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Original Research Article

Hematological and coagulation profile of dengue infection in age group 1 to 12 years children in a tertiary care hospital

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ABSTRACT

Introduction: Dengue is an arboviral infection of public health problems in tropical and sub-tropical countries transmitted to humans through the bite of an infected mosquito of the Stegomyia family. It varies in severity, ranging from influenza-like self-limiting illness to life- threatening, which if left untreated, are associated with mortality as high as 20%.
Objectives: Find out hematological and coagulation profile in dengue infected children aged 1 to 12 years and association of hematological and coagulation profile with dengue severity.
Materials and Methods: It is an Observational Cross- sectional study done on 100 dengue patients aged 1 to 12 years during the study period from March 2019 –February 2020.
Result: Among 100 dengue fever, 85 (85%) were categorized as dengue fever (DF), 11(11%) DF with warning signs and 4 (4%) were cases of severe dengue (DHF/DSS) according to revised World Health Organisation 2009. The most common age of presentation was above 6 years and females were afflicted more with dengue fever.100% dengue patients presented with fever. Persisting vomiting, pain abdomen, hepatomegaly and hypotension indicate progression towards severe dengue. Raised Hb% and PCV, low to normal values of WBC as well as predominantly decrease in platelet was seen in severe dengue cases however, both ESR and CRP were normal. The Liver function test was deranged SGOT>SGPT in almost all of the dengue patients and it was 3 to 4 times maximally in DFW and SD. PT, APTT prolongation, increased D- dimer and hypofibrinogenemia associated with the severity of dengue fever.
Conclusion: Dengue is a common viral infection that may have serious consequences especially in children. There is clear difference in pattern of change of both haematological and biochemical parameters in non-severe dengue fever and severe dengue fever. Rising trend of Hb%, PCV, decreasing value of platelet count, raised transaminases (SGOT>SGPT), elevated D- dimer, PT and APTT and hypofibrinogenemia can be used as predictor of entry into critical phase

1. Introduction

Dengue, an arthropod- borne viral infection transmitted by Aedes mosquitoes, is a public health problem in tropical and sub-tropical regions of the world. Dengue incidence and death are highest in children aged ≤15 years and case

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fatality rate is also highest in young children.[1,2] Dengue is ss-RNA and belongs to Flaviviridae family. It has 4serotype. The dengue virus genome is composed of 3 structural proteins, a membrane associated protein -M, an Envelop protein -E, and seven non-structural protein NS protein. NS1 has been shown to interact with the host immune system, known to evoke T cell response. In dengue virus infection, patients have a measurable level of NS1 protein in the blood, which are utilised as diagnostic markers of the infection.

Dengue viral infected person may be asymptomatic or symptomatic and clinical manifestations vary from undifferentiated fever to florid haemorrhage and shock. It is characterised by fever, headache, gastrointestinal disturbance, body pain and rash. More severe dengue is marked by increased vascular permeability, thrombocytopenia and haemorrhagic manifestation, fluid leakage into interstitial space result in shock, which without appropriate treatment may lead to death.[3] The haematological effects observed are changes in blood counts, haemoconcentration due to plasma leakage, leukopenia because of decreased neutrophils near the end of the febrile phase, presence of atypical lymphocytes and relative lymphocytosis before shock, thrombocytopenia and changes in blood haemostasis with frequent presence of haemorrhagic manifestation.[4] Biochemical and coagulation parameters include raised transaminases (SGOT>SGPT), elevated D-dimer, PT and APTT prolongation and hypofibrinogenemia.

2. Aims and Objectives

1. To find out haematological and coagulation profile in dengue infected children aged 1 to 12 years admitted in tertiary care hospital.
2. To find out if possible, any association of haematological and coagulation profile with dengue severity.

3. Materials and Methods

Ethical Committee clearance was taken from the institution and informed consent was taken from the guardian of every patient who took part in this study. This prospective, Hospital- based study was conducted in the Department of Paediatrics, of a Tertiary Care Hospital of Eastern India from February 2019 to March 2020. All clinically suspected dengue infection as per the revised World Health Organization (WHO) guidelines 2009 in children of age between 1 to 12 years were screened. A detailed history and a thorough clinical examination were done in all the cases. Data was collected in a prewritten proforma. All the cases were subjected to following investigations: Dengue IgM capture ELISA, Haemoglobin (Hb), total count (TC), differential leukocyte count (DLC), Platelet count, Haematocrit (HCT), Serum Bilirubin, alanine transaminase (ALT), aspartate transaminase (AST), serum albumin, total proteins, Prothrombin time (PT) Activated partial thromboplastin time (APTT), Fibrinogen, D-dimer, urea, creatinine, ESR, CRP, Quantitative Buffy Coat for a malarial parasite, Urine RE/ME blood culture, chest x-ray, widal test, Ultrasound abdomen. Data were collected over a one-year duration then analysed over the next 6 months. Data analysis was done by using a suitable statistical technique.

3.1. Statistical analysis

The data were entered into the Microsoft excel enterprise 2007 spreadsheet. The analysis of the available data was done by using IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. 2013 and Graph Pad Prism version 5. Statistical methods employed for data analysis was Descriptive statistics, Cross tabs, Chi-Square test for categorical outcomes. The level of significance was considered as 95% of confidence interval. So, P value ≤ 0.5 was considered as statistically significant.

4. Results

There were total of 123 patients admitted to our hospital during the study period. After exclusion 100 patients were enrolled for the study. Among 100 dengue patients, 85 were Dengue fever (DF), 11 were Dengue fever with warning signs (DFW) and 4 were severe dengue (SD). There were 56 male patients and 44 female patients with P-value >0.05. Among age groups 1 to 12 years, 21 were in 1- 3 years, 28 were in >3 to 6 years and max. i.e 51 were in >6 years of age. We found severity in > 6 years of age which was statistically not significant. (P- value .260 i.e >.05)

In our study, all the dengue patients i.e 100% had fever, only 4% presented with rash, 18% retroorbital pain, 21% body-ache, 28% headache, vomiting present in 52%. Pain abdomen was present in 21% including all 4 SD patients and 9 patients of DFW (P- value.000, <.05). 14% of dengue patients had generalized swelling (DF-4%, DFW-6%, SD- 4%, P value .000, <.05), bleeding was present in 3 SD which is statistically significant. Among 100 dengue, hepatomegaly was present in only 16 patients, All the 4 SD had hepatomegaly and out of 11 DHF, 7 patients were found with enlarged liver (P-value .000 <.05), 4% developed ascites, 3% pleural effusion and 1% had oliguria. We had not found pallor, Jaundice, cyanosis, splenomegaly and lymphadenopathy which differ from many other studies. 64% had normal SBP and 21% had < 50^{th} percentile as shown in the table number 2. 2 out of 4 SD presented with hypotension which was statistically significant (P-value < 0.05).

In hematological profile, 50% patients had their Hb% in the normal range, 20% patients found anemic and 30% patient had high Hb% (SD- 3, DFW- 7, DF- 20, P value .013, <.05). > 40% PCV was found among 25% of the patients

(SD-3, DFW- 6, DF- 16 P value .002, <.05), Leukocytosis WBC >11000 was found in only 4% and leukopenia WBC <4000 found in 22% of dengue fever. Only 1 out of 4 SD had leukopenia (P- value .870, >.05), neutropenia seen in 60% and neutrophilia in 17 %, Lymphocytes count >60%, found in 30 dengue patients (P- value >.05). 39 patients had platelet count < 1.5 lakh among them 3 patients (SD 2, DF 1) had platelet <50000, 17 patients (SD 1, DFW 4, DF 12) had platelet count between 50000 -1lakh, which was statistically significant P value .000, <.05. ESR and CRP was within normal range in 90 and 70 dengue patients respectively and found statistically not significant (P- value >.05). Table 3 depicts the hematological profile of dengue.

The liver function test was deranged in almost all of the dengue patients and it was 3 to 4 times maximally in DFW and SD. Only 28 patients had SGOT ≤40 IU and 72 patients had abnormal SGOT. 42 patients of DF had SGOT value between 40-80 IU i.e slightly raised. 4 out of 11 DFW, had between 81- 120 IU and 6 out of 100 had SGOT value more than 160 IU (2- DF, 2-DFW, 2-SD) P- value .000, <.05. The SGPT was normal in 59 patients. Almost all DFW and SD had abnormal SGPT profile. In out of 11 DFW 4 had less than 2 times, 4 had more than 2 times, 1 had > 3times and 1 had >4 times SGPT value (P- value .000, <.05). Only 4 patient had protein less than 5.6 (DFW-1, SD-3, P- value.000, <.05). Out of 100 patients hypoalbuminemia was found in only 11 patients (DF-3, DFW-4, SD-4, P value.000, <.05). So, we can say that hypoproteinemia and hypoalbuminemia was associated with dengue severity.

In the coagulation profile, we had monitored INR, APTT, D-dimer and Fibrinogen. 17 patients had PT> 16 (normal range of INR in our hospital lab 11-16). 12 out of 17 dengue patients belongs to DF (14.1%), 1 belongs to category DFW (9.1%), 4 dengue patients to SD (100%), P value <.000, <.05. Out of 100 patients aPTT >34 was seen in only 12 patients (5.9%- DF, 27.3%-DFW, 100%-SD) which was statistically significant. 39 Patients had fibrinogen level <200 (<150-5 and 150-200- 34). 100% of SD and 81.8 % of DFW had low fibrinogen which was statistically significant. Same like fibrinogen, D-dimer was also associated with dengue severity.100% of SD and 7 out of 11 DFW i.e 63.6% had D-dimer value >0.5 (P- value .000, <.05).

5. Discussion

Based on the WHO TDR 2009 dengue guidelines, the total number of cases analysed were 100, out of which 85(85%) were categorised as dengue fever (DF), 11(11%) DF with warning signs and 4 (4%) were cases of severe dengue (DHF/DSS). Non-severe dengue includes both DF and DFW and SD includes DHF/DSS. We had included age group from 1 to 12 years and maximum numbers of cases were seen in the age group >6 years of age (51%) and the least affected age group was 1-3 years of age (21%) which was similar findings to the many other studies like

Table 1: Showing age and sex distribution in DF, DFW and SD. (N=100)

Demographic profile		Category				Statistics		
		DF	DFW	SD	Total	X^2	df	P value
Age 1- 3	Count % within Cat Class	20(23.5 %)	1(9.1 %)	0(.0 %)	21(21 %)			
>3-6	Count % within Cat Class	24(28.2%)	4(36.4%)	0(0.0%)	28(28%)	5.276[a]	4	.260
>6	Count % within Cat Class	41(48.2 %)	6(54.5%)	4(100%)	51(51%)			
Total	Count % within Cat Class	85(100 %)	11(100%)	4(100%)	100(100%)			
Gender M	Count % within Cat Class	46(54.1 %)	8(72.7%)	2(50.0%)	56(56%)	5.276[a]	4	.260
F	Count % within Cat Class	39(45.9 %)	3(27.3%)	2(50.0%)	44(46%)			
Total	Count % within Cat Class	85(100%)	11(100%)	4(100%)	100(100%			

(DF- Classical dengue fever, DFW- Dengue fever with warnings sign, SD- Severe dengue M-Male, F-Female).

Table 2: Showing clinical features in different category of dengue infection

Clinical features		Category DF	DFW	SD	Total	Statistics X^2 Df P value
Fever Durations	2-7 days	75(88.2%)	11(100.0%)	4(100.0%)	100(90.0%)	
	>7 days	3(3.5%)	0(0.0%)	0(0.0%)	3(3.0%)	1.961 4 .743
	<2 days	7(8.2%)	0(0.0%)	0(0.0%)	7(7.0%)	
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Rash	A	83(97.6%)	10(90.9%)	3(75.0%)	96(96.0%)	
	P	2(2.4%)	1(9.1%)	1(25.0%)	4(4.0%)	5.937 2 .051
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Retro-Orbital Pain	A	70982.4%)	9(81.8%)	3(75.0%)	82(82.0%)	.140 2 .932
	P	15(17.6%)	2(18.2%)	1(25.0%)	18(18.0%)	
	Total	85(100.0%)	11(100.0%)	4(100.0%)	85(100.0%)	
Body-ache	A	74(87.1%)	4(36.4%)	1(25.0%)	79(79.0%)	
	P	11(12.9%)	7(63.6%)	3(75.0%)	21(21.0%)	22.412 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Headache	A	67978.8%)	4(36.4%)	1(25.0%)	72(78.8%)	
	P	18(21.2%)	7(63.6%)	3(75.0%)	28(28.0%)	13.275 2 .001
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Vomiting	A	48(56.5%)	0(0.0%)	0(0.0%)	48(48.0%)	
	P	37(42.4%)	11(100%)	4(100.0%)	52(52.0%)	16.29 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Abdominal pain	A	71(83.5%)	2(18.2%)	0(0.0%)	73(73.0%)	
	P	14(16.5%)	9(81.8%)	4(100.0%)	27(27.0%)	32.367 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Generalized swelling	A	81(95.3%)	5(45.5%)	0(0.0%)	86(86.0%)	
	P	4(4.7%)	6(54.5%)	4(100.0%)	14(14.0%)	45.689 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Bleeding	A	85(100.0%)	11(100.0%)	1(25.0%)	97(97.0%)	
	P	0(0.0%)	0(0.0%)	3(75.0%)	3(3.0%)	74.227 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Hepatomegaly	A	80(94.1%)	4(36.4%)	0(0.0%)	84(84.0%)	
	P	5(5.9%)	7(63.6%)	4(100.0%)	16(16.0%)	46.047 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Ascites	A	85(100.0%)	10(90.9%)	1(25.0%)	96(96.0%)	
	P	0(0.0%)	1(9.1%)	3(75.0%)	4(4.0%)	56.795 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Oliguria	A	85(100.0%)	11(100.0%)	3(75.0%)	99(99.0%)	
	P	0(0.0%)	0(0.0%)	1(25.0%)	1(1.0%)	24.242 2 .000
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
SBP	50^{th}-90^{th}	61(71.8%)	3(27.3%)	0(0.0%)	64(64.0%)	
	90^{th} -95^{th}	4(4.7%)	2(18.2%)	1(25.0%)	7(7.0%)	
	95^{th} – 99^{th}	4(4.7%)	0(0.0%)	0(0.0%)	4(4.0%)	24.554 8 .000
	$> 99^{th}$	3(3.5%)	0(0.0%)	1(25.0%)	4(4.0%)	
	$<50^{th}$	13(15.3%)	6(54.5%)	2(50.0%)	21(21.0%)	
	Total	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	

(DF- Classical dengue fever, DFW- Dengue fever with warnings sign, SD- Severe dengue, A-Absent, P- Present, SBP-Systolic Blood Pressure)

Table 3: ShowingHaematological profile in different category of dengue infection (N=100)

Heamatological Profile			Category Class DF	DFW	SD	Total	X Df P value
Hb	Normal	Count	45(52.9%)	4(36.4%)	1(25.0%)	50(50.0%)	12.534
		% within Cat Class					4
	<normal	Count	20(23.5%)	0(0.0%)	0(0.0%)	20(20.0%)	.013
		% within Cat Class					P <.05
	>normal	Count	20(23.5%)	7(63.6%)	3(75.0%)	30(30.0%)	
		% within Cat Class					
Total		Count	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
		% within Cat Class					
PCV <40		Count	69(81.2%)	5(45.5%)	1(25.0%)	75(75.0%)	12.184
		% within Cat Class					2
>40		Count	16(18.8%)	6(54.5%)	3(75.0%)	25(25.0%)	.002
		% within Cat Class					P <.05
Total		Count	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
		% within Cat Class					
WBC <4000		Count	20(23.5%)	1(9.1%)	1(25.0%	22(22.0%)	2.488
		% within Cat Class			)		6
4000-6000		Count	35(41.2%)	5(45.5%)	2(50.0%)	42(42.0%)	.870
		% within Cat Class					P>.05
>6000-11000		Count	26(30.6%)	5(45.5%)	1(25.0%)	32(32.0%)	
		% within Cat Class					
>11000		Count	4(4.7%)	0(0.0%)	0(0.0%)	4(4.0%)	
		% within Cat Class					
Total		Count	85(100.0%)	11(100.0%)	4(100.0%	100(100.0%)	
		% within Cat Class					
NEUTROPHIL <54%		Count	53(62.4%)	5(45.5%)	2(50.0%)	60(60.0%)	3.388
54-62 %		% within Cat Class					4
>62%		Count	18(21.2%)	3(27.3%)	2(50.0%)	23(23.0%)	.495
		% within Cat Class					P >.05
		Count	14(16.5%)	3(27.3%)	0(0.0%)	17(17.0%)	
		% within Cat Class					
Total		Count	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
		% within Cat Class					
Lymphocytes <25%		Count	1	1(9.1%)	0(0.0%)	2(2.0%)	.5.213
		% within Cat Class	1.2%				6
25-33%		Count	13(15.3%)	1(9.1%)	0(0.0%)	14(14.0%)	.517
		% within Cat Class					P >.05

Continued on next page

Table 3 continued

34-60%	Count	44(51.8%)	7(63.6%)	3(75.0%)	54(54.0%)	
	% within Cat Class					
>60%	Count	27(31.8%)	2(18.2%)	1(25.0%)	30(30.0%)	
	% within Cat Class					
Total	Count	85(100.0%)	11(100.0%)	4(100.0%)	100(	
	% within Cat Class				100.0%)	
PLATELET < 0.5	Count	1(1.2%)	0(0.0%)	2(50.0%)	3(3.0%)	
(lakh)	% within Cat Class					37.152
0.5-1	Count	12(14.1%)	4(36.4%)	1(25.0%)	17(17.0%)	6.000
	% within Cat Class					P <.05
>1-1.5	Count	16(18.8%)	3(27.3%)	0(0.0%)	19(19.0%)	
	% within Cat Class					
>1.5	Count	56(65.9%)	4(36.4%)	1(25.0%)	61(61.0%)	
	% within Cat Class					
Total	Count	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
	% within Cat Class					
ESR 0-20	Count	78(91.8%)	9(81.8)0	3(75.0%)	90(90.0%)	2.112
(mm/hr)	% within Cat Class					2
>20	Count	7(8.2%)	2(18.2%)	1(25.0%)	10910.0%)	.348
	% within Cat Class					P < 0.5
Total	Count	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
	% within Cat Class					
CRP	Count	59(69.4%)	8(72.7%)	3(75.0%)	70(70.0%)	.101
<10	% within Cat Class					2.951
(mg/dl)						P >0.5
≤ 10	Count	26(30.6%)	3(27.3%)	1(25.0%)	30(30.0%)	
	% within Cat Class					
Total	Count	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
	% within Cat Class					

(DF- Classical dengue fever, DFW-Dengue fever with warnings sign, SD- Severe dengue, Hb- Hemoglobin, PCV- Packedcell volume, WBC- Whole blood cell, ESR- Erythrocyte sedimentation rate, CRP-C-Reactive protein)

Table 4: Showing LFT parameters in different category of Dengue Fever (N=100)

			Cat Class				
			DF	DFW	SD	Total	X^2 Df P value
SGOT Cat	≤ 40 IU	Count % within Cat Class	27(31.8%)	1(9.1%)	0(0.0%)	28(28.0%)	34.841[a] 8 .000 P <0.5
	41-80 IU	Count % within Cat Class	42(49.4%)	2(18.2%)	1(25.0%)	45(45.0%)	
	81-120 IU	Count % within Cat Class	12(14.1%)	4(36.4%)	0(0.0%)	16(16.0%)	
	>120-160 IU	Count % within Cat Class	2(2.4%)	2(18.2%)	1(25.0%)	5(5.0%)	
	>160 IU	Count % within Cat Class	2(2.4%)	2(18.2%)	2(50.0%)	6(6.0%)	
TOTAL		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
SGPT ≤ 40 IU		Count % within Cat Class	58(68.2%)	1(9.1%)	0(0.0%)	59(59.0%)	37.756 8 .000 P <.05
41-80 IU		Count % within Cat Class	22(25.9%)	4(36.4%)	2(50.0%)	28(28.0%)	
81-120 IU		Count % within Cat Class	3(3.5%)	4(36.4%)	1(25.0%)	8(8.0%)	
>120-160 IU		Count % within Cat Class	0.00(0.0%)	1(9.1%)	0(0.0%)	1(1.0%)	
>160 IU		Count % within Cat Class	2(2.4%)	1(9.1%)	1(25.0%)	4(4.0%)	
Total		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
Total protein ≤ 5.6		Count % within Cat Class	0(0.0%)	3(27.3%)	1(25.0%)	4(4.0%)	23.651 2 .000 P <.05
> 5.6		Count % within Cat Class	85(100.0%)	8(72.7%)	3(75.0%)	96(96.0%)	
Total		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	
ALBUMIN ≤ 3.5		Count % within Cat Class	3(3.5%)	4(36.4%)	4(100.0%)	11(11.0%)	44.437 2 .000 P <.05
>3.5		Count % within Cat Class	82(96.5%)	7(63.6%)	0(0.0%)	89(89.0%)	
TOTAL		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	

(DF- Dengue fever, DFW- Dengue fever with warning sign, SD- Severe Dengue, SGOT- serum glutamic- oxaloacetic transaminase, SGPT- Serum glutamic-pyruvic transaminase, LFT- Liver function test)

Table 5: Showing Coagulation Profile in different category of Dengue Fever (N=100)

			Category Class			Total	X^2
			DF	DFW	SD		Df
PT	<16	Count % within Cat Class	65(76.5%)	5(45.5%)	0(0.0%)	70(70.0%)	P value
	=16	Count % within Cat Class	8(9.4%)	5(45.5%)	0(0.0%)	13(13.0%)	31.559
	>16	Count % within Cat Class	12(14.1%)	1(9.1%)	4(100.0%)	17(17.0%)	4 .000
Total		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	P<.05
APTT < 34		Count % within Cat Class	73(85.9%)	6(54.5%)	0(0.0%)	79(79.0%)	
=34		Count % within Cat Class	7(8.2%)	2(18.2%)	0(0.0%)	9(9.0%)	36.550
>34		Count % within Cat Class	5(5.9%)	3(27.3%)	4(100.0%)	12(12.0%)	4 .000
Total		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	P<.05
INR < 1.2		Count % within Cat Class	19(22.4%)	1(9.1%)	0(0.0%)	20(20.0%)	
= 1.2		Count % within Cat Class	49(57.6%)	6(54.5%)	0(0.0%)	55(55.0%)	14.417
> 1.2		Count % within Cat Class	17(20.0%)	4(36.4%)	4(100.0%)	25(25.0%)	4 .006
Total		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	P<.05
Fibrinogen 150-199		Count % within Cat Class	26(30.6%)	6(54.5%)	2(50.0%)	34(34.0%)	
≥ 200		Count % within Cat Class	59(69.4%)	2(18.2%)	0(0.0%)	61(61.0%)	40.054
<150		Count % within Cat Class	0(0.0%)	3(27.3%)	2(50.0%)	5(5.0%)	4 .000
Total		Count % within Cat Class	859100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	P <.05
D-dimer Total ≤ 0.5		Count % within Cat Class	65(76.5%)	4(36.4%)	0(0.0%)	69(69.0%)	
> 0.5		Count % within Cat Class	20(23.5%)	7(63.6%)	4(100.0%)	31(31.0%0	16.599
Total		Count % within Cat Class	85(100.0%)	11(100.0%)	4(100.0%)	100(100.0%)	2 .000
							P<.05

(PT- Prothrombin Time, DF- Dengue fever, APTT- Activated Partial Thromboplastin Time, INR- International normalized ratio, DFW- Dengue fever with warning sign, SD- Severe Dengue)

Table 6: Descriptive analysis of different parameter in dengue fever

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
age (YRS)	DF	85	6.076	3.1493	.3416	5.397	6.756	1.0	12.0
	DFW	13	6.923	2.4987	.6930	5.413	8.433	2.0	11.0
	SD	2	8.000	1.4142	1.0000	-4.706	20.706	7.0	9.0
	Total	100	6.225	3.0560	.3056	5.619	6.831	1.0	12.0
Fever days	DF	85	1.200	.5732	.0622	1.076	1.324	1.0	3.0
	DFW	13	1.000	.0000	.0000	1.000	1.000	1.0	1.0
	SD	2	1.000	.0000	.0000	1.000	1.000	1.0	1.0
	Total	100	1.170	.5329	.0533	1.064	1.276	1.0	3.0
SBP	DF	85	101.165	7.7978	.8458	99.483	102.847	80.0	124.0
	DFW	13	100.769	16.0320	4.4465	91.081	110.457	82.0	142.0
	SD	2	83.000	4.2426	3.0000	44.881	121.119	80.0	86.0
	Total	100	100.750	9.4574	.9457	98.873	102.627	80.0	142.0
Hb	DF	85	12.119	1.5269	.1656	11.789	12.448	8.2	16.0
	DFW	13	13.354	1.7052	.4729	12.323	14.384	11.0	17.4
	SD	2	15.000	1.4142	1.0000	2.294	27.706	14.0	16.0
	Total	100	12.337	1.6342	.1634	12.013	12.661	8.2	17.4
PCV	DF	85	36.627	4.4035	.4776	35.677	37.577	24.6	49.0
	DFW	13	40.585	5.6742	1.5737	37.156	44.013	33.0	52.0
	SD	2	45.000	4.2426	3.0000	6.881	83.119	42.0	48.0
	Total	100	37.309	4.8518	.4852	36.346	38.272	24.6	52.0
WBC	DF	85	5897.647	2768.8306	300.3218	5300.424	6494.870	1800.0	16500.0
	DFW	13	6430.769	2106.0962	584.1260	5158.068	7703.470	3600.0	9400.0
	SD	2	6000.000	.0000	.0000	6000.000	6000.000	6000.0	6000.0
	Total	100	5969.000	2659.8661	265.9866	5441.225	6496.775	1800.0	16500.0
Neutrophil	DF	85	46.153	15.5491	1.6865	42.799	49.507	10.0	74.0
	DFW	13	54.538	12.6136	3.4984	46.916	62.161	30.0	74.0
	SD	2	35.000	7.0711	5.0000	-28.531	98.531	30.0	40.0
	Total	100	47.020	15.3596	1.5360	43.972	50.068	10.0	74.0
Lymphocytes	DF	85	50.929	15.7675	1.7102	47.528	54.330	24.0	88.0
	DFW	13	42.462	12.6795	3.5167	34.799	50.124	24.0	66.0
	SD	2	62.500	6.3640	4.5000	5.322	119.678	58.0	67.0
	Total	100	50.060	15.5627	1.5563	46.972	53.148	24.0	88.0
Platelet	DF	85	1.899	.6402	.0694	1.761	2.037	.3	3.0
	DFW	13	1.515	.8092	.2244	1.026	2.004	.4	3.1

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Table 6 continued

	SD	2	.550	.3536	.2500	-2.627	3.727	.3	.8
	Total	100	1.822	.6917	.0692	1.685	1.959	.3	3.1
	DF	85	.496	.0906	.0098	.477	.516	.3	.7
TSB	DFW	13	.492	.0954	.0265	.435	.550	.3	.6
	SD	2	.600	.0000	.0000	.600	.600	.6	.6
	Total	100	.498	.0910	.0091	.480	.516	.3	.7
	DF	85	63.785	52.0920	5.6502	52.549	75.021	19.0	392.0
SGOT	DFW	13	143.923	118.3874	32.8348	72.382	215.464	32.0	445.0
	SD	2	288.000	229.1026	162.0000	-1770.405	2346.405	126.0	450.0
	Total	100	78.687	78.5243	7.8524	63.106	94.268	19.0	450.0
	DF	85	43.867	38.7853	4.2069	35.501	52.233	13.0	310.0
SGPT	DFW	13	99.154	86.1992	23.9074	47.064	151.244	22.0	370.0
	SD	2	243.500	218.4960	154.5000	-1719.609	2206.609	89.0	398.0
	Total	100	55.047	61.1513	6.1151	42.913	67.181	13.0	398.0
	DF	85	6.927	.5227	.0567	6.814	7.040	5.8	8.4
T Protein	DFW	13	6.146	1.1304	.3135	5.463	6.829	4.2	7.6
	SD	2	6.300	.4243	.3000	2.488	10.112	6.0	6.6
	Total	100	6.813	.6807	.0681	6.678	6.948	4.2	8.4
	DF	85	3.946	.2893	.0314	3.883	4.008	3.0	4.8
Albumin	DFW	13	3.485	.6336	.1757	3.102	3.867	2.0	4.3
	SD	2	3.100	.1414	.1000	1.829	4.371	3.0	3.2
	Total	100	3.869	.3954	.0395	3.791	3.947	2.0	4.8
	DF	85	15.341	.5530	.0600	15.222	15.460	14.2	16.9
PT D1	DFW	13	15.762	.5124	.1421	15.452	16.071	14.8	16.4
	SD	2	17.250	1.0607	.7500	7.720	26.780	16.5	18.0
	Total	100	15.434	.6251	.0625	15.310	15.558	14.2	18.0
	DF	85	32.306	1.1129	.1207	32.066	32.546	30.0	36.0
APTT	DFW	13	33.577	1.6310	.4524	32.591	34.563	30.0	36.0
	SD	2	53.500	21.9203	15.5000	-143.446	250.446	38.0	69.0
	Total	100	32.895	3.8940	.3894	32.122	33.668	30.0	69.0
	DF	85	1.2032	.07774	.00843	1.1864	1.2199	1.10	1.50
INR	DFW	13	1.2385	.06504	.01804	1.1992	1.2778	1.10	1.30
	SD	2	1.7500	.35355	.25000	-1.4266	4.9266	1.50	2.00
	Total	100	1.2187	.11342	.01134	1.1962	1.2412	1.10	2.00
	DF	85	210.647	40.7296	4.4177	201.862	219.432	140.0	391.0
	DFW	13	169.000	36.7718	10.1987	146.779	191.221	130.0	251.0
FIBRINOGEN	SD	2	132.500	17.6777	12.5000	-26.328	291.328	120.0	145.0
	Total	100	203.670	43.3194	4.3319	195.074	212.266	120.0	391.0

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Table 6 continued

d-DIMER	DF	85	.4449	.52695	.05716	.3313	.5586	.01	4.20
	DFW	13	2.3562	5.61004	1.55595	-1.0340	5.7463	.10	20.94
	SD	2	1.2500	.35355	.25000	-1.9266	4.4266	1.00	1.50
	Total	100	.7095	2.11513	.21151	.2898	1.1292	.01	20.94
CRP D1	DF	85	9.889	14.3996	1.5619	6.783	12.995	1.2	105.0
	DFW	13	12.000	16.7901	4.6567	1.854	22.146	2.6	65.0
	SD	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0
	Total	100	10.026	14.5475	1.4547	7.139	12.913	1.2	105.0
UREA	DF	85	20.882	4.9097	.5325	19.823	21.941	15.0	46.0
	DFW	13	23.615	8.5102	2.3603	18.473	28.758	16.0	43.0
	SD	2	20.000	.0000	.0000	20.000	20.000	20.0	20.0
	Total	100	21.220	5.4875	.5488	20.131	22.309	15.0	46.0
Creatinine	DF	85	.524	.1681	.0182	.487	.560	.2	1.0
	DFW	13	.562	.1446	.0401	.474	.649	.3	.8
	SD	2	.400	.1414	.1000	.871	1.671	.3	.5
	Total	100	.526	.1649	.0165	.493	.559	.2	1.0

Table 6 Representing Descriptive result of Demographic, clinical, Hematological, Biochemical and coagulation Profile of Dengue fever (DF), Dengue Fever with warning (DFW) and Severe Dengue (SD).

Ramana Sastry C.P.V et al. who found almost 50% were among 6-8 years age group.[5] The mean age group in this study was 6.8. More involvement in children > 6years could be explained by the diurnal adaptation of Aedes mosquito in stored water.

These children spent their spare time more open field. This makes them prone to repeated attacks by Aedes mosquitoes. We could see that severity was also seen more in the age group >6 years but it was not statistically significant P value >.05. There was significant difference in male: female ratio in our study 1.2: 1 which was similar to other study as above but in Amrita Roy et al. finding was contrary to our study where the females were more affected in dengue fever than males.[6] We had found female and male having equal chance to develop complication. This was probably due to more importance being given to the male children in the Indian society. Covered dress used by females may be another cause for fewer incidences.

Fever was present in 100% dengue patients, vomiting in 52%, headache in 28%, pain abdomen 21%, retroorbital pain 18%, generalized swelling in 14% and only 4% presented with rash. Persisting vomiting, pain abdomen, generalized swelling, bleeding, hepatomegaly, ascites, pleural effusion and oliguria mainly associated with severity of dengue which was statistically significant.

In this study 30 % dengue patients had Hb more than the normal value for their age. Among them 23.5% belonged to DF, 63.6% DFW and 75% in SD. 25 % patients had PCV value >40% which correspond to 18.8%, 54.5% and 75% to DF, DFW, SD respectively i.e more Hb and hemoconcentration indicate severity of dengue which was statistically significant. Similar findings were seen in Ramana Sastry C.P.V et al. and Amrita Roy et al. The percentage increase in haematocrit is an accurate indicator of vascular permeability and plasma leakage. In some DF patients the rise of PCV could have been due to dehydration as a result of poor intake and vomiting.[7] There are no clear-cut guidelines for haemoconcentration in the Indian population.

74% patients had normal WBC count, 22% had leukopenia and only 4% had leukocytosis seen in this study population and leukopenia and leucocytosis was not associated with dengue severity (P- value >0.05). Similarly, Mishra et al. also reported that 58.76% of the cases had normal leukocyte count, while leucopoenia was seen in 25.77% and leukocytosis in 15.46% of the cases.[8] In dengue neutropenia and lymphocytosis are more common than neutrophilia and lymphopenia. In our study maximum patients had normal WBC count, 60% had neutropenia and 84% had lymphocytosis but did not have any correlation with dengue severity. 39 patients had platelet count < 1.5 lakh among them 3 patients (SD 2, DF 1) had platelet <50000, 17 patients (SD 1, DFW 4, DF 12) had platelet count between 50000 – 1lakh , which was statistically significant P-value .000, <.05 similar to Kumar et al. who observed 14.1% of their patients had a platelet count <20,000 and low platelet count had significantly correlated with the severity of dengue.[9] ESR and CRP was within normal range in 90 and 70 dengue patients respectively and found statistically not significant (P value >.05) which was contrary to finding in study Atukuri SR et al. which depict that C-reactive protein had positive correlation in severe dengue, with significant P value (<0.0001), and non-severe dengue cases found to have no significant correlation.[10] Ho et al. in his study observed low CRP values (<20mg/dl) as a marker for dengue[11,12] which was similar to our findings where we had also found low CRP more.

The liver function test was deranged, SGOT>SGPT in almost all of the dengue patients and it was 3 to 4 times maximally in DFW and SD which was similar to the findings in Amrita Roy et al. kalenahaalli and Jagadishkumar et al. According to Shubhankar Mishra et al, Elevation of SGOT was significantly more compared to SGPT is more associated with severity of infection which coincides with others also.[13] Almost all DFW and SD had abnormal SGPT profile. SGOT raised more than SGPT in dengue may be due to involvement of myocytes. Very high levels of SGOT and SGPT indicate severity of the disease along with morbidity and mortality.

In the coagulation profile we had monitored PT, INR, APTT, D-dimer and Fibrinogen. Dengue fever is associated with transient coagulopathy during course of illness. PT and APTT prolongation may be due to impaired synthesis of the coagulation factor due to involvement of the liver. 100% of SD and 81.8% of DFW had low fibrinogen which was statistically significant which was similar to the study that used 125 I-fibrinogen[14], increased rates of consumption of fibrinogen were demonstrated in patients who had DHF both with and without shock or haemostatic abnormalities. A possible scenario is that dengue infection primarily activates fibrinolysis in the absence of a thrombotic stimulus, degrading fibrinogen directly and prompting secondary activation of various procoagulant homeostatic mechanisms.[15] In the study Kittiya Setrkraising,Chansuda Bongsebandhu-phubhakdi et al**.** showed significantly higher D-dimer levels in DHF patient compared with DF patient with the sensitivity of D-dimer in predicting DHF of 90%.[16] In our study 100% of SD and 7 out of 11 DFW i.e 63.6% had D-dimer value >0.5 (P- value .000, <.05). D-dimer was also found to be positively correlated with dengue severity in all stage of disease namely febrile, toxic and convalescent (P value <0.05). Detection of D-dimer in febrile stage of dengue infection may be beneficial for predicting the clinical course of the disease. It may help in the clinicians in predicting dengue severity before the patient progress into toxic stage so that close monitoring and proper management can be arranged.

6. Conclusion

Dengue is a mosquito-borne infection found in tropical and sub-tropical regions around the world. Series of clinical, hematological and biochemical changes occur during course of the illness. They could be used to identify the complications early and introduce effective management strategies, thus reducing morbidity and mortality.

Maximum of the patients present with simple dengue fever. We find age group > 6 years are more and age group <1-3 years are least prone to develop dengue fever. Male are slightly more effected than female but both Genders have an equal chance to develop complications. All dengue patients present with fever. Persisting vomiting, pain abdomen, generalized swelling, hepatomegaly and low Blood pressure is a prognostic indicator of dengue severity and monitoring of the child is of utmost importance. Severe dengue presents with the signs of plasma leakage i.e increased Hb % and PCV, thrombocytopenia which is statistically significant. Elevated transaminase > 3 to 4 times of its normal value associated with dengue severity which is also statistically significant.

In the coagulation profile, raised aPTT, PT, D-dimer and hypofibrinogenemia reflect progression towards complication. So, by using these biochemical parameters, we can segregate the complicated one and by providing adequate monitoring and treatment we can prevent mortality and morbidity associated with dengue fever.

7. Limitations

1. Small sample size.
2. No follow up of cases included in the study.
3. Blood sample was not taken separately in febrile phase, critical phase and convalescent phase.
4. Only the worst value of all the parameters were selected and analysed.

8. Conflict of Interest

The authors declare that there are no conflicts of interest in this paper.

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None.

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