# Role of Sonography in the Assessment of Severity and its' Correlation with Platelet Count of Dengue Fever in Children

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**Abstract**

**Background:** Dengue Fever (DF), Dengue Hemorrhagic Fever (DHF), and Dengue Shock Syndrome are among the disorders caused by the Dengue virus. **Objective:** The purpose of the present study was to assess severity of dengue by ultrasound findings and to correlate the ultrasound findings with blood platelet count. **Methodology:** This prospective study was conducted in the at Dr. MR Khan Shishu Hospital & ICH, Dhaka, Bangladesh from May 2019 to October 2019. Total 107 dengue children patients aged from 0 to14 years old were selected as a study population. Purposive sampling technique was used. Data were collected with pre-tested, modified and structured questionnaire. Complete blood count/picture (CBC), Laboratory based serological tests and Ultra sonographic test were performed. **Results:** USG studies were performed on all patients with severe dengue fever. Most of the dengue patients had blood platelet counts under 100000. USG studies revealed that Pericholecystic collection was the most common finding in dengue patients followed by thickening of GB, pleural effusion, pelvic collection, peri renal collection and ascites. In this study there was positive correlation between sonographic findings with platelet count of Dengue fever in children. The Mean and SD of platelet count was 56635.51±26267.633. Paired Samples correlations of sonographic finding with platelet findings were positively correlated but paired difference and t test result was significant. Clinical features and thrombocytopenia are help in lead us to the diagnosis of dengue. There were 86.92% patients had platelet counts under 100,000. There was positive correlation between sonography findings and platelet count. About 95.33% of the patients had Pericholecystic collection and 92.50% had GB Wall edema. **Conclusion:** in conclusion, USG abdomen showing Pericholeystic collection and GB wall edema is a useful marker for early diagnosis of severe Dengue Fever. [*Bangladesh Journal of Infectious Diseases, June 2024;11(1):16-21*]

**Keywords**: Dengue fever; sonographic findings; gall bladder; platelet counts

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## Introduction

Infection with the dengue virus is a serious threat to people, especially in tropical and subtropical areas. In the previous four decades, the incidence of dengue fever (DF) has increased 30-fold, putting more than half of the world's population at risk of infection[1]. Dengue fever was a threat to about 2.5 billion people (two-fifths of the world's population), according to the World Health Organization (WHO)[2]. More than 100 countries, including Africa, America, the Eastern Mediterranean, Southeast Asia, and the Western Pacific, now have the disease. Southeast Asia and the Western Pacific are the most severely affected of these regions[3].

The exact scope of this countrywide outbreak is uncertain; the Ministry of Health in Bangladesh reported 5,575 hospitalized dengue cases with a case-fatality rate of 1.61 percent through mid-November 2000, and the majority of patients had DF, with 25% having bleeding symptoms[4]. Although the four dengue viruses, DEN1 to DEN4, are immunologically linked, they do not confer cross-protection against one another[5]. Co-infection of two separate serotypes of dengue fever causes the most severe illnesses. Ultrasonography is a non-ionizing radiation imaging method that is safe, low-cost, and dynamic.

Sonography is a portable imaging technique that can be performed right at the patient's bedside. The findings of sonographic imaging in a patient are related to capillary permeability and plasma leakage[6]. Serial ultrasonography imaging can also aid in evaluating the severity of the disease, early detection of complications, and patient prognosis[7-8]. Since the initial outbreak in 2000, dengue fever has become a growing public health concern in Bangladesh[9].

Dengue fever cases have been steadily increasing since 2001, and there is an outbreak of varying magnitude and severity[7]. However, there is a scarcity of information about the prevalent dengue virus serotypes in Bangladesh. As a result, it is critical to determine the circulating serotype of dengue virus at the start of each season in order to predict illness severity and to contribute to an early preparedness strategy for disease management and containment at the country's policy making level.

The purpose of this study was to assess severity of dengue by ultrasound findings and to correlate the ultrasound findings with blood platelet count.

## Methodology

**Study Settings and Population:** The cross-sectional study was performed in the Department of Radiology and Imaging at Dr. MR Khan Shishu Hospital & ICH, Dhaka, Bangladesh from May 2019 to October 2019 for period of 5 months. All the patients age between 0 to 14 years with dengue fever who were confirmed by serological tests were included in the study. The patients who were not willing for ultrasound were excluded from the study.

**Study Procedure:** Purposive sampling technique was used. Data were collected with pre-tested, modified and structured questionnaire. Complete blood count/picture (CBC), Laboratory based serological tests and Ultra sonographic test were performed.

**Statistical Analysis:** Statistical analyses was performed with SPSS software, versions 23.0 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). Continuous data that were normally distributed were summarized in terms of the mean, standard deviation, median, minimum, maximum and number of observations. Categorical or discrete data were summarized in terms of frequency counts and percentages. When values are missing, the denominator was stated. Chi-square test was used for comparison of categorical variables. Every effort was made to obtain missing data. A two-sided P value of less than 0.05 was considered to indicate statistical significance.

**Ethical Clearance:** All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration) and also with the ethical guidelines of the Institutional research ethics. Formal ethics approval was granted by the IRB of local institute. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and analyzed using the coding system.

## Results

Among the 107 patients most of the patients 34.6% were 3 to 5 years' age range and the lowest range was 0 to 1 years (Table 1).

**Table 1: Age Distribution of the Patients**

| Age Group | Frequency | Percent |
|---|---|---|
| 0 To 1 Years | 6 | 5.61 |
| 1 To 3 Years | 16 | 14.95 |
| 3 To 5 Years | 37 | 34.58 |
| 5 To 10 Years | 32 | 29.91 |
| 10 To 14 Years | 16 | 14.95 |
| **Total** | **107** | **100.0** |

USG studies revealed that Pericholecystic collection was the most common finding in dengue patients which was 95.33% cases followed by thickening of GB, pleural effusion, Pelvic collection, perirenal collection and ascites (Figure I).
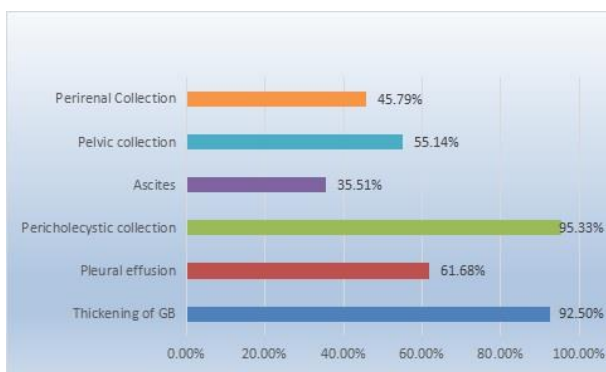


**Figure I: USG findings among Study Population**

Most of the dengue patients had blood platelet counts bellow 100000. The Mean and SD of platelet count was 56635.51±26267.633 (Figure II).
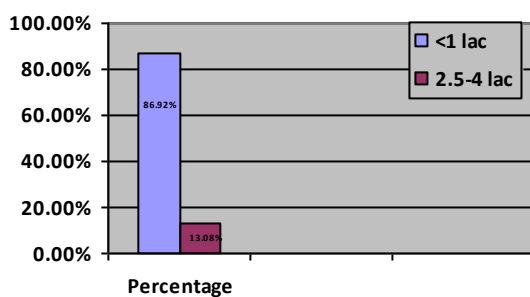


**Figure II: Platelet Counts of the Patients**

Paired Samples correlations of sonographic findings with platelet count was not significant but paired difference and t test result was significant. There was positive correlation between sonographic findings with platelet count of Dengue fever in children. ROC curve showing the sensitivity and specificity of sonographic findings with platelet count (Table 3).

**Table 3: Paired Samples Correlations of Sonographic with platelet findings**

| Correlations | r value | P value |
|---|---|---|
| Platelet count of the patients & Thickness of GB | 0.049 | 0.617 |
| Platelet count of the patients & Pleural effusion | 0.101 | 0.299 |
| Platelet count of the patients & Pericholecystic collection | 0.181 | 0.062 |
| Platelet count of the patients & Ascites | 0.173 | 0.074 |
| Platelet count of the patients & Pelvic collection | 0.116 | 0.234 |
| Platelet count of the patients & Perirenal Collection | 0.183 | 0.059 |

The mean difference of platelet counts of the patients and thickness of GB was 56634.4±26267.61 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Pleural effusion was 56634.1±26267.58 which was statistically different (p value 0.002). The mean difference of Platelet count of the patients & Pericholecystic collection was 56634.5±26267.59 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Ascites was 56633.9±26267.55 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Pelvic collection was 56634.1±26267.57 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Perirenal Collection was 56633.9±26267.54 which was statistically different (p value 0.000) (Table 4).

**Table 4: Paired Differences of Sonographic with Platelet Findings**

| Paired Differences | Mean±SD | P value |
|---|---|---|
| Platelet count of the patients & Thickness of GB | 56634.4±26267.61 | 0.001 |
| Platelet count of the patients & Pleural effusion | 56634.1±26267.58 | 0.002 |
| Platelet count of the patients & Pericholecystic collection | 56634.5±26267.59 | 0.001 |
| Platelet count of the patients & Ascites | 56633.9±26267.55 | 0.001 |

| Paired Differences | Mean±SD | P value |
|---|---|---|
| Platelet count of the patients & Pelvic collection | 56634.1±26267.57 | 0.001 |
| Platelet count of the patients & Perirenal Collection | 56633.9±26267.54 | 0.000 |

ROC curve showing the sensitivity and specificity of sonographic findings with platelet count (Figure III).
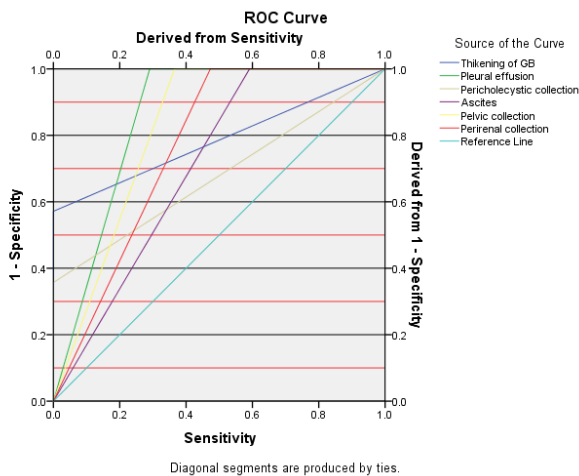


**Figure III: ROC Curve of Sonographic Findings with Platelet Count**

The test result variables like thickening of GB, Pleural effusion, pericholecystic collection, ascites, pelvic collection, perirenal collection had at least one tie between the positive actual state group and the negative actual state group (Table 5).

**Table 5: Area Under the Curve**

| Test Result Variable(s) | AUC Value |
|---|---|
| Thickening of GB | 0.214 |
| Pleural effusion | 0.145 |
| Pericholecystic collection | 0.321 |
| Ascites | 0.296 |
| Pelvic collection | 0.183 |
| Perirenal collection | 0.237 |

**Discussion**

Dengue fever is one of the world's most rapidly spreading diseases. There have been several outbreaks reported all throughout the world. Early diagnosis is critical for successful care of dengue cases during epidemic[10]. This study was conducted during an epidemic of dengue between July to

September of 2019. Incubation periods for classic Dengue infection range from three to fourteen days, with an average of five to eight days. A fever develops rapidly after this phase, with temperatures in the 39C 40C range. Chills, as well as heavy and broad osteo muscle pain, particularly in the lumbar region, neck and shoulders, as well as the knees and hips, are further symptoms.

The symptoms of hemorrhagic Dengue are similar to those of classic Dengue, but they are also linked with bleeding, which varies in intensity depending on the severity of the clinical manifestation. There are four levels of severity for this disease: Fever, nonspecific symptoms, and a positive tourniquet test (degree I). Degree II: Degree I plus spontaneous hemorrhage on the skin, gums, GI system, and other regions. Degree III consists of a degree II plus agitation and a circulatory deficit. Shock is the fourth degree. Thrombocytopenia and hemo concentration are present in all phases. DHF-SSD is linked to degrees III and IV[11-12]. Dengue fever is an infectious disease caused by the Arbovirus (family Flavivirus), which is most common at the end of the rainy season.

Paired Samples correlations of sonographic findings with platelet count was not significant but paired difference and t test result was significant. There was positive correlation between sonographic findings with platelet count of Dengue fever in children. ROC curve showing the sensitivity and specificity of sonographic findings with platelet count.

The mean difference of platelet counts of the patients and thickness of GB was 56634.4±26267.61 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Pleural effusion was 56634.1±26267.58 which was statistically different (p value 0.002). The mean difference of Platelet count of the patients & Pericholecystic collection was 56634.5±26267.59 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Ascites was 56633.9±26267.55 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Pelvic collection was 56634.1±26267.57 which was statistically different (p value 0.001). The mean difference of Platelet count of the patients & Perirenal Collection was 56633.9±26267.54 which was statistically different (p value 0.000).

For this virus, four serotypes have been found (DEN1, DEN2, DEN3, and DEN4), with cross-

immunity between the antibodies produced by these serotypes. As a result, when a person is infected with a given serotype, he will only develop immunity to that serotype[13]. Ultrasound techniques have been used for the evaluation of children suffering from dengue. In children pleural effusion has been observed in 61.6% of cases, thickness of gall bladder walls in 85 in 45.79%. These reported findings in the existing literature considerably match our observations. An indicator based on ultrasonography data with shock-predictive value was recently developed (DHF-SSD).

The ultra-sonography abnormalities seen like pleural effusion, liquid within the Morrison's pouch, thickening of gall bladder walls and so one produces the score of 0 to 12, with a "cut-off" value of 5. Patients with a BMI greater than this have a greater chance of having the most severe form of the disease[14]. In this study the test result variables like thickening of GB, Pleural effusion, pericholecystic collection, ascites, pelvic collection, perirenal collection had at least one tie between the positive actual state group and the negative actual state group

## Conclusion

Clinical features and thrombocytopenia are helpful in leading us to the diagnosis of dengue. There is high platelet count between severe Dengue Fever and positive blood platelet count under 100,000. Majority patients have Perichole cystic collection. Correlations of severity of sonographic findings with platelet count are positively correlated and are also paired difference of paired sample test and t test result is significant. Most of the patients have GB Wall edema and Pericholecystic collection. Therefore, USG abdomen showing Pericholecystic collection and GB wall edema are a useful marker for early diagnosis of severe Dengue Fever.

**Data Availability**
Any questions regarding the availability of the study's supporting data should be addressed to the corresponding author, who can provide it upon justifiable request.

**Ethics Approval and Consent to Participate**
The Institutional Review Board granted the study ethical approval. Since this was a prospective study, every study participant provided formal informed consent. Each method followed the appropriate rules and regulations.

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