation (p=0.000001) between patient outcome and gallbladder wall thickness (Table 5).

Table 5: Association between outcome and GB wall thickness.

Outcome	GB thickness< 5mm	GB thickness >5mm	Total
Discharged	232	26	258
Death	08	14	22
Total	240	40	280

DISCUSSION

Dengue fever constitutes a significant global health concern, particularly prevalent in tropical and subtropical regions. This study investigates the correlation between gallbladder wall thickness and dengue fever severity observed in Amala Institute of Medical Sciences, Thrissur, India. A total of 280 cases were analysed. The most frequently affected age groups were (Age Group 1)

50-60 years, followed by (Age Group 2) 40-50 years. Our findings indicate a male predominance among affected individuals.

Potential factors contributing to the male predominance include increased occupational outdoor exposure, a higher likelihood of mosquito bites, and the protective effect of women's clothing.

Consistent findings were reported by Selvan *et al*. [5]; Singh *et al*. [6]; and Jain [7] study comprised 28 severe dengue cases, 34 cases with warning signs, and 78 cases without warning signs, mirroring the study by Parmar *et al*. [8]. The most prevalent clinical features observed were fever with conjunctival congestion (99%), myalgia (60.3%), arthralgia (64.15%), retro-orbital pain (54.7%), exanthem/rash (43.3%), abdominal pain (35.8%), melena (13.2%), and persistent vomiting (27%). These findings align with those reported by Mogra *et al*. [9]. Petechiae were present in a significant proportion (17.9%) of cases, followed by melena (13.2%), consistent with observations by Lim *et al*. [10]. Gallbladder wall edema was present in all 140 cases. Gallbladder wall thickness measurements revealed that 18 of the 28 severe dengue cases exhibited thickness exceeding 5 mm.

Two patients presented with gallbladder wall thickness exceeding 5 mm; one also had dengue fever with warning signs, while the other did not. This suggests a positive correlation between dengue fever severity and gallbladder wall thickness. This aligns with the findings of Colbert *et al*. [11] and Parmar *et al*. [8]. Their study reported mean gallbladder wall thicknesses of 3.32 mm in dengue fever without warning signs, 4.95 mm in dengue fever with warning signs, and 8.80 mm in severe dengue fever. A significant correlation exists between gallbladder wall thickness and disease severity.

Setiawan *et al*. [12] study demonstrated a positive association between gallbladder wall thickening and disease severity. Their conclusion suggests this finding may aid in identifying patients at increased risk of progressing to shock. Gallbladder wall thickness and mortality in dengue patients. Regarding outcomes and gallbladder thickness, 7 of the 11(63.6%) fatal cases exhibited gallbladder wall thickness exceeding 5 mm, indicating a potential association between increased gallbladder wall thickness and mortality [13].

CONCLUSIONS

In conclusion, our study recommends routine gallbladder wall thickness measurement for all dengue patients to aid in severity prediction. Dengue typically presents as a self-limiting illness of short duration. Effective diagnostic confirmation, prompt therapeutic intervention, public education, and vector control are crucial considerations for developing comprehensive dengue prevention and management policies. Reliable early predictors of dengue infection severity require further investigation. This study demonstrates a significant correlation between gallbladder wall thickness and dengue fever.

CONTRIBUTION OF AUTHORS

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