Research Article

Sonographic Findings of NS1 Positive Dengue Fever Patients and Its Correlation with Platelet Count

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Abstract

Background: Dengue fever is a significant threat to human populations, particularly in tropical and subtropical regions. Usually, it is transmitted from human to human by the Aedes aegypti mosquito. In detecting dengue infections ultrasonography is used because of its ability to detect plasma leakage signs as well as prediction of disease severity. For the better management of dengue, we require more research-based information regarding the sonographic findings of NS1-positive dengue fever patients and its correlation with platelet count.

Aim of the study: This study aimed to assess the sonographic findings of NS1-positive dengue fever patients and their correlation with platelet count.

Methods: This prospective observational study was conducted in the Radiology & Imaging department, Kurmitola General Hospital, Dhaka, Bangladesh during the period from July 2019 to December 2019. In total 450 NS1-positive dengue fever patients were enrolled in this study as study subjects. As per the inclusion criteria of this study, NS1 antigen (for dengue) positive patients from different age groups of either gender, scheduled for USG of the Whole abdomen were included. According to the exclusion criteria of this study, patients without proper adequate diagnostic reports were excluded. All the demographic, clinical and diagnostic information of the participants was recorded and analyzed by using MS Excel and SPSS version 23.0 program as per necessity.

Results: In this study, as per the specific abnormal sonographic report, gallbladder wall thickness (49%), ascites (27%), and right pleural effusion (25%) were found in ≥25% of cases. In comparing the platelet count (x10³) between patient groups of normal and abnormal sonographic findings we found significantly (Extremely) lower platelet count in the abnormal sonographic findings group where the $p<0.001$. In comparing against specific abnormal sonographic findings cases, we observed that, in GB wall thickness, pericholecystic collection, fatty liver, hepatitis, ascites, right pleural effusion, left pleural effusion, bilateral pleural effusion and pericardial effusion cases, the platelet counts were extremely significantly lower than normal group patients where the $p<0.001$. In hepatomegaly cases, we found a significant correlation but in splenomegaly, we did not find any correlation with platelet count.

Conclusion: Gallbladder wall thickness, ascites and right pleural effusion are the most common abnormal sonographic findings of NS1-positive dengue fever patients. NS1-positive dengue fever patients have a significantly negative correlation with platelet count.

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Introduction

Dengue fever is a significant threat to human populations, particularly in the tropical and subtropical regions which are mainly transmitted from human to human by the Aedes aegypti mosquito. Over the past few years, dengue fever is endemic to the Southeast Asian region and poses a major public health problem with an increasing incidence of epidemics. It is the most common acute arboviral infection in the world, caused by a flavivirus called dengue virus [1]. Dengue fever is transmitted by the female Aedes aegypti mosquito which is surpassed only by malaria [2]. It is endemic in >100 countries across the world and threatens the health of 40% of the world's population [3]. It is more common during the rainy season due to the breeding of mosquitoes facilitated by water stagnation. The diagnosis procedure of dengue fever is based on clinical suspicion in the endemic areas along with positive serology. Anti-dengue antibody appears only after 7 days of the onset of this disease and thus delaying the diagnosis [4]. Ultrasonography is a rapid economical and widely available non-invasive imaging modality in the diagnosis of dengue fever. [5] In the early diagnosis of dengue fever, several studies have proven that ultrasonography (USG) of the chest, as well as the abdomen, can be an important adjunct to the clinical profile [2]. The severe form of dengue fever is characterized by fluid collections in the perirenal and pararenal spaces, pericardial effusion, hepatic as well as splenic subcapsular fluid collections, moderate ascites, moderate pleural effusion, hepatic intraparenchymal hemorrhages, significant gallbladder walls thickening and pancreatic enlargement [6]. In a study, [7] it was reported that the disease severity of dengue is directly related to thrombocyte count and the findings are severe with falling platelet counts. In another study, it was also reported that using an ultrasonography machine, the diagnosis of dengue can be made within three days of initial signs and symptoms, which may be life-saving for patients. [8] The major objective of this current study was to assess the sonographic findings of NS1-positive dengue fever patients and their correlation with platelet count.

Methodology

This was a prospective observational study that was conducted in the Radiology & Imaging department, Kurmitola General Hospital, Dhaka, Bangladesh during the period from July 2019 to December 2019. In total 450 NS1-positive dengue fever patients were enrolled in this study as study subjects. Properly written consent was taken from all the participants before data collection. The whole intervention was conducted under the principles of human research specified in the Helsinki Declaration [9] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation
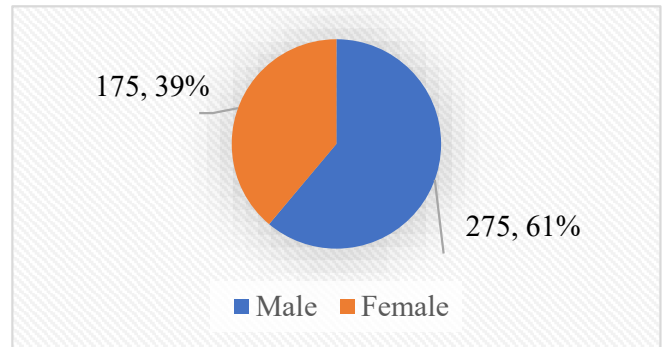

Figure 1: Distribution of participants as per gender(N=450)

Table 1: Distribution of participants as per age(N=450)

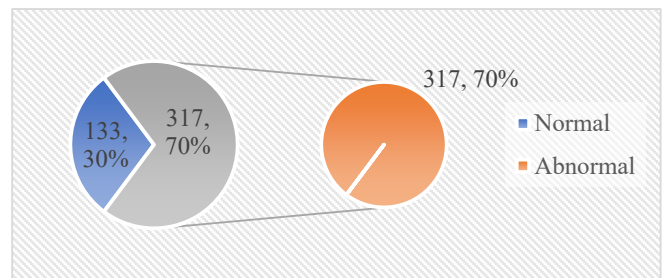| Age (Year)	n	%
<20	161	36%
21-30	159	35%
31-40	71	16%
41-50	37	8%
>50	22	5%

Figure 2: Distribution of participants as per normal and abnormal sonographic findings(N=450)
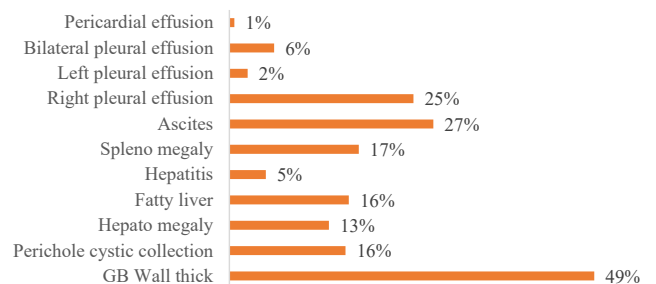

Figure 3: Specific sonographic findings among participants (N=450)

Table 2: Comparison of platelet count (x10³) between patient groups of normal and abnormal sonographic findings (N=450)

Sonographic Findings	Platelet count (x 10³)	P value
Normal (n=133)	139.91 ±76.80	<0.001
Abnormal (n=317)	102.53 ±83.93	

(GDPR) [10]. As per the inclusion criteria of this study, NS1antigen (for dengue) positive patients from several age groups of either gender, scheduled for USG of the Whole abdomen were included. On the other hand, according to the exclusion criteria of this study, patients without proper adequate diagnostic reports were excluded. Besides these, cases with repeated infection of dengue were rejected. All the demographic, clinical and diagnostic information of the participants was recorded and analyzed. All data were processed, analyzed and disseminated by using MS Excel and SPSS version 23.0 program as per necessity. In assessing the significance between group means, a 't-test' was performed. In statistical analysis, a p-value <0.05 was considered as the indicator of significance.

Results

In this study, among the total of 450 participants, 61% were male whereas the rest 39% were female. So, the male-female ratio of the participants was 1.6:1. The ages of the majority of the participants were within 30 years. Among them, 36% and 35% of the total population were from <20 and 21-30 years age groups respectively. Among the total of our participants, in the majority (70%) abnormal sonographic reports were found. As per the specific abnormal sonographic report, gallbladder wall thickness (49%), ascites (27%), and right pleural effusion (25%) were found in $\geq25\%$ of cases. In this study, in comparing the platelet count ($\times10^3$) between patient groups of normal and abnormal sonographic findings we found significantly (Extremely) lower platelet count in the abnormal sonographic findings group where the $p<0.001$.
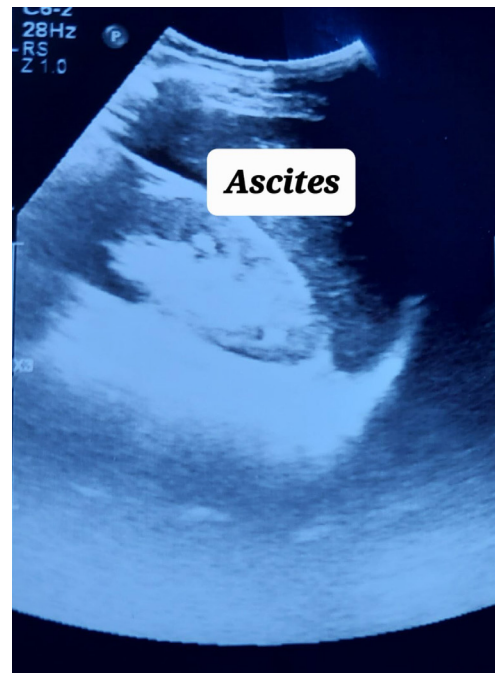

Figure 5: Ascites in the hepato-renal pouch.

Figure 6: Pelvic ascites.

Figure 4: Right sided pleural effusion

On the other hand, in comparing against specific abnormal sonographic findings cases, we observed that, in GB wall thickness, pericholecystic collection, fatty liver, hepatitis, ascites, right pleural effusion, left pleural effusion, bilateral pleural effusion, and pericardial effusion cases, the platelet counts were extremely significantly lower than normal group patients where the $p<0.001$. In hepatomegaly cases, we found a significant correlation but in splenomegaly, we did not find any correlation with platelet count.
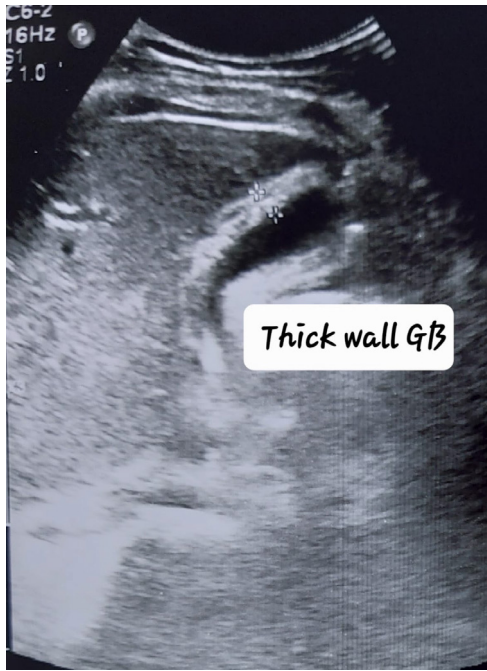
Figure 7: Thick wall Gall Bladder.

Table 3: Comparison of platelet count (x10³) of normal patients with specific abnormal sonographic findings cases (N=450)

Sonographic findings		P value
Abnormal	Normal	
(n=317)	(n=133)	
Thick wall GB		<0.001
Pericholecystic collection		<0.001
Fatty liver		<0.001
Hepatitis		<0.001
Ascites		<0.001
Right pleural effusion	139.91 ±76.80	<0.001
Left pleural effusion		<0.001
Bilateral pleural effusion		<0.001
Pericardial effusion		<0.001
Hepatomegaly		0.017
Splenomegaly		0.255

Discussion

This study aimed to assess the sonographic findings of NS1-positive dengue fever patients and its correlation with platelet count. In this study, among a total of 450 participants, the male-female ratio of the participants was 1.6:1. In a previous study [5] also male patients were dominating in number. The ages of majority of the participants were within 30 years. Among them, 36% and 35% of the total population were from <20 and 21-30 years age groups respectively. Among the total of our participants, in the majority (70%) abnormal sonographic reports were found. Another study [11] showed an average age of 28.7 years, out of a total of 213 cases, 63.8% were male and 36.2% were female; the male-female ratio was 1.7:1 which was similar to our findings. As per the specific abnormal sonographic report of our patients, gallbladder wall thickness (49%), ascites (27%), and right pleural effusion (25%) were found in ≥25% of cases. Similarly, Santosh et al [12] found that sonographic findings of dengue fever were thickened gallbladder wall, hepatosplenomegaly, ascites, and pleural effusion. On the other hand, Nataraj et al [13] have reported multiple atypical manifestations such as encephalitis, myocarditis, polyneuropathy etcetera in a few patients with dengue fever. In this study, in comparing the platelet count (x10³) between patient groups of normal and abnormal sonographic findings we found significantly (Extremely) lower platelet count in the abnormal sonographic findings group where the p<0.001. In a study, it was reported that, if a patient shows all ultrasound features related to dengue fever (DF) it indicates the platelet count is likely to be <40,000 and the patient may require a blood transfusion. [14] In the same study [14] it was also mentioned that a decrease in platelet count, (40,000) was associated with the presence of various ultrasound features like GB wall thickening (P < 0.001), ascites (P < 0.001), pleural effusion (P < 0.001) and splenomegaly (P < 0.024) where the correlations being statistically significant. In our study, in comparing against specific abnormal sonographic findings cases, we observed that, in GB wall thickness, pericholecystic collection, fatty liver, hepatitis, ascites, right pleural effusion, left pleural effusion, bilateral pleural effusion, and pericardial effusion cases, the platelet counts were extremely significantly lower than normal group patients where the p<0.001. In hepatomegaly cases, we found a significant correlation but in splenomegaly, we did not find any correlation with platelet count. Setiawan reported ascites as the most common ultrasonographic (USG) finding (76%) in cases of dengue fever followed by pleural effusion (68%) in their study. [15] Another study found that among the ultrasonographic findings reported, the thick wall GB was the commonest finding in 65.08% of cases followed by ascites in 62.70% and pleural effusion in 49.21%. [16] All the findings of this current study may be helpful in further similar studies.

Conclusion & Recommendation

As per the findings of this current study, we can conclude that gallbladder wall thickness, ascites, and right pleural effusion are the most common abnormal sonographic findings of NS1-positive dengue fever patients. NS1-positive dengue fever patients have a significantly negative correlation with platelet count. For getting more specific results we would like to recommend conducting similar studies in several places with larger-sized samples.

Limitation of the study

This was a single-centered study with small-sized samples. Moreover, the study was conducted over a short period. So,

the findings of this study may not reflect the exact scenario of the whole country

Funding

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Conflict of interest

None declared.

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