"STUDY OF PLATELET INDICES IN PATIENTS WITH FEBRILE THROMBOCYTOPENIA"

BY
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Dissertation submitted to the

B.L.D.E. University , Bijapur, Karnataka

In partial fulfillment of the requirements for the degree of

DOCTOR OF MEDICINE

IN

PATHOLOGY

Under the guidance of

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2013

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I hereby declare that this dissertation entitled **"STUDY OF PLATELET INDICES IN PATIENTS WITH FEBRILE THROMBOCYTOPENIA"** is a bonafide and genuine research work carried out by me under the guidance of **DR.MAHESH.H. KARIGOUDAR$_{MD,DNB}$** Professor, Department of Pathology B.L.D.E. University Shri B.M Patil Medical College, Bijapur.

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Date: **DR.RAMU. R.**

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LIST OF ABBREVATIONS USED

MPV **:** Mean platelet volume

PDW **:** Platelet distribution width

P-LCR **:** Platelet large cell ratio

AA **:** Aplastic anemia

ITP **:** Immune thromobocytopenic purpura

IL **:** Interleukin

TNF **:** Tumor necrosis factor

IFN **:** Interferon

TGF **:** Transforming growth factor

VEGF **:** Vascular endothelial growth factor

LPS : Lipopolysacharide

LPB **:** Lipopolysacharide Binding Protein

ABSTRACT

Introduction: Platelet indices viz. Mean platelet volume (MPV), Platelet distribution width (PDW) and Platelet large cell ratio (P-LCR) are measured in the automated cell counter. These indices are well utilized for certain conditions like idiopathic thrombocytopenic purpura, aplastic anemia and other hemotological disorders to assess the prognosis. Platelet count is decreased in various conditions including infectious and non-infectious disease processes. Infectious conditions like dengue fever, malaria, rickettsia, leptospirosis cause fever and variable degree of thrombocytopenia. Hence a detailed study of platelet indices is undertaken in patients having fever with thrombocytopenia.

Materials & Methods: A study of 150 patients presenting with fever of less than 7 days in duration and thrombocytopenia was done over a period of 1 year from Jan 2011 to Dec 2011. Detailed histories, physical and clinical examination of the patients were done to assess the etiology of febrile thrombocytopenia. Serological investigations for dengue fever, leptospirosis and rickettsia were done for confirmation.

Results: Majority of the cases were of viral fever(72.6%) {which includes dengue fever (10.6%) },followed by malaria(15.3%), , septicemia(4.6%), enteric fever (4%), leptospirosis(2%), rickettsia (0.6%) & brucellosis(0.6%). The platelet indices PDW (74.6%), MPV(86.6%), P-LCR(80.6%) were within normal limits.

Conclusion: Platelet indices are not changed in febrile thrombocytopenic patients. Whenever patient with febrile thrombocytopenia presents with changes in platelet indices, non infectious conditions are also to be considered in differential diagnosis.

Key words: Febrile thrombocytopenia, platelet indices

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INTRODUCTION

Platelet parameters – Mean platelet volume (MPV), Platelet distribution width (PDW) and Platelet large cell ratio (P-LCR) are measured in the automated cell counter. These parameters are well utilized for certain conditions like idiopathic thrombocytopenic purpura (ITP), aplastic anemia and other hemotological disorders to assess the prognosis[1].

Platelet count is decreased (thrombocytopenia) in various conditions including infectious and non-infectious disease processes. Infectious conditions like dengue fever, malaria, rickettsia, leptospirosis cause fever and variable degree of thrombocytopenia, sometimes even death of the patient [2].

Platelet indices like MPV, PDW, P-LCR are easily recorded by automated cell counter but are underutilized. The changes in these indices in patients with febrile thrombocytopenia are not well documented in the previous literatures.

Hence, a detailed study of platelet indices is undertaken in patients having febrile thrombocytopenia.

OBJECTIVES OF THE STUDY

1) To know the proportion of malaria, dengue, rickettsia, leptospirosis in patients having febrile thrombocytopenia.
2) To evaluate platelet indices viz. MPV, PDW, P-LCR in patients with febrile thrombocytopenia.

REVIEW OF LITERATURE

Blood platelets are small, anucleate cellular fragments that play an essential role in hemostasis. During normal circulation, platelets circulate in a resting state as small discs. However, when challenged by vascular injury, platelets are rapidly activated and aggregate with each other to forma plug on the vessel wall that prevents vascular leakage. Each day, 100 billion platelets must be produced from megakaryocytes to maintain the normal platelet count of 2 to 4lakhs/cu.mm^3.

THE STRUCTURE OF THE PLATELET:

Human platelets circulate in the blood as discs that lack the nucleus found in most cells. Platelets are heterogeneous in size, exhibiting dimensions of 0.5 × 3.0μm. The surface of the platelet plasma membrane is smooth except for periodic invaginations that delineate the entrances to the open canalicular system (OCS), a complex network of interwinding membrane tubes that permeate the platelet's cytoplasm. The lipid bilayer of the resting platelet contains a large concentration of transmembrane receptors that include the glycoprotein receptor for vonWillebrand factor (VWF); the major serpentine receptors for ADP thrombin,epinephrine and thromboxane A2; the Fc

receptor Fcγ RIIA; and the β3 and β1 integrin receptors for fibrinogen and collagen[3].

TABLE 1

PLATELET ULTRASTRUCTURE & FUNCTIONS[4]:

Zone & Component	**Function**
Peripheral zone	
Glycocalyx – proteins, phospholipids, mucopolysaccharides	Adhesion & Aggregation
Phospholipid bilayer Phospholipids	Source of arachidonic acid
Integral proteins Glycoproteins Ib/IX, IIb/IIIa Enzymes	Adhesion & aggregation, activation

Structural zone	
Microtubules Cytoskeletal network Cytoplasmic network – actin, myosin Actin binding protein	
Organelle zone	
Granules Dense bodies Alpha granules Lysosomes Microperoxisomes	 Non protein mediators Protein mediators Enzymes Break down H_2O_2
Membrane systems	
Open canalicular system Dense tubular system	Secretion of granule contents Calcium storage site

TABLE 2

DEVELOPMENTAL STAGES OF MEGAKARYOCYTES[4]:

	Name	**Characteristics**
Stage 1	Megakaryoblast	6-24μm, scant basophilic cytoplasm, no visible granules, round nucleus, visible nucleoli
Stage 2	Promegakaryocyte	14-30μm, primarily blue cytoplasm, few visible granules, nucleus lobulated or indented
Stage 3	Granular megakaryocyte	16-56μm, more cytoplasmic granules with abundant cytoplasm, multilobulated nucleus, no nucleoli
Stage 4	Mature megakaryocyte	20-60μm, abundant pinkish granular cytoplasm, multilobulated nucleus, no nucleoli

The lower limit of the platelet count is generally considered to be 150,000/μl[5].

Some of the important infectious conditions associated with febrile thrombocytopenia are

1) Malaria
2) Dengue fever
3) Rickettsial infection
4) Leptospirosis
5) Typhoid fever

Malaria: It is a global health problem with an annual incidence of 300 million people with one million deaths. The bulk of mortality is seen in infants, those who survive to adulthood, acquire significant immunity with low grade parasitemia and few symptoms. Malaria is usually associated with various degrees of reduced blood counts as evidenced by reduced platelets and WBC counts. Mild or moderate thrombocytopenia is a common association of malaria and is rarely associated with hemorrhagic manifestations. The cause of thrombocytopenia is poorly understood, although increased platelet destruction is significant and platelet lifespan is reduced during malaria [6.]

Khan SJ et al conducted a study in one of the private clinics of authors on 947 suspected patients of malaria from January 2006 to December 2006 and platelet counts were done in 95 patients, 236 patients were positive for

malaria parasite and 58% patients with malaria showed thrombocytopenia and concluded that malaria should be a consideration in febrile patients with low platelets [6].

Dengue: In recent years, dengue has become a worldwide public health concern. Infection with one or more dengue viruses imperils an estimated 2.5 billion people living in tropical and subtropical countries, mostly in cities. In India, epidemics are becoming more frequent and are straining the limited sources of the public health system.

Many dengue cases are self- limiting but complications such as hemorrhage and shock can be life threatening. If untreated, mortality from the complications of dengue is as high as 20%, whereas if recognised early and managed properly, motility is less than 1%.

According to WHO guidelines, dengue hemorrhagic fever (DHF) cases must fulfill all the four following criteria [7].

i. Fever or history of acute fever lasting 2 to 7 days
ii. Hemorrhagic tendencies evidenced by at least one of the following: a positive tourniquet test, petechiae, purpura, ecchymoses, bleeding from the mucosa, injection sites, hematemesis, melena.

iii. Thrombocytopenia (100,000 platelets/µl or less).

iv. Hemoconcentration (20% or more rise in the hematocrit value relative to the baseline average for the same age and sex) or evidence of plasma leakage(pleural effusion, ascites and/or hypoproteinemia).

Prashant Gupta et al, conducted a study on 145 clinically suspected cases of dengue infection from August 2004 to July 2005 and 50 patients were serologically positive for dengue. Thrombocytopenia was found in 30% of the cases in their study[7].

Scrub typhus: It is an acute febrile illness caused by Orienta tsutsugamushi (Rickettsia tsutsugamushi). It is a zoonotic disease transmitted by the larval mites (chiggers) of Leptotrombidium deliense group. Man is accidently infected when he encroaches the mite-infested areas, known as mite islands. The infection manifests clinically as non specific febrile illness often accompanied by headache, myalgia, nausea, vomiting, diarrhea. The complications include meningitis, shock, thrombocytopenia, renal impairment[8].

Vivekanandan M et al, conducted a study on 50 patients between April 2006 and April 2008 which were diagnosed as scrub typhus with detailed investigations and they found 10% of the patients with thrombocytopenia[8].

Leptospirosis: It is a zoonotic disease that affects mostly male patients belonging to the working population. The morbidity and mortality caused by this disease arise from fatal complications, which include hemorrhagic diathesis, the most feared of which is pulmonary hemorrhage. Thrombocytopenia in leptospirosis has received little attention. Some authors have postulated that this could be due to disseminated intravascular coagulation or a toxin or cytotoxin mediated mechanism[9].

Casiple LN, has studied the occurance of thrombocytopenia and the bleeding manifestations caused by leptospirosis in 59 patients in July to November 1995 and June to October 1996 and found the prevalence of thrombocytopenia to be 61% and its presence seemed to indicate a more severe form of the disease[9].

Typhoid fever: Typhoid fever is an enteric disease due to Salmonella typhi, presenting as a septicaemic illness, affecting an elevated number of people living in regions with poor sanitary conditions, acquired through the ingestion of water and food contaminated by feces of acutely ill patients or

chronic carriers of the microorganism. The pathogenic mechanisms of typhoid fever begin with bacilli ingestion[10].

The infecting dose of S. typhi needs to be large to produce illness in healthy individuals, varying between 1000 and 1 million microorganisms[11].

Yap P.K & Chua C T have studied the diagnosis of typhoid fever in 31 patients where they found thrombocytopenia to be present in 10 patients (32%) [12].

Principle of Autoanalyzer: Impedance measurement principle [13,14,15]

In impedance measurement (resistance measuring principle), cells are passed one after the other through a capillary opening. The passing cell produces an electrical resistance and thus an electronic signal which is proportionate to its volume. Hence, the cells are identified based on their size and get represented in a volume distribution curve.

Platelet indices: Recent advances in automated blood cell analysers have made it possible to measure various blood cell parameters automatically. Among these parameters, platelet indices, such as mean platelet volume (MPV), platelet size deviation width (PDW), and platelet large cell ratio (P-LCR), provide some important information, but are not accepted for routine clinical use. If these indices really are informative regarding platelet kinetics, they might become very useful laboratory measures for thrombocytopenia[13].

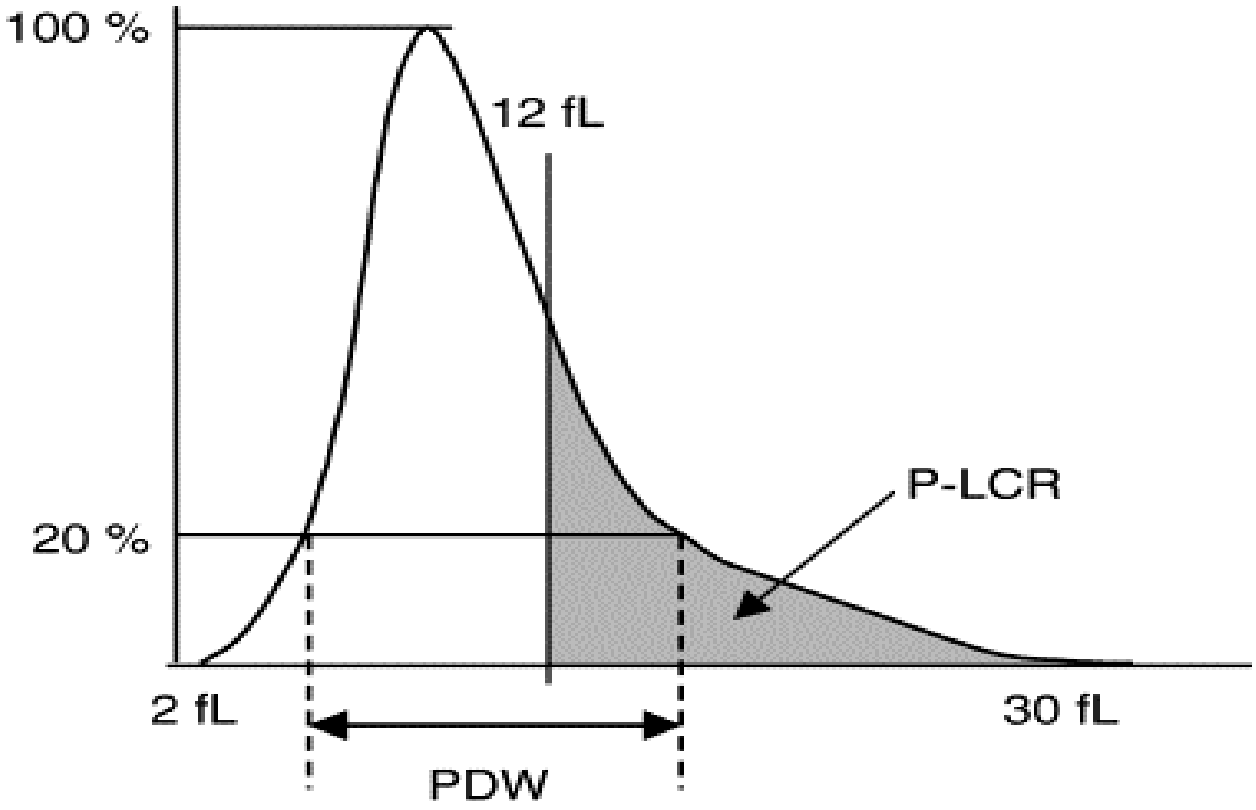

Fig 1 Platelet Histogram

MPV: a measurement of the average size of platelets.

MPV was calculated by the following formula, MPV (fL) = [(plateletcrit (%)/ platelet count ($x10^9$/l)] x 10^5. Plateletcrit is the ratio of the platelet volume to the whole blood volume[16].

Circulating platelets are very different in size, metabolism, and functional activity. The largest are more reactive and produce a greater quantity of thrombogenic factors [17].

The increase of MPV in conditions with increased platelet turnover is probably mediated by several cytokines (interleukins 6 and 11 and thrombopoietin) that affect megakaryocyte ploidy and result in the production of larger and more reactive platelets[18].

PDW: PDW is the distribution width on 20% frequency level with the peak taken as 100% [16].

The PDW is useful in differentiating reactive thrombocytosis from the essential type, especially when it is combined mathematically with the MPV and platelet count to obtain a discriminant function[19].

P-LCR: This is the ratio of large platelets exceeding 12 fL discriminator and is calculated as the ratio of the particle count between the 12-fL fixed discriminator and Upper discriminator (UD) to the particle count between Lower discriminator (LD) and Upper discriminator (UD) [16].

TABLE 3

CAUSES OF THROMBOCYTOPENIA[20]:

DECREASED PRODUCTION OF PLATELETS
Selective impairment of platelet production Drug-induced: alcohol, thiazides, cytotoxic drugs, Infections: measles, human immunodeficiency virus (HIV) Nutritional deficiencies - B_{12}, folate deficiency (megaloblastic leukemia) Bone marrow failure - Aplastic anemia Bone marrow replacement - Leukemia, disseminated cancer, granulomatous disease Ineffective hematopoiesis - Myelodysplastic syndromes
DECREASED PLATELET SURVIVAL
Immunologic destruction: Primary autoimmune – Chronic & Acute immune thrombocytopenic purpura Secondary autoimmune - Systemic lupus erythematosus, B-cell lymphoid neoplasms Alloimmune: post-transfusion and neonatal Drug-associated: quinidine, heparin, sulfa compounds Infections: HIV, infectious mononucleosis (transient, mild), dengue fever Nonimmunologic destruction - Disseminated intravascular coagulation, Thrombotic microangiopathies
SEQUESTRATION – Hypersplenism
DILUTION – Transfusions

PATHOPHYSIOLOGY OF FEVER:

The physiologic mechanisms are controlled by the central nervous system, especially by the neurons in and near the hypothalamus including the anterior hypothalamus, preoptic area and adjacent septal regions. Such neurons sense changes in the deep body temperature and integrate this information with afferent sensory information from thermo receptors in the skin and more central locations. In response to peripheral temperature changes, hypothalamic neurons initiate approximate thermoregulatory responses to maintain a constant core temperature[21,22].

Exogenous pyrogens:

Three different cytokines – interleukin-1, (IL-1), Tumor Necrosis Factor (TNF) and Interleukin-6(IL-6) account for endogenous pyrogen activity and that exogenous pyrogens by themselves do not cause fever unless they elicit cytokine release.Gram negative bacteria possesses two known pyrogens: Lipopolysacharide (LPS), which is component of the bacterial outer membrane and peptidoglycan, which forms cross link lattice below the outer membrane.LPS is the most potent stimulus known for TNF production and release.

TNF causes fever by affecting brain prostaglandin production. LPS binds to Lipopolysacharide Binding Protein (LBP) which is present in the normal human sera and its concentration rises 100-fold during acute phase response. LBP catalyses the binding of LPS to LPS receptor known as CD14 which is present on macrophages and granulocytes. This markedly enhances LPS induced inflammatory cytokine production by cells[23].

Cytokines as Endogenous Pyrogens:

The following cytokines are known to be intrinsically pyrogenic, in that they produce rapid onset of fever by acting directly on the hypothalamus, they are IL-1a, IL-1b, TNF-γ, TNF-β, IFN-α, IL-6 [23].

Definitions of Febrile Patterns[24]:

1. **Continuous (sustained):** Fever does not fluctuate more than about (1.5°F) during 24 hours, but at no time touches the normal.

Eg: Pneumonia, rickettsial diseases, typhoid fever central nervous system disorders, tularemia and plasmodium falciparum (malignant tertian malaria).

2. **Intermittent fever:** When fever is present only for several hours during the day, it is called intermittent fever.

When a paroxysm of intermittent fever occurs daily, the fever is described as Quotidian, when on alternate days, it is tertian, when two days intervene between consecutive attacks, it is Quartan.

Eg: Localized pyrogenic infections and bacterial endocarditis; Malaria (commonly with leukopenia) may present as quotidian (daily spike), tertian (spike every third day) or quartan (spike every fourth day) types.

A double quotidian pattern with two daily spikes occurs sufficiently often to be helpful in salmonellosis, miliary tuberculosis, double malarial infections, and gonococcal and meningococcal endocarditis.

3. **Remittent Fever:** Fever with daily fluctuation exceeding 2°C in 24 hours.

4. **Relapsing fever:** Short febrile periods punctuating one or several days of normal temperature. Eg: Pel-Ebstein fever - Hodgkin's disease, Brucellosis of the Bruciella melitensis type, Rat-bite fever, Dengue fever, Yellow fever, etc.

5. **Saddleback (biphasic fever)**: With several days of fever, a gap of reduced fever of about 1 day and then several additional days of fever.

Eg: dengue and yellow fever, Colorado tick fever and viral infections such as influenza, poliomyelitis.

THROMBOCYTOPENIA ASSOCIATED WITH INFECTION:

Viral causes:

CMV, Dengue, Parvo-B19, HSV, HIV, Hantana virus etc[24].

Mechanism:

Viruses produced thrombocytopenia by impaired platelet production as a result of invasion of megakaryocytes by the virus, toxic effects of viral protein on progenitor cells, virus induced haemophagocytosis, destruction of circulating platelets by viruses – by viral antigen antibody complexes[25].

Bacterial causes :

Gram +ve and gram –ve septicemia, miliary tuberculosis, leptospirosis, typhoid , mycoplasma pneumonia, etc [24].

Septicemia resulting from gram –ve and gram +ve is the commonest cause of thrombocytopenia. May be caused by disseminated intravascular coagulation (DIC) and the diagnosis of DIC may be apparent when coagulation studies are performed. Platelets adherence to damaged vascular surfaces also accounts for thrombocytopenia in certain bacterial infections, such as meningococcemia. Endotoxin, exotoxin, platelet activating factor may damage platelets, resulting in increased clearance. Patients with sepsis syndrome may develop phagocytosis of platelets, white cells in bone marrow[26].

Protozoal causes:

Thrombocytopenia occurs in over 75% of patients with malaria[27].

Other causes:

Certain hematological conditions also caused thrombocytopenia by marrow infiltration (lymphoma, leukemia).

MATERIALS AND METHODS

Source of data:

Patients with fever of less than 7 days in duration and thrombocytopenia admitted in BLDEU Shri B.M.Patil Medical College, Hospital and Research centre, Bijapur were taken for study over a period of one year from 1st Jan 2011 to 31st Dec 2011.

Methods of collection of data:

The blood samples of the patients with a history of acute febrile illness attending B.L.D.E.U's Shri B.M.Patil Medical college's central laboratory will be drawn from the antecubital vein using 3/5ml EDTA vaccutainer system. The complete blood count analysis of the sample was made using the 3 part differentiated automated hematoanalyzer (Sysmex KX-21) including the platelet indices (MPV, PDW, P-LCR).

The peripheral smear slides of the samples was also be made using Leishmann's stain to counter check the WBC total count, WBC differential count, platelet count and morphology obtained from the autoanalyser, also to look for the presence of malarial parasite.

Detailed history, physical and clinical examination of the patients were done to assess the etiology of febrile thrombocytopenia.

Relevant investigations like serological investigations for dengue fever, leptospirosis and rickettsia were done for confirmation.

Sample Size:

With prevalence rate of acute febrile illness with thrombocytopenia of 45% and 95% confidence interval, 20% allowable error the required sample size wascalculated using formula.

Statistical formula $n = \frac{(1.96)^2 \, p \, (1-p)}{L^2}$

Where p : prevalence rate

L: allowable error

Hence, a minimum of 117 prospective cases would be included in the study

Statistical analysis:

Data was analysed by using

1) Diagrammatic presentation

2) Mean $\pm$ SD

Inclusion criteria: Patients with acute febrile illness of less than 7 days in duration associated with thrombocytopenia.

Exclusion criteria: Patients with thrombocytopenia other than associated with acute febrile illness [ITP, aplastic anemia, megaloblastic anemia, functional platelet disorders, hypersplenism and other hematological disorders].

RESULTS AND OBSERVATION

A total number of 150 patients admitted over a period of one year in our hospital were studied.

No particular age group was considered, but the study subjects were in the age group of 1-80 years. The mean age was 37.52 ± 21.36.

The sex of the patient was not taken into consideration for the study. Out of 150 cases of fever with thrombocytopenia, 78 were males and 72 were females.

The duration of hospitalization varied between 3 days to 21 days. The average duration of hospitalization was 7 days.

TABLE 4

DISTRIBUTION OF CASES ACCORDING TO AGE

Age (in years)	No. of patients	Percentage
0-10	17	11.3
11-20	25	16.6
21-30	25	16.6
31-40	24	16.0
41-50	21	14.0
51-60	13	8.6
>60	25	16.6
Total	150	100

In our study the maximum number of cases 25 (16.6%) were seen in the age groups of 11-20, 21-30 & > 60 years and minimum number of cases 13(8.6%) in the age group of 51-60.

The mean age was 37.52 ± 21.36

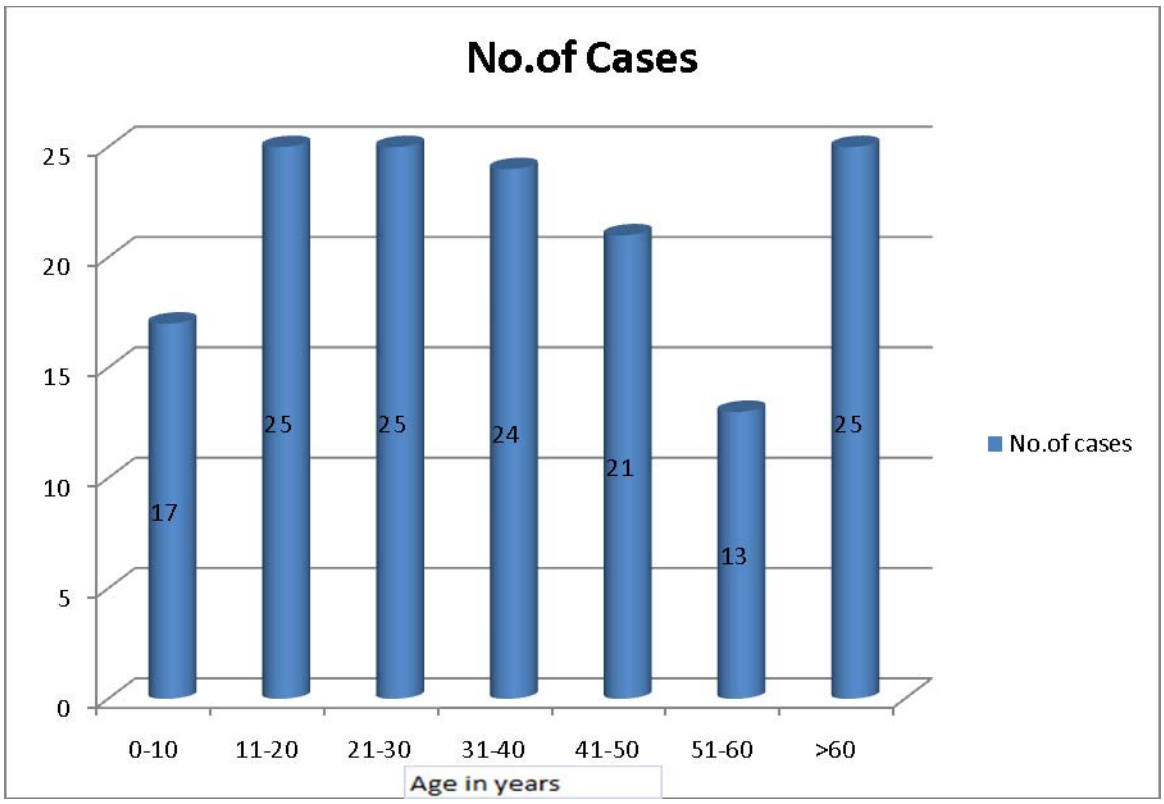

Fig 2) Bar Diagram showing distribution of cases according to age.

TABLE 5

DISTRIBUTION OF CASES ACCORDING TO SEX

Gender	Number of patients	Percentage
Male	78	52.0
Female	72	48.0
Total	150	100

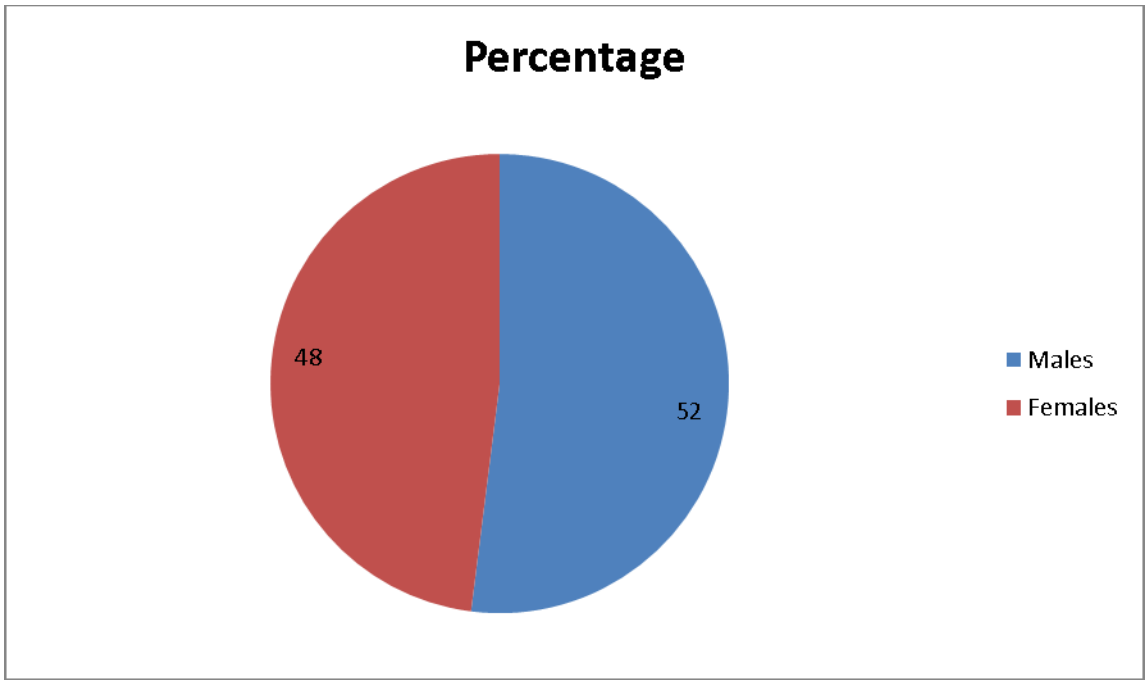

Fig 3) Pie chart showing percentage of cases in relation to sex

TABLE 6

INCIDENCE OF VARIOUS CAUSES OF FEBRILE THROMBOCYTOPENIA

Disease category	No. of patients	Percentage
Viral fever	93	62.0
Malaria	23	15.3
Dengue	16	10.6
Septicemia	07	4.6
Typhoid	06	4.0
Leptospirosis	03	2.0
Rickettsia	01	0.6
Brucellosis	01	0.6
Total	150	100

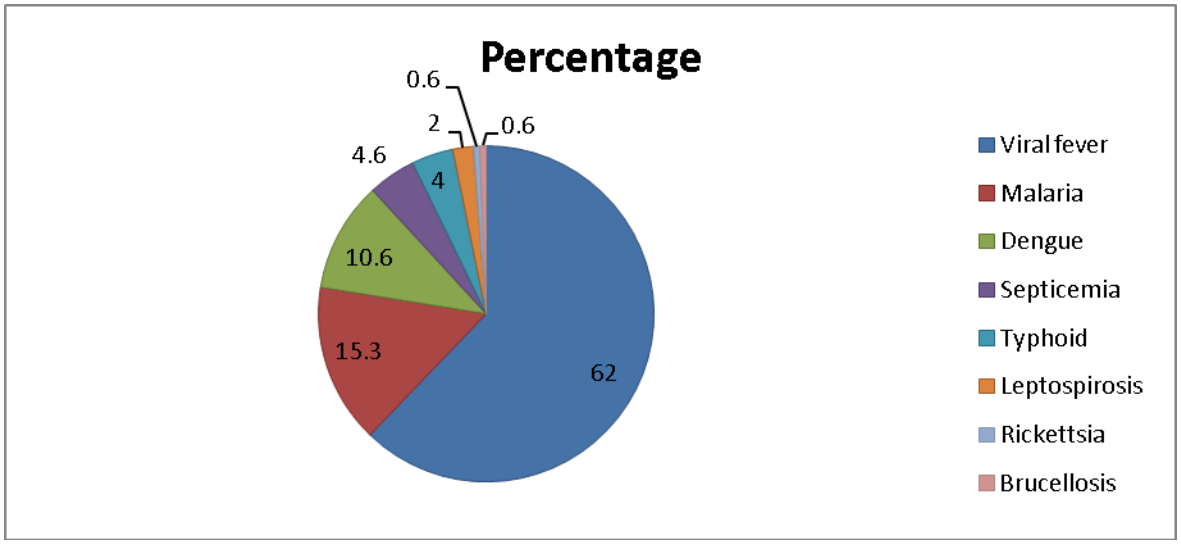

Fig 4) Pie chart showing percentage various causes of febrile thrombocytopenia

In our study viral fever 93cases (62%) was the leading cause of febrile thrombocytopenia, followed by malaria 23 cases (15.3%), dengue 16 cases (10.6%), septicemia 7 cases (4.6%), typhoid fever 6 cases (4%), leptospirosis 3 cases (2%), rickettsia & brucellosis 1 case each (0.6%).

Dengue fever was separately included due to availability of specific serological tests.

TABLE 7

DISTRIBUTION OF CASES ACCORDING TO PLATELET COUNT & DISEASE CATEGORY

Platelet count in thousands (all age group)	Viral fever	Malaria	Septicemia	Dengue	Typhoid	Leptospirosis	Rickettsia	Brucellosis
<20,000 (7cases)	4	-	-	2	-	-	-	1
20,000– 50,000 (24 cases)	11	3	3	6	-	1	-	-
50,000-150,000 (119 cases)	78	20	4	8	6	2	1	-

The mean platelet count was 0.86 ± 0.35.

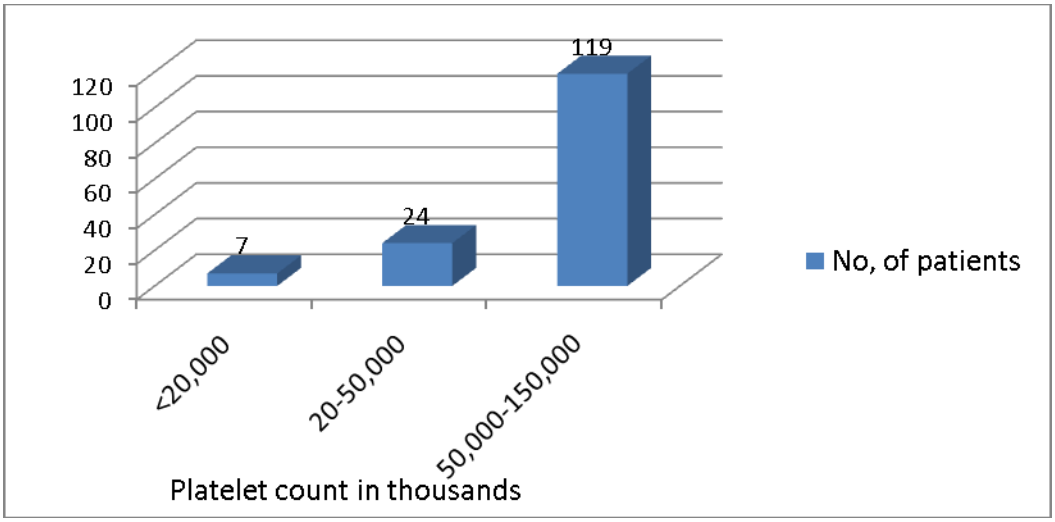

Fig 5) Bar diagram showing number of cases in relation to platelet count

TABLE 8

DISTRIBUTION OF CASES ACCORDING TO PLATELET INDICES

	PDW **(9-18fl)** **Mean (14.99 ± 4.56)**	**MPV** **(8-12 fl)** **Mean (10.37 ±1.80)**	**P-LCR** **(18.5 – 42.5 %)** **Mean (30.59 ± 10.89)**
Low	6 cases (4%) Mean (0.83±0.50)	3 cases (2%) Mean (7.23±0.32)	11 cases (7.3%) Mean (14.47±3.56)
Normal	112 cases (74.6%) Mean (13.68±2.26)	130 cases (86.6%) Mean (9.97±0.98)	121 cases (80.6%) Mean (29.08±6.22)
High	32 cases (21.3%) Mean (21.43±2.14)	17 cases (11.3%) Mean (13.87±2.65)	18 cases (12%) Mean (51.87±11.58)
Total	150 cases (100%)	150 cases (100%)	150 cases (100%)

TABLE 9

INCIDENCE OF DISEASES ACCORDING TO INDIVIDUAL PLATELET INDICES

PDW in fL	Viral fever	Malaria	Septicemia	Dengue	Leptospirosis	Typhoid	Rickettsia	Brucellosis
Low (<9) 6 cases	4	1	1	-	-	-	-	-
Normal (9-18) 112 cases	69	18	4	12	3	4	1	1
High (>18) 32 cases	20	4	2	4	-	2	-	-

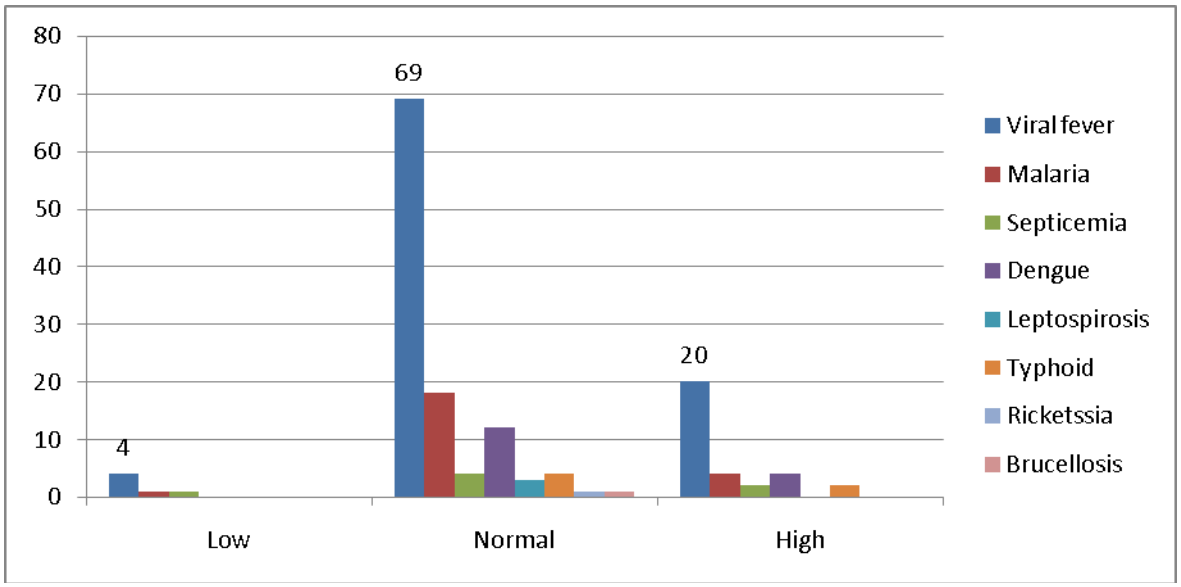

Fig 6) Bar diagram showing number of cases according to individual platelet indices (PDW)

TABLE 10

INCIDENCE OF DISEASES ACCORDING TO INDIVIDUAL PLATELET INDICES

MPV in fL	Viral fever	Malaria	Septicemia	Dengue	Typhoid	Leptospirosis	Rickettsia	Brucellosis
Low (<8) 3cases	2	-	-	-	-	-	-	1
Normal (8-12) 131 cases	82	21	7	13	5	2	1	-
High (>12) 16 Cases	9	2	-	3	1	1	-	-

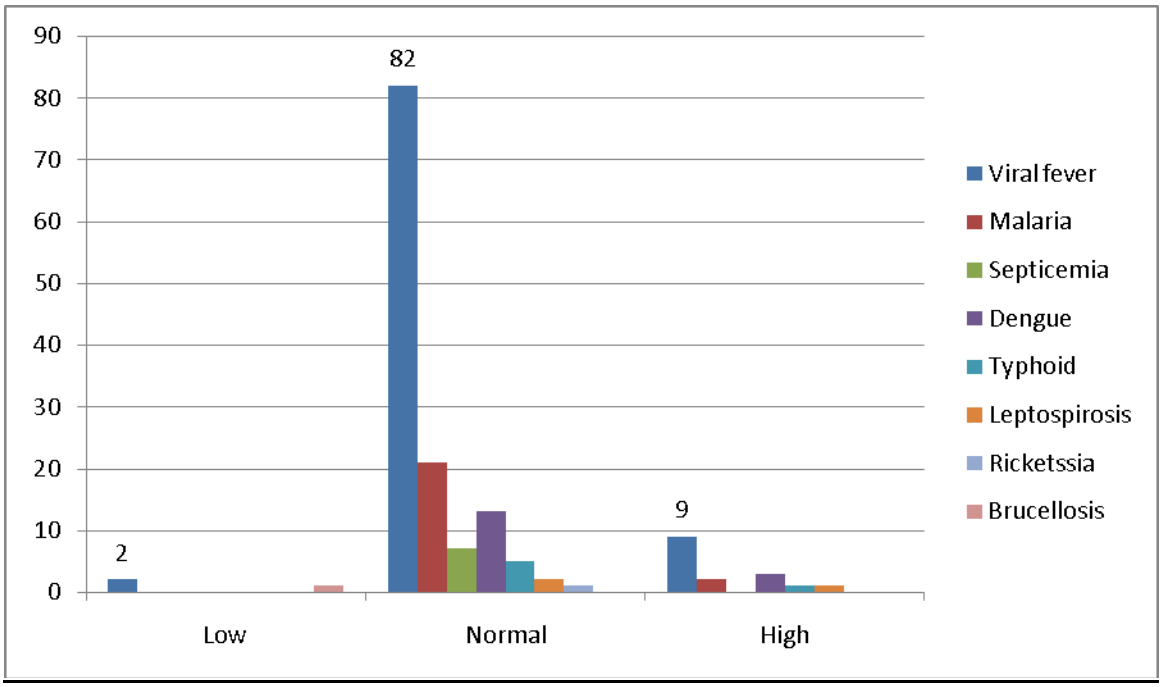

Fig 7) Bar showing number of cases according to individual platelet indices (MPV)

TABLE 11

INCIDENCE OF DISEASES ACCORDING TO INDIVIDUAL PLATELET INDICES

P-LCR in %	Viral fever	Malaria	Septicemia	Dengue	Typhoid	Leptospirosis	Rickettsia	Brucellosis
Low (<18.5) 11 cases	5	2	-	3	-	-	-	1
Normal (18.5-42.5) 122 cases	78	19	7	10	5	2	1	-
High (>42.5) 17 Cases	10	2	-	3	1	1	-	-

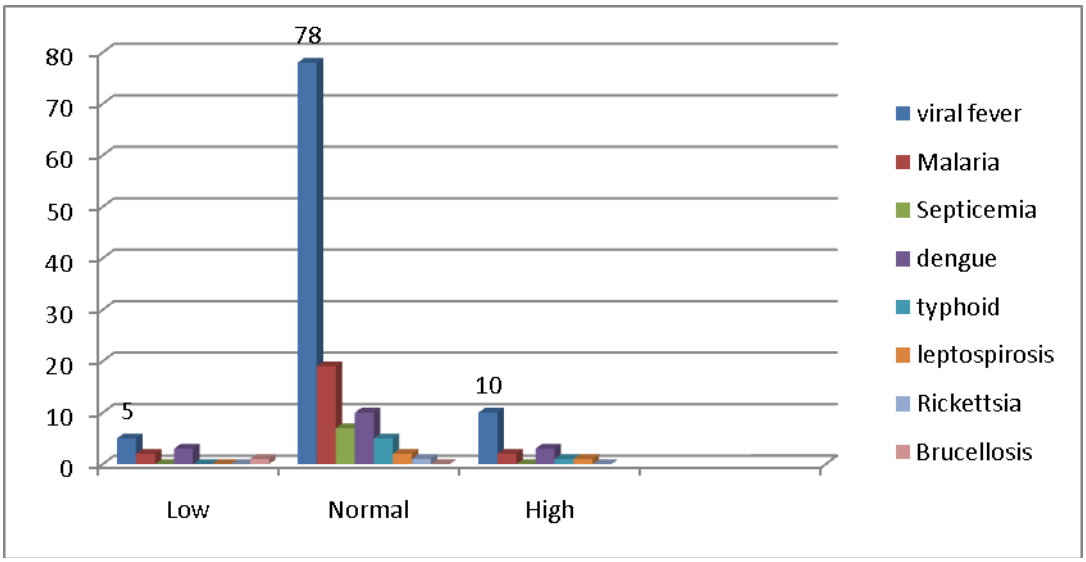

Fig 8) Bar diagram showing number of cases according to individual platelet indices (P-LCR)

Fig. 1 Photograph showing petechiae in a case of dengue fever

Fig.2 Photograph showing purpuric rashes in a case of dengue fever.

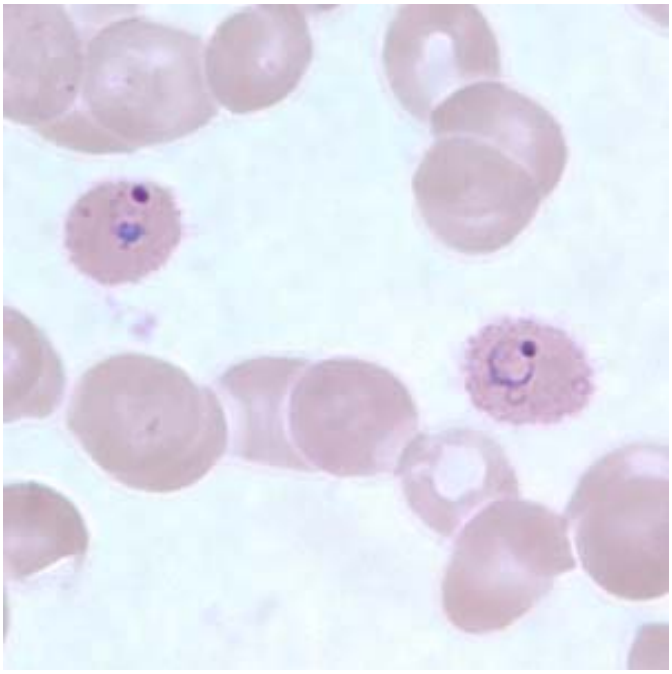

Fig.3 Photomicrograph showing Plasmodium vivax ring forms (40x, Leishmann's stain)

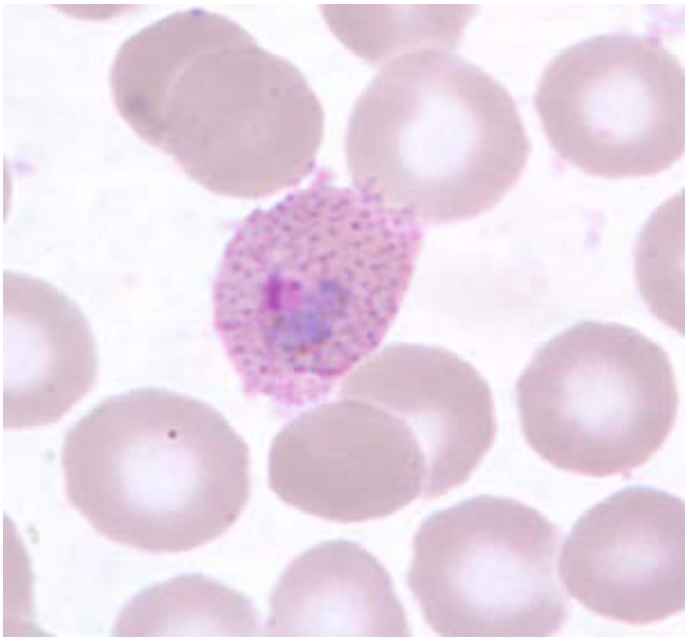

Fig.4 Photomicrograph showing Plasmodium vivax trophozoites (40x, Leishmann's stain)

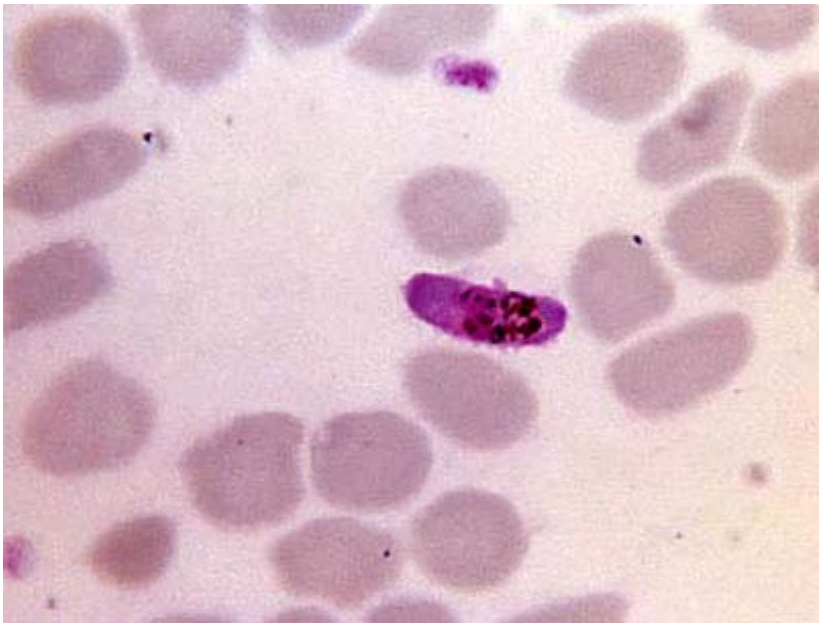

Fig.5 Photomicrograph showing Plasmodium falciparum gametocyte (40x, Leishmann's stain)

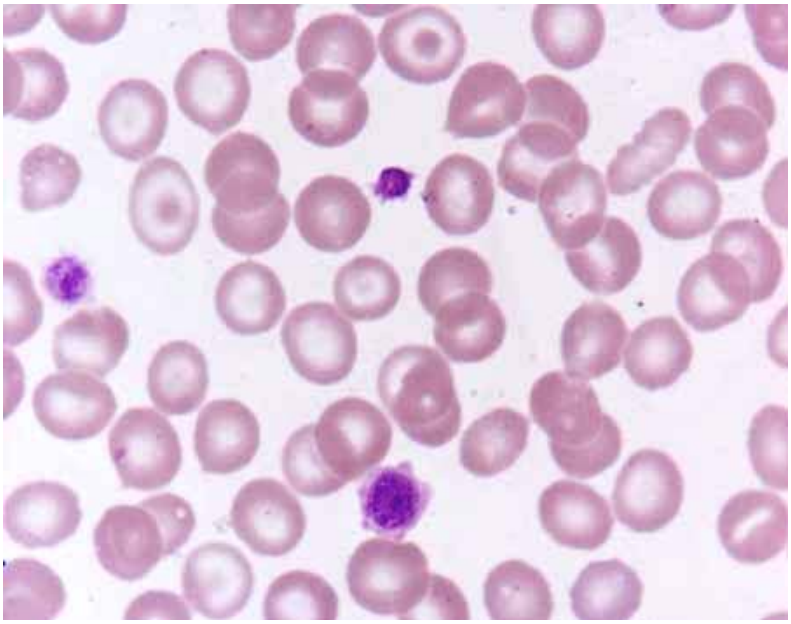

Fig.6 Photomicrograph showing giant platelets (40x, Leishmann's stain)

DISCUSSION

This study was conducted in department of pathology, BLDEU Shri.B.M.Patil Medical College for a period of one year from 1st January to 31st December 2011.

A total of 150 cases presenting with febrile thrombocytopenia were studied.

In our study the maximum number of cases 25 (16.6%) were seen in the age groups of 11-20, 21-30 & > 60 years and minimum number of cases 13(8.6%) in the age group of 51-60.

Similar study was conducted by Nair PS, Jain A, Khanduri U, Kumar V. (2003) at St.Stephen's hospital, New Delhi, for period of one and half years. A total of 109 cases (76 male, 33 female patients) were studied[28].

A study by Kaito et al. found that platelet indices were significantly higher in ITP than in AA, and platelet indices showed sufficient sensitivity and specificity[1]. Seventy-nine patients with thrombocytopenia were included in their study. There were 47 women and 32 men. Their ages ranged from 20 to 84 years. There were 40 patients with AA and 39 patients with ITP. All platelet indices were significantly higher in ITP than in AA ($P < 0.0001$). In particular, PDW and P-LCR showed marked differences between the two types of thrombocytopenia[1].

A study by Waseem FA & Mouayed BH found that increased platelet volume is associated with a higher risk of suffering an acute coronary event independent of the extent of a previous coronary artery disease (CAD)[29]. Thirty six (36) patients were included in the study: 22 of them had myocardial infarction (MI) and 14 had unstable angina (UA). It was found that MPV and P-LCR were the most significant parameters that showed statistical difference between patient with UA and those with MI ($P=0.042$ & $P=0.031$) respectively. Increased platelet reactivity and shortened bleeding time are associated with increased platelet volume. Large platelets are metabolically and enzymatically more active than small platelets and

have a higher thrombotic potential due to high concentration of thromboxane A2[29].

A study by Vamseedhar A et al. found a relationship between platelet indices and severity of pre-eclampsia where the all platelet indices were increased[30].

82 cases of preeclampsia and 63 cases of eclampsia were evaluated prospectively. One hundred healthy pregnant women with similar demographic features and gestational age and without the diagnosis of preeclampsia, gestational or chronic hypertension and proteinuria were included in the study as the control group. The platelet counts were lower while the mean platelet volume, platelet distribution width and platelet large cell ratio were increased in pre-eclampsia and eclampsia as compared to control group (P value <0.0001). Increase in MPV in pre-eclampsia and eclampsia probably indicated hyperdestruction of platelets due to shorter platelet half-life. Increase in PDW reflected increased platelet turnover - platelet survival time is decreased resulting in increased destruction of platelets. Rise of P- LCR in patients suggested increased bone marrow activity[30].

TABLE 12

COMPARISON OF STUDY

Disease category	**Nair study** [28]		**Present study**	
	No. of cases	Percentage	No. of cases	Percentage
Viral fever	-	-	93	62
Malaria	10	9.2	23	15.3
Dengue fever	15	13.8	16	10.6
Septicemia	29	26.6	7	4.6
Typhoid fever	16	14.7	6	4
Leptospirosis	-	-	3	2
Rickettsia	-	-	1	0.6
Brucellosis	-	-	1	0.6
Megaloblastic anemia	13	11.9	-	-
Hematologic malignancy	4	3.7	-	-
Unknown	20	18.3	-	-

Septicemia with 29 cases was the leading cause of febrile thrombocytopenia in other study. Second common cause was typhoid fever followed by dengue/viral fever, megaloblastic anemia, malaria, hematological malignancy with 16, 15, 13, 10, 4 cases respectively .

In our study viral fever (62%) was the leading cause of febrile thrombocytopenia, followed by malaria (15.3%), dengue (10.6%), septicemia (4.6%), typhoid fever (4%), leptospirosis (2%), rickettsia & brucellosis (0.6%).

Dengue fever was separately included due to availability of specific serological tests. This may be due to seasonal and regional variations. However, cases of megaloblastic anemia and hematological malignancy were excluded from our study.

Out of 109 patients in the other study 56.8% (62 cases) had platelet count between 50,000- 1,50,000/μl followed by 25.7% (28cases) had count between 20,000 to 50,000/μl, 17.4% (19 cases) had a platelet count between 0-20,000/μl.

The study of platelet indices in febrile thrombocytopenia due to infections were not done in the other study.

In our study 4.6% (7 cases) had a platelet count between 0-20,000/μl, 16% (24 cases) had count between 20,000 – 50,000/μl & 79.3% (119 cases) had count between 50,000 – 150,000/μl.

Possible mechanisms of thrombocytopenia:

Malaria: Thrombocytopenia is common finding in malaria and about 80% of malaria patients have the same. Immune-mediated lysis, sequestration in the spleen and a dyspoietic process in the marrow with diminished platelet production have all been postulated in the cause for thrombocytopenia. Abnormalities in platelet structure and function have been described as a consequence of malaria, and in rare instances platelets can be invaded by malarial parasites themselves [27].

Dengue: The release of high levels of platelet-activating factor by monocytes with heterologous secondary infection may explain the haemorrhage, given that platelet-activating factor may induce platelet consumption and augment adhesiveness of vascular endothelial cells resulting in thrombocytopenia[31].

Leptospirosis & Brucellosis: Thrombocytopenia could possibly be attributed to disseminated intravascular coagulation (DIC) or a toxin or cytotoxin mediated mechanism[9,32].

Typhoid fever: The etiology is uncertain. It may be due to bone marrow suppression during initial septicemic phase of the illness. It has also been suggested that DIC may account for thrombocytopenia[12].

SUMMARY

- This study was conducted in department of pathology, BLDEU Shri.B.M.Patil Medical College for a period of one year from 1st January to 31st December 2011.
- Patients with acute febrile illness of less than 7 days in duration associated with thrombocytopenia were included in the study.
- Patients with thrombocytopenia other than associated with acute febrile illness [ITP, aplastic anemia, megaloblastic anemia, functional platelet disorders, hypersplenism and other hematological disorders] were excluded from the study.
- A total of 150 cases presenting with febrile thrombocytopenia due to infections were studied.
- There were 78 males (52%) and 72 females (48%) included in the study.
- In our study the maximum number of cases 25 (16.6%) were seen in the age groups of 11-20, 21-30 & > 60 years and minimum number of cases in the age group of 51-60 (8.6%).

- Viral fever (62%) was the leading cause of febrile thrombocytopenia, followed by malaria (15.3%), dengue (10.6%), septicemia (4.6%), typhoid fever (4%), leptospirosis (2%), rickettsia & brucellosis (0.6%).
- 4.6% (7 cases) had a platelet count between 0-20,000/µl, 16% (24 cases) had count between 20,000 – 50,000/µl &) 79.3% (119 cases) had count between 50,000 – 150,000/µl.
- Platelet indices like PDW (74.6%, 112 cases), MPV (86.6%, 130 cases), P-LCR (80.6%, 121 cases) were within normal limits.

CONCLUSIONS

- The study of platelet indices in patients with febrile thrombocytopenia due to infectious conditions was conducted in department of pathology, BLDEU Shri.B.M.Patil Medical College for a period of one year from 1st January to 31st December 2011.
- A total of 150 cases presenting with febrile thrombocytopenia due to infections were studied.
- The mean age was 37.52 ± 21.36 and there were 52% males and 48% females included in the study.
- Platelet indices like PDW (74.6%, 112 cases), MPV (86.6%, 130 cases), P-LCR (80.6%, 121 cases) were within normal limits.
- Hence, whenever patient with febrile thrombocytopenia presents with changes in platelet indices, non infectious conditions are also to be considered in differential diagnosis.

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RESEARCH INFORMED CONSENT FORM

TITLE OF THE PROJECT : STUDY OF PLATELET INDICES IN PATIENTS WITH FEBRILE THROMBOCYTOPENIA

PRINCIPAL INVESTIGATOR : Dr. RAMU.R
P.G. DEPARTMENT OF PATHOLOGY

P.G.GUIDE : Dr. MAHESH KARIGOUDAR M.D, D.N.B
PROFESSOR,
DEPARTMENT OF PATHOLOGY

PURPOSE OF RESEARCH:

I have been informed that this study is done to know the efficacy of platelet analysis in assessing the prognosis of febrile thrombocytopenia

PROCEDURE:

I understand that my blood sample will be drawn from my forearm using a 5ml syringe in an EDTA containing vial and given for complete blood count analysis.

RISK AND DISCOMFORTS:

I understand that, there is no risk involved in the procedures performed.

BENEFITS:

I understand that my participation in the study will help to know the prognosis of febrile thrombocytopenia.

CONFIDENTIALITY:

I understand that the medical information produced by the study will become a part of hospital record and will be subjected to confidentiality and privacy regulations of the hospital. If the data is used for publications the identity of patient will not be revealed.

REQUST FOR MORE INFORMATION:

I understand that I may ask more information about the study at any time.

REFUSAL FOR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and that I may refuse to participate or may withdraw from the study at any time.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me during the study I will get medical treatment but no further compensations.

I have read and fully understood this consent form. Therefore I agree to participate in the present study.

_____ _____

Participant / Guardian Date:

_____ _____

Signature of Witness Date:

I have explained the patient the purpose of the study, the procedure required and possible risk and benefit to the best of my ability in the vernacular language.

_____	_____
Investigator / P.G.	Date:
_____	_____
Witness to Signature	Date

PROFORMA

NAME	**:**	OP/IP No.	:
AGE	**:**		
SEX	:	D.O.A	:
ADDRESS	:	D.O.D	:

History of present illness:

1) Fever: duration, chills, rigors, diurnal variation, character
2) Myalgia
3) Cough with expectoration
4) Rash : onset, duration, site
5) Hemetemesis
6) Melena

Past history:

Family history:

General physical examination:

Systemic examination:

Per Abdomen:

Cardiovascular system

Respiratory system:

Clinical diagnosis:

Hematological investigations: (Complete blood count)

		Follow-up CBC, if done		
Parameters	Day 1	Day _____	Day_____	Day _____
WBC				
RBC				
HGB				
HCT				
MCV				
MCH				
MCHC				
PLATELETS				
LYMPHOCYTES(%)				
MIXED (%)				
NEUTROPHILS(%)				
RDW				
PDW				
MPV				
P-LCR				

Peripheral Smear Examination:

RBC:

WBC:

PLATELETS:

PARASITES: Malarial parasite

IMPRESSION:

Serological examination for:

i. Dengue
ii. Leptospirosis
iii. Scrub typhus

Direct Microscopy (if any): 1)Urine examination for spirochetes

2)Blood examination for spirochetes

Other investigations (if any): 1)Bone marrow examination

2)Ultrasonography , CT/MRI scan.

Sl. No.	Date	IPD	OPD	Name	Age(Yrs)	Sex	Clinical diagnosis	Hb(gm/dl)	WBC/µL	HCT (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)	RDW (%)	Platelet/ µL	PDW (fL)	MPV (fL)	P-LCR (%)	Serology (Dengue)	Leptospira	Widal test	PS for MP	Weil felix	Others	Final Diagnosis
1	8/21/2011	17415		Aman Hadimani	9	M	Viral fever	11.3	4,900	34.3	79	26	32.9	13.3	1.1	10.4	8.7	17.7							Viral Fever
2	11/14/2011	24087		Annakka Bidagi	25	F	Acute febrile illness	11.4	4,500	32.5	93.9	32.9	35.1	12.8	0.9	11.6	10.5	32.2				Not seen			Viral Fever
3	8/16/2011	17060		Annakka Layadagundi	60	F	Viral fever	11.3	9,900	36.9	78	23.9	30.6	13.6	0.8	12.3	9.8	23.4							Viral Fever
4	6/7/2011	13428		Arati	8	F	Malaria	9.4	3700	28	82.6	27.7	33.6	13.8	1.4	9.5	8	14.4				Pl.vivax			Malaria
5	8/13/2011		195398	Aravindkumar Pande	22	M	Viral fever	13.4	9,700	41.4	82.3	26.6	32.4	17	0.43	23.9	11.9	42.8							Viral Fever
6	11/14/2011	24054		Arman Patel	0.6	M	Acute febrile illness	7.3	25,600	23.5	72.1	22.1	30.6	25.2	0.75	15.7	8.5	18.9				Not seen			Viral Fever
7	8/1/2011	15780		Ashwini	20	F	Viral fever	9.6	19,700	30	82.2	26.3	32	14.3	1.36	6	11.7	31.6							Viral Fever
8	9/2/2011	18330		Ashwini Ghorpade	15	F	?Dengue	9.9	20,600	29.4	85.2	28.7	33.7	16.1	1.2	25.3	13.3	50	Dengue -ve		Widal +ve				Typhoid
9	7/2/2011	13230		Awakka	70	F	Viral fever	10.3	6300	30.4	83.3	28.2	33.9	13	1	13	9.6	22.9							Viral Fever
10	8/18/2011	17230		Balabai Patil	56	F	Viral fever	13.6	9,300	41.7	92.3	30.1	32.6	14.2	0.96	14	9.9	27.5							Viral Fever
11	6/18/2011	12329		Basamma	22	F	Malaria	9.6	4,200	27.4	100.7	35.6	35.4	14.4	1.4	11.2	9.3	22.7				Pl.vivax			Malaria
12	8/2/2011	15923		Basamma	48	F	?Malaria	9	3,900	27.7	114	37	32.5	14.9	1.2	18.4	11.2	35.1				Not seen			Viral Fever
13	10/21/2011	22361		Basanagouda	65	M	Acute febrile illness	8.6	4,300	23.8	107.2	38.7	36.1	17.8	0.9	11.8	8.7	20				Not seen			Viral Fever
14	11/2/2011	23207		Basawwa	70	F	Malaria	6.7	25,000	20.1	89.3	29.8	33.3	16.4	0.6	16.8	8.2	20.4				Pl.falciparum			Malaria
15	9/9/2011	18979		Bhagavant Talawar	60	M	?Malaria	14.4	6,100	40.7	85.3	30.2	35.4	16.9	0.9	21.1	12.5	46.7	Dengue +ve			Not seen			Dengue fever
16	9/9/2011	18941		Bharati Pujari	10	F	Dengue fever	13.6	5,700	41	78.2	26	33.2	16.1	1.1	20	12.2	32.2	Dengue +ve						Dengue fever
17	11/8/2011	23599		Bhemawwa	65	F	Acute febrile illness	8.8	8,600	30.1	104.5	30.6	29.2	18.4	0.45	13.8	10.3	32.9		Leptospira -ve		Not seen			Viral Fever
18	3/27/2011	6225		Bhimashankar	45	M	?Malaria	12.2	6900	36.4	88.3	29.6	33.5	13.5	0.6	11.3	9.6	22.7				Pl. vivax			Malaria
19	7/16/2011	14630		Bilenasidda	38	M	Malaria	14.1	8900	39.6	81.6	29.1	35.6	13.6	1.1	10.8	8	13.8				Pl.vivax			Malaria
20	3/14/2011	5201		Boramma	42	F	Viral fever	9.5	2700	29	80.8	26.1	32.3	14.4	1.1	13.8	10.8	31.1			Widal -ve				Viral Fever
21	11/8/2011	23640		Boramma Janagond	60	F	?Dengue	13.9	2,500	40.7	83.4	27.9	33.4	11.9	0.9	13.7	9.6	24.1	Dengue -ve						Viral Fever
22	8/20/2011	17422		Bouramma Masimanal	50	F	Septicemia	6.9	3,600	19.8	120	41.2	34.3	15.2	0.65	16.8	9.3	27.8							Septicemia
23	6/26/2011	12926		Chandrawwa	70	F	Viral fever	12.6	4,800	39.7	87.8	27.9	31.7	14.3	1.4	14.6	10.6	30.8							Viral Fever
24	6/28/2011	12965		Chandrawwa bidagi	65	F	?Dengue	9.2	11,000	31.7	101	29.3	29	15.5	0.8	16.6	11.4	37.2				Not seen			Viral Fever
25	8/25/2011	17890		Chidanand	35	M	?Ricketssia	12.9	5,200	37.9	82.2	28	34	12	1.3	10.4	8.5	16.8		Leptospira -ve					Viral Fever
26	8/12/2011	13299	154968	Dekemma	80	F	Septicemia	6.5	17,300	19.1	73.7	25.1	34	25.7	0.63	17.3	9.1	23.4							Septicemia
27	6/21/2011	12575		Devakamma	50	F	Malaria	10.3	4,800	31.4	96	31.5	32.8	14.7	0.4	12.8	9.9	28			Widal -ve				Viral Fever
28	8/16/2011	17089		Dundappa	45	M	Viral fever	11.3	5,700	33.9	75.5	25.2	33.3	15	1.32	15.8	9.5	27.6				Pl.vivax			Malaria
29	8/22/2011	17521		Ganesh Chettarki	29	M	?Malaria	12.7	2,600	35.6	94.2	33.6	35.7	15.8	0.7	15.8	11	32.4			Widal -ve	Not seen			Viral Fever
30	6/28/2011	13013		Gangawwa	80	F	Septicemia	7.8	9,100	24.7	79.7	25.2	31.6	13.5	0.75	21.3	11.8	40							Septicemia
31	8/24/2011	17697		Girimallappa	75	M	Viral fever	10.4	9,300	32.8	94.8	30.1	31.7	14	1.25	14	9.6	25.5							Viral Fever
32	8/24/2011	17714		Girish	32	M	?Malaria	10.5	5,800	29.6	98.5	38.5	33.4	17.5	0.87	13.9	10.2	29.7				Not seen			Viral Fever
33	8/2/2011		184413	Gurupadappa	79	M	Viral fever	13.7	15,700	40.4	85.6	29	33.9	13.5	0.9	25.5	15.2	61.6			Widal -ve				Viral Fever
34	8/22/2011	17540		Hanamanth Hugar	30	M	Viral fever	3.2	2,400	10.4	86	26.4	30.8	28.3	1.1	15.1	9.3	26.5							Viral Fever
35	4/25/2011	8207		Hasanawwa	40	F	?Malaria	10.6	5100	32.2	78.5	25.9	32.9	17.6	0.6	19.4	9.7	33.3				Pl.vivax			Malaria
36	9/9/2011	19022		Hasina Turki	60	F	?Malaria	10.3	11,400	30.9	89.8	29.9	33.3	13.5	1.2	11.6	10.1	25.4				Not seen			Viral Fever
37	8/21/2011	17396		Irrana Patil	19	M	Viral fever	12.6	7,100	36.1	100.3	35	34.9	17.1	1.15	11.9	9	20.9			Widal +ve				Typhoid
38	11/8/2011	23600		Irrana Vandal	58	M	?Dengue	12	13,100	35.9	97.8	32.7	33.4	17.8	0.45	22.8	11.3	42.7	Dengue +ve			Not seen			Dengue fever
39	6/24/2011	12818		Jayashree	16	F	Viral fever	10.6	3,400	32	92	30.5	33.1	24.8	0.7	10.6	8.2	17	Dengue +ve	Leptospira -ve					Dengue fever
40	8/11/2011		192697	Jayashree Nagashetti	16	F	Viral fever	3.6	3,300	15.8	62.7	14.7	23.4	21.9	1.25	13.3	9.2	25.1							Viral Fever
41	8/3/2011	16053		Jettappa	40	M	?Malaria	12.4	14,800	34.7	80.5	28.8	35.7	12.5	1	12.8	10.1	26.7			Widal -ve	Not seen			Viral Fever
42	8/22/2011		202044	Kajal Bandargotti	13	F	?Dengue	4.8	1,200	15.8	93.5	28.4	30.4	15.8	0.2	13.4	8.2	15.3	Dengue +ve						Dengue fever
43	6/29/2011	13167		Kamal	25	M	Malaria	11.9	5200	36	85.1	28.1	33.1	14	1	10.1	9	20.1				Pl.vivax			Malaria
44	6/30/2011	13222		Kasturi	25	F	Malaria	6.8	5,900	25.1	70.9	19.2	27.1	21.8	0.2	10.2	7.6	10.1						Brucella +ve	Brucellosis
45	11/3/2011	23230		Kavaleppa	42	M	Dengue fever	16	5,300	46.2	88.2	30.5	34.6	14.3	0.45	16.1	11.4	36.7	Dengue +ve			B			Dengue fever
46	4/16/2011	7639		Kavery	11	F	?Malaria	8.6	9500	23.3	81.5	24.1	29.6	20.7	0.95	14.7	9.7	26.9	Dengue -ve			Not seen			Viral Fever
47	11/6/2011	23464		Kavya	3	F	Dengue fever	11.8	9,800	37.1	89.2	28.4	31.8	12.7	0.45	17.3	11.3	35.2	Dengue +ve						Dengue fever
48	9/14/2011	19432		Keshav Raj	40	M	?Malaria	12	5,400	40.5	87.4	26.7	31.3	12.7	1	12.8	9.5	31.1				Not seen			Viral Fever
49	8/21/2011	17467		Khajappa Madde	24	M	Viral fever	12.7	3,400	38	79.2	26.5	33.4	15.5	0.4	18.2	10.2	32.7				Pl.vivax				Malaria

Sl. No.	Date	IPD	OPD	Name	Age(Yrs)	Sex	Clinical diagnosis	Hb(gm/dl)	WBC/µL	HCT (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)	RDW (%)	Platelet/ µL	PDW (fL)	MPV (fL)	P-LCR (%)	Serology (Dengue)	Leptospira	Widal test	PS for MP	Weil felix	Others	Final Diagnosis
50	8/29/2011		208354	Lakshmi Shankreppagol	20	F	?Dengue	13	1,900	36.3	81.4	29.1	35.8	12.3	0.55	11.8	9.3	28	Dengue +ve						Dengue fever
51	9/13/2011	18903		Lakshmibai	65	F	Viral fever	12.1	7,200	38.4	95.8	30.2	31.5	15	1.1	12.2	9.5	24.2			Widal +ve				Typhoid
52	10/9/2011	21322		Lalibai	35	F	Malaria	13.9	6,100	40.5	88.2	30.3	34.3	14.9	0.23	15.6	12.5	45.1		Leptospirosis +ve		Not seen			Leptospirosis
53	8/15/2011	16859		Lalita Bagewadi	35	F	?Dengue	11	3,900	32.1	88.9	30.5	34.3	13.7	1.12	11.1	9.1	19.4	Dengue -ve	Leptospira -ve					Viral Fever
54	8/16/2011	17114		Laxman Hosamani	8	M	?Dengue	13.6	5,000	43.3	68.8	21.6	31.4	14.8	0.45	14.1	8	17.8	Dengue +ve						Dengue fever
55	8/22/2011		202558	Laxman Lamani	50	M	Viral fever	15.4	6,800	45.7	80.9	27.3	33.7	14.3	1.3	17.2	12	39.5							Viral Fever
56	7/19/2011	14751		Laxmi	2	F	?Malaria	10.2	23,000	29.8	83.5	28.6	34.2	19.3	0.8	19.9	10.6	35.9	Dengue -ve			Not seen			Viral Fever
57	6/17/2011	12248		Mahadevi	30	F	?Malaria	11.1	5700	32.1	80.5	27.8	34.6	14.9	1.3	13.8	10.4	29.3				Pl. vivax			Malaria
58	8/16/2011	17103		Mahadevi	46	F	?Dengue	4	4,200	11.7	83	28.4	34.2	14.6	1.15	10.7	9.4	22.6	Dengue -ve		Widal -ve				Viral Fever
59	8/24/2011		204224	Mahalingappa	55	M	?Malaria	6	4,500	15.4	117.6	38.9	33.1	18.3	1.3	21.9	11.9	40.8				Not seen			Viral Fever
60	8/19/2011	15564		Mahantayya	30	M	Viral fever	10.7	10,100	30	81.7	29.2	35.7	17.9	1.35	15.2	10.5	32.1							Viral Fever
61	11/14/2011	23992		Mahantesh Ananthapur	30	M	?Dengue	12	4,900	35.3	88	29.9	34	17.2	0.6	21.7	13.1	54.4	Dengue -ve				Weil Felix -ve		Viral Fever
62	7/1/2011	13378		Malakappa	85	M	Pneumonia	8.8	7700	27.6	100	31.9	31.9	15.2	0.3	13.9	9.4	25.6							Viral Fever
63	6/10/2011	11705		Mallamma	17	F	?Malaria	9	7300	26.2	88.5	30.4	34.4	17.9	0.6	11.4	10.2	32.3				Pl. vivax			Malaria
64	8/23/2011	17590		Mallamma Nadagoud	65	F	?Malaria	10.9	15,700	33.6	96.8	31.4	32.4	16.6	0.75	16.7	11.2	36.1				Not seen			Viral Fever
65	3/27/2011	6236		Mallanagouda	40	M	?Malaria	13.4	6900	39.8	93	31.4	33.8	14.2	1.05	20.4	12.3	43.8				Pl. vivax			Malaria
66	8/16/2011	16989		Mallappa	81	M	Viral fever	3.4	3,900	12.3	75.9	21	27.6	22.2	0.83	17.9	10.5	25.7							Viral Fever
67	11/14/2011	24086		Malleshi	16	M	Acute febrile illness	11.6	8,400	33	93.5	32.9	35.2	14.5	0.54	10.4	8.6	18.5					Weil felix +ve		Rickettsia
68	7/30/2011	15723		Mallikarjun	40	M	?Dengue	12.9	16,600	38.1	89.6	30.4	33.9	15.4	0.7	24.2	19.8	65.5	Dengue -ve	Leptospira -ve		Not seen			Viral Fever
69	10/21/2011	22348		Manjula Bagalkoti	38	F	Acute febrile illness	10.8	1,600	34	65.1	20.7	31.8	18.5	1.4	16.4	10.3	34.1				Not seen			Viral Fever
70	10/5/2011		242205	Manshibai R Shah	80	F	?Malaria	8.7	10,700	28	92.1	28.6	31.1	15.7	0.4	17.9	10.6	33.6				Pl.vivax			Malaria
71	5/13/2011		111604	Mantesh	30	M	?Malaria	11.7	4500	35.6	74.6	24.5	32.9	20.1	1.2	19.3	10.6	36.7			Widal -ve	Not seen			Viral Fever
72	6/22/2011	12578		Maruti	17	M	Malaria	9.9	4,000	29.8	84.2	28	33.2	16.7	1.1	16.3	9.8	28.4				Pl.vivax			Malaria
73	8/5/2011	16157		Mashak	30	M	Viral fever	13.1	6,400	36.5	81.1	29.1	35.9	15.5	1.4	8.2	7.1	8							Viral Fever
74	8/26/2011	17768		Meenakshi Hiremath	50	F	?Malaria	9.2	4,700	27.4	80.8	27.1	33.6	18	0.2	11.4	7	10.2				Not seen			Viral Fever
75	9/13/2011	19330		Muppanna	45	M	?Malaria	13.7	4,800	42.6	76.6	24.6	32.2	14.1	0.4	14.4	8.3	20.7	Dengue -ve			Not seen			Viral Fever
76	8/18/2011	17001		Muttappa	32	M	?Malaria	12.2	5,000	35.4	85.1	29.3	34.5	14.8	0.4	20	10.5	36.6	Dengue -ve			Not seen			Viral Fever
77	8/20/2011	17376		Namratha	19	F	?Dengue	14.3	4,400	43.4	82.7	27.2	32.9	12.6	0.1	9.9	9.4	28.8	Dengue +ve						Dengue fever
78	10/24/2011	22512		Narayan Shinde	31	M	Acute febrile illness	4.9	22,200	16.4	90.1	26.9	29.9	22.5	1	16.6	9.3	25							Viral Fever
79	4/9/2011	7160		Neelabai	72	F	?Malaria	10.3	7200	30	87.7	30.1	34.3	14.1	0.8	17.3	10.3	31.8				Pl. vivax			Malaria
80	9/9/2011	19049		Neelamma Chandakote	50	F	?Malaria	11.2	5,100	34.6	85	27.5	32.4	14	1.2	14.3	9.6	24.2				Not seen			Viral Fever
81	12/5/2011		297409	Nikitha	8	F	Viral fever	5.6	3,300	16.3	78.7	27.1	34.4	13.6	1.25	15.6	10.4	30.4				Not seen			Viral Fever
82	8/26/2011	17944		Nilamma Mailsehwar	50	F	?Malaria	10.5	3,300	28.7	79.9	29.2	36.6	12.9	0.87	12.2	9.9	24.4	Dengue +ve			Not seen			Dengue fever
83	8/25/2011	17720		Ningappa	55	M	?Malaria	7	5,700	22.4	77.2	23.6	30.6	20.3	1.05	16.3	9.4	27				Not seen			Viral Fever
84	3/11/2011	4988		Niranjan	2	M	Viral fever	7.8	7400	26.2	65.5	19.5	29.8	20.3	1.2	12.2	9.7	23.9							Viral Fever
85	7/22/2011	15091		Nishikant	40	M	?Malaria	11.8	8,500	35.4	95.4	31.1	32	16.9	0.8	21.2	11.6	40.4	Dengue -ve			Not seen			Viral Fever
86	7/12/2011		165189	Pandu	38	M	?Malaria	13.5	4300	39.4	109.1	37.4	34.3	16.8	0.9	10.5	8.9	18.5				Not seen			Viral Fever
87	6/22/1911	12583		Pandurang	70	M	Septicemia	11.8	7,900	35.8	89.1	29.4	33	15.2	0.4	1.6	9.2	23.3							Septicemia
88	8/9/2011	16488	191357	Parvathibai H	70	F	Viral fever	9.1	2,200	27.4	110.9	32	32.2	18.9	1.2	19.8	10.2	32.3							Viral Fever
89	8/11/2011	16722	193783	Piraji Shantaram More	45	M	Rickettsial fever	10.9	11,200	34.7	91.1	28.6	31.4	16.9	0.93	14.5	10.7	33.3		Leptospira +ve					Leptospirosis
90	6/21/2011	12497		Prajwal	0.8	M	?Dengue	12.1	23,500	37.3	73.1	23.7	32.4	19.5	0.4	13.3	8.9	20.1				Not seen			Viral Fever
91	8/18/2011	17261		Pushpa	5	F	Viral fever	12	18,100	36.3	79.1	26.1	33.1	13.4	1.2	9.6	8.8	19.4							Viral Fever
92	11/2/2011		267457	R S Khilari	37	M	?Malaria	15.4	6,600	45.5	82.4	27.9	33.8	13.8	0.8	12.9	8.8	19.1				Not seen			Viral Fever
93	6/24/2011	12445		Rajashekar	19	M	?Malaria	13.2	5,600	37.8	96.9	33.8	34.9	14.1	0.7	14.4	10.6	32.8				Pl.falciparum			Malaria
94	8/23/2011	17528		Rajesh	29	M	?Malaria	12.3	2,300	34.9	93.8	33.1	35.2	15.1	0.95	12.9	10	26.8				Not seen			Viral Fever
95	12/5/2011		297341	Raju Agasar	21	M	?Malaria	12	10,400	36.3	90.8	30	33.1	15.4	1	19.3	12.6	43.7				Not seen			Viral Fever
96	6/12/2011	11833		Ramachandra	46	M	?Malaria	11.5	4400	34.4	85.6	28.6	33.4	13.8	0.8	16.2	9.6	28.7				Pl. vivax			Malaria
97	7/21/2011		174586	Ramu	20	M	?Malaria	14.1	4400	44.2	91.5	29.2	31.9	14.5	0.7	13.5	9.9	26.3				Pl.vivax			Malaria

Sl. No.	Date	IPD	OPD	Name	Age(Yrs)	Sex	Clinical diagnosis	Hb(gm/dl)	WBC/µL	HCT (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)	RDW (%)	Platelet/ µL	PDW (fL)	MPV (fL)	P-LCR (%)	Serology (Dengue)	Leptospira	Widal test	PS for MP	Weil felix	Others	Final Diagnosis
98	8/7/2011	16317	189311	Ratnabai M	65	F	?Malarai	13.3	7,200	38.6	84.1	29	34.5	13	1.23	11.5	9.4	21.7			Widal -ve	Not seen			Viral Fever
99	8/8/2011	16387	189894	Ratnabai Mirji	65	F	Viral fever	12.6	8,800	39.6	86.8	27.6	31.8	14.8	0.9	15.8	11.3	33.6							Viral Fever
100	12/5/2011	25831		Ratnachand	69	M	Viral fever	13.5	8,600	39.8	84	28.5	33.9	13	0.75	13.8	10.7	30.9				Not seen			Viral Fever
101	6/30/2011	13276		Rautappa	70	M	?Dengue	8.9	5500	28	79.8	25.4	31.8	17.1	0.2	19.4	10.4	38.6	Dengue -ve			Not seen			Viral Fever
102	8/9/2011	16378	189818	Rayagondappa	45	M	Viral fever	11.9	3,000	35.7	97.3	32.4	33.3	17	1.13	12.5	10.3	28.3							Septicemia
103	4/14/2011		87781	Renuka	28	F	Malaria	10.3	4600	30.7	99.4	33.3	33.6	16.1	1.3	15.7	11.2	34.4				Pl.vivax			Malaria
104	10/1/2011	20581		Riyaj M Navalgund	14	M	Viral fever	12.3	2,100	37.5	80	26.2	32.8	14.1	1.1	14.4	10.2	27.4	Dengue -ve	Leptospira +ve		Not seen			Leptospirosis
105	7/11/2011		165125	Roopa	25	F	Malaria	11.4	4900	33.2	76.7	26.3	34.3	16	0.4	15	9.3	25.2							Viral Fever
106	7/30/2011	15737		Rudragouda	27	M	?Malaria	14.8	5300	43.2	86.7	29.7	34.3	12.5	1.36	11.2	9	20.5	Dengue -ve			Not seen		Chickungunya -v	Viral Fever
107	8/9/2011	16484	191027	Sadashiva	40	M	Viral fever	11.9	2,800	37.5	78.5	24.9	31.7	20	1.35	14.5	8.8	21.5							Viral Fever
108	11/2/2011	23217		Sampat Bhairadogi	6	M	Dengue fever	11	5,000	34.6	71.9	22.9	31.8	13.5	0.95	10.6	9.2	22.2	Dengue +ve						Dengue fever
109	8/22/2011		202061	Sangamesh Biradar	18	M	?Malaraia	13.9	5,800	39.4	83.7	29.5	35.3	14.9	0.9	14.7	11.3	35.6				Not seen			Viral Fever
110	12/5/2011	25837		Sangeeta	35	F	Malaria	6.3	2,100	19.2	79.7	26.1	32.8	16.5	1.1	17.1	11.2	36.6			Widal -ve	Not seen			Viral Fever
111	8/17/2011	16197		Sanju Biradar	25	M	Septicemia	9.4	8,400	29.6	102.4	32.5	31.8	18.9	0.5	22	10.9	36.7							Septicemia
112	8/7/2011		189310	Santosh	2	M	Viral fever	10.1	9,600	30.3	78.3	26.1	33.3	15.1	0.51	15.2	9	20.8					Weil Felix -ve		Viral Fever
113	8/15/2011	16950		Sateesh Anatapur	40	M	?Malaria	10.8	36,700	32.3	94.2	31.5	33.4	15.8	1.2	10.2	8.8	18.7				Not seen			Viral Fever
114	5/29/2011	10715		Savitri	30	F	?Dengue	13.5	5500	41.1	79.5	26.1	32.8	13.4	0.8	12.1	10.3	28.7				Not seen			Viral Fever
115	6/22/2011	12642		Savitri	10	F	?Malaria	9.7	7000	28.8	85.2	28.7	33.7	14	0.45	2.8	10.2	28.7				Pl.vivax			Malaria
116	7/7/2011	13882		Shabana	20	F	?Dengue	10.3	11,400	33.3	90	27.8	30.9	14	0.1	0	14.5	65				Not seen			Viral Fever
117	12/5/2011	25800		Shakuntal Jadhav	58	F	Malaria	14.3	3,500	44.6	83.5	26.8	32.1	12	1.2	15.4	10.8	31.8	Dengue -ve			Not seen	Weil Felix -ve		Viral Fever
118	6/29/2011	12976		Shankar	55	M	?Malaria	14	7300	43.4	85.6	27.6	32.3	14.4	0.85	22.3	11.3	38.4				Not seen			Viral Fever
119	11/7/2011		271407	Shankar	20	M	Acute febrile illness	16.6	6,600	48.7	93.5	31.9	34.1	14.9	0.8	19.4	12.2	40.4			Widal -ve		Wil felix -ve		Viral Fever
120	6/15/2011		141024	Shantabai	30	F	Viral fever	7.5	6600	23.4	72.2	23.1	32.1	16.9	0.43	15.4	10.1	31.9							Viral Fever
121	6/22/2011		147143	Shantabai	16	F	Malaria	12.7	7,100	36.6	88	30.5	34.7	12.7	1.4	11.2	9.3	21				Pl.vivax			Malaria
122	8/11/2011	16301	189250	Shantappa	45	M	Viral fever	6.3	3,800	18.5	100.5	33.7	33.5	23.8	0.32	22.5	11.3	37.6							Viral Fever
123	8/17/2011	16814		Sharanappa	45	M	Viral fever	9.8	6,300	31.1	92.3	29.1	31.5	17.8	0.6	20.1	10.5	33.3			Widal +ve				Typhoid
124	7/2/2011	13441		Sharanappa	45	M	Viral fever	9.2	6000	28.7	90.5	29	32.1	18.9	1.2	13.9	10.3	29.1							Viral Fever
125	10/17/2011	21802		Sharanappa Naganur	22	M	Dengue fever	13.1	4,200	38.8	93.9	31.7	33.8	13.8	1	14.4	10.3	30	Dengue +ve						Dengue fever
126	8/23/2011	17545		Shashikant	35	M	?Malaria	12.7	4,500	37.2	85.9	29.3	34.1	14.9	0.6	16	11.2	34.4				Not seen			Viral Fever
127	8/21/2011	17469		Sheevaleela N	8	F	Viral fever	5.9	4,300	17.6	86.7	29.1	33.5	16	0.1	10.1	9.8	30.1							Viral Fever
128	10/13/2011	21724		Shivakumar	40	M	Septicemia	10	9,800	30.1	80.1	26.6	33.2	15.7	0.4	11.8	8.3	22.4							Septicemia
129	6/11/2011		137734	Shivalaingappa	35	M	Malaria	9.6	5500	28.2	88.4	30.1	34	17.9	1.4	11.7	8.7	18.7				Pl.vivax			Malaria
130	8/16/2011	17105		Shivanand	27	M	?Dengue	12.2	5,200	35.1	84	29.2	34.8	14.7	1.42	16.2	11.6	36.4	Dengue -ve						Viral Fever
131	8/8/2011	16342	189437	Shivanna	25	M	Cerebral Malaria	13.8	5,400	39.9	85.6	29.6	34.6	12.8	0.42	15.7	10.9	30.8	Dengue +ve			Not seen			Dengue fever
132	8/22/2011	17552		Shobha	30	F	Viral fever	9.4	19,000	29.3	92.7	29.7	32.1	15.4	1.2	16.4	11.5	36.5		Leptospira -ve	Widal +ve				Typhoid
133	7/27/2011	15230		Shreeshailappa	56	M	Viral fever	11.4	11,200	31.9	84.8	30.3	35.7	15.5	1.2	13.5	10	27.7	Dengue -ve		Widal -ve				Viral Fever
134	8/16/2011		197105	Shrishail Masuti	16	M	Viral fever	14.1	3,200	41.8	91.7	30.9	33.7	12.9	1.2	11	9.6	22							Viral Fever
135	5/14/2011	9695		Siddawwa	0.1	F	?Dengue	10.2	4700	30.2	81.8	27.6	33.8	23.5	0.55	2.7	20.8	85.8	Dengue -ve			Not seen			Viral Fever
136	9/29/2011		236668	Sridevi Biradar	19	F	?Malaria	3.1	2,800	9.8	119.5	37.8	31.6	21.1	0.42	14.2	9.8	30.1				Not seen			Viral Fever
137	4/8/2011	16095		Subhas	63	M	Viral fever	12.1	4,300	33.3	90.2	32.8	36.3	16.5	1.2	11.2	9.2	21.6							Viral Fever
138	7/14/2011	14449		Sunanda	36	F	Viral fever	11.3	5,600	35.4	103.2	32.9	31.9	18.2	0.8	19.8	11	39.4			Widal -ve				Viral Fever
139	8/8/2011	16346	189438	Sunanda	45	F	Viral fever	11.1	5,000	32.6	80.1	27.3	34	13.5	0.9	20.1	10.9	36.5							Viral Fever
140	11/3/2011	23238		Sushilabai	60	F	Acute febrile illness	12	6,200	35.5	89.6	30.3	33.8	14	0.9	15.6	10.9	32.9			Widal -ve			Brucella -ve	Viral Fever
141	8/12/2011	16729	193825	Sweta Patil	19	F	Viral hepatitis	14.7	3,600	45.5	82.1	26.5	32.3	14.4	1.12	13.5	10.8	32.5			Widal +ve				Typhoid
142	10/19/2011	22011		Tarabai	45	F	Dengue fever	11.3	5,500	32.7	90.3	31.2	34.6	13.6	0.75	16	11.4	36.4	Dengue +ve				Wil felix -ve		Dengue fever
143	5/14/2011	9674		Tulasawwa	60	F	?Dengue	8.6	14,000	26.1	110.1	36.3	33	17.8	0.7	22.5	12.4	45.2			Widal -ve	Not seen			Viral Fever
144	5/25/2011	10446		Ulagamma	32	F	Malaria	3.5	6200	9.4	93.1	34.7	37.2	19.6	0.8	26.1	13.2	51.2				Pl.vivax			Malaria
145	12/6/2011	25827		Veerabadrappa Sajjan	83	M	Acute febrile illness	11.3	11,100	34	90.4	30.1	32.2	13.8	0.9	15.7	11.4	37.9				Not seen	Weil felix -ve		Viral Fever

Sl. No.	Date	IPD	OPD	Name	Age(Yrs)	Sex	Clinical diagnosis	Hb(gm/dl)	WBC/µL	HCT (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)	RDW (%)	Platelet/ µL	PDW (fL)	MPV (fL)	P-LCR (%)	Serology (Dengue)	Leptospira	Widal test	PS for MP	Weil felix	Others	Final Diagnosis
146	8/2/2011		184668	Vijayalaxmi	19	F	?Malaria	8.7	4,200	29	58.4	17.5	30	24	1.3	11.1	8.7	18.1				Not seen			Viral Fever
147	10/23/2011	22476		Vinay Patil	19	M	Viral fever	12.5	6,300	37.5	86.2	28.7	33.3	13.6	1.2	20.9	12	45.3				Not seen			Viral Fever
148	3/8/2011	16006		Yallappa	19	M	Viral fever	15.2	8,100	45	91.8	31	33.8	13.1	1.3	24.2	13.2	48.9							Viral Fever
149	10/23/2011	22458		Yallappa Bajantri	35	M	?Dengue	12.7	11,400	39	91.3	29.7	32.6	15.7	1.2	16.7	12	41.1	Dengue -ve	Leptospira -ve					Viral Fever
150	10/1/2011	20743		Yemanappa	65	M	Malaria	11.4	10,500	33.7	100.9	34.7	34.4	19.7	0.4	24.3	12.2	44.2	Dengue +ve			Not seen			Dengue fever