



Diagnostic Evaluation of Pancytopenia: A Retrospective Analysis

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ABSTRACT

Background: Pancytopenia is a hematological condition characterized by a reduction in all three cellular components of blood—erythrocytes, leukocytes, and platelets. It encompasses a wide range of etiologies, from nutritional deficiencies to bone marrow disorders.

Aim: To analyze the clinical, hematological, and etiological profile of pancytopenia in patients presenting to a tertiary care center.

Materials and Methods: This retrospective study was conducted at Government Medical College and Hospital, Sawai Madhopur, Rajasthan, over a period of one year (February 2025–January 2026). A total of 410 patients fulfilling diagnostic criteria for pancytopenia were included. Clinical data, laboratory investigations, and bone marrow findings were evaluated.

Results: Among 410 patients, females (55.1%) slightly outnumbered males (44.9%). The most commonly affected age group was 41–60 years (34.6%). Megaloblastic anemia was the leading cause (39.5%), followed by aplastic anemia (15.9%), infections (15.1%), hematological malignancies (12.2%), chronic diseases (10.2%), and miscellaneous causes (7.1%).

Conclusion: Megaloblastic anemia remains the predominant and reversible cause of pancytopenia. Bone marrow examination plays a crucial role in diagnosis, and early identification of etiology is essential for effective management.

Keywords: Pancytopenia, Megaloblastic anemia, Bone marrow, Hematological malignancies, varied etiologies

INTRODUCTION

Pancytopenia is a commonly encountered hematological abnormality defined by the simultaneous decrease in hemoglobin concentration, total leukocyte count, and platelet count. It is not a disease entity but a manifestation of various underlying pathological conditions affecting bone marrow function or peripheral blood cell survival.

The etiological spectrum includes nutritional deficiencies, bone marrow failure syndromes, infections, malignancies, and chronic systemic illnesses. The pattern of these causes varies depending on geographic region, socio-economic status, and healthcare access.

Bone marrow aspiration and biopsy remain indispensable tools in the evaluation of pancytopenia, providing valuable insights into marrow cellularity and pathology.

This study was undertaken to evaluate the etiological spectrum and clinicopathological features of pancytopenia in our Government district hospital in Rajasthan.



MATERIALS AND METHODS

Study Design:

Retrospective observational study

Study Location:

Government Medical College and Hospital, Sawai Madhopur, Rajasthan, India

Study Duration:

February 2025 – January 2026

Sample Size:

410 cases

Inclusion Criteria:

- Patients aged >10 years
- Hemoglobin <9 g/dL
- Total leukocyte count <4000/mm³
- Platelet count <100,000/mm³

Exclusion Criteria:

- Patients on chemotherapy
- Previously diagnosed hematological malignancies under treatment

Data Collection:

Data were retrieved from hospital records including:

- Demographic details
- Clinical presentation
- Hematological parameters
- Peripheral smear examination
- Bone marrow findings

RESULTS

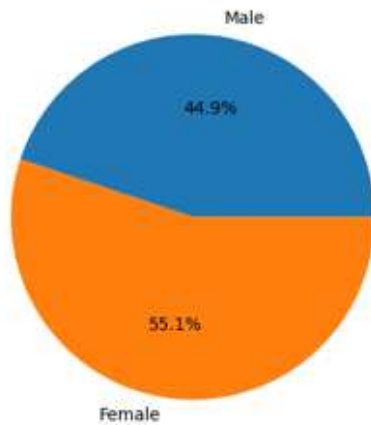
Demographic Profile:

Out of the 410 cases, 226 patients (55.1%) were females and 184 (44.9%) were males, showing a slight female predominance with a female-to-male ratio of approximately 1.2:1.

The age of the patients ranged from 10 to over 80 years. The highest number of cases was observed in the 41–60 years age group, accounting for 142 cases (34.6%), followed by the 61–80 years group with 109 cases

(26.6%). Younger age groups contributed comparatively fewer cases, with 10% in the 10–20 years category and 22.9% in the 21–40 years group. Patients above 80 years constituted the smallest proportion (5.9%).

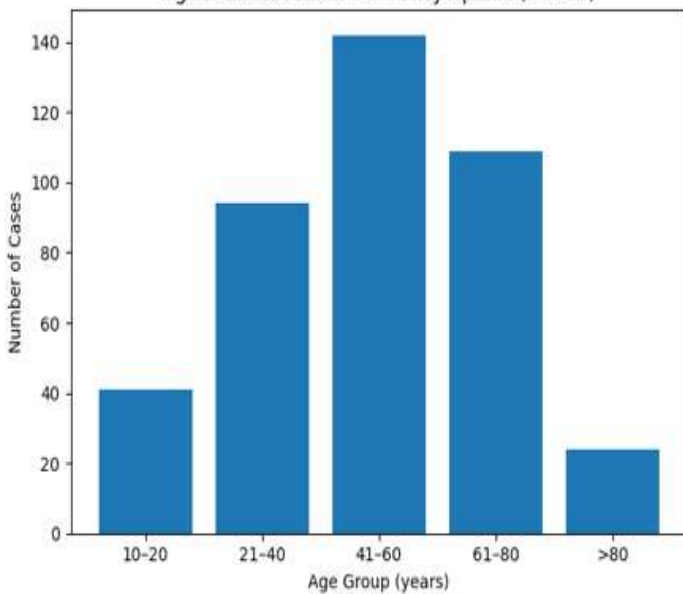
Gender Distribution (p = 0.046, significant)



Gender	Cases	Percentage
Male	184	44.9%
Female	226	55.1%

Age-wise Distribution:

Age-wise Distribution of Pancytopenia (n=410)



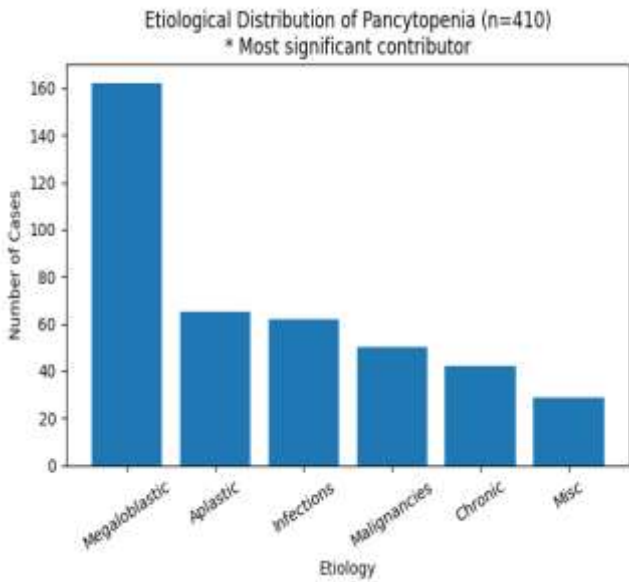
Age groups	Cases	Percentage
10–20	41	10.0%
21–40	94	22.9%
41–60	142	34.6%
61–80	109	26.6%
>80	24	5.9%

Etiological Spectrum:

The etiological analysis revealed that megaloblastic anemia was the most common cause of pancytopenia, identified in 162 cases (39.5%). Aplastic anemia was the second most frequent etiology, seen in 65 cases (15.9%).

Infectious causes, including sepsis, tuberculosis, and viral infections, accounted for 62 cases (15.1%). Hematological malignancies such as leukemia and lymphoma were observed in 50 patients (12.2%).

Chronic diseases, including chronic liver disease and autoimmune disorders, were responsible for pancytopenia in 42 cases (10.2%). Miscellaneous causes, comprising hypersplenism and other less common conditions, accounted for 29 cases (7.1%). There was a statistically significant association between gender and etiology (p < 0.05), indicating that certain causes like megaloblastic anemia and chronic diseases were more prevalent in females.

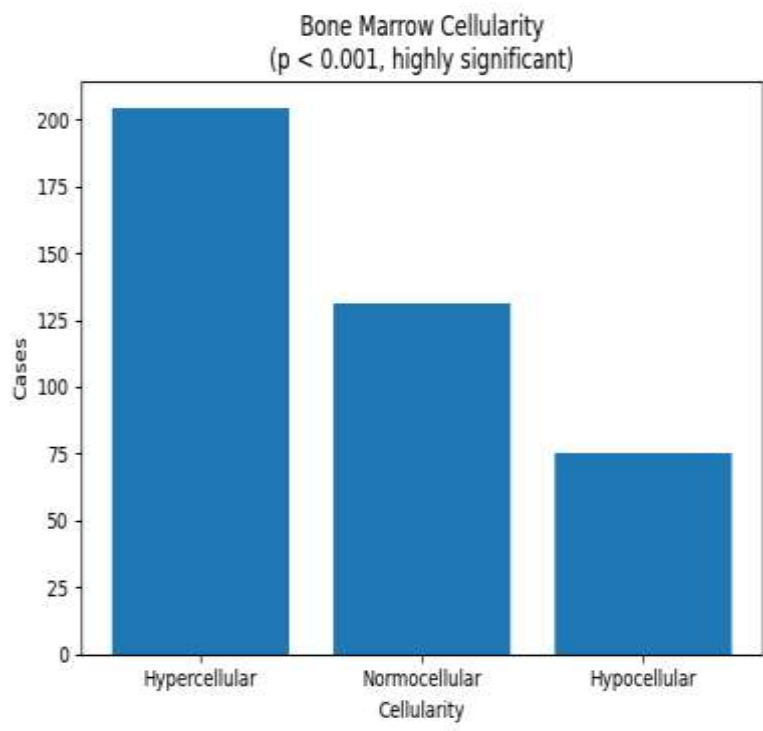


Etiology	Male	Female
Megaloblastic anemia	70	92
Aplastic anemia	34	31
Infections	33	29
Malignancies	28	22
Chronic diseases	11	31
Miscellaneous	8	21

Bone Marrow Findings

Bone marrow examination findings showed that hypercellular marrow was the most common pattern, observed in 204 cases (49.8%). This pattern was predominantly associated with megaloblastic anemia.

Normocellular marrow was noted in 131 cases (32.0%), while hypocellular marrow was seen in 75 cases (18.2%), primarily in patients diagnosed with aplastic anemia.



Marrow Cellularity	Cases	Percentage
Hypercellular	204	49.8%
Normocellular	131	32.0%
Hypocellular	75	18.2%

- Hypercellular marrow predominantly seen in **megaloblastic anemia**
- Hypocellular marrow associated with **aplastic anemia**

Chi-square analysis demonstrated a statistically significant association between gender and etiology (p=0.046) and a highly significant association between bone marrow cellularity and underlying cause (p<0.001), while age-wise distribution did not show statistical significance (p>0.05).



CONCLUSION

Pancytopenia is a significant hematological condition with varied etiologies. Megaloblastic anemia continues to be the most common and reversible cause in this region. Importantly, a large proportion of cases identified in this study were potentially reversible or manageable with timely intervention. This emphasizes the need for a systematic and stepwise diagnostic approach, including clinical assessment, hematological investigations, and bone marrow evaluation where indicated.

Pancytopenia should be approached as a clinical indicator of underlying disease rather than a standalone diagnosis. Early detection, appropriate etiological classification, and targeted management are essential to improve patient outcomes. Strengthening nutritional awareness, improving diagnostic facilities, and ensuring timely referral to specialized centres can significantly reduce morbidity and mortality associated with pancytopenia.

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