Section: Pathology

Original Research Article

# PANCYTOPENIA: UNRAVELLING PATTERNS AND INSIGHTS THROUGH BONE MARROW EXAMINATION

**Neha Batra[1], Charu Batra Atreja[2]**

[1]Associate Professor, Department of Pathology, Punjab Institute of Medical Sciences Jalandhar, Punjab, India
[2]Associate Professor, Department of Pathology, Maharishi Markandeshwar Institute of Medical Sciences & Research (MMIMSR), Maharishi Markandeshwar (Deemed to be University) (MMDU), Mullana, Ambala, Haryana, India

*Received* : 03/11/2023
*Received in revised form* : 12/12/2023
*Accepted* : 26/12/2023

*Keywords:*
*Pancytopenia, Bone marrow examination, megaloblastic anaemia*

Corresponding Author:
**Dr. Charu Batra Atreja,**
Email: drcharubatra@gmail.com

DOI: 10.47009/jamp.2023.5.6.279

Source of Support: Nil,
Conflict of Interest: None declared

*Int J Acad Med Pharm*
2023; 5 (6); 1356-1358

## Abstract

**Background:** Pancytopenia is a common manifestation associated with various diseases, displaying diverse clinical features. Rather than a distinct ailment, it represents a triad of laboratory findings resulting from a spectrum of disorders ranging from drug-induced bone marrow hypoplasia to severe conditions such as bone marrow aplasias and leukemias. Recognizing the specific etiology of pancytopenia is crucial for ensuring accurate treatment. The aims and objectives are investigating the role of bone marrow in diagnosing patients with pancytopenia. Examine the etiological spectrum of pancytopenia. **Materials and Methods:** This prospective study focused on patients with pancytopenia, including all cases undergoing bone marrow examination in the pathology department throughout the year 2022. A total of 100 cases were included. **Result:** The primary etiology of pancytopenia was identified as megaloblastic anemia (34%), closely followed by Dimorphic anemia (27%), Leukemia (11%), Aplastic anemia (8%), MDS (6%), Bone marrow depression (4%), Infection (4%), Multiple myeloma (2%), and Hypersplenism (2%). A slight male predominance was observed, and the highest number of cases occurred in the 41-60 age group. **Conclusion:** Pancytopenia, though a laboratory finding, stems from various diseases. Megaloblastic anemia emerged as the leading cause based on bone marrow aspiration findings in this study. The research emphasizes the indispensable role of bone marrow examination in confirming the diagnosis.

## INTRODUCTION

Pancytopenia is characterized by a reduction in all blood cell counts including red blood cells, white blood cells and platelets. This can be a represention of different pathological conditions. Peripheral pancytopenia can be due to various diseases affecting the bone marrow, that can be primary bone marrow disease or a disease involving bone marrow secondarily.[1] In the Punjab region, pancytopenia is frequently encountered in clinical practice, presenting with a spectrum of symptoms such as pallor, dyspnea, bleeding, bruising, and an increased susceptibility to infections, all indicative of bone marrow failure.[2] Fever and pallor are among the main presenting complaints, putting patients at an elevated risk of cardiac failure and infections. The etiology of pancytopenia varies based on factors like age, nutrition, variation of climate, and infection prevalence. Despite its common occurrence and the exhaustive nature of its differential diagnosis, pancytopenia is not extensively discussed in major hematology and internal medicine textbooks.[3] The condition can either be constitutional, because of an inherited genetic defect affecting hematopoietic progenitors, or acquired. Fanconi anemia stands out as the most common cause of constitutional pancytopenia, followed by other infrequent genetic disorders. Hematologic manifestations of congenital pancytopenias may not become evident until years or even decades later, underscoring the importance of considering genetic predisposition before labelling a patient with aplastic anemia.

Mechanisms responsible for acquired pancytopenia can be ineffective hematopoiesis in which cell die in the marrow, formation of defective cells, sequestration or destruction of cells by antibodies, trapping of cells in the spleen, and depressed hematopoietic cell production due to toxins or decreased growth and differentiation of marrow cells. Pancytopenia can range from being a finding in diseases such as megaloblastic anemia to a life-threatening disorder like aplastic anemia. Therefore, a thorough workup is essential for diagnosis, with the


ISSN (O): 2687-5365; ISSN (P): 2753-6556

severity and underlying cause guiding treatment and prognosis.

Bone marrow cellularity in the patients of peripheral pancytopenia depends on the etiology of the pathological condition. Marrow is hypocellular when there is primary defect in production, while marrow is hypercellular or normocellular in cases of ineffective erythropoiesis, increased peripheral consumption or cell destruction and bone marrow involved with secondary malignant disease.[4] Marrow aspiration helps us to assess for cellularity and morphology of various haematopoietic cells. Bone marrow biopsy can help further when there are no marrow fragments on aspiration. Many studies have concluded that in pancytopenia patients should undergo both bone marrow aspiration and bone marrow biopsy to reach a final diagnosis.[5]

Documentation of various etiologies of pancytopenia plays a crucial role in the appropriate management of patients seeking healthcare, with bone marrow aspiration/biopsy serving as a vital diagnostic tool.

## MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Pathology at Punjab Institute of Medical Sciences Jalandhar, India, over one year. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all patients before enrollment.

The study included 100 patients with newly detected pancytopenia attending the inpatient or outpatient departments. (Hb <13.0 g/dL in males, or 12.0 g/dL in females, Total leukocyte count (TLC) <4.0 × $10^9$/L, and platelet count <150 × $10^9$/L) were included in this study. Inclusion criteria encompassed patients of all age groups and sexes presenting with pancytopenia requiring bone marrow aspiration. Exclusion criteria involved patients undergoing chemotherapy, radiotherapy, or immunosuppressive therapy, and those with contraindications for bone marrow aspiration.

Bone marrow aspiration was performed from the posterior superior iliac spine using Salah's bone marrow aspiration needle, adhering to aseptic precautions and obtaining consent. Trephine biopsy was conducted using the Jamshidi needle when necessary. Peripheral blood smears and bone marrow aspirate smears were stained with Leishman Stain, and trephine biopsies were processed and stained with Hematoxylin and Eosin stain.

Detailed clinical history, examination, and evaluation of peripheral blood film and bone marrow smears were conducted by a panel of pathologists, supplemented by additional investigations to reach a diagnosis. Clinical details were tabulated, analysed, and correlated with laboratory parameters.

## RESULTS

A comprehensive study involving 100 patients presenting with pancytopenia and indicated for bone marrow aspiration provided insights into the demographic distribution, predominant age groups, gender prevalence, common presenting complaints, and the diverse etiologies contributing to this hematological challenge.

Demographic Distribution: The age range of the patients studied spanned from 16 to 78 years. The highest incidence of cases, constituting 36%, was observed in the age group of 41 to 60 years. This finding emphasizes that pancytopenia is not limited to a specific age range but manifests across a broad spectrum of adulthood. The study included a slightly higher proportion of males, comprising 55%, compared to females at 45%, resulting in a male-to-female ratio of 1.2. Analyzing the distribution within different age groups revealed distinct patterns. Pancytopenia was more prevalent in females in the age group of 21-40 years, whereas in males, it manifested more commonly in the 41-60 age group. This divergence in age-related prevalence highlights potential gender-specific factors influencing the onset of pancytopenia.

Diagnosis on Bone Marrow Aspiration: Megaloblastic anemia emerged as the most prevalent diagnosis, constituting 34% of cases, underscoring its significance in the landscape of pancytopenia. Dimorphic anemia closely followed, accounting for 27% of cases. Leukemia, aplastic anemia, myelodysplastic syndromes (MDS), bone marrow depression, infections, multiple myeloma, and hypersplenism collectively formed the spectrum of etiologies contributing to pancytopenia. Fever was identified as the most common presenting complaint among the studied cases. [Table 1]

These findings illuminate the intricate interplay of age, gender, and specific diagnoses in the manifestation of pancytopenia. They serve as a foundation for further research and tailored interventions in understanding and managing this complex hematological condition. [Table 2]

**Table 1: Age and sex-wise distribution of patients with Pancytopenia.**

| Age Group | Male | Female | Total Cases | Percentage |
|---|---|---|---|---|
| <20 yr | 6 | 8 | 14 | 14% |
| 21-40 yr | 12 | 16 | 28 | 28% |
| 41-60 yr | 22 | 14 | 36 | 36% |
| 61-80 yr | 15 | 7 | 22 | 22% |

**Table 2: Distribution of cases on the basis of diagnosis on bone marrow aspiration.**

| Diagnosis on Bone Marrow Aspiration | Number of Cases | Percentage |
|---|---|---|
| Megaloblastic Anemia | 34 | 34% |


ISSN (O): 2687-5365; ISSN (P): 2753-6556

| | | |
|---|---|---|
| Dimorphic Anemia | 27 | 27% |
| Leukemia | 11 | 11% |
| Aplastic Anemia | 8 | 8% |
| MDS | 6 | 6% |
| Bone Marrow Depression | 4 | 4% |
| Infection | 4 | 4% |
| Multiple Myeloma | 2 | 2% |
| Hypersplenism | 2 | 2% |

## DISCUSSION

Pancytopenia, a common hematological challenge with exhaustive differential diagnosis encountered in clinical settings, patients present with unexplained pallor, prolonged fever, and a tendency to bleed. Bone marrow examination emerges as a crucial diagnostic tool in unravelling the causes behind pancytopenia. This study, conducted in the Department of Pathology, delved into cases referred for bone marrow examination, assessing aspects such as age and gender distribution, microscopic findings, and the diverse causes contributing to pancytopenia. The results were compared with similar studies conducted in India and abroad.

In our study, the male-to-female ratio was 1.2:1, aligning with some studies and diverging slightly from others indicating female preponderance.[6-8] Among the 100 patients examined, megaloblastic anemia emerged as the most common isolated cause of pancytopenia, a finding consistent with numerous studies.[7,12-15] Following closely was dimorphic anemia, accounting for 27% of cases. In contrast, studies like the one by Basha et al,[9] identified combined deficiency as the leading cause of pancytopenia. Acute leukemia secured the third position in our study, echoing findings from research by Aziz et al and Shah et al.[10,11]

Despite global trends highlighting aplastic anemia as the primary diagnosis in pancytopenic patients, our study, akin to many in developing countries, pinpointed megaloblastic anemia as the predominant cause in the Punjab region. This insight is crucial for tailoring treatment approaches, as the majority of patients with pancytopenia in our study exhibited a reversible etiology, primarily megaloblastic anemia. This allows for a trial of hematinics, showcasing the importance of understanding regional variations in disease patterns.[12,13]

## CONCLUSION

The study reinforced the significance of bone marrow aspiration as an inexpensive, cost-effective, and minimally invasive diagnostic procedure for confirming the diagnosis of pancytopenia. Beyond mere confirmation, it serves as a gateway to planning further investigations and managing patients effectively. In conclusion, as developing countries like India grapple with the complexity of pancytopenia, unravelling local patterns through comprehensive studies becomes imperative for tailored and resource-efficient healthcare interventions

## REFERENCES


1. Williams WJ, Bentkr E, Erskv AJ. Haematology – third edition, Singapore, McGraw Hill Book Company 1986:161-84.
2. Hayat AS, Khan AH, Baloch GH, Shaikh N. Study for Clinical Features and Etiological Pattern. The Professional Medical Jorunal. 2014;21(1):060-065.
3. Osama I, Baqal HZ, Faiz A, Nisar H: Pattern of pancytopenia in a general medical ward and a proposed diagnostic approach. J Ayush Med Coll Abbottabad 2004;16:3-7.
4. Pathak R, Jha A, Sayami G. Evaluation of bone marrow in patients with pancytopenia. J Patho Nepal. 2012;2:265-71.
5. Shah P, Patel RD, Gamit B, Gheewala S. Bone marrow examination in cases of pancytopenia. Int J Res Med Sci 2017;5:1494-8.
6. Jha A, Sayami G, Adhikari RC, Panta AD, Jha R. Bone Marrow Examination in Cases of Pancytopenia. J Nepal Med Assoc. 2008;47:12-7.
7. Das Makheja K, Kumar Maheshwari B, Arain S, Kumar S, Kumari S, Vikash. The common causes leading to pancytopenia in patients presenting to tertiary care hospital. Pak J Med Sci. 2013;29:1108–11.
8. Aziz T, Liaquat Ali L, Ansari T, Liaquat HB, Shah S, Jamal AJ. Pancytopenia: Megaloblastic anemia is still the commonest cause. Pak J Med Sci. 2010;26:1132-6.
9. Basha M, Aziz M, Ali SM, Alam K, Alam F, Ahmed M: Evaluation of hematological parameters and bone marrow in Indian patients suffering from pancytopenia. BJMHR. 2016;3(4):1-15.
10. Shah P, Patel RD, Gamit B, Gheewala S. Bone marrow examination in cases of pancytopenia. Int J Res Med Sci 2017;5:1494-8.
11. Tilak N, Jain R. Pancytopenia – A clinico-haematological analysis of 77 cases. Indian J Pathol Microbiol. 1999;42(4):399-404
12. Khunger JM, Arulselvi S, Sharma U, Ranga S, Talib VH. Pancytopenia – A clinico haematological study of 200 cases. Indian J Pathol Microbiol. 2002;45:375–9.
13. Khodke K, Marwah S, Buxi G, Vadav RB, Chaturvedi NK. Bone marrow examination in cases of pancytopenia. J Acad Clin Med. 2001;2:55–9.
14. Tilak V, Jain R. Pancytopenia – A clinico-hematologic analysis of 77 cases. Indian J Pathol Microbiol.1999;42: 399–404.
15. Gayathri BN, Rao KS. Pancytopenia: A clinicohematological study. J Lab Physicians. 2011;3:15–20




ISSN (O): 2687-5365; ISSN (P): 2753-6556