JK SCIENCE pISSN: 0972-1177

ORIGINAL ARTICLE

Spectrum of Hematological Disorders on Bone Marrow Aspiration - An Experience in a Tertiary Care Center

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Abstract

Background: Hematological disorders are quite frequent in all age groups. Bone marrow aspiration is a relatively safe procedure done for the diagnosis and management of hematological disorders. **Aims and Objectives:** The present study aimed to evaluate the spectrum of various hematological disorders diagnosed on bone marrow aspiration. **Material and Methods:** It was a one year observational study conducted in the hematology section of Department of Pathology, Govt. Medical College, Jammu. Bone marrow aspirations were performed, smears were prepared, stained with Giemsa stain and examined under microscope. Bone marrow findings were noted. **Results:** Of 323 cases, 166 (51%) were males and 157 (49%) were females. Mean age was 37.9 years with range of 5 months to 85 years. Various disorders seen were megaloblastic anemia (89,27.5%), dual deficiency anemia (27,8.4%), erythroid hyperplasia (50,15.5%), hypoplastic marrow (11,3.4%), acute leukemia (46,14.2%), chronic lymphoproliferative disorder (13, 4.0%), chronic myeloid leukemia (21, 6.5%), ITP (14, 4.3%), myelodysplastic syndrome (4,1.2%), plasma cell dyscrasia (9,2.8%), leishmaniasis (1,0.3%), metastatic malignancy (1,0.3%). Megaloblastic anemia was the most common bone marrow diagnosis. Acute leukemia was the most frequently diagnosed hematological malignancy. **Conclusion:** Bone marrow aspiration remains an important tool in the diagnosis of wide range of hematological disorders.

Keywords

Hematology, Bone Marrow Aspiration, Megaloblastic Anemia

Introduction

Bone marrow examination is useful in the diagnosis of hematological disorders.[1],[2] The bone marrow evaluation may either confirm clinically suspected disease or may provide previously unsuspected diagnosis.[3] It may be necessary in staging, prognostication and evaluation of therapeutic response in some disorders.[4],[5] The two most important techniques used for the diagnosis of hematological disorders are bone marrow aspiration and trephine biopsy.[6],[7]

Bone marrow aspiration (BMA) is a relatively safe procedure done routinely in the hospitals for the diagnosis and management of hematological disorders.[4],[8],[9] The aspirate yields semi-liquid bone marrow, which can be examined under a light microscope.[10] BMA samples are also useful in further diagnostic assays including special staining, immunophenotyping, cytogenetic studies and molecular studies.[10],[11] Bone marrow aspiration (BMA) provides reliable information regarding bone marrow cellularity and the stage of maturation of different blood cells.[1]

Although peripheral blood picture is studied in all the cases of hematological disorders, however, peripheral blood findings alone do not reflect the nature of the disease

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Manuscript Received: 8.11.2022; **Revision Accepted**: 19.1.2023

Published Online First: 10 Oct 2023

Open Access at: https://journal.jkscience.org

Cite this article as: Gupta C, Kaur A, Bhardwaj S. Spectrum of Hematological Disorders on Bone Marrow Aspiration - An Experience in a Tertiary Care Center. JK Science 2023;25(4):210-3.

process.[12] Depending upon the diagnosis suspected from clinical features and peripheral blood findings, bone marrow examination is indicated.[9] A detailed study of the morphology of the marrow components may provide sufficient explanation for unexplained cytopenias, leukemia, and other hematological disorders including metastases to the bone marrow.[4]

Material and Method

The present study was carried out with the aim to evaluate the spectrum of various hematological disorders diagnosed on bone marrow aspiration.

It was an observational, one year retrospective study conducted in the hematology section of Department of Pathology, Govt. Medical College, Jammu w.e.f. 31st August 2022 to 1st September 2021. Bone marrow aspirations done during this duration were included. Aspirates of inadequate material or dry tap were excluded from the study.

Bone marrow aspirations were performed for various indications after taking written informed consent from patients. Posterior superior iliac spine was the most preferred site. The procedure was done under local anaesthesia using Salah's bone marrow aspiration needle. Smears were prepared and stained with Giemsa stain. Perl's stain was used to assess bone marrow iron stores. Patients' detailed information, clinical details, indication for the procedure and all laboratory test findings including complete blood counts (CBC) and peripheral blood film (PBF) findings were noted. All slides were examined and bone marrow findings were recorded. The bone marrow aspirates were evaluated for cellularity of the fragments, M:E ratio, megakaryocytes - number, functional status, presence of immature forms; erythroid series - erythropoiesis, relative proportions of normoblasts; myeloid series - relative proportions, morphology; presence of lymphocytes, plasma cells, parasites, abnormal cells, granulomas, storage cells. Assessment of iron stores was done. A differential count of marrow cells was performed, simultaneously noting any morphological abnormalities.

Result

Bone marrow aspirates from a total of 323 patients were included in our study. Of these, 166 (51%) were males and 157 (49%) were females with male to female ratio of 1.06 :1. Mean age of patients was 37.9 years, median 39 years with range of 5 months to 85 years. Maximum number of patients were in the age groups 11-20 years and 41-50 years (49, 15.2%) followed by 0-10 years (47, 14.6%). (*Table 1*)

The spectrum of hematological disorders diagnosed by bone marrow aspiration in our study are shown in Table 2. Nutritional anemias accounted for maximum number of cases in our study with megaloblastic anemia being the most common anemia (89, 27.5%) followed by dual deficiency anemia (27, 8.4%). Cases showing erythroid hyperplasia only or with mild megaloblastoid changes or few micronormoblasts with no other significant findings were grouped under erythroid hyperplasia (50, 15.5%). Malignant hematological disorders included Acute leukemia (46, 14.2%) followed by Chronic Myeloid Leukemia (CML) (Table 2). Acute Myeloid leukemia (AML) was seen 23 (7%) cases and Acute lymphoblastic leukemia (ALL) in 20 (6.2%) cases. AML subtypes according to FAB classification were AML M1 (2 cases), M3 (5 cases), M4 (7 cases), M5 (1 case), M6 (1 case). Possibilities of M4 and M5b were given in 2 cases. 5 cases could not be subtyped. WHO 2016 criteria were used to classify myeloproliferative neoplasms that included Chronic Myeloid Leukemia (CML) [21, 6.5% - Chronic Phase (19 cases), Accelerated Phase (2 cases)], Chronic Neutrophilic Leukemia (CNL)(1, 0.3%), Polycythemia Vera (PV) (2, 0.6%) and Essential Thrombocythemia(1, 0.3%) Other malignant disorders include chronic lymphoproliferative disorder [Chronic Lymphocytic Leukemia (CLL)- 12 cases; Chronic Lymphocytic Leukemia-Prolymphocytic Leukemia (CLL-PLL)-1 case], juvenile myelomonocytic leukemia (1, 0.3%). Plasma cell dyscrasia was seen in 9 cases (2.8%). Clinical, biochemical and radiological parameters were correlated to confirm multiple myeloma. There was 1 case of adenocarcinoma metastases to bone marrow; the patient was advised to investigate for primary site of origin.

Discussion

A wide spectrum of hematological disorders exists. These disorders, both non -neoplastic and neoplastic constitute a major health problem. Bone marrow aspiration is a safe procedure performed to arrive at a final diagnosis. A total of 323 cases were included in the present study. There were 166 (51%) males and 157 (49%) females with male to female ratio of 1.06 :1. The Male to female ratio was comparable to studies by Pudasaini *et al* and Marwah *et al*.[5],[8]

Mean age of patients was 37.9 years with age range of 5 months to 85 years; similar to study by Pudasini *et al.*[8] Maximum number of patients were in the age groups 11-20 years and 41-50 years (49, 15.2%) followed by 0-10 years (47, 14.6%). In a study by Choudhary *et al*, maximum cases were in age group 11-20 years, comparable to our study.[13] Maximum cases were in age group 41-50 years in a study by Shah *et al.*[14]

Megaloblastic anemia (89, 27.5%) was the most common

Table 1. Age wise distribution of patients

Age (years)	No. of patients	Percentage (%)
0-10	47	14.6
11-20	49	15.2
21-30	40	12.4
31-40	34	10.5
41-50	49	15.2
51-60	42	13.0
61-70	35	10.8
71-80	23	07.1
81-90	04	01.2
Total	323	100.0

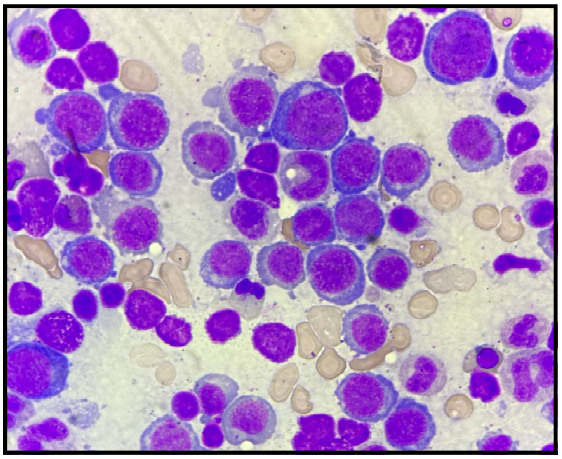

Fig 1: Photomicrograph of bone marrow aspiration smear from a case of megaloblastic anemia showing early and intermediate megaloblasts with sieve like chromatin (Giemsa, 1000X)

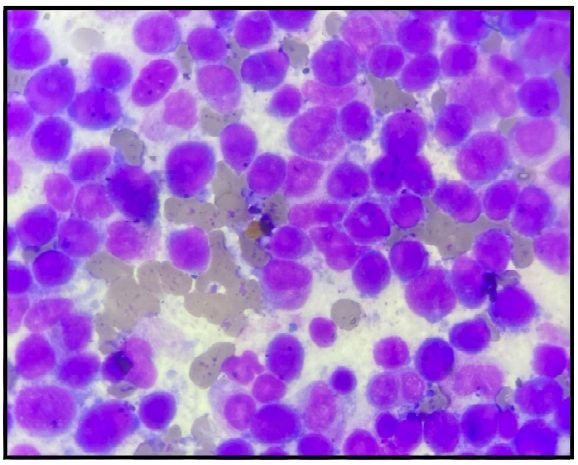

Fig 2: Photomicrograph of bone marrow aspiration smear from a case of acute leukemia showing blasts having high N:C ratio, scant cytoplasm, fine chromatin with prominent nucleoli (Giemsa, 1000X)

Table 2: Various hematological disorders on bone marrow aspiration

Bone marrow aspiration findings	Number of cases	Percentage (%)
Megaloblastic anemia	89	27.5
Iron deficiency anemia	3	1.0
Dual deficiency anemia	27	8.4
Erythroid hyperplasia	50	15.5
Hemolytic anemia	2	0.6
Anemia of chronic disease	4	1.2
Hypoplastic marrow	11	3.4
Acute leukemia	46	14.2
Chronic lymphoproliferative disorder	13	4.0
Chronic Myeloid Leukemia (CML)	21	6.5
Chronic Neutrophilic Leukemia	1	0.3
Polycythemia Vera	2	0.6
Essential Thrombocythemia	1	0.3
Juvenile Myelomonocytic Leukemia	1	0.3
ITP	14	4.3
Myelodysplastic Syndrome	4	1.2
Plasma cell dyscrasia	9	2.8
Lymphoma	3	1.0
Plasmacytosis	3	1.0
Leishmaniasis	1	0.3
Metastatic malignancy	1	0.3
Normal study	17	5.3
Total	323	100.0

bone marrow diagnosis in our study followed by erythroid hyperplasia (50, 15.5%) and acute leukemia (46, 14.2%) respectively. In many other studies, most common finding on bone marrow aspiration was megaloblastic anemia similar to our study.[1],[10],[13]-[15] However, some studies show erythroid hyperplasia as the most common bone marrow finding.[8],[16],[17] Anemias overall account for maximum cases in our study; megaloblastic anemia being commonest type of anemia followed by dual deficiency anemia, similar to other studies.[10],[18]

Iron deficiency anemia cases were very less in our study similar to Bashir *et al;*[10] this could be due to the fact that bone marrow examination is not routinely performed for diagnosis of iron deficiency anemia. Hypoplastic marrow was seen in 11 (3.4%) cases compared to studies by Rathod *et al* (7, 1.22%) and Shastry *et al* (13, 11.81%).[15],[19] Bone marrow biopsy was advised to correlate and confirm as it provides a more reliable index of marrow cellularity.[8]

Acute leukemia was the most frequently diagnosed hematological malignancy in the present study. This is also seen in many available studies.[1],[4],[5],[8],[15] Acute

Myeloid leukemia cases were higher than Acute lymphoblastic leukemia, similar to these studies. Acute leukemia cases were advised immunophenotyping and cytogenetic studies for further categorization according to WHO criteria. AML- M3 (FAB subtype) cases were advised PML-RARA gene testing.

In few studies, however, Chronic Myeloid Leukemia was the most common hematological malignancy.[9],[14],[16] CML was the second common malignancy in our study (21,6.5%). Bone marrow findings in these cases were correlated with peripheral blood smear findings. These cases were advised Philadelphia chromosome/ bcr-abl fusion gene estimation. Plasma cell dyscrasia cases in our study were 9 (2.8%) compared to studies by Bashir *et al* (37,12%), Shastry et al (1, 0.9%).[10],[19] Chronic lymphoproliferative disorders in the present study were 13 (4%) compared to other studies by Rathod *et al* (15, 2.62%), Bashir *et al* (11, 3.6%).[10],[15] There was 1 case of leishmaniasis in our study, similar to other studies.[8],[10],[20] Immune Thrombocytopenia (ITP) in our study constituted 4.3% (14) cases compared to studies by Sudhakar et al (6, 10.5%) and Bagle *et al* (20, 5.15%).[11],[21]

Conclusion

The findings of our study are comparable to many studies available in literature. Bone marrow aspiration remains an important tool in the diagnosis of wide range of hematological disorders.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

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