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# Clinicopathological profile of thrombocytopenia in a tertiary care center in Himachal Pradesh

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## Abstract

**Introduction:** Thrombocytopenia is a common condition seen in clinical practice. A wide range of etiologies and variation in clinical presentation often pose a challenge in its diagnosis. Early recognition of thrombocytopenia and its causes can avoid critical bleeding.
**Aim:** This study aimed to assess etiology and clinicopathological profile of thrombocytopenia in a tertiary care center.
**Materials and methods:** Of all patients whose blood samples were received for complete blood count analysis, 500 patients with thrombocytopenia were included. Blood samples were run in Sysmex XP-100 and PCi 20 fully automated, three-part differential hematology analyzers. Leishman-stained peripheral blood smears were also studied.
**Results:** Mild thrombocytopenia (platelet count 60,000-1,50,000/µl) was seen in majority (84.8%) of the patients followed by moderate thrombocytopenia (platelet count 20,000-60,000/µl) in 10.8% and severe thrombocytopenia (platelet count <20,000/µl) in 4.4% of the patients The most common cause of thrombocytopenia was found to be infections (50% patients) followed by chronic liver disease (14.8% patients), macrothrombocytopenia (10.6% patients), hematological disorders (8.6% patients), gestational thrombocytopenia (7.8% patients), drug intake (4.4% patients) and chronic kidney disease (1.8% patients). Among infections, acute febrile illness (nonspecific) was the most (23.2%) common cause followed by COVID 19 infection (19.4%) and bacterial sepsis (5.4% patients). Four distinct patterns of platelet histogram in patients with thrombocytopenia were seen.
**Conclusion:** Similar to most previous studies, infections were the most common cause of thrombocytopenia in the present study. The present study also highlights two novel entities- suspected asymptomatic macrothrombocytopenia and Covid-19 infection.

**Keywords:** Covid-19, macrothrombocytopenia, platelet histogram, thrombocytopenia

## Introduction

Thrombocytopenia (platelet count below 1,50,000/µl) is a common condition seen in clinical practice among outdoor patients to critically ill patients. A wide range of etiologies and variation in clinical

presentation often pose a challenge in its diagnosis. Patients with platelet counts higher than 50,000/µL are usually asymptomatic. Those with platelet count ranging between 30,000/µL to 50,000/µL bleed on significant trauma. Patients with platelet counts between 10,000/µL to 30,000/µL are vulnerable to bleeding with minimal trauma and those with counts below 10,000/µL are susceptible for spontaneous bleeding [1].

True thrombocytopenia may be acquired or hereditary. Acquired causes of thrombocytopenia are more common and include infections or sepsis, bone marrow depression (aplastic anemia), hematological malignancies, myelosuppressive drugs, irradiation, Immune Thrombocytopenia (ITP), Thrombotic Thrombocytopenic Purpura (TTP), Disseminated Intravascular Coagulation (DIC) or massive transfusion. Hereditary causes are often syndromic and are related to thrombocytopenia with giant platelets with Wiskott-Aldrich syndrome being the exception with microplatelets [2].

A detailed comprehensive history and bleeding sites can provide valuable diagnostic information in patients with thrombocytopenia. Platelet and vascular abnormalities usually involve the mucocutaneous sites. Deep seated bleeding is uncommon in thrombocytopenic patients [3]. Drug history, family history of abnormal bleeding and history of consanguineous marriage helps to distinguish between drug induced thrombocytopenia, inherited or acquired hemostatic disorder and Immune Thrombocytopenia (ITP) [4, 5]. Early recognition of thrombocytopenia and its causes can avoid critical bleeding. Immediate attention and platelet transfusion should be given to patients with evidence of severe thrombocytopenia or hemorrhage.

## Materials & methods

This cross-sectional study was undertaken in the Department of Pathology, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti, Solan, Himachal Pradesh over a one-and-a-half-years period from 1st December, 2019 to 31st May, 2021.

**Sample size and inclusion criteria:** Cases for the study were selected by simple random sampling. Five hundred adult patients (inpatient and outpatient) between 18-65 years of age with thrombocytopenia (platelet count < 1,50,000/µl) whose blood samples were received for CBC analysis were included.

**Exclusion criteria:** Patients with sample quantity insufficient for analysis and those detected to have pseudothrombocytopenia following peripheral blood smear (PBS) examination were excluded from the study.

In all patients with thrombocytopenia, detailed history was recorded for fever, bleeding, medication, previous disease history, family history and previously documented thrombocytopenia. Examination findings recorded were pallor, jaundice, lymphadenopathy, organomegaly and bleeding sites. Other ancillary investigations like vitamin B12, folate levels, widal, dengue serology and bone marrow examination were also recorded wherever available.

**Procedure:** Blood samples received from various specialties in evacuated containers containing dipotassium EDTA were analyzed. Samples were run in Sysmex XP-100 and PCi 20 fully automated, three-part differential hematology analyzer within 1 hour of collection. Automated CBC data including routine RBC and WBC parameters along with platelet count and mean platelet volume were recorded. Platelet histograms were also studied. Trilevel quality control samples were run daily. Peripheral blood smears stained by Leishman stain were studied in each case.

Thrombocytopenia was graded as mild, moderate and severe depending upon the platelet counts ranging between 60,000-1,50,000/µl, 20,000-60,000/µl and less than 20,000/µl respectively.

**Statistical analysis:** Descriptive statistics-Mean, Median and proportions were used to analyze the data.

**Ethical consideration:** This study was approved by the Institutional Ethical Committee.

## Results

Five hundred patients with age between 18-65 years with thrombocytopenia who met the inclusion criteria were included. The mean age of patients was 46.7 ± 14.6 years. The most common age group affected was in the 5th to 7th decades constituting 63.2% patients. There was slight male predominance among patients with thrombocytopenia included in the study (M:F=1.3:1).

**Symptoms:** Abdominal pain (78.2%) was the most common symptom followed by fever (52.6%), breathlessness (44.6%), body ache (20.6%) and Anorexia (10.2%). The details are shown in Table 1.

**Table 1:** Symptoms of patients presenting with thrombocytopenia (n=500)

| Symptoms* | Number of patients | Percentage (%) |
|---|---|---|
| Abdominal pain | 391 | 78.2 |
| Fever | 263 | 52.6 |
| Breathlessness | 223 | 44.6 |
| Body ache | 103 | 20.6 |
| Loss of appetite | 51 | 10.2 |
| Sore throat | 34 | 6.8 |
| Headache | 22 | 4.4 |
| Bleeding | 18 | 3.6 |
| Loose stools | 18 | 3.6 |
| Cough | 16 | 3.2 |
| Miscellaneous symptoms** | 38 | 7.6 |

*Many patients presented with more than one symptom. **Other symptoms included chills (13), chest pain (7), Dysuria (5), joint pain (5) altered sensorium (6), abnormal body movements (1) and weight loss (1 patient).

**Clinical signs:** Nearly half of the patients presenting with thrombocytopenia were asymptomatic (46.2%). Among symptomatic patients, pallor (20.4%) was the most common sign seen followed by splenomegaly (9.4%) and edema (8.2%). The details are shown in Table 2.

**Table 2:** Clinical signs in patients presenting with thrombocytopenia (n=500)

| Signs* | No. of patients | Percentage (%) |
|---|---|---|
| Pallor | 102 | 20.4 |
| Splenomegaly | 47 | 9.4 |
| Edema | 41 | 8.2 |
| Rhonchi | 36 | 7.2 |
| Altered sensorium | 14 | 2.8 |
| Hepatomegaly | 07 | 1.4 |
| Icterus | 06 | 1.2 |
| Miscellaneous signs** | 16 | 3.2 |
| Asymptomatic | 231 | 46.2 |

*Many patients presented with more than one sign. **Other signs included abdominal rigidity (5), lymphadenopathy (4), petechiae (4), ecchymosis (1), systolic murmur (1) and enlarged tonsils (1 patient).

Of the 500 patients, isolated thrombocytopenia was seen in 43.8% patients, anemia and

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thrombocytopenia in 43%, pancytopenia in 10.2% and leucopenia with thrombocytopenia in 3% patients. Mild thrombocytopenia (platelet count 60,000-1,50,000/µl) was seen in majority (84.8%) of the patients followed by moderate thrombocytopenia (platelet count 20,000-60,000/µl) in 10.8% and severe in thrombocytopenia (platelet count 20,000-60,000/µl) in 4.4% of the patients.

**Etiology of thrombocytopenia:** Infections (50%) was the most common cause of thrombocytopenia in our study followed by chronic liver disease (14.8%), macrothrombocytopenia (10.6%), hematological disorders (8.6%) and gestational thrombocytopenia (7.8%). The details are shown in Table 3.

**Table 3:** Etiology of thrombocytopenia among patients (n=500)

| Causes | No. of patients | Percentage (%) |
|---|---|---|
| Infections (n=250) | | |
| *Acute febrile illness* (nonspecific) | 116 | 23.2 |
| *COVID 19 infection* | 97 | 19.4 |
| *Bacterial sepsis* | 27 | 5.4 |
| *Acute bacterial infection* | 10 | 2.0 |
| Chronic liver disease | 74 | 14.8 |
| Macrothrombocytopenia | 53 | 10.6 |
| Hematological disorders (n=43) | | |
| Benign | | |
| *Nutritional anemia* | 25 | 5.0 |
| *ITP* | 03 | 0.6 |
| *Aplastic anemia* | 02 | 0.4 |
| *PNH* | 01 | 0.2 |
| Malignant | | |
| *Acute leukemia** | 06 | 1.2 |
| *Non-Hodgkin lymphoma* (NHL) | 01 | 0.2 |
| *Lymphoproliferative disorder* | 01 | 0.2 |
| *Chronic Lymphocytic leukemia* | 01 | 0.2 |
| *Chronic Myeloid leukemia* (Blast crisis) | 01 | 0.2 |
| *Myelodysplastic syndrome* (MDS) | 01 | 0.2 |
| *Primary myelofibrosis* (PMF) | 01 | 0.2 |
| Gestational thrombocytopenia | 39 | 7.8 |
| Drug intake** | 22 | 4.4 |
| Chronic kidney disease | 09 | 1.8 |
| Miscellaneous*** | 10 | 2.0 |

*Acute leukemia included AML-M4 (3), acute promyelocytic leukemia (hypergranular type) (1) and ALL (2). **Drugs implicated were: [Etoricoxib, Gliclazide, Allopurinol, Aspirin, Rifampicin, Sulphas, Cannabis, Propranolol and Clopidogrel] ***Miscellaneous causes included-COPD (8), severe eclampsia with HELLP syndrome (1) and SLE (1).

The hematological parameters of all patients with thrombocytopenia are shown in Table 4.

**Table 4:** Various CBC parameters according to etiology among patients presenting with thrombocytopenia (n=500)

| Cause | Hb(g/dL) | MCV(fL) | MCH(pg) | MCHC(g/dL) | TLC($mm^3$) | PLTs($mm^3$) | MPV(fL) |
|---|---|---|---|---|---|---|---|
| Infections (n=250) | 12.5±2.8 | 88.8 ±7.4 | 28.4 ±2.9 | 33 ±16.4 | 8526±5733 | 93904±25807 | 12.5±4.3* |
| Chronic Liver Disease (n=74) | 11.9±3.4 | 92.1 ± 8.9 | 30.8±3.9 | 33.4±3.3 | 6550±3006 | 78123±30775 | 11.8±1.4* |
| Macrothrombocytopenia (n=53) | 13.1±2.4 | 87.9±11.5 | 30.3±6.7 | 32.9±2.3 | 8722±3698 | 111283±19303 | 12.6±0.6* |
| Hematological disorders (n=43) | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *-Benign* | 7.8±3.2 | 105±12.4 | 33±4.9 | 31.7±3.3 | 6116±4343 | 65968±42187 | 12.1±0.6* |
| *-Malignant* | 6.6±3.2 | 89.8±12 | 30.4±4.7 | 34.2±5.5 | 64052±12667 | 649909±45205 | 11.3±1.2* |
| Gestational thrombocytopenia (n=39) | 12.1±1.4 | 89.3±7.2 | 29 ±3.1 | 32.5± 1.7 | 10007±2905 | 111820±13379 | 13.1±1.2* |
| Drugs intake (n=22) | 13.5±2.8 | 89.5±6.2 | 29.4±2.6 | 32.9 ±3.4 | 6624±2696 | 104954±21034 | 12.7±1.9* |
| Chronic Kidney Disease (n=9) | 8.3±0.8 | 87.8 ±6.2 | 28.5±2.6 | 32.6 ±3.6 | 5044±1268 | 113444±20082 | 10.5±1.2* |
| Miscellaneous** | 13.3±2.4 | 88.5±8.5 | 28.2±3.5 | 31.9 ±3.2 | 9731±6675 | 73000 ±24014 | 12.0±1.5* |

*Mean Platelet Volume was not generated in Infections (187), CLD (27), Macrothrombocytopenia (36), Benign hematological conditions (23), Malignant hematological conditions (8), Gestational thrombocytopenia (23), Drugs (12), CKD (1) and Miscellaneous (4). **Miscellaneous includes COPD (8), Severe eclampsia with HELLP syndrome (1) and SLE (1).

Of the 250 patients with infections, 116 (46.4%) patients presented with acute febrile illness, 97 (38.8%) patients with COVID 19 infection, 27 (10.8%) patients with bacterial sepsis and 10 (4%) patients had acute bacterial infection. The hematological parameters of patients with infections are shown in Table 5.

**Table 5:** Shows the hematological parameters in patients with infections

| **Infections** | **Hb (g/dL)** | **TLC ($mm^3$)** | **PLT ($mm^3$)** | **MPV(fL)** |
|---|---|---|---|---|
| Acute febrile illness (n=116) | 12.8±3.2 | 6635±2879 | 96948±22437 | 12.1±1.4* |
| COVID 19 infection (n=97) | 12.3±2.5 | 10436±6624 | 97824±22229 | 12.4±1.4* |
| Bacterial sepsis (n=27) | 12.3±2.6 | 7946±6545 | 71667±36215 | 12.0±1.3* |
| Acute bacterial infection (n=10) | 11.7±1.8 | 13511±9880 | 80600±31117 | 12.2±0.9* |

*MPV was not generated in acute febrile illness (66), COVID 19 infection (58), bacterial sepsis (11) and acute bacterial infection (5).

COVID 19 infection was seen in 38.8% patients. Just over two thirds (67%) of the patients were in the 6th-7th decades of life. Males (54) were affected slightly more than females (43) (M:F= 1.2:1). Most of the patients presented with fever (85.6%) followed by breathlessness (79.4%), body ache (17.5%), sore throat (12.4%) and diarrhea (8.2%). Less common manifestations were headache, cough and chest pain. Seven pregnant patients with COVID 19 presented for term delivery. Other co-morbidities like diabetes mellitus, hypertension, COPD, CKD, alcoholism and Parkinsonism were seen in 31 patients.

Peripheral blood smear in these patients showed normocytic normochromic red cells, neutrophilic leukocytosis with toxic changes, atypical and plasmacytoid lymphocytes, monocytosis and dysplastic neutrophils (Figure 1).

Of the 500 patients included in the study, 53 (10.6%) patients were diagnosed to have macrothrombocytopenia. The mean age of the patients was 43.3 ±16.2 years. There were 31 males and 22 females (M:F=1.4: 1). Two thirds (66%) of these patients were asymptomatic. Symptomatic patients had clinical features unrelated to thrombocytopenia (fracture, chest pain, cough, loose stools and body ache).

Patients were suspected to have macrothrombocytopenia if they had:

a) No defined cause of thrombocytopenia.
b) No history of bleeding.
c) Raised MPV.
d) Abnormal platelet histogram with plot in the high volume zone.
e) Significant difference in manual and automated platelet count.
f) Presence of numerous large and giant platelets on the peripheral blood smear.

Peripheral blood smear in all patients showed normocytic normochromic red cells, normal leucocyte count and variable degree of thrombocytopenia along with frequent large and giant platelets (Figure 2). Abnormal platelet histograms with high volume trails extending into the RBC zone were seen in all patients. Hematological parameters in these patients are shown in Table 4.

The platelet count ranged from 75,000-1,40,000/mm$^3$ with mean platelet count of 111000 ± 19000/mm$^3$. MPV was 12.6±0.6 fl.

Four platelet histogram patterns were noted-

i) Normal pattern.
ii) Platelet histogram with long trail of descending limb.
iii) Platelet histogram with the descending limb not touching the baseline.
iv) Platelet histogram close to the base line]. (Figure 3)

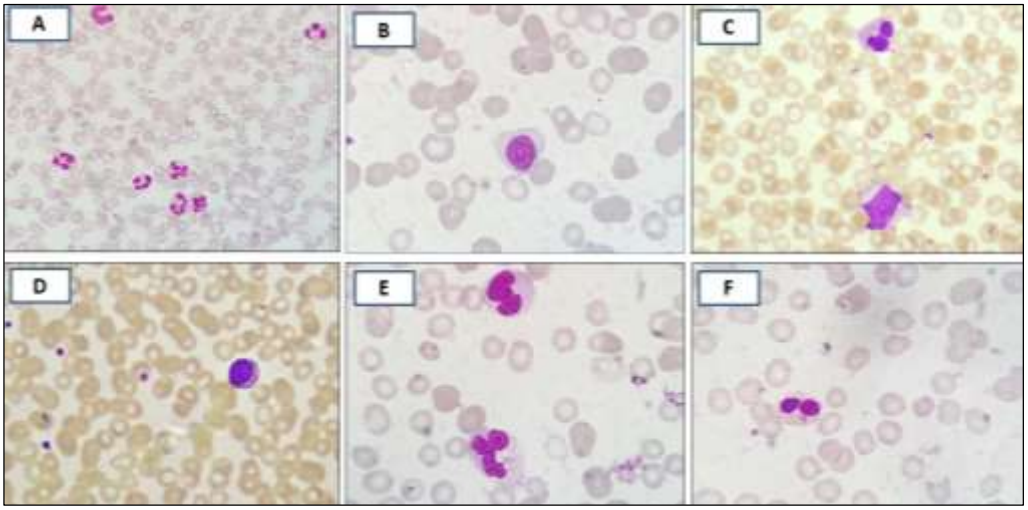


**Fig 1:** Peripheral blood findings in patients with thrombocytopenia who had COVID 19 infection A) Neutrophils, B) Atypical lymphocyte, C) Severe thrombocytopenia, D) Plasmacytoid lymphocyte, E) Monocytosis with abnormal lobation and F) Dysplastic (Pelgeroid) neutrophil

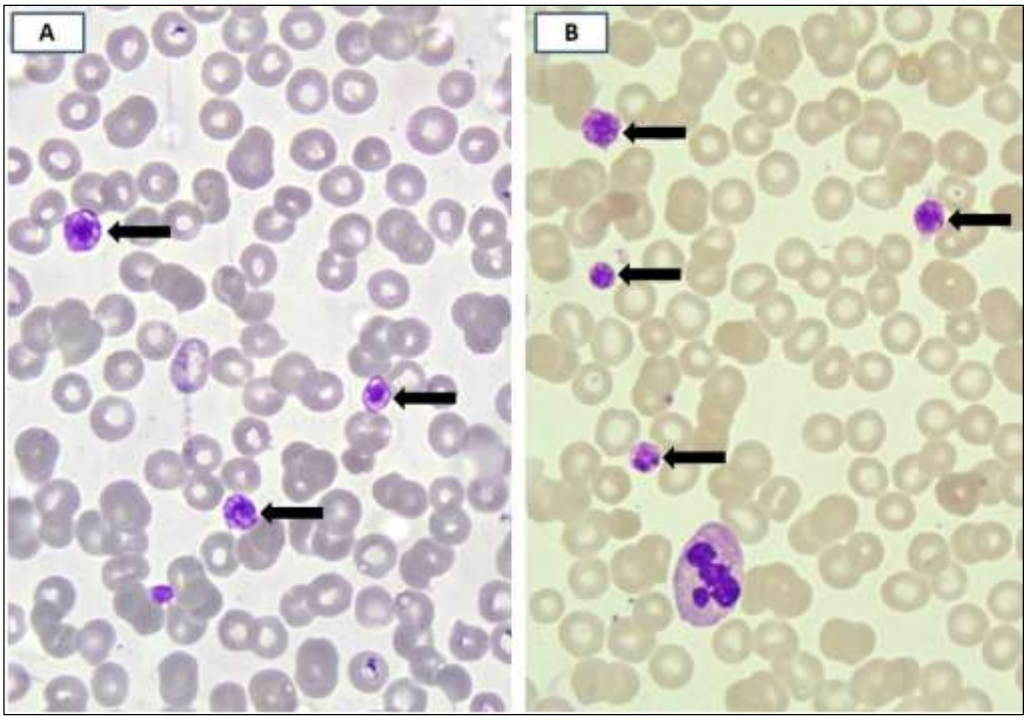


**Fig 2:** Shows large and giant platelets (arrows) in two patients with macrothrombocytopenia Platelet counts were A) 44,000/mm$^3$ (automated platelet count) and 90,000/mm$^3$ (manual count) and B) 61,000/mm$^3$ (automated platelet count) and 1,10,000/mm$^3$ (manual count) respectively. Mean Platelet Volume (MPV) was not generated in both cases

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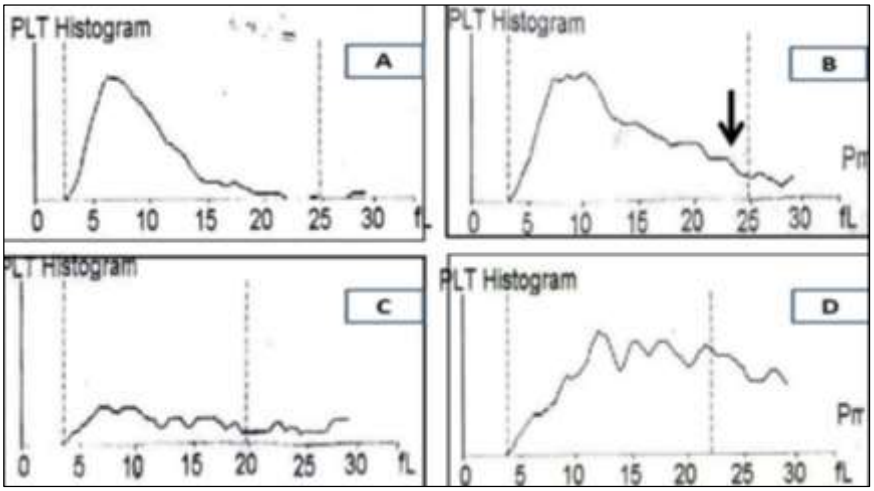


**Fig 3:** Platelet histogram patterns in patients with thrombocytopenia: A) Normal pattern, B) Platelet histogram with long trail of descending limb, C) Platelet histogram close to the base line and D) Platelet histogram with plot in the high volume zone extending into the RBC zone and descending limb not touching the baseline. This patient had macrothrombocytopenia

## Discussion

Our study has shown infections to be the commonest cause of thrombocytopenia similar to previous studies. Since the study was conducted during the Covid-19 pandemic, Covid-19 infection was a novel etiology reported in our study. Asymptomatic macrothrombocytopenia, an underreported condition was also seen among few patients.

The mean age of patients in our study was 46.7±14.6 years. The most common age group affected was in the $5^{th}$ to $7^{th}$ decades constituting 63.2% patients. In a study of 200 patients with thrombocytopenia, 53.5% of the patients were in the age group 41-64 years [6]. Another study in 389 thrombocytopenic patients found the most common age group affected to be in the fourth decade [7]. In our study, there was slight male predominance among patients with thrombocytopenia (M:F=1.3:1). Achalkar *et al*. [8] and Bhalara *et al*. [9] also had the similar finding in their study on etiology of thrombocytopenia with M:F=2.1:1 and M:F=1.3:1 respectively.

In our study, the most common symptoms observed were abdominal pain (78.2%), fever (52.6%), breathlessness (44.6%) and bodyache (20.6%). Bleeding (mucosal bleed, hemoptysis, hematemesis, hematuria or melena) was present in only 3.6% of patients.

In a study of 100 patients with thrombocytopenia, fever was the commonest (59%) symptom followed by abdominal pain and vomiting in 23% patients. Bleeding was seen in 10% patients in the form of hematuria and bleeding gums [10]. Another study in 412 patients with thrombocytopenia reported fever in 79.3% of the patients. Bleeding was seen in 11.2% patients [9].

We found only 3.6% patients with bleeding compared to previous studies as the patients with severe thrombocytopenia in our study was less (3.0%).

In our study, nearly half of the patients presenting with thrombocytopenia were asymptomatic (46.2%). Among symptomatic patients, pallor (20.4%) was the most common sign seen followed by splenomegaly (9.4%) and edema (8.2%).

Infection (50%) was the most common cause of thrombocytopenia in our study followed by chronic liver disease (14.8%), macrothrombocytopenia (10.6%), hematological disorders (8.6%) and gestational thrombocytopenia (7.8%). Among infections, acute febrile illness (non-specific) was the most (46.4%) common cause. Compared to previous literature on etiology of thrombocytopenia, in our study COVID 19 infection has emerged as a novel cause as significant period of the present study overlapped with the ongoing Covid-19 pandemic. In the present study, COVID-19 infection was seen in 38.8% patients comprising the second most common cause of thrombocytopenia among infections. Thrombocytopenia

in patients with Covid-19 infection ranged from 10,000 to 1,40,000/$mm^3$ with a mean platelet count of 97,000±22,000/$mm^3$.

Similar to our study, infection was the most common cause of thrombocytopenia in their (Paramjit *et al*. and Bhalara *et al*.) [11, 9] study on clinicopathological profile of thrombocytopenia. Among infections, malaria was the commonest cause (57.7% and 22.8% respectively) followed by dengue (27.7% and 28.6% respectively).

Among infections, the geographical area has a bearing on the etiological agents. The present study was conducted in a hilly area with an altitude of 5000 feet. There were no patients with dengue or malaria diagnosed in our study. Both these infections are endemic in the plains and other studies have shown dengue and malaria to be the commonest causes of thrombocytopenia [8, 9, 11, 12].

In our study, 14.8% patients were diagnosed to have chronic liver disease with a male predominance (M:F =13.8 : 1). The most common (85%) cause among patients with CLD was alcoholism. Similar to our study, two other studies on etiology of thrombocytopenia reported 15.2% and 17.2% patients respectively with chronic liver disease [7, 9].

In our study, 10.6% patients were diagnosed to have macrothrombocytopenia. Two thirds (66%) of the patients were asymptomatic including pregnant women. Other symptomatic patients had clinical features unrelated to thrombocytopenia. High volume platelet histograms were seen in all patients. Seven patients even on follow up after two months continued to have similar platelet counts as in the initial presentation and with persistence of large and giant platelets on the peripheral blood smear.

Limited studies from India have shown varying prevalence of macrothrombocytopenia in patients from North-east and Northern India. Most of the patients in Indian reports are asymptomatic and have mild to moderate thrombocytopenia, giant platelets in peripheral smear and absence of morphological abnormalities in other cell lines [13-15].

A study from Tamil Nadu reported 64 (80%) blood donors from West Bengal to have giant platelets (mean platelet volume >10 fL) along with thrombocytopenia. No history of excessive bleeding in any of the donors was seen [13].

Ali *et al*. studied inherited macrothrombocytopenia in 112 patients from West Bengal and North eastern states of India and Nepal. Of these, 61% of the patients were detected incidentally on routine blood tests and were asymptomatic while the remaining had bleeding symptoms of variable severity [14].

Another study in 10,047 healthy college students from Surat in Western India reported asymptomatic macrothrombocytopenia in 196 (1.95%) students. None of the individuals had a history of bleeding [15].

Benign and malignant hematological disorders were seen in 8.6% patients with thrombocytopenia. In our study, benign disorders included nutritional anemia (megaloblastic anemia) (5%), ITP (0.6%), aplastic anemia (0.4%) and PNH (0.2%). Similar to our study, other studies reported 39.6% and 6% respectively patients with thrombocytopenia who had megaloblastic anemia. Local socioeconomic factors can cause regional differences in prevalence of nutritional anemias. In our study, malignant disorders were seen in 2.4% patients. Khatib *et al*. [7] and Mittra *et al*. [11] observed 1.6% and 3.7% respectively patients with leukemia in their studies on thrombocytopenia similar to the findings of our study.

In our study, 7.8% patients were diagnosed to have gestational thrombocytopenia after other causes were ruled out. Over three fourths (76.9%) of the patients were in the 3rd trimester. In their study on clinicopathological profile of thrombocytopenia, Patel *et al*. [11], Mittra *et al*. [16] and Singh *et al*. [17] reported 5.6% and 6.6% and 8.8% cases of gestational thrombocytopenia respectively.

In our study, 4.4% of the patients with thrombocytopenia had drug induced thrombocytopenia. Other contributing factors like splenomegaly, febrile illness, sepsis or radiation exposure were ruled out in these patients. Other studies on causes of thrombocytopenia found 7.1% and 1.2% patients with drug induced thrombocytopenia respectively.

In our study, 1.8% of the patients with thrombocytopenia had chronic kidney disease. Similar to our study, Shankarappa *et al*. [10] and Paul *et al*. [6] found 2% and 3.5% patients with CKD in their study.

## Conclusion

The causes of thrombocytopenia in the present study are mostly in concordance with previous studies. The variations observed are explainable by regional differences or the patient profile in different hospital settings. Similar to most previous studies, infections were the most common cause of thrombocytopenia in the present study. The present study also highlights two new entities, COVID 19 and Macrothrombocytopenia. Although infection by a variety of viruses is well known to cause thrombocytopenia, the emergence of the Covid 19 pandemic during the present study added a new dimension to the existing causes.

## References

1. Bhalara SK, Shah S, Goswami H, Gonsai RN. Thrombocytopenia in adults: A tertiary-care hospital-based cross-sectional study. Int. J Med Sci. Public Health. 2015;4:7-10.
2. Rodgers GM, Lehman CM. Diagnostic approach to the bleeding disorders. In: Greer JP, Arber DA, Glader B, List AF, Means RT, Paraskevas F, *et al*., editors. Wintrobe's Clinical Hematology. 13th ed. China: Lippincott Williams & Wilkins, 2014, 1043-57.
3. Bashawri LA, Ahmed MA. The approach to a patient with a bleeding disorder: for the primary care physician. J Family Community Med. 2007;14:53-8.
4. George JN, Raskob GE, Shah SR, Rizvi MA, Hamilton SA, Osborne S, *et al*. Drug-Induced Thrombocytopenia: A systemic review of published case reports. Ann Intern Med. 1998;129:886-90.
5. Pedersen-Bjergaard U, Andersen M, Hansen PB. Drug-Induced Thrombocytopenia: Clinical data on 309 cases and the effect of corticosteroid therapy. Eur. J Clin. Pharmacol. 1997;52:183-9.
6. Paul R, Mushtaq S, Yerramilli A, Lakshmi S, Ryaka R, Kumar P, *et al*. A study to evaluate thrombocytopenia in a tertiary care hospital. J Evid Based Med Healthc. 2018;5:1100-2.
7. Baheti M, Nikumbh D, Desai S. Clinicopathological overview of thrombocytopenia: A retrospective study in tertiary care hospital. Arch Cytol Histopathol Res. 2018;3:214-8.
8. Achalkar GV. Approach to thrombocytopenia-a clinicopathological study. J Evolution Med Dent Sci. 2017;6:3003-6.
9. Bhalara SK, Shah S, Goswami H, Gonsai RN. Clinical and etiological profile of thrombocytopenia in adults: A tertiary-care hospital-based cross-sectional study. Int. J Med Sci. Public Health. 2015;4:7-10.
10. Shah HR, Vaghani BD, Gohel P, Virani BK. Clinical profile review of patients with thrombocytopenia: A study of 100 cases at a tertiary care centre. Int. J Cur Res Rev. 2015;7:33-7.
11. Baheti M, Nikumbh D, Desai S. Clinicopathological overview of thrombocytopenia: A retrospective study in tertiary care hospital. Arch Cytol Histopathol Res. 2018;3:214-8.
12. Paramjit E, Rao R, Sudhamani S, Roplekar P, Shaffi Z, Roy S. Spectrum of thrombocytopenia: A clinicopathological study with review of the literature. Muller J Med Sci Res. 2016;7:121-4.
13. Naina HV, Nair SC, Daniel D, George B, Chandy M. Asymptomatic constitutional macrothrombocytopenia among West Bengal blood donors. Am J Med. 2002;112:742-3.
14. Ali S, Shetty S, Ghosh K. Bengal macrothrombocytopenia is not totally an innocuous condition. Blood Cells Mol Dis. 2016;60:3-6.
15. Patel P, Shah A, Mishra K, Ghosh K. Prevalence of macrothrombocytopenia in healthy college students in western India. Indian J Hematol Blood Transfus. 2019;35:144-8.
16. Khatib Y, Jain DV, Patel DR. One year study of thrombocytopenia in a peripheral hospital of Mumbai. IOSR J Pharm. 2016;6:26-30.
17. Singh N, Dhakad A, Singh U, Tripathi AK, Sankhwar P. Prevalence and characterization of thrombocytopenia in pregnancy in Indian women. Indian J Hematol Blood Transfus. 2012;28:77-81.
18. Rashid DN, Imtiaz U, Mobeen S, Iqbal I, Khalid A. Etiological evaluation of thrombocytopenia in a tertiary care hospital. Pak Postgrad Med J. 2018;29:90-2.