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Bone marrow examination: An important diagnostic tool for haematological disorders

***Rajlaxmi Sharma, Sudha Iyengar**
Department of Pathology, GR Medical College, Gwalior, Madhya Pradesh, India

Abstract
Background: Bone marrow aspiration is an invasive test but have a crucial role in diagnosis of various haematological disorders. Most of these disorders present as anemia followed by pancytopenia or thrombocytopenia. In our hospital, bone marrow aspiration is performed by trained resident doctors of Paediatrics/Medicine departments with the help of Pathology residents. The aim of this study was to interpret the bone marrow aspiration findings to rule out underlying haematological disorders.
Materials and Methods: This was a retrospective study carried out in the department of Pathology, G.R. Medical College, Gwalior for a period of 12 months (January 2016 – January 2017). Bone marrow examination of total 82 cases of suspected haematological disorders was carried out. All the relevant history was also recorded for correlation.
Result: In present study, 82 cases of bone marrow aspiration were taken. 50 were females and 32 were males aged between 1 year to 55 years. Commonest indication of bone marrow examination was unexplained anemia followed by thrombocytopenia/leucopenia and pancytopenia. Majority of cases were diagnosed as Megaloblastic anemia (23 cases, 28.6%) followed by acute leukemia (20 cases, 24%) and erythroid hyperplasia (13 cases, 15.8%). Idiopathic thrombocytopenic purpura, myelodysplastic syndrome and infective pathology were seen in 4.8%, 1.2% and 1.2 %, respectively. 7 cases (8.5%) had normal marrow findings.
Conclusion: Bone marrow aspiration is a highly informative diagnostic test to rule out underlying haematological disorders.

Keywords: bone marrow aspiration, anemia, pancytopenia, haematological disorders, megaloblastic anemia

Introduction
The spectrum of various haematological disorders is different in the developing world than the developed countries. These disorders usually present with anemia in any age group. Bone marrow aspiration (BMA) is an invasive procedure but still remains a tool for conducting diagnosis and differentiating primary and secondary hemopathies. BMA specimen is also useful in further diagnostic assays including cytochemical/ special staining, immunophenotyping, microbiological test, cytochemical analysis and molecular studies. Before BMA is performed, clinical history and laboratory tests including complete blood count (CBC), peripheral blood film (PBF) and reticulocyte count must be evaluated. This study was carried with an aim to find out various causes of haematological disorders and its spectrum through the BMA findings.

Materials and Methods
This was a retrospective study done in the Department of Pathology, G.R. Medical College for a period of 12 months (January 2016 – January 2017). A total of 82 cases were included in the study. During this period, BMA reports of patients were retrieved from the department. Other required details like peripheral smear exam report, clinical details and history were also recorded, which were included at the time of reporting the BMA. Well prepared slides stained with Leishman and Giemsa stains were examined. The dry tap and inadequate material cases were not included in the study. The data was manually collected and subsequently analysed.

Result
A total of 82 patients were included in this study for a duration of 12 months, from January 2016 to January 2017. Patients were aged between 1 y and 55y with 32 (40%) males and 50 (62.5%) females. So M:F ratio was 1:1.6. Most of the patients were less than 15 years (60.9%) (Table 1).
Blood CBC study revealed 40 cases of unexplained anemia, 20 (24.3%) cases of unexplained thrombocytopenia/leucopenia and 08 cases (9.7%) of pancytopenia. Hypercellular marrow was reported in majority of the cases with few cases of normocellular marrow (8.5 %) (Table 2).
Megaloblastic anemia was the predominant cause of anemia and was seen in 23 cases (28.6%) (Table 3). Acute leukemia was seen in 20 cases(24.3%), out of which 8 cases(40%) were of acute lymphoid leukemia (ALL) and 12 cases(60%) were of acute myeloid leukemia (AML) (M2 and M3). There were 13 cases (15.2%) of erythroid hyperplasia with micronormoblast in 6 cases. 5 cases showed megaloblastoid type of picture, but due to less number, were grouped under erythroid hyperplasia.
In our study, 8 cases (9.7%) were of hypoplastic anemia with hypocellular marrow and showed pancytopenia when correlated with PBF 4 cases showed picture of idiopathic thrombocytopenic purpura (ITP) while myelodysplastic syndrome (MDS) and infective pathology (plasmodium) were diagnosed in 1 case each. Normal bone marrow was found in 7 cases (8.5%).

Table 1: Age distribution of the patients

Age group	No. of patients	Percentage (%)
< 15 years	50	60.9
15-30 years	12	14.6
31-45 years	12	14.6
>45 years	08	9.7

Table 2: Indication of marrow aspiration

Indication	No. of cases	Percentage (%)
Unexplained anemia	40	48.7
Unexplained leucopenia/ thrombocytopenia	20	24.3
Unexplained pancytopenia	08	9.7
Suspected leukemia	08	9.7
Staging/Diagnosis of lymphoma	02	2.4
Lymphadenopathy	04	4.8

Table 3: Bone marrow examination findings

Bone marrow diagnosis	No. of cases	Percentage (%)
Erythroid hyperplasia	13	15.8
Megaloblastic anemia	23	28.6
Acute leukemia	20	24.3
ITP	04	4.8
Microcytic anemia	05	6.0
Infective pathology	01	1.2
Hypoplastic anemia	08	9.7
MDS	01	1.2
Multiple myeloma	00	0
Leishmaniasis	00	0
Normal marrow	07	8.5

Discussion

The spectrum of haematological disorders is very wide, but bone marrow examination is very useful test to arrive at a final diagnosis.

In our study, most common age group undergoing BMA was less than 15 years. In a study done by Niazi *et al.*, majority of patient belonged to the age group of 1-30 years [1]. Male and female ratio of 1:1.6 in our study is comparable with prior studies.[1-5]

The commonest indication of BMA in our study was unexplained anemia (48.7%) followed by unexplained leucopenia/thrombocytopenia (24.3%) and pancytopenia (9.7%). Similar to our finding, pancytopenia was third indication for BMA (11.9%) in a study done by Bashawri *et al.* [6]. In contrast, pancytopenia was the commonest indication in a study done by Ahmed *et al.* [7]. Erythroid hyperplasia was seen in 13 cases (15.8%). Similar finding was demonstrated in studies conducted by Jha *et al.* [5] and Khondke *et al.* [8].

Megaloblastic anemia was the most common diagnosis in our study as well as study done by Gayathri *et al.* [4]. We could not rule out vitamin B12 and folic acid deficiencies as a cause of megaloblastic anemia as their estimation was not part of our study, but in our country such nutritional deficiencies are common. Acute leukemia was seen in 20 cases (24.3%) out of which 12 cases were AML (M_2 and M_3) and 8 cases were ALL. Other studies also showed that AML is more common than ALL [2-5].

We had only one case (1.2%) of MDS and none of multiple myeloma. Other studies also showed less incidence of multiple myeloma ranging from 0.94% to 4.1%. [3-5, 9].

Our study had only 5 cases (6%) of microcytic anemia. In contrast, study conducted by Ahmed *et al.* [7] demonstrated 23.8% cases of microcytic anemia which were later labelled as iron deficiency anemia after iron profile estimation. Hypoplastic anemia was seen in 8 cases (9.7%) in our study, although this was the finding of BMA examination only as no biopsy was done. Prior studies [4, 5, 8] showed varied number of cases of hypoplastic anemia ranging from 14% to 29%.

ITP was seen in 4 cases (4.8%) in our study. It was comparable with other studies [3, 7, 8]. We had only one case of infective pathology with plasmodium vivax infestation. Three studies [1, 3, 5] done in past, showed leishmaniasis as cause of infection in 2.8%, 1.2% and 0.67% cases, respectively.

Conclusion

BMA study is an important diagnostic tool to reach a confirmatory diagnosis of wide varieties of haematological spectrum of diseases. Commonest cause of pancytopenia in our study was megaloblastic anemia. This study also focussed the need to rule out the underlying cause in cases of unexplained anemia and pancytopenia.

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