Int. J Med. Pharm. Res. (P-ISSN: 2958-3675 | E-ISSN: 2958-3683)
Available on: https://ijmpr.in/

International Journal
of Medical and Pharmaceutical Research

ORGINAL ARTICLE **OPEN ACCESS**

A Study of Bone Marrow Morphology and Hematological Parameters in Pancytopenia

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OPEN ACCESS

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Received: 28-09-2024
Accepted: 25-11-2024
Available online: 30-11-2024

A B S T R A C T

Introduction: Pancytopenia is the reduction of all three cellular elements of peripheral blood, leading to anemia, leukopenia and thrombocytopenia, and clinico-hematological entity commonly encountered in clinical practice as a feature of a myriad of diseases, ranging from non-malignant disease to malignant neoplasms. ***Material and Methods***: In our study, a total of 100 cases of pancytopenia were included. Complete evaluation of clinical findings, haematological indices and bone marrow examination were carried out. ***Results***: In our study the most common cause of pancytopenia was megaloblastic anemia (44%), followed by dimorphic anemia or nutritional anemia (32%) and less commonly observed causes were acute leukemia and iron deficiency anemia. Most common anemia found to be macrocytic hypochromic. Hypercellular marrow was seen in 64% of cases, whereas hypocellular marrow was present in 8% of cases. ***Conclusion***: Bone marrow aspiration and haematological parameters are useful, economical, and safe diagnostic tool in the evaluation of pancytopenia.

Keywords: Pancytopenia, bone marrow morphology

INTRODUCTION

Pancytopenia is an important hematologic problem encountered frequently in clinical practice [1]. It is the reduction of all three cellular elements of peripheral blood, leading to anemia, leucopenia and thrombocytopenia, It is characterized by a hemoglobin value of less than 12 g/dL in women and 13 g/dL in men, platelets of less than 100,000 per mcL, and leucocytes of less than 4000 per ml (or absolute neutrophil count of less than1800perml) [2]. Patients present with symptoms and signs due to anemia, leucopenia or thrombocytopenia. The possible underlying causes are viral infections, nutritional anemia, hypersplenism, malignant conditions e.g.,myelofibrosis, leukaemia, myelodysplastic syndrome (MDS), metastasis to bone marrow, multiple myeloma and hairy cell leukaemia [3].

Aims and Objectives:

To observe hematological indices and bone marrow findings in different diseases producing Pancytopenia in a tertiary care hospital in western Rajasthan.

Material and Methods:

It was a hospital based observational study was done from February 2024 to august 2024 at Department of Pathology, Dr S.N Medical College, Jodhpur. Patients of all age groups and both sexes with relevant clinical features and hematological findings who met the criteria of pancytopenia with hemoglobin < 12 g/dL, total leucocyte count < 4×10^{9}/L and platelet count < 100×10^{9} /L, were included in the study. Patients who received myelotoxic chemotherapy were excluded. Patients fulfilling the criteria of pancytopenia had undergone bone marrow aspiration using Salah/Jamshidi needle either from posterior iliac crest or sternum and trephine biopsy with Jamshidi needle from posterior iliac crest, under local anesthesia (2% xylocaine). Bone marrow aspiration was stained with Giemsa stain and Iron stain (whenever required) and Bone marrow Trephine biopsy was stained with H&E and reticulin stain (whenever required).

RESULTS

We studied 100 patients of pancytopenia during the period from February 2024 to August 2024 in our department. Full clinical and laboratory parameters were taken and analyzed. Among the 100 patients taken, majority of cases were in the 11-20 years group (36%), followed by ≤10 years (18%) and 31-40 years (16%) and 54% were females and46% were males. The most common symptoms were weakness (47%), fever (36%), and fatigue (25%).

The most prevalent finding was macrocytic hypochromic (48%), followed by normocytic normochromic (28%). The most common bone marrow findings was Hypercellular (68%), followed by normocellular (22%) (Figure 1). Specific abnormalities include blast cells in 2% (Figure 2), dysmyelopoiesis in 2%, and giant metamyelocytes in 10% of cases. Erythroid hyperplasia with megaloblasts and dyserythropoiesis was the most common finding in bone marrow, accounting for 46% of cases (Figure 3). Erythroid hyperplasia with both micro normoblasts and megaloblasts was seen in 26%, while 10% showed erythroid hyperplasia with micro normoblasts alone. The most frequent cause of pancytopenia was megaloblastic anemia (44%), followed by nutritional anemia (32%).

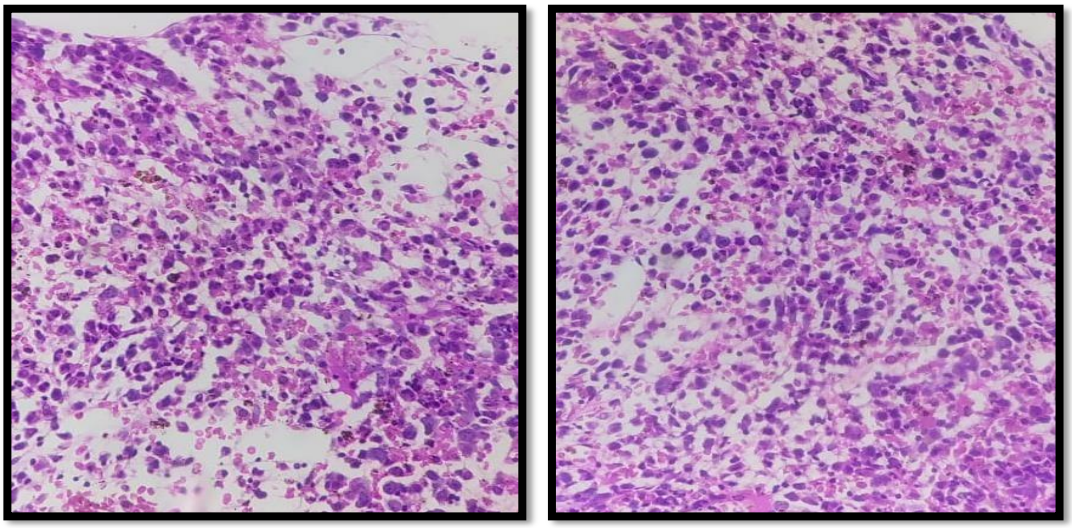


Figure 1: A trephine biopsy section showing hypercellular bone marrow with erythroid hyperplasia in megaloblastic anemia

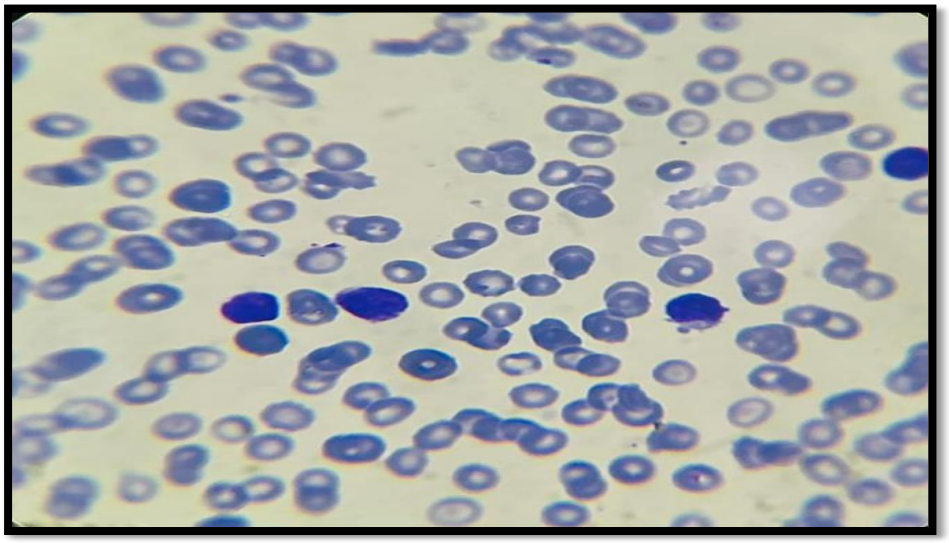


Figure 2: PBF showing blast cell 100x in Acute Leukaemia

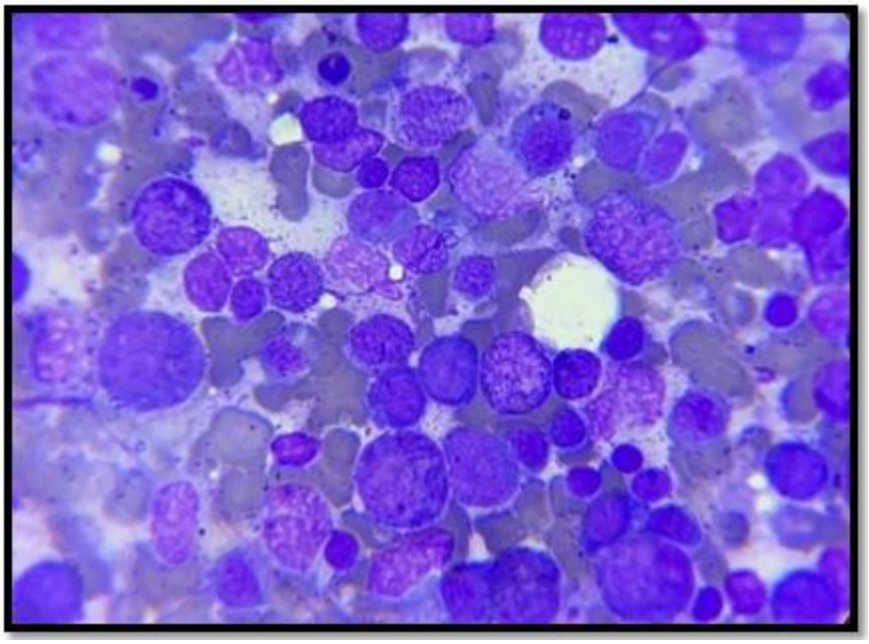
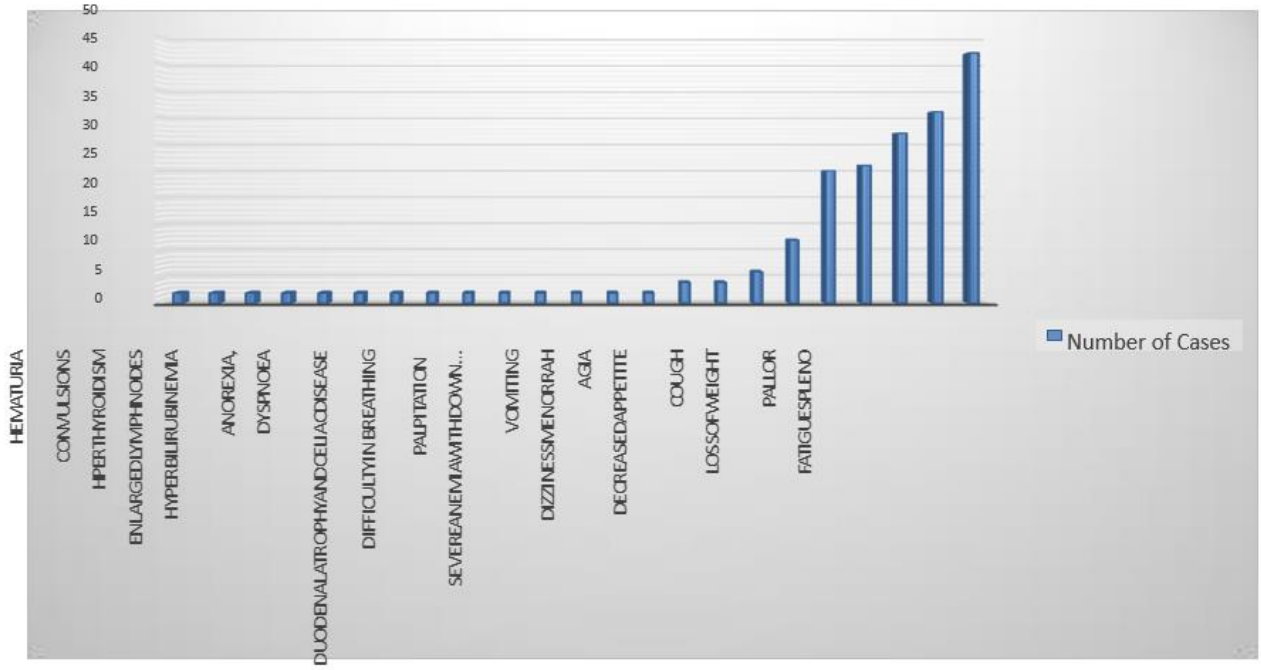


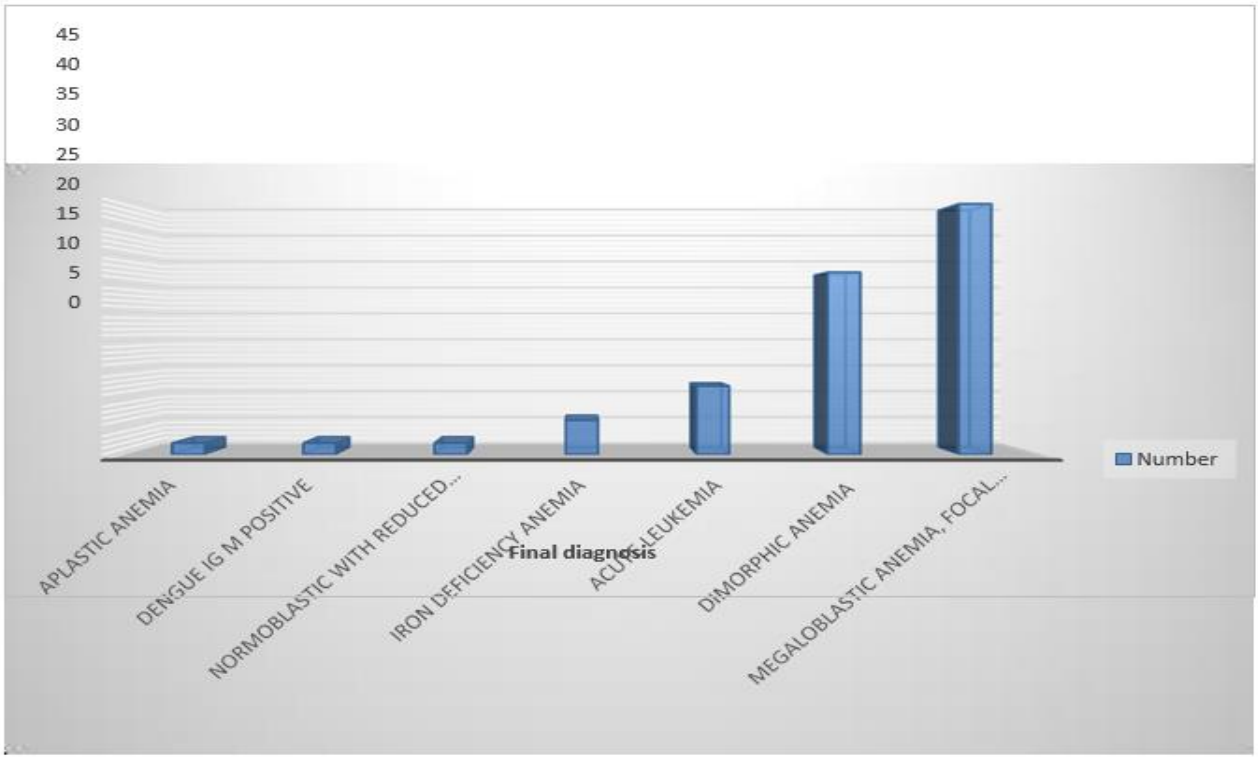
Figure 3: Bone Marrow aspiration showing megaloblasts100x

DISCUSSION

The development of pancytopenia appears to be linked to a decrease in hematopoietic cell production due to toxins destroying the marrow tissue, and replacement by aberrant or malignant tissue, or possibly suppression of normal growth and differentiation. As a result, determining the underlying cause of pancytopenia is crucial for effective treatment [4].



The above diagram shows various signs and symptoms along with their corresponding percentages. The most common symptoms were weakness (47%), fever (36%), and fatigue (25%) as compared to Singh *et al*., [5]most common clinical manifestation was generalized weakness (88%) followed by bleeding (65%). In Shwetha and Ashoka [6] study most common presenting complaints in their study were generalized weakness (100%) and fever (52.17%).



The above diagram outlines final diagnoses with their corresponding percentages. The most frequent diagnosis was megaloblastic anemia with focal dyserythropoiesis and focal megaloblastic changes (44%), followed by dimorphic anemia (nutritional anemia) (32%). Other diagnoses, such as acute leukemia and iron deficiency anemia, occurred less frequently as compared to Singh *et al*., [5]study where aplastic anemia (44%) was the commonest cause of pancytopenia, followed by megaloblastic anemia (20%), hypersplenism (12%), malignant diseases (12%), myelodysplastic syndromes (6%) and others (6%).

The most common PBF findings in cases of pancytopenia was macrocytic hypochromic (48%), followed by normocytic normochromic (28%). Other findings, such as microcytic hypochromic, occurred less frequently as compared to Agarwal *et al*., (2015) [7] which showed the predominant blood picture was dimorphic anemia constituting 35.71%, followed by normocytic hypochromic (28.57%) and microcytic hypochromic anemia (28.57%).

In our study we found that in bone marrow examination majority have hypercellular marrow present in 68%, 8% have hypocellular, 4% have mild hypercellular and 2% have mild hypocellular marrow. Normocellular marrow is present in 22% cases. In Agarwal *et al*., (2015) [7] study hypocellular marrow was observed in 11 cases (44%) followed by hypercellular marrow in 7 cases (28 %) and normocellular marrow in 3 cases (12%).

CONCLUSION

Bone marrow morphology and hematological indices (bone aspiration complemented with trephine biopsy) is a reliable, useful, and safe diagnostic tool in the evaluation of pancytopenia and aids in diagnosis in most of the cases. But in hematological malignancies and myelodysplastic syndromes, immunohistochemical and cytogenetic studies are required for a conclusive report.

Financial support and sponsorship: Nil

Conflicts of Interest: There are no conflicts of interest

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