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Original Research Article

Clinico-Etiological Spectrum of Pancytopenia in Adults at a Tertiary Care Hospital in Mathura, Uttar Pradesh: A Cross-Sectional Study

Anjul Baisoya[1], Sushama[2], Aman Malik[3], Preeti[4], Anuj Sharma[5], Nishant Malik[6]

[1]Resident, Department of Medicine, K.M. Medical College and Hospital, Mathura, U.P., India
[2]Assistant Professor, Department of Medicine, K.D. Medical College and Hospital, Mathura, U.P., India
[3]Resident, K.M. Medical College and Hospital, Mathura, U.P., India
[4]Senior Resident, Medicine Department, Hindu Rao Hospital, Delhi
[5]Senior Resident, G.B. Pant Hospital, New Delhi, India
[6]Senior Resident, K.M. Medical College and Hospital, Mathura, U.P., India

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Corresponding author: Dr. Anjul Baisoya
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Abstract

Introduction: Pancytopenia is a hematological syndrome characterized by reduction in erythrocytes, leukocytes, and platelets. Its etiological spectrum varies among populations and healthcare settings. Objectives: To evaluate the etiological and clinicopathological profile of adults presenting with pancytopenia at a tertiary-care hospital in Mathura, Uttar Pradesh.

Materials and Methods: A cross-sectional observational study was conducted among 100 consecutive newly detected adult patients (>14 years) with pancytopenia at K.M. Medical College & Hospital, Mathura, from May 2024 to November 2025. Pancytopenia was defined as hemoglobin <10 g/dL, total leukocyte count <4,000/mm³, and platelet count <100,000/mm³. Clinical evaluation, complete blood count, peripheral smear, relevant biochemical and serological investigations, and bone-marrow examination when indicated were performed.

Results: Males constituted 58% of participants. Pallor was present in 100%, easy fatigability in 80%, bleeding tendency in 56%, and fever in 33%. Mean hemoglobin was 6.70 ± 2.10 g/dL, mean total leukocyte count 2310.00 ± 738.89/mm³, and mean platelet count 29,200.00 ± 29,308.52/mm³. Bone-marrow examination showed hypocellularity in 54%, hypercellularity in 45%, and was not performed in 1%. Aplastic anemia was the most frequent etiology (38%), followed by hypersplenism (18%), subleukemic leukemia (12%), infiltrative disorders (9%), myelodysplastic syndrome (9%), and megaloblastic anemia (5%). Myelodysplastic changes without full syndrome criteria, sepsis, and systemic lupus erythematosus each accounted for 1%, while 6% remained of unknown etiology.

Conclusion: Pancytopenia demonstrated a heterogeneous etiological spectrum in this tertiary-care cohort, with aplastic anemia being the predominant cause. Systematic clinical evaluation and appropriately selected peripheral smear and bone-marrow assessment are important for establishing the underlying etiology.

Keywords: Pancytopenia; Aplastic Anemia; Hypersplenism; Leukemia; Bone Marrow.

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Introduction

Pancytopenia is characterized by reduction in all three major cellular components of peripheral blood—erythrocytes, leukocytes, and platelets. It is a hematological finding rather than a disease entity and may result from disorders affecting hematopoietic production, marrow cellularity, marrow infiltration, ineffective hematopoiesis, peripheral destruction, or sequestration. [1,2] The etiological spectrum varies between populations and healthcare settings. Indian studies have reported substantial differences in the relative contribution of aplastic anemia, megaloblastic anemia, hypersplenism, acute leukemia, and other marrow disorders. [3,4] More recent studies have similarly demonstrated heterogeneous diagnostic spectra among patients undergoing evaluation for pancytopenia. [5,6] The present study was undertaken to evaluate the etiological and clinicopathological profile of adults presenting with pancytopenia at K.M. Medical College & Hospital, Mathura, Uttar Pradesh.

Materials and Methods

Study design and setting: A cross-sectional observational study was conducted at K.M.

Medical College & Hospital, Mathura, Uttar Pradesh, from May 2024 to November 2025.

Patients were recruited from the inpatient and outpatient departments of General Medicine and Haematology.

Participants and sample size: The study included 100 consecutive newly detected adult patients (>14 years) with pancytopenia. The thesis protocol records a calculated sample size of approximately 100; the final study population comprised 100 patients. No control group was included in the final study population.

Case definition and eligibility: Pancytopenia was defined as hemoglobin <10 g/dL, total leukocyte count <4,000/cu.mm, and platelet count <100,000/cu.mm. Patients aged <14 years were excluded. Patients with normal counts at the first visit who subsequently developed pancytopenia secondary to drugs, radiotherapy, or similar causes were excluded.

Clinical and laboratory evaluation: A detailed clinical history and physical examination were performed. All patients underwent complete blood count and peripheral blood smear examination. Additional investigations included reticulocyte count, serum vitamin B12 and folate, liver and renal function tests, iron studies and ferritin, viral serology, and autoimmune markers where clinically indicated.

Bone-marrow examination: Bone-marrow aspiration and biopsy were performed in patients with persistent or severe pancytopenia to assess cellular morphology, megakaryocyte distribution, infiltration, fibrosis, dysplasia, and features suggestive of aplastic anemia, megaloblastic anemia, or hematological malignancy.

Ethical approval and consent: The study protocol entitled "Clinico-Etiological Profile of Patients with Pancytopenia" was considered by the Research Advisory Committee on 14 May 2024 and approved by the University Ethics Committee, K.M. (Krishna Mohan) University, Mathura, at its meeting on 27 May 2024 (Ethical Clearance Certificate No. KMU/RO/ECC/2023-24/13, dated 30 May 2024). Written informed consent was obtained from all participants.

Statistical analysis: Data were processed using IBM SPSS Statistics. Continuous variables were summarized as mean ± standard deviation and categorical variables as frequencies and percentages. The thesis methodology reports use of chi-square testing, Student's t-test, and one-way analysis of variance, with $P<0.05$ considered statistically significant.

Results

A total of 100 patients were included. The mean age was 39.76 ± 16.90 years. Males constituted 58% and females 42%. Pallor was present in all patients (100%), followed by easy fatigability (80%), bleeding tendency (56%), fever (33%), breathlessness on exertion (17%), splenomegaly (24%), hepatomegaly (13%), icterus (9%), lymphadenopathy (5%), and peripheral neuropathy (3%). The mean hemoglobin was 6.70 ± 2.10 g/dL, mean total leukocyte count was 2310.00 ± 738.89/mm³, and mean platelet count was 29,200.00 ± 29,308.52/mm³. Bone-marrow examination showed hypocellularity in 54% and hypercellularity in 45%; it was not performed in 1% of patients.

Table 1: Clinical characteristics of the study population

Clinical characteristic	n (%)
Pallor	100 (100)
Easy fatigability	80 (80)
Bleeding tendency	56 (56)
Fever	33 (33)
Breathlessness on exertion	17 (17)
Splenomegaly	24 (24)
Hepatomegaly	13 (13)
Icterus	9 (9)
Lymphadenopathy	5 (5)
Peripheral neuropathy	3 (3)

Table 2: Hematological and bone-marrow findings

Parameter	Mean ± SD / n (%)
Hemoglobin (g/dL)	6.70 ± 2.10
Total leukocyte count (/mm³)	2310.00 ± 738.89
Platelet count (/mm³)	29,200.00 ± 29,308.52
Hypocellular marrow	54 (54%)
Hypercellular marrow	45 (45%)
Bone marrow not done	1 (1%)

Table 3: Etiological distribution of pancytopenia

Etiology	n (%)
Aplastic anemia	38 (38)
Hypersplenism	18 (18)
Subleukemic leukemia	12 (12)
Infiltrative disorders	9 (9)
Myelodysplastic syndrome	9 (9)
Megaloblastic anemia	5 (5)
Myelodysplastic changes without full syndrome criteria	1 (1)
Sepsis	1 (1)
Systemic lupus erythematosus	1 (1)
Unknown	6 (6)
Total	100 (100)

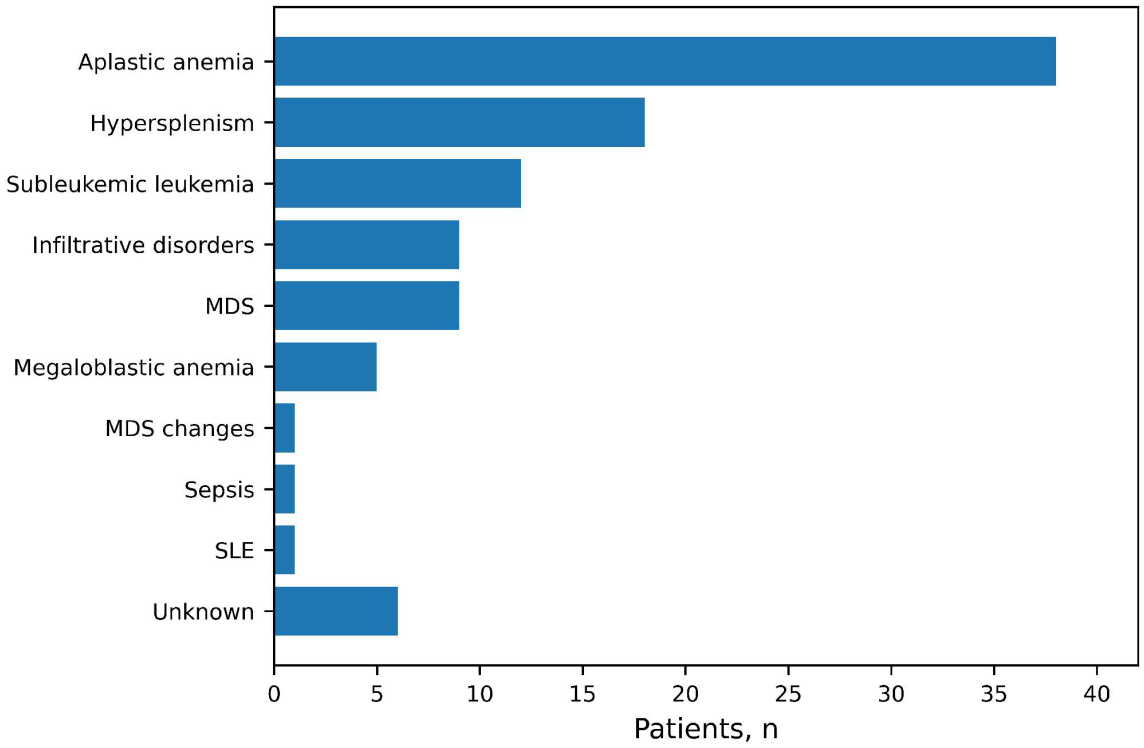

Figure 1: Etiological distribution of pancytopenia in the study population.

Discussion

The present study demonstrates a heterogeneous etiological spectrum among adults presenting with pancytopenia at a tertiary-care hospital in Mathura. Aplastic anemia was the most frequent diagnosis (38%), followed by hypersplenism (18%) and subleukemic leukemia (12%).

The predominance of aplastic anemia is comparable to findings from a 248-patient study from eastern India, in which aplastic anemia accounted for 33.47% of cases.[3] In contrast, a 546-patient western Indian hematology cohort reported acute leukemia as the most common cause (17.9%), followed by megaloblastic anemia (15.4%) and aplastic anemia (11%). [4] These differences support substantial variation in the etiological spectrum between tertiary-care populations.

Recent studies have also demonstrated heterogeneity in the distribution of pancytopenia etiologies. [5,6] Differences may reflect referral patterns, geographic setting, inclusion criteria, age distribution, nutritional and infectious disease burden, and diagnostic work-up.

Pallor was universal in the present cohort and easy fatigability was reported in 80%. The mean hemoglobin of 6.70 g/dL indicates substantial anemia, while the mean platelet count was markedly reduced.

Aplastic anemia was the leading diagnosis. In the aplastic-anemia subgroup, idiopathic disease accounted for 92.1% and drug-induced disease for 7.9%. Hypersplenism was characterized clinically by splenomegaly, while subleukemic leukemia highlights the importance of considering

hematological malignancy even without prominent leukocytosis.

The study's main contribution is documentation of the local etiological spectrum of pancytopenia in a tertiary-care hospital in Mathura. The 38% prevalence of aplastic anemia should be interpreted as a finding of this study population and not as a regional or national estimate.

Limitations

This was a single-center observational study with 100 patients, limiting generalizability. Convenience sampling, as reported in the thesis, may introduce selection bias. Not every patient underwent every specialized investigation; bone-marrow examination was performed according to clinical indication.

The study is descriptive and cross-sectional and therefore cannot establish causality. The final manuscript reports the thesis-derived dataset; no new patient-level data have been introduced.

Conclusion

In this tertiary-care cohort of 100 adults with pancytopenia, aplastic anemia was the predominant etiological diagnosis, followed by hypersplenism and subleukemic leukemia. The heterogeneous spectrum emphasizes the importance of systematic clinical evaluation, peripheral smear examination, and appropriately selected bone-marrow assessment.

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Declarations

Ethical Approval: University Ethics Committee, K.M. (Krishna Mohan) University, Mathura; Ethical Clearance Certificate No. KMU/RO/ECC/2023-24/13, dated 30 May 2024.

Informed Consent: Written informed consent was obtained from all participants.

Author Contributions: Dr. Anjul Baisoya contributed to study conception and design, data acquisition, analysis and interpretation, manuscript preparation, revision, and final approval, and is the guarantor of the work.

Data Availability: The manuscript is based on the thesis dataset. The original standalone patient-level dataset is not currently available as a separate file.

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