

Comparison of different blood indices and smear finding among dengue cases: a retrospective review

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Abstract

Background: Dengue disease is typically found in tropical and subtropical regions, where environmental and socioeconomic conditions favor the development of vector, the mosquito *Aedes aegypti*. Due to changing climate, urbanization, poor living conditions and inadequate waste management, vector borne diseases like dengue fever are becoming more common. **Aims & Objectives:** This study aims to compare different blood indices among the dengue cases. **Material & Methods:** A retrospective study among dengue positive cases was conducted at one of the tertiary care centre, Bhopal. Blood sample reports of all the cases from July 2014 to December 2015 was retrieved from records. Total sample size of study was 62 dengue positive cases. All the parameters related to blood smear was recorded and analyzed. The study was approved from institutional ethical committee. Data was analysis using appropriate statistical software. **Result:** This study included 62 dengue positive cases. In first follow up 41 and in second follow up 28 patients' details was found. Thrombocytopenia was present in 54.8% cases however 30.6% cases had platelet count below 50000. Median MPV, PDW and hematocrit were 10.15, 15.85 and 40.35% respectively. Low MPV (<9 fl) which indicate bone marrow suppression was observed in 8 (12.9%) patients. High PDW (>13 fl) which is a useful marker for platelet activation seen in 62 (100%) patients. **Conclusion:** Laboratory parameters and their regular follow up are essential elements of dengue management. Complete blood picture with some indices may predict the chances of dengue positivity. Appearance of platelet clumps in peripheral smear could be used as an early indicator for severity of disease.

Keywords: Dengue, Blood indices, Platelet clumps, Thrombocytopenia

Introduction

Dengue is a fast emerging pandemic viral disease in many parts of the world especially in tropical and subtropical countries. In recent days there has been an alarming increase in the incidence of dengue fever and has emerged as a serious international public health threat with almost half of the world's population at risk for infection. The disease is also endemic in many parts of India, especially the metropolitan cities and towns. Outbreaks are now reported quite frequently from different parts of the country like rural areas of Haryana, Maharashtra, Andhra Pradesh and Karnataka [1].

Dengue is an arbo viral disease caused by a virus of the genus *Flavivirus*. There are four serotypes of virus classified as Den-1, 2, 3 and 4. This disease is typically found in areas where environmental and social conditions favor the development of *Aedes aegypti* mosquito vector [2].

Most of dengue infections are asymptomatic. Those with symptoms can be classified into 3 patterns, based on their severity; undifferentiated fever, dengue fever (DF) and dengue hemorrhagic fever (DHF) which if accompanied by shock, is called dengue shock syndrome (DSS) [3]. Some clinical and hematological parameters associated with severity of dengue infection may be used to forecast disease severity in patients suspected of dengue infection.

These are Age > 6 years, female gender, Hematocrit > 40%, platelet \leq 100,000/ μ L, white cell count < 5,000/ μ L, absolute neutrophil count < 3,000 / μ L and any bleeding episodes associated with severity of disease [3,4]. DF in adults lasts longer than non-dengue febrile illnesses [5]. In india epidemics becoming more frequent and are straining the limited resource of public health system.

There is also paucity of prognostic markers for dengue fever in adults.⁵ Such markers may be particularly useful in determining the necessity for hospitalised care, which would not only reduce the healthcare cost but also aid in the

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appropriate utility of hospital beds [5]. The cause of mortality in dengue infection are from prolonged shock, massive bleeding and fluid overload [5,6,7].

As yet, there is no specific treatment for DF and management remains largely supportive, although progress has been made in drug and vaccine development [6].

At present Very few studies have been conducted in central part of our country on dengue infection, hence this study was undertaken to study the significance of clinical picture and laboratory profile of dengue positive cases.

This study principally aims to compare different blood indices among the dengue cases and also find out whether platelet clumping phenomenon was occur before platelet disintegration.

Methodology

Type of study- Retrospective study

Setting- This study was done in Department of Pathology & Lab Medicine at one of the tertiary care centre at Bhopal, Madhya Pradesh.

Duration of Study- The total duration of study was 18 months from July 2014 to December 2015.

Sample Size calculation: All cases admitted during the study period was included in the study. Total sample size of study was 62 dengue positive cases.

Results

In this study, total 62 dengue positive patients were included and analyzed. In first follow up 41 and in second follow up 28 patients' details was found. The patients were both 37 (59.7%) males and 25 (40.3%) females ranging from 7 year - 53 years. Mean age of patients was 24.52 years.

Laboratory investigations revealed that thrombocytopenia present in 34(54.8%) patients (platelet count less than 1,00,000/cumm).

However, in 19(30.6%) patients platelet count was below 50,000/cumm and only 03 (04.83%) cases had platelet count below 20,000/cumm at the time of presentation.

Median MPV was 10.15 (Range 7.8-14.9), Median PDW was 15.85 (Range 13.9-17.4), Median platelet count was 120000 (Range 13000-351000), Median haematocrit was 40.35% (Range 23.60% -50.70%).

Low MPV (<9 fl) which indicate bone marrow suppression was observed in 8 (12.9%) patients. High PDW (>13 fl) which is a useful marker for platelet activation seen in 62 (100%) patients. haematocrit >40% was present in 33 (53.2%) patients.

In this study at the time of first presentation 32 (51.6%) cases showed WBC count less than 4000 /cumm while 44 (71%) cases had absolute neutrophil count less than 3000/cumm.

The peripheral smears in all these cases were examined, 78% of the smears showed reactive lymphocytes which are seen as large monocytoid cells.

Sampling Method: All dengue positive patients admitted in the center was included in the study.

Data collection procedure: Blood sample reports of all the dengue confirmed case came to the department was retrieved from records without revealing the identity of the patient.

Blood sample report was prepared with the combination of automated hematology analyzer reports and smear examination.

All the parameters like platelet count, MPV, PDW, HCT, WBC count and absolute neutrophil count were recorded related to blood smears.

Ethical Consideration and Permission: Ethical approval was obtained from institutional ethics committee.

The confidentiality of the patient was not breached at any point as only reports of all dengue cases was collected and patient identity was not known to either the principal or the co-investigators.

The patient details were not included at any time in the study.

Data Analysis- Data was entered in MS office excel and analyzed with appropriate method.

Table-1: Demographic and blood indices distribution among dengue positive cases.

		Frequency	Percentage
Age (in years)	<10	5	8.1
	11-20	19	30.6
	21-30	24	38.7
	31-40	8	12.9
	41-50	4	6.5
	51-60	2	3.2
Sex	Male	37	59.7
	Female	25	40.3
Platelet count	<50000	19	30.6
	50000-100000	15	24.2
	>100000	28	45.2
Mean Platelet volumn (MPV)	<9	8	12.9
	>9	54	87.1
Hematocrit (HCT)	< 40%	29	46.8
	>40%	33	53.2
Platelet distribution width (PDW)	< 13	0	0
	>13	62	100

Table-2: Distribution of laboratory parameters among cases.

		Minimum	Maximum	Mean	Std. Deviation
	Age	7	53	24.52	11.303
First Presentation (N=62)	Platelet count counter	13000	351000	103661.29	73999.323
	Platelet count manual	20000	300000	121370.97	63918.040
	MPV	7.8	14.9	10.355	1.4144
	PDW	13.9	17.4	15.837	0.6356
	HCT	0.2360	0.5070	0.407274	0.0582646
	WBC Count	1100	9300	4196.77	1893.3
	Absolute neutrophil count	600	6900	2619.35	1345.77
First Follow up (N=41)	Platelet count counter	14000	461000	84487.80	86098.526
	Platelet count manual	20000	480000	100975.61	87472.992
	MPV	8.0	12.6	10.508	1.0102
	PDW	14.8	17.4	16.076	0.6236
	HCT	0.3140	0.5440	0.410366	0.0540480
Second Follow up (N=28)	Platelet count counter	16000	383000	84142.86	83787.082
	Platelet count manual	20000	320000	88964.29	75013.817
	MPV	8.3	14.1	10.311	1.2515
	PDW	14.5	16.8	15.950	0.5281
	HCT	0.3270	0.5070	0.412857	0.0516381

Out of total 62 cases only blood sample of 41 cases came for follow, out of these 41 cases, 33 cases show decreased platelet count. In these 33 cases, 11 (33.3%) cases had platelet clumps on peripheral smear previously. About 8 patients out of these 41 cases shows increased platelet count on follow up, in all these 8 patients, no one had platelet clumps first time.

As per records, 41 cases that came for first follow up blood, only blood sample of 28 cases come for second follow up. Decreased platelet count seen in 18 cases. Out of these 18 cases platelet clumps was present in 6 (33.3%) cases on peripheral smear previously. 10 cases out of the 28 cases shows increased platelet count, not even single case out of these 10 cases shows platelet clumps in peripheral smear.

Discussion

In the present study, there was a slight male preponderance (37 (59.7%) males and 25 (40.3%) females). Similar observations have been made by Patel K et al [8], Malthesha MK et al [9], Basir AB et al [7] and Banerjee M et al [10]. Hypothetically, this can be related to the increased risk of exposure of male gender to mosquito bites due to occupational and recreational activities [8].

The significant laboratory abnormality seen in our patients was thrombocytopenia, as also observed by Malthesha MK et al [9] and N Ali et al [11]. It was observed that thrombocytopenia was present in 54.8% patient. Thrombocytopenia is due to the direct and antibody mediated destruction of the platelets and megakaryocytes and also due to the suppression of the bone marrow by virus. [12] Haemorrhagic manifestations are very common with severe thrombocytopenia and severity of haemorrhagic tendency correlates with the platelet counts.

Platelet count was evaluated by automated haematology analyzer as well as on peripheral smear. The analyzer gives a false low reading when platelets clumps are present; such cases were abviated by assessment of platelets on smear.

In this study it was found that there was not even single case with MPV (<7fl). high MPV (>11fl) were present in 19 (30.64%) cases and MPV within normal limits (7fl-11fl) were present in 43 (69%) cases. Study conducted by Bashir AB et al found that low MPV present in 17.4% cases, high MPV present in 0.6% cases, whereas MPV within normal limits present in 82% cases [7].

In present study low PDW (<15) present in 5 (8.06%) cases, high PDW (>17) found in 4 (6.45%) cases, whereas PDW within normal limits (15-17) found in 53 (85.48%) cases, however study done by Bashir AB et al [7] found increased PDW in dengue patients.

This study showed that total leukocyte count less than 4000/cumm seen in 51.6% cases similar finding was suggested by study of Rashmi V et al [13], Arshad et al [14], Vanamali et al [1] and singh R et al [15] who reported leucopenia in 60%, 49%, 46% and 41.4% of cases respectively. However, studies done by Rusmawati I et al [16] and Dutta P et al [17] found lower incidence of leokopenia that is 33% and 30% of cases respectively.

Leucopenia in dengue infection mainly affects the neutrophills and monocyte lineage. It was observed that absolute neutrophill count less than 3000 per cumm in 71% of cases similar was suggested by Lei HY et al [18] and Kalayanarooj S et al [4]. Atypical lymphocytes were seen in 78% of total cases. These cells were large monocytoid

cell. MV Rashmi et al [13] and Rusmawati et al [16] reported activated lymphocytes in 80% and 85.1% of cases respectively. Higher percentage of 93% was reported by Jameel et al [12]. At present as far there is no study done to find out whether there is presence of platelet clumps seen in peripheral smear in dengue patients prior to platelet destruction, probably their occurrence is due to formation of anti-platelet antibodies in dengue positive cases. This is retrospective study based on the records of patients available at the center. The sample size of study is relatively less which could not predict exact picture of the community.

Conclusion

This study concluded that each and every blood parameter is important in case of dengue positive patients. In complete blood picture some changes in particular parameter give an indication towards chances of dengue positivity. Similarly, peripheral smear examination is essential in dengue affected areas as some changes in different blood cells gave indication towards positivity.

What the study adds to the existing knowledge?

This study recommended that use of different blood parameters like Platelet count, haemotocrit, WBC count, ANC along with different platelet indices is essential for early assessment of prognosis as well as to do proper management of dengue cases.

Also, the appearance of platelet clumps could be a early indicator of proceeding platelet depletion and this will help in better management of dengue cases and requirement of platelet transfusion.

Author's contributions

Dr. Smriti Pandey: Concept, study design, manuscript preparation.

Dr. Dhruvendra Pandey: Data analysis, manuscript preparation

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