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Original Article

Regional Clinical Profile and Predictors of Thrombocytopenia in Adults with Dengue Fever

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Abstract

Introduction: Dengue is caused by dengue virus (DENV) 1-4. *Aedes aegypti* mosquitoe is the predominant vector. Dengue is one of the most important arthropod-borne diseases worldwide, with estimated 50-100 million cases per year. Dengue epidemics are frequent in India. Most of the dengue viral infections are self-limiting, but complications can result in high morbidity and mortality.

Aims and Objectives: (1) To study the regional clinical profile for dengue fever. (2) To assess if any clinical parameter can be used as a predictor for thrombocytopenia and platelet transfusion.

Materials and Methods: A total of 100 patients admitted to Government Medical College, Ernakulam during 2014-2015, were studied. This is a prospective observational cohort study. The SPSS software (version 22) was used for analysis of data, and descriptive statistics were calculated.

Results: In our study of 100 patients, the mortality was nil. A significant incidence of thrombocytopenia was seen in patients with a second spike of fever (P = 0.001, linear association = 0.041). Patients with a second spike of fever had a significant incidence of needing platelet transfusions as opposed to those cases with no second fever spike (P = 0.041, linear association = 0.003). An increase of serum glutamic oxaloacetic transaminase (SGOT)/serum glutamic pyruvic transaminase (SGPT) >40 was associated with an increased incidence of platelet transfusion with statistical significance (SGOT: P = 0.004, linear association = 0.001), (SGPT: P = 0.034, linear association = 0.001). 23% of the study population showed electrocardiogram (ECG) changes. The presence of ECG changes had a statistically significant association with thrombocytopenia (P = 0.035). A positive dengue immunoglobulin G antibody (IgGAb) was associated with an increased incidence of thrombocytopenia with statistical significance (P = 0.021), whereas immunoglobulin M antibody showed no statistical significance (P = 0.352).

Conclusion: We conclude that routine clinical parameters such as second spike of fever and routine clinical parameters such as platelet count on seeing the patient, liver enzymes (SGOT/SGPT), and erythrocyte sedimentation rate as well as dengue IgGAb when available could be used as useful indicators to predict patient who are at higher risk in having morbidities due to dengue infection.

Key words: Dengue fever, Thrombocytopenia, Predictors, Profile

INTRODUCTION

Dengue is caused by dengue virus (DENV) 1-4. *Aedes aegypti* mosquitoes are the predominant vector. Dengue is one of the most important arthropod-borne diseases worldwide, with estimated 50-100 million cases per year.[1] A larger population of people are vulnerable to dengue due to international travel and spreading of mosquitoes from tropical countries to nontropical areas. The World Health Organization estimates that almost half the world's population lives in countries where dengue is endemic. Dengue epidemics are frequent in India. Most of the dengue viral infections are self-limiting, but complications can result in high morbidity and mortality.[2,3]

The dengue epidemic which has a seasonal recurrence is growing in magnitude as of recently. It has become one of the major causes of fever in inpatients as well

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as outpatients causing unprecedented panic among the general population. Thus, DENV remains a major cause of morbidity and mortality in tropical areas.[4-6]

This prospective study was designed to build the clinical profile of 100 cases of dengue fever attending a tertiary care center in South India. There is a lot of panic regarding the platelet counts in dengue season. Any patient of fever causes panic among the patient and relatives about possibility of thrombocytopenia. Thrombocytopenia is an important pointer to the diagnosis of dengue for the lay-person and the general physician. We attempt to find if any clinical parameter can be used as a predictor thrombocytopenia/platelet transfusion which will be particularly useful in referring a patient to a tertiary care setting.

Aims and Objectives

1. To establish a regional clinical profile for dengue fever.
2. To assess if any clinical parameter can be used as a predictor for thrombocytopenia/platelet transfusion.

MATERIALS AND METHODS

This is a prospective observational study done on patients admitted to the Government Medical College, Ernakulam, in the 2014-2015 period with dengue fever. The diagnosis of dengue infection was made clinically on the basis of fever, myalgia, and skin rash during an epidemic and confirmed by laboratory investigation. All patients with acute febrile illness underwent NS1 Ag and serology (immunoglobulin M [IgM] and immunoglobulin G [IgG]) by IVD microwell ELISA. Other causes of thrombocytopenia such as chronic liver diseases and idiopathic thrombocytopenic purpura were not excluded in all cases.

The patients were subjected to a thorough clinical examination, and a structured pro forma was filled in for each case. They underwent investigations such as complete hemogram, urea, creatinine, liver function tests, chest X-ray, electrocardiogram (ECG), and serum electrolytes.

The SPSS software (version 22) was used for analysis of data. Descriptive statistics were calculated. Numbers and percentages were enumerated for all categorical variables such as clinical characteristics and biochemical tests.

Limitations

Dengue fever being seasonal in occurrence the cases over a year span of 2014-2015 were chosen for the study. More parameters could not be included in the study. A more detailed study on a larger population is warranted spread over a longer period.

RESULTS

In our study, the main age group affected was between 20 and 49 constituting 69% of the total study group (Table 1). 22% of the population had other co-infections. The mean duration of fever on presentation to the hospital was 3.23 ± 0.649 days (Table 2). 75% of patients presented with mild to moderate grades of fever. 25% had high-grade fever (Table 3). The second spike of fever was seen in 14% of the study population (Table 4). 25% showed no thrombocytopenia (>100,000). 35% had a platelet count of <100,000; 26% had counts <50,000. Only 14% of the study population had a platelet count <20,000 (Table 5). 23% of the study population required platelet transfusion (Table 9).

Table 1: The age category

Age	Frequency	Percent	Valid percent	Cumulative percent
Valid				
10-19	15	15.0	15.0	15.0
20-29	41	41.0	41.0	56.0
30-39	17	17.0	17.0	73.0
40-49	12	12.0	12.0	85.0
50-59	6	6.0	6.0	91.0
60-69	5	5.0	5.0	96.0
70+	4	4.0	4.0	100.0
Total	100	100.0	100.0	

Table 2: Fever duration

Duration of fever	Number	Minimum	Maximum	Mean±Standard deviation
Duration of fever	100	3	7	3.23±0.649
Valid number (list wise)	100			

Table 3: Grade of fever

Grade of fever	Frequency	Percent	Valid percent	Cumulative percent
Valid				
Mild	42	42.0	42.0	42.0
Moderate	33	33.0	33.0	75.0
High	25	25.0	25.0	100.0
Total	100	100.0	100.0	

Table 4: Second spike of fever

Second spike	Frequency	Percent	Valid percent	Cumulative percent
Valid				
NA	86	86.0	86.0	86.0
<3 days	11	11.0	11.0	97.0
4-7 days	3	3.0	3.0	100.0
Total	100	100.0	100.0	

There was a significant association both statistical as well as linear between the units of platelet transfusions required and degree of thrombocytopenia (P = 0.006, linear association = 0.001). A significant incidence of thrombocytopenia was seen in patients with a second spike of fever (P = 0.001, linear association = 0.041) (Table 6). Patients with a second spike of fever had a significant incidence of needing platelet transfusions as opposed to those cases with no second fever spike (P = 0.041, linear association = 0.003) (Table 10). Although not statistically significant, mild to moderate increase of serum glutamic oxaloacetic transaminase (SGOT)/serum glutamic pyruvic transaminase (SGPT) (40-500) (Tables 6-8) was seen in 81% and 79% of the study population, respectively. Of the 14 cases with 2nd spike of fever, 12 patients had elevated SGOT/SGPT levels >40, but no statistical significance could be proven; possibly due to the reduced numbers of patients with second fever spike as compared to the study population (Tables 11 and 12). An increase of SGOT/SGPT >40 was associated with an increased incidence of platelet transfusion with statistical significance. (SGOT: P = 0.004, linear association = 0.001) (SGPT: P = 0.034, linear association = 0.001) (Tables 13 and 14). A positive dengue IgG antibody (Ab) was associated with an increased incidence of thrombocytopenia with statistical significance (P = 0.021) (Table 15), whereas IgMAb showed no statistical significance (P = 0.352) (Table 16). However, IgGAb showed no statistical association with units of platelets transfused (P = 0.554). 23% of the study population showed ECG changes. The presence of ECG changes (Table 17) had a statistically significant association with thrombocytopenia (P = 0.035). A low erythrocyte sedimentation rate (ESR) of <20 mm showed a non-linear statistically significant association with the units of platelets transfused (P = 0.036); but no statistical correlation with thrombocytopenia (P = 0.563) (Tables 18 and 19). Lymphocytosis showed no correlation with either thrombocytopenia or platelet transfusions (P = 0.837; P = 0.196). In our case study of 100 patients, the mortality was nil.

Table 5: Incidence of thrombocytopenia

Thrombocytopenia	Frequency	Percent	Valid percent	Cumulative percent
Valid				
No	25	25.0	25.0	25.0
<1 lakh	35	35.0	35.0	60.0
<50,000	26	26.0	26.0	86.0
<20,000	14	14.0	14.0	100.0
Total	100	100.0	100.0	

Table 6: Thrombocytopenia versus 2nd spike of fever (cross tabulation)

Thrombocytopenia	2nd spike of fever			Total
	NA	<3 days	4-7 days	
No				
Count	23	0	2	25
% of total	23.0	0.0	2.0	25.0
<1 lakh				
Count	30	5	0	35
% of total	30.0	5.0	0.0	35.0
<50,000				
Count	26	0	0	26
% of total	26.0	0.0	0.0	26.0
<20,000				
Count	7	6	1	14
% of total	7.0	6.0	1.0	14.0
Total				
Count	86	11	3	100
% of total	86.0	11.0	3.0	100.0

Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	26.392[a]	6	0.001
Likelihood ratio	27.745	6	0.001
Linear-by-linear association	4.173	1	0.041
Number of valid cases	100		

Critical value: >16.8

DISCUSSION

Our study aimed at establishing a regional clinical profile for patients with dengue fever. We attempted to ascertain if any clinical parameter could be used as an indicator for the patient developing thrombocytopenia. Such a parameter could be of use in peripheral setups to pick the subset of patients who could be at risk for developing thrombocytopenia.

In our study, dengue fever was distributed more among the young and middle-aged population with 69% of the affected patients falling in the age group between 20 and 49 (Figure 1). In a similar study by Aroor *et al.*, 87 patients (42%) were in the age group of 18-30 years.[7] Munir *et al.* found that most cases were between 20 and 49 years of age.[8]

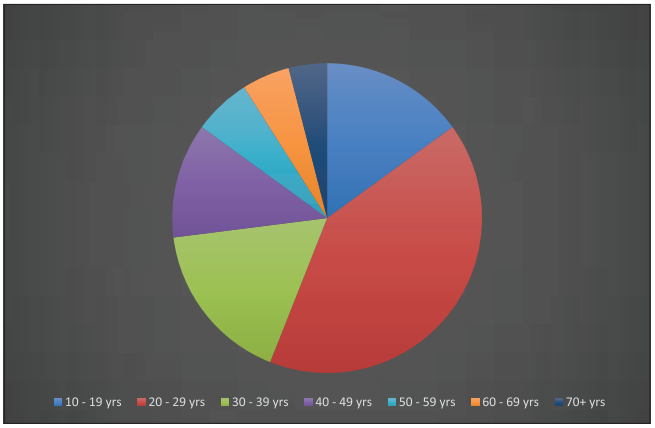

Figure 1: Age distribution

Table 7: Thrombocytopenia versus SGOT cross tabulation

Thrombocytopenia	SGOT						Total
	ND	<40	40-100	100-500	500-1000	More than 1000	
No							
Count	2	2	13	7	1	0	25
% of total	2.0	2.0	13.0	7.0	1.0	0.0	25.0
<1 lakh							
Count	2	2	21	9	1	0	35
% of total	2.0	2.0	21.0	9.0	1.0	0.0	35.0
<50,000							
Count	0	3	13	8	2	0	26
% of total	0.0	3.0	13.0	8.0	2.0	0.0	26.0
<20,000							
Count	0	2	5	5	1	1	14
% of total	0.0	2.0	5.0	5.0	1.0	1.0	14.0
Total							
Count	4	9	52	29	5	1	100
% of total	4.0	9.0	52.0	29.0	5.0	1.0	100.0

SGOT: Serum glutamic oxaloacetic transaminase

Chi-square tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	12.495[a]	15	0.641
Likelihood ratio	11.661	15	0.704
Linear-by-linear association	2.846	1	0.092
Number of valid cases	100		

Critical value: > 12.511

Table 8: Thrombocytopenia versus SGPT cross tabulation

Thrombocytopenia	SGPT					Total
	ND	<40	40-100	100-500	500-1000	
No						
Count	2	2	17	4	0	25
% of total	2.0	2.0	17.0	4.0	0.0	25.0
<1 lakh						
Count	2	6	18	9	0	35
% of total	2.0	6.0	18.0	9.0	0.0	35.0
<50,000						
Count	0	5	11	10	0	26
% of total	0.0	5.0	11.0	10.0	0.0	26.0
<20,000						
Count	0	3	5	5	1	14
% of total	0.0	3.0	5.0	5.0	1.0	14.0
Total						
Count	4	16	51	28	1	100
% of total	4.0	16.0	51.0	28.0	1.0	100.0

SGPT: Serum glutamic pyruvic transaminase

Chi-square tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	15.565[a]	12	0.212
Likelihood ratio	14.961	12	0.244
Linear-by-linear association	2.774	1	0.096
Number of valid cases	100		

Critical value: > 15.605

Kumar *et al.* reported the most common symptoms in their study as fever, myalgia, vomiting, headache, and abdominal pain, and the most common hemorrhagic manifestation was petechiae, and they recorded in their study 83.9% cases dengue fever, 8.8% dengue hemorrhagic fever (DHF), and 7.3% dengue shock syndrome (DHS).[9] In children, if symptoms such as fever, pain, rashes, and vomiting are associated with hepatomegaly and elevated SGOT in the context of low total plate count, a strong possibility of dengue fever is present, especially in an epidemic setting. Early suspicion and effective management can reduce the severity.[10] In our study group, only classical dengue cases were found. No case of DHF or DHS was observed.

In the study conducted by Aroor *et al.,* abdominal symptoms such as nausea and vomiting (53.6%), abdominal pain (25.1%), and diarrhea (13.5%) were present.[7] However, these symptoms were not prominent in our patients.

In our study, 75% of the population had thrombocytopenia (platelet count <100,000/mm^3); and 14% had a count <20,000/mm^3 on admission. 23% required platelet transfusion during their hospital stay. Jayanthi *et al.* found that platelet count could be used to predict the complication and duration of hospital stay and hence better use of resources.[11]

In our study, the second spike of fever was seen in 14% of the population. A significant incidence of thrombocytopenia was seen in patients with a second spike of fever ($P = 0.001$, linear association = 0.041) (Figure 2). Patients with a second spike of fever needed platelet transfusions as well as more units of platelets compared to

Table 9: Thrombocytopenia*Platelet transfusion cross tabulation

Thrombocytopenia	Platelet transfusion											Total
	No	1 U platelet concentration	2 U platelet concentration	4 U platelet concentration	5 U platelet concentration	6 U platelet concentration	7 U platelet concentration	8 U platelet concentration	10 U platelet concentration	12 U platelet concentration		
No	19	1	0	2	2	0	0	1	0	0		25
<1 lakh	28	0	1	1	0	4	0	1	0	0		35
<50,000	17	0	1	5	0	2	0	0	0	1		26
<20,000	4	0	1	1	0	3	1	3	1	0		14
Total	68	1	3	9	2	9	1	5	1	1		100

Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	48.683[a]	27	0.006
Likelihood ratio	44.087	27	0.020
Linear-by-linear association	11.551	1	0.001
Number of valid cases	100		

Critical value: > 46.963

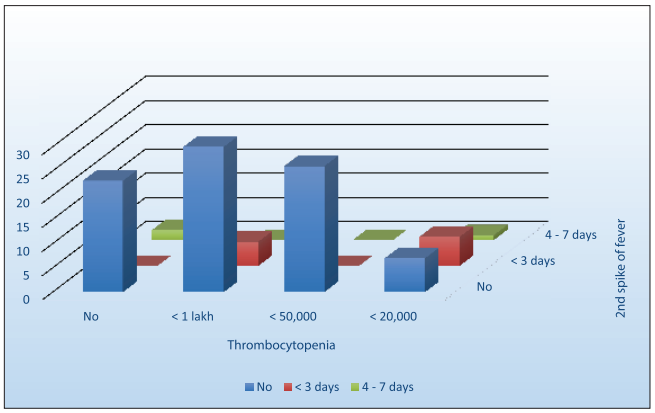

Figure 2: Second spike of fever and thrombocytopenia

those cases with no second fever spike ($P = 0.041$, linear association = 0.003) (Figure 5). This observation suggests the fact that dengue associated with the second spike of fever tends to have higher morbidity (Figure 6).

There was significant statistical as well as the linear correlation between the units of platelet transfusions required and degree of thrombocytopenia ($P = 0.006$, linear association = 0.001) (Figure 5). Platelet transfusions do little to alleviate the thrombocytopenia in patients and have hence led to the current consensus of platelet transfusion in dengue fever induced thrombocytopenia. Aroor *et al.* found that low platelet count on admission was associated with the presence of rash, high aspartate aminotransferase (AST) and alanine aminotransferase levels, and low albumin levels.[7] The need for platelet transfusions was also compared with other parameters. According to current recommendations, platelet transfusions are not indicated unless the patient develops bleeding manifestations or has a high risk of life-threatening bleeds. The incidence of bleeding manifestations was nil in our study.

Aroor *et al.* found that the duration of hospital stay was longer with presence of diarrhea, abdominal pain, ascites, and low hemoglobin on admission, but it did not correlate with the platelet count on admission.[7]

Although not statistically significant, a mild to moderate increase of SGOT/SGPT (40-500) was seen in 81% and 79% of the study population, respectively. Of the 14 cases with a second spike of fever, 12 patients had elevated SGOT/SGPT levels >40, but no statistical significance could be proven; possibly due to the reduced numbers of patients with second fever spike as compared to the study population. An increase of SGOT/SGPT >40 was associated with an increased incidence of platelet transfusion with statistical significance (SGOT: $P = 0.004$, linear association = 0.001) (SGPT: $P = 0.034$, linear association = 0.001) (Figures 3 and 4). Senaratne

Table 10: 2nd spike of fever versus platelet transfusion cross tabulation

2nd spike of fever	Platelet transfusion										Total
	No	1 U platelet concentration	2 U platelet concentration	4 U platelet concentration	5 U platelet concentration	6 U platelet concentration	7 U platelet concentration	8 U platelet concentration	10 U platelet concentration	12 U platelet concentration	
NA											
Count	62	1	3	8	2	6	0	3	0	1	86
Expected count	58.5	0.9	2.6	7.7	1.7	7.7	0.9	4.3	0.9	0.9	86.0
% of total	62.0	1.0	3.0	8.0	2.0	6.0	0.0	3.0	0.0	1.0	86.0
<3 days											
Count	5	0	0	0	0	2	1	2	1	0	11
Expected count	7.5	0.1	0.3	1.0	0.2	1.0	0.1	0.6	0.1	0.1	11.0
% of total	5.0	0.0	0.0	0.0	0.0	2.0	1.0	2.0	1.0	0.0	11.0
4-7 days											
Count	1	0	0	1	0	1	0	0	0	0	3
Expected count	2.0	0.0	0.1	0.3	0.1	0.3	0.0	0.2	0.0	0.0	3.0
% of total	1.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0
Total											
Count	68	1	3	9	2	9	1	5	1	1	100
Expected count	68.0	1.0	3.0	9.0	2.0	9.0	1.0	5.0	1.0	1.0	100.0
% of total	68.0	1.0	3.0	9.0	2.0	9.0	1.0	5.0	1.0	1.0	100.0

Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	29.619[a]	18	0.041
Likelihood ratio	21.261	18	0.266
Linear-by-linear association	8.593	1	0.003
Number of valid cases	100		

Critical value: >29.6492

Table 11: SGOT versus 2nd spike of fever

SGOT	2nd spike of fever			Total
	NA	<3 days	4-7 days	
ND				
Count	3	1	0	4
% of total	3.0	1.0	0.0	4.0
<40				
Count	8	1	0	9
% of total	8.0	1.0	0.0	9.0
40-100				
Count	44	6	2	52
% of total	44.0	6.0	2.0	52.0
100-500				
Count	26	2	1	29
% of total	26.0	2.0	1.0	29.0
500-1000				
Count	4	1	0	5
% of total	4.0	1.0	0.0	5.0
More than 1000				
Count	1	0	0	1
% of total	1.0	0.0	0.0	1.0
Total				
Count	86	11	3	100
% of total	86.0	11.0	3.0	100.0

SGOT: Serum glutamic oxaloacetic transaminase

Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	2.528[a]	10	0.990
Likelihood ratio	3.003	10	0.981
Linear-by-linear association	0.184	1	0.668
Number of valid cases	100		

Critical value: > 2.558

Table 12: SGPT versus 2nd spike of fever

SGPT	2nd spike of fever			Total
	NA	<3 days	4-7 days	
ND				
Count	3	1	0	4
% of total	3.0	1.0	0.0	4.0
<40				
Count	15	1	0	16
% of total	15.0	1.0	0.0	16.0
40-100				
Count	43	6	2	51
% of total	43.0	6.0	2.0	51.0
100-500				
Count	24	3	1	28
% of total	24.0	3.0	1.0	28.0
500-1000				
Count	1	0	0	1
% of total	1.0	0.0	0.0	1.0
Total				
Count	86	11	3	100
% of total	86.0	11.0	3.0	100.0

SGPT: Serum glutamic pyruvic transaminase

Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	2.193[a]	8	0.975
Likelihood ratio	2.786	8	0.947
Linear-by-linear association	0.021	1	0.885
Number of valid cases	100		

Critical value: > 2.310

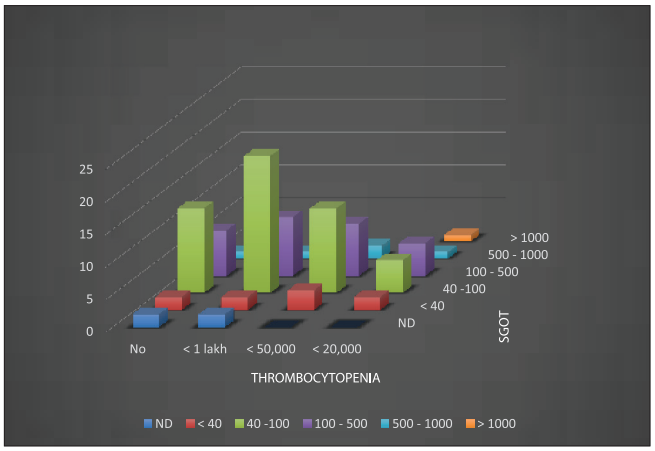

Figure 3: Serum glutamic oxaloacetic transaminase versus thrombocytopenia

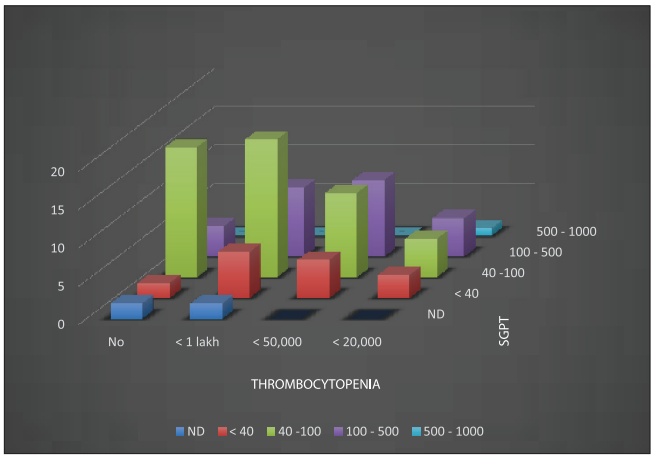

Figure 4: Serum glutamic pyruvic transaminase versus thrombocytopenia

et al. found that AST and ALT levels correlate with both disease severity and circulating interleukin-2 levels.[12] This statistical significance to platelet transfusion and not to thrombocytopenia could be explained by the fact that not all patients with thrombocytopenia developed bleeding manifestations. Those subsets of patients who had low platelet count (<20,000/mm^3) tend to require more units of platelet transfusions.

A positive dengue IgGAb was associated with an increased incidence of thrombocytopenia with statistical significance (P = 0.021); whereas IgMAb showed no statistical significance (P = 0.352). However, IgGAb showed no statistical association with units of platelets transfused (P = 0.554). This is supportive of the fact that the second infection with another strain tends to develop thrombocytopenia more frequently.

About 23% of the study population showed ECG changes. The presence of ECG changes had a statistically significant association with thrombocytopenia (P = 0.035). However,

Table 13: SGOT versus platelet transfusion cross tabulation

SGOT	Platelet transfusion										Total
	No	1 U platelet concentration	2 U platelet concentration	4 U platelet concentration	5 U platelet concentration	6 U platelet concentration	7 U platelet concentration	8 U platelet concentration	10 U platelet concentration	12 U platelet concentration	
ND											
Count	4	0	0	0	0	0	0	0	0	0	4
% of total	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
<40											
Count	8	0	0	0	0	1	0	0	0	0	9
% of total	8.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	9.0
40-100											
Count	42	0	1	2	1	3	1	2	0	0	52
% of total	42.0	0.0	1.0	2.0	1.0	3.0	1.0	2.0	0.0	0.0	52.0
100-500											
Count	13	1	1	7	1	3	0	2	0	1	29
% of total	13.0	1.0	1.0	7.0	1.0	3.0	0.0	2.0	0.0	1.0	29.0
500-1000											
Count	1	0	1	0	0	2	0	0	1	0	5
% of total	1.0	0.0	1.0	0.0	0.0	2.0	0.0	0.0	1.0	0.0	5.0
More than 1000											
Count	0	0	0	0	0	0	0	1	0	0	1
% of total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
Total											
Count	68	1	3	9	2	9	1	5	1	1	100
% of total	68.0	1.0	3.0	9.0	2.0	9.0	1.0	5.0	1.0	1.0	100.0

SGOT: Serum glutamic oxaloacetic transaminase

Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	74.474[a]	45	0.004
Likelihood ratio	46.186	45	0.423
Linear-by-linear association	16.724	1	0.001
Number of valid cases	100		

Critical value: > 74.165

Table 14: SGPT versus platelet transfusion cross tabulation

SGPT	Platelet transfusion										Total
	No	1 U platelet concentration	2 U platelet concentration	4 U platelet concentration	5 U platelet concentration	6 U platelet concentration	7 U platelet concentration	8 U platelet concentration	10 U platelet concentration	12 U platelet concentration	
ND											
Count	4	0	0	0	0	0	0	0	0	0	4
% of total	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
<40											
Count	15	0	0	0	0	1	0	0	0	0	16
% of total	15.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	16.0
40-100											
Count	39	0	1	2	2	4	1	2	0	0	51
% of total	39.0	0.0	1.0	2.0	2.0	4.0	1.0	2.0	0.0	0.0	51.0
100-500											
Count	10	1	2	7	0	4	0	2	1	1	28
% of total	10.0	1.0	2.0	7.0	0.0	4.0	0.0	2.0	1.0	1.0	28.0
500-1000											
Count	0	0	0	0	0	0	0	1	0	0	1
% of total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0
Total											
Count	68	1	3	9	2	9	1	5	1	1	100
% of total	68.0	1.0	3.0	9.0	2.0	9.0	1.0	5.0	1.0	1.0	100.0

SGPT: Serum glutamic pyruvic transaminase

Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	52.956[a]	36	0.034
Likelihood ratio	42.587	36	0.209
Linear-by-linear association	16.631	1	0.001
Number of valid cases	100		

Critical value: > 52.946

Table 15: IgGAb versus thrombocytopenia cross tabulation

IgGAb	Thrombocytopenia				Total
	No	<1 lakh	<50,000	<20,000	
Negative					
Count	19	25	23	6	73
% of total	19.0	25.0	23.0	6.0	73.0
Positive					
Count	6	10	3	8	27
% of total	6.0	10.0	3.0	8.0	27.0
Total					
Count	25	35	26	14	100
% of total	25.0	35.0	26.0	14.0	100.0

IgGAb: Immunoglobulin G antibody

Chi-square tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	9.765[a]	3	0.021
Likelihood ratio	9.501	3	0.023
Linear-by-linear association	1.362	1	0.243
Number of valid cases	100		

Critical value: > 9.730

Table 16: IgMAb versus thrombocytopenia cross tabulation

IgMAb	Thrombocytopenia				Total
	No	<1 lakh	<50,000	<20,000	
Negative					
Count	15	22	20	7	64
% of total	15.0	22.0	20.0	7.0	64.0
Positive					
Count	10	13	6	7	36
% of total	10.0	13.0	6.0	7.0	36.0
Total					
Count	25	35	26	14	100
% of total	25.0	35.0	26.0	14.0	100.0

IgMAb: Immunoglobulin M antibody

Chi-square tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	3.269[a]	3	0.352
Likelihood ratio	3.355	3	0.340
Linear-by-linear association	0.008	1	0.927
Number of valid cases	100		

Critical value: > 3.283

the changes seen were non-specific and were not indicative of myocarditis ECG wise or clinically. Kularatne *et al.* have recorded in their study that 62.5% of their patients had ECG changes (T inversion, ST depression, bundle branch blocks).[13]

A low ESR of <20 mm showed a non-linear statistically significant association with the units of platelets transfused ($P = 0.036$); but no statistical correlation with thrombocytopenia ($P = 0.563$). Lymphocytosis showed no correlation with either thrombocytopenia or platelet transfusions ($P = 0.837$; $P = 0.196$). Souza *et al.* in their study found that ESR was within normal ranges

Table 17: ECG changes versus thrombocytopenia cross tabulation

ECG changes	Thrombocytopenia				Total
	No	<1 lakh	<50,000	<20,000	
ND	2	0	0	0	2
Absent	16	31	16	12	75
Present	7	4	10	2	23
Total	25	35	26	14	100

ECG: Electrocardiogram

Chi-square tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	13.579[a]	6	0.035
Likelihood ratio	13.193	6	0.040
Linear-by-linear association	0.413	1	0.520
Number of valid cases	100		

Critical value: > 13.556

Table 18: Low ESR versus thrombocytopenia

Low ESR	Thrombocytopenia				Total
	No	<1 lakh	<50,000	<20,000	
Normal/High	3	5	5	4	17
Low	22	30	21	10	83
Total	25	35	26	14	100

ESR: Erythrocyte sedimentation rate

Chi-square tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	2.046[a]	3	0.563
Likelihood ratio	1.915	3	0.590
Linear-by-linear association	1.829	1	0.176
Number of valid cases	100		

Critical value: > 2.060

in most dengue cases, independent of gender or clinical presentation.[14]

Pone *et al.* reported in their study lethargy, abdominal distension, pleural effusion, and hypoalbuminemia as the best clinical and laboratorial markers of serious dengue disease in hospitalized children.[15] However, these were not recorded in our study in the mentioned age group.

In the study conducted by Aroor *et al.,* they concluded that though thrombocytopenia on admission was associated with the presence of rash, high AST and ALT levels, and low albumin levels, it was not predictive of length of hospitalization and duration of hospital stay was longer with the presence of diarrhea, abdominal pain, ascites, and low hemoglobin level on admission.[7]

There was no mortality our study group. Munir *et al.* reported from Pakistan, a mortality rate of 0.6% in admitted cases of dengue, conducted at five tertiary care hospitals.[8,16-18] Total number of deaths was 110 all over India in 2010 (mortality 0.4% of 28,066 cases).[9]

Table 19: Low ESR versus platelet transfusion

Low ESR	Platelet transfusion											Total
	No	1 U platelet concentration	2 U platelet concentration	4 U platelet concentration	5 U platelet concentration	6 U platelet concentration	7 U platelet concentration	8 U platelet concentration	10 U platelet concentration	12 U platelet concentration		
Normal/High	11	0	3	2	0	0	0	1	0	0		17
Low	57	1	0	7	2	9	1	4	1	1		83
Total	68	1	3	9	2	9	1	5	1	1		100

ESR: Erythrocyte sedimentation rate

Chi-square tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	17.958[a]	9	0.036
Likelihood ratio	16.447	9	0.058
Linear-by-linear association	0.528	1	0.468
Number of valid cases	100		

Critical value: > 17.929

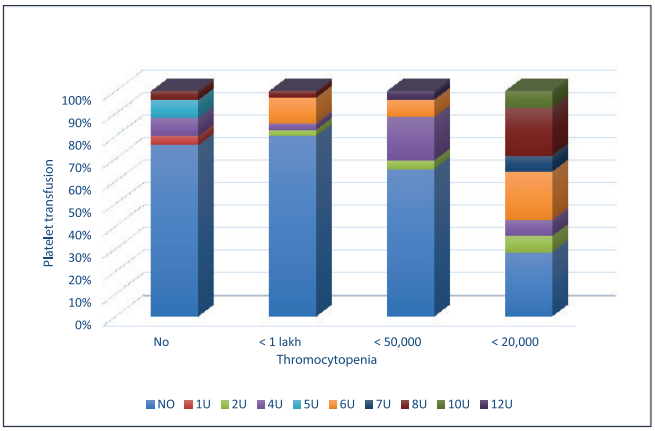

Figure 5: Thrombocytopenia versus platelet transfusion

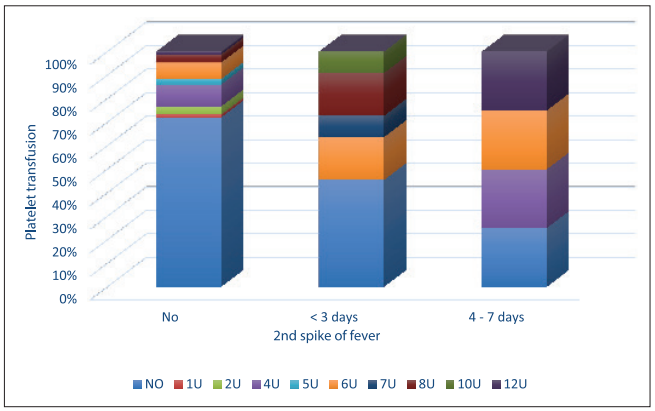

Figure 6: Second spike of fever versus platelet transfusion

CONCLUSION

A significant association of thrombocytopenia was seen in patients with a second spike of fever as well as a positive IgGAb. Greater units of platelet transfusions were required in patients with a second spike of fever, thrombocytopenia on admission to the hospital, an increase of SGOT/SGPT more than 40 and a low ESR of <20 mm.

We conclude that routine clinical parameters such as second spike of fever and routine clinical parameters such as platelet count on seeing the patient, liver enzymes (SGOT/SGPT), and ESR as well as dengue IgGAb when available could be used as useful indicators to predict patient who are at higher risk in having morbidities due to dengue infection.

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