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Original Research Article

A STUDY OF SPECTRUM OF HEPATIC DYSFUNCTION AND ULTRASONOGRAPHIC FINDINGS IN CHILDREN WITH DENGUE FEVER

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Abstract

Background: The dengue epidemic is causing an increase in hepatic dysfunction, potentially misdiagnosed as viral or enteric hepatitis, necessitating early diagnosis and ultrasonographic findings to prevent morbidity and mortality. This study investigates hepatic abnormalities and ultrasonographic findings in dengue fever, hemorrhagic fever, and dengue shock syndrome, examining their correlation with disease severity. **Materials and Methods:** 80 hospitalized Dengue fever patients were categorized as Dengue Fever, Dengue Haemorrhagic Fever and Dengue Shock Syndrome based on clinical symptoms, monitored in the lab, and underwent abdominal and thorax ultrasonography. **Result:** The study found significant differences in SGOT and SGPT in DSS compared to DHF, increased total serum bilirubin, increased coagulation profiles, and significant ultrasound findings in DSS. **Conclusion:** Using hepatic and ultrasound indicators, treating severe dengue can improve management and reduce mortality and morbidity by detecting clinical deterioration early.

INTRODUCTION

Dengue virus infection is a significant public health issue in South East Asia and over 100 tropical and subtropical regions.[1,2] From 2000 to 2019, global cases surged from 500,000 to 5.2 million.

After a slight decline of cases between the year 2020-2022 due to the COVID-19 pandemic and lower reporting rate, in 2023, over five million cases and 5000 deaths were reported in 80 countries and five WHO regions. India experiences 33 million clinically apparent dengue cases annually, a third of the global dengue burden.[3,4]

Dengue is caused by four distinct virus serotypes (DEN 1, DEN 2, DEN 3 and DEN 4), spreads due to population growth, urban overpopulation, inadequate public health systems, poor vector control, and increased international travel.[5]

Dengue viral infections have a diverse clinical spectrum, ranging from asymptomatic to fatal, and are classified into DF/DHF/DSS (Based on WHO 2014 guidelines), with unusual manifestations becoming more common such as encephalitis, Gullian Barre syndrome, haemolytic uremic syndrome, dengue hepatitis, myocarditis, acute respiratory distress syndrome.[6-9]

Dengue infection causes liver injury in children, ranging from mild to severe, with severity varying based on clinical presentation and more common in patients with complicated dengue.10-13 Complicated dengue may cause prolonged shock, metabolic acidosis, and DIC, leading to hypoxia or ischemia, resulting in severe hepatic dysfunction compared to classical dengue.[10-15]

The dengue epidemic in India is causing an increase in hepatic dysfunction, potentially misdiagnosed as viral or enteric hepatitis, necessitating early diagnosis and ultrasonographic findings to prevent morbidity and mortality.[16-20] This study aims to investigate hepatic dysfunction and ultrasonographic findings in children with dengue infection, as few studies have reported on this topic.

Aims & Objectives

1. To investigate the hepatic dysfunction and ultrasonographic findings in children who have been infected with dengue.
2. To determine the correlation between these findings and the severity of dengue fever.

MATERIALS AND METHODS

Methodology

Setting and study design: A hospital based observative prospective study

Study size: 80 children

Participants: Children between the age group of 2 months to 18 yrs admitted in the pediatric department at Teerthankar Mahaveer Institute of medical sciences and research, Moradabad, in period of July 2019- June 2020 with acute onset fever were included by simple random sampling.

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Data source: For data entry, questionnaire was used, where all the symptoms and lab investigations were entered and checked by the investigators.

Inclusion Criteria

Children who were Dengue NS1 and/or IgM positive only were included in the study.

Exclusion Criteria

Children with other diseases like enteric fever, rickettsial fever, malaria, leptospirosis, septicaemia and other viral hemorrhagic fevers.

Ethical consideration and permission: Ethical committee clearance was taken prior to study. Consent from parents / caretakers of the patients was obtained during the study.

Statistical methods: The results were analyzed using standard normal test and student t- test

Variables: Quantitative variables: Liver enzymes (SGOT& SGPT), prothrombin time (PT), activated partial thromboplastin time (APTT), international normalized ratio (INR), total protein, albumin, globulin, serum bilirubin, alkaline phosphatase, USG abdomen findings ascites, pleural effusion, hepatosplenomegaly and gall bladder thickening.

Qualitative variables: Fever, nausea, pain abdomen, hepatomegaly, splenomegaly, bleeding, pleural effusion, shock, jaundice, encephalopathy.

After clinical assessment, the patients were classified as DF/DHF/DSS. Lab investigations included CBC, WBC count, platelet count, hematocrit, SGOT, SGPT, PT, APTT and INR were monitored. Monitoring of hepatic and ultrasonographic parameters were done. Cut off value of prolonged activated partial thromboplastin time (APTT) was 38 second, elevated serum aminotransferase levels (aspartate aminotransferase (AST) or alanine aminotransferase (ALT) were>40 U/L).Liver enzymes and ultrasonographic parameters in DF/DHF/DSS were compared in the study.

RESULTS

Out of 80 patients, 55% were male and 45% female, with a male-to-female ratio of 1.2:1. The majority (41.5%) were aged 6-10 years.

The study found significant increases in mean SGOT and SGPT in DSS, increased total serum bilirubin, and increased coagulation profiles in all three groups.

Table 1: SGOT, SGPT levels in Dengue fever.

	DF(N=10)	DHF(N=51)	DSS(N=19)	P-value (DHF vs DSS)
	Mean±SD	Mean±SD	Mean±SD	
SGOT(U/L)	278.30±170.51	268.41±427.57	659.63±855.03	0.024*
SGPT (U/L)	149.00±69.10	173.57±278.12	524.79±899.53	0.025*

The mean SGOT/SGPT in DHF was 268.4 and 173.5 and in DSS was 659.6 and 524.7 with was statistically significant.

Table 2: Prothrombin time/INR, Activated partial thromboplastin time in dengue

	DF(N=10)	DHF(N=51)	DSS(N=19)	P-value (DHF vs DSS)
	Mean±SD	Mean±SD	Mean±SD	
APTT(seconds)	26.7±4.1	34.5±5.7	39.9±6.2	0.041*
PT/INR	1.15±0.19	1.13±0.15	1.28±0.37	0.035*

The values of PT/INR/APTT was progressively more in 3 groups.

Table 3: Protein, bilirubin and alkaline phosphatase abnormalities in dengue

	DF(N=10)	DHF(N=51)	DSS(N=19)	P-value (DHF vs DSS)
	Mean±SD	Mean±SD	Mean±SD	
Total protein(gm/dl)	6.23±0.25	6.25±0.34	6.03±0.46	0.069
Albumin(gm/dl)	3.18±0.19	3.32±0.35	3.09±0.47	0.052
Bilirubin(mg/dl)	0.91±0.29	1.16±0.94	1.77±1.79	0.127
Alkaline phosphatase (IU/L)	298.30± 172.10	206.78±122.99	396.53±314.33	0.062

Total protein, albumin, bilirubin, and alkaline phosphatase levels in all the 3 groups were not statistically significant.

Table 4: Ultrasonographic abnormalities in dengue fever

	DF(N=10)	DHF(N=51)	DSS(N=19)	P-value (DHF vs DSS)
	N (%)	N (%)	N (%)	
Ascites	0(0)	14(27.45)	14(73.68)	0.00008*
Hepatomegaly	4(40)	31(60.78)	12(63.16)	0.430
Splenomegaly	0(0)	7(13.7)	5(26.3)	0.154
Pleural effusion	0(0)	12(23.53)	12(63.16)	0.00009*
GB thickening	0(0)	17(33.33)	18(94.74)	0.00006*

*P<0.05 is statistically significant

Ascites, pleural effusion and gall bladder thickening findings in ultrasound were statistically significant in DSS when compared to DHF.

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DISCUSSION

Dengue is a global public health concern, causing symptoms through complex immune mechanisms, T-cell mediated antibodies, complement, and soluble mediators. These targets vascular endothelium, platelets, and organs, leading to haemorrhage and shock.[7]

The study found a high burden of acute dengue fever in low-middle income urban areas in Moradabad, particularly among children aged 5-10 years. All children recovered without major complications or death. Acute dengue fever episodes were higher in August to December, with more recorded in 2019 than 2020. The findings correlated with a cohort study by Sinha B et al.[21]

Dengue infection causes liver parenchyma involvement, releasing markers into the blood. In the acute phase, aminotransferase (AST) levels increase, which decrease as the liver recovers.[22] AST levels are usually higher than ALT, but return to normal levels after follow-up. Studies show that AST is more markedly raised than ALT in children with acute dengue infection.[17,18,23-25] The mechanism behind this is not clearly described, but it has been hypothesized that AST comes from sources other than the liver, such as the heart, erythrocytes, and striated muscle, while ALT is hepatic in origin. The release of AST from damaged myocytes could also explain the higher elevation of AST than ALT in children with acute dengue infection.[26]

A study in Delhi found that liver enzyme levels reached a peak during the second week and declined towards normal in the third week.[27] Serum ALP levels also showed a similar trend, even without hepatomegaly. Children with DSS and DHF had elevated enzymes, with mean values significantly higher than those with DF.[27] In our study, Alkaline phosphatase levels were also raised in the DHF and DSS groups, but the trend was not established due to lack of follow-up.

Our study found that APTT was 34.5/39.9 in DHF/DSS, and PT/INR was significantly higher in DSS compared to DHF, a finding consistent with Nguyen RN et al.[17] This suggests that PT/INR can be used as a potential marker for monitoring severity, in addition to APTT.[28] The study also found similar total protein, albumin, and bilirubin values in DHF and DSS groups, with hyperbilirubinemia and S. albumin being statistically significant in both groups, as per Nguyen RN et al.[17]

Ultrasonography is a safe and cost-effective imaging method that can detect early signs of plasma leakage, such as pleural effusion, up to two days before defervescence. Sonographic findings show an increase in capillary permeability, cavitary effusion, and gallbladder wall thickening in one-third of mild DHF patients and 95% of severe cases. Fluid in the perirenal space can also be visualized, and splenomegaly, hepatomegaly, and pancreatic volumetric increase may also be observed.[24] A study on 120 cases found gallbladder wall thickness (83.3%) and pericholecystic edema (81.6%) as the most common sonographical findings.[21]

Significant differences were noted in variables such as ascites, pleural effusion, and perinephric edema between mild and severe groups.

Strengths of the study: Some of the previous studies are retrospective and focused on seronegative dengue cases, while our study focused on serologically confirmed children of dengue infection. In tropical countries, liver damage can occur from malaria, enteric fever, and viral hepatitis, so we carefully excluded these common disorders.

Limitations: The diagnosis of liver disease in children was not confirmed through a liver biopsy due to humanitarian reasons.

CONCLUSION

Dengue is increasing in India, affecting both rural and urban areas, making it crucial to diagnose alongside common post-monsoon infections like enteric fever, malaria, scrub typhus, and viral hepatitis.

Recent reports show varying degrees of hepatic involvement and ultrasonographic findings in dengue infections, leading to an increase in cases of fulminant and acute hepatic failure. Clinicians must identify these issues early to prevent life-threatening complications and reduce mortality and morbidity due to dengue infections, as most damage is transient and reversible.

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