

SPECTRUM OF HEMATOLOGICAL DISORDERS ON BONE MARROW ASPIRATE EXAMINATION

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ABSTRACT

Background: Blood disorders are very common ranging from anemias to hematological malignancies. Bone marrow aspiration is a key investigation for hematological disorders. The objective of this study was to determine the sex and age distribution, and pattern of hematological disorders on bone marrow aspirate examination.

Material & Methods: This cross-sectional study was conducted at Aksa Laboratory, Abbottabad, Pakistan from January 2011 to December 2013. A consecutive sample of 168 patients was selected. All patients referred to this laboratory for bone marrow aspiration were eligible. Patients with history of bleeding disorders like hemophilia were excluded. Those with inconclusive report were dropped. The demographic variables were sex and age grouping. The research variable was pattern of the disorder on bone marrow aspirate examination. All these categorical data was analyzed manually by frequency and percentage.

Results: Out of 168 patients, 12(7%) cases were dropped, 13(8.33%) had normal marrow, 26 (16.67%) had non-hematological disorders, 78(50%) had non-malignant hematological disorders while 39(25%) had hematological malignancies. Among non-malignant hematological disorders, megaloblastic anemia was the most common disease affecting 31 patients (39.74%). Out of hematological malignancies, 23(58.97%) were of acute leukemia, followed by five(12.82%) cases of multiple myeloma and four(10.25%) cases of chronic myeloid leukemia.

Conclusion: Megaloblastic anemia was the most common disease among non-malignant hematological disorder followed by iron deficiency anemia. Among malignant hematological disorders, acute leukemias were most common. Bone marrow aspiration is very helpful in arriving at the correct diagnosis and ascertaining the cause of disease.

KEY WORDS: Hematological malignancies; Anemia; Megaloblastic anemia; Multiple myeloma; Chronic myeloid leukemia; Acute myeloid leukemia; Acute lymphocytic leukemia; Leukemia; Lymphoma; Bone marrow aspiration.

This article may be cited as: Anjum MU, Shah SH, Khaliq MA. Spectrum of hematological disorders on bone marrow aspirate examination. Gomal J Med Sci 2014; 12:193-6.

INTRODUCTION

Blood disorders are very common among different age groups. They usually range from anemias to advanced hematological malignancies.¹ Megaloblastic anemia, which is usually caused by B12 or folate deficiency, is a very common cause of nutritional deficiency anemias.² Among hematological malignancies, acute myeloid leukemia is especially widespread among adults. It is characterized by proliferation of myeloid cells in bone marrow with their maturation arrest.^{3,4} However, the pattern of these disorders is quite different in developing countries than from developed countries.^{5,6} In most cases, a

diagnosis can be made by a detailed history, physical examination and some basic blood tests. But in certain cases bone marrow examination is required for the confirmation of diagnosis.⁶

Bone marrow examination is quite a valuable test which has become very important these days for the diagnosis of hematological disorders.^{7,8} Bone marrow aspiration provides reliable information regarding bone marrow cellularity, its architecture and the stage of maturation of different blood cells.⁹ It helps in the diagnosis and staging of hematological malignancies especially leukemias. It also provides detailed information regarding the presence hemoparasites within the bone marrow, the presence of infiltrates and storage diseases.^{6,10-14}

Bone marrow aspiration is an invasive procedure. The risk of adverse events associated with it is 0.08%.¹⁵ The most common complications of this procedure are bleeding, infection and pain at the biopsy site.^{11,16,17}

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The objective of this study was to determine the sex and age distribution, and pattern of hematological disorders on bone marrow aspirate examination.

MATERIAL AND METHODS

This cross-sectional study was conducted at Aksa Laboratory, Abbottabad, Pakistan from January 2011 to December 2013. A sample of 168 patients was selected by consecutive non-probability technique. All patients referred to this laboratory for bone marrow aspiration were eligible. Patients with history of bleeding disorders like haemophilia were excluded. Those with inconclusive report, either due to improper technique or inadequate sample were dropped from the study.

Detailed history was taken along-with physical examination to look specifically for the presence of anemia, lymphadenopathy and hepatosplenomegaly. Complete blood count including hemoglobin, total and differential leucocyte count, total platelet count, and blood indices were performed using automated hematology analyzer (Erma Ink, PLC 210, Manchester). Peripheral blood smear examination was done after Leishman and retic stain.

Bone marrow aspiration was performed following standard protocol. The procedure was done following aseptic technique. The most common site used was iliac crest. However, in obese patients, sternum was used for aspiration. After the procedure, patients were observed to make sure that their vitals remained stable (especially pulse, blood pressure and temperature). Biopsy site was observed for infection and bleeding.

The bone marrow aspirate was collected in a sterile test tube containing anticoagulant (Ethylene-diaminetetraacetic acid, EDTA) and stained with Leishman stain. It was examined for the presence of cellularity, megakaryocytes, immature cells, hemoparasites and the presence or absence of the iron stores using Prussian blue stain.

The demographic variables were sex and age grouping. The research variable was pattern of the

disorder on bone marrow aspirate examination. The age grouping was; 0-10, 11-20, 21-30, 31-40, 41-50, 50-60, 61-70, 71-80, 81-90, and 90-100 years. All these categorical data was analyzed manually by frequency and percentage.

RESULTS

There were 168 patients included at the inception of the study. Among these, 92 (54.76%) were males and 76 (45.23%) were females. The male to female ratio was 1.2:1. The patient distribution into different age groups was studied. The maximum number of patients was 35 (20.83%) in age group 21-30 years. (Table 1)

Out of 168, 12 (7%) cases were dropped from analysis due to inconclusive report, either due to improper technique or inadequate sample.

Out of 156 cases, 13 (8.33%) were normal, 26 (16.67%) with non-hematological disorders, 78 (50%) with non-malignant hematological disorders and 39 (25%) were with malignant hematological disorders.

Out of 26 non-hematological disorders, in descending order were; reactive marrow in seven (26.92%), visceral leishmaniasis in four (15.38%), dry tap in four (15.38%), pancytopenia in three (11.54%), hypoplastic marrow in two (7.69%), hemolysis in two (7.69%), hemolytic anemia in two (7.69%), diluted marrow in one (3.85%) and contaminated marrow in one (3.85%).

Out of 78 non-malignant hematological disorders, in descending order were; megaloblastic anemia in 31 (39.74%), iron deficiency anemia in 20 (25.65%), mixed deficiency in eight (10.26%), aplastic anemia in six (7.70%), hemolytic anemia in five (6.40%), ITP and depressed erythropoiesis each in two (2.56%), hemochromatosis, lipid storage disease, myeloid hyperplastic marrow, and Gaucher's disease each in one (1.28%) patient as shown in Figure 1.

Table 1: Age distribution of patients with hematological disorders based on bone marrow aspirate examination.

S.No.	Age group in years	Frequency	Percent-age	S.No.	Age group in years	Frequency	Percent-age
1	00-10	27	16.07	6	51-60	20	11.90
2	11-20	17	10.12	7	61-70	13	07.74
3	21-30	35	20.83	8	71-80	12	07.14
4	31-40	8	04.77	9	81-90	12	07.14
5	41-50	17	10.12	10	91-100	7	04.17
Total						168	100

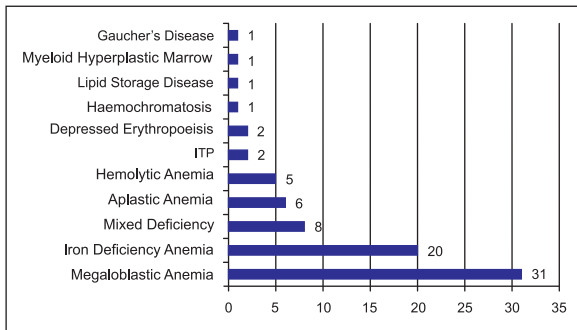


Figure 1: Frequency of non-malignant hematological disorders based on bone marrow aspirate examination. (n=78)

Out of 39 hematological malignancies, 23 (58.97%) were of acute leukemia, including both acute myeloid and acute lymphocytic leukemia, followed by five (12.82%) cases of multiple myeloma, four (10.25%) cases each of chronic myeloid leukemia and lymphoproliferative disorder, two (5.13%) cases of chronic lymphocytic leukemia, and one (2.56%) case of lymphoma as shown in Figure-2.

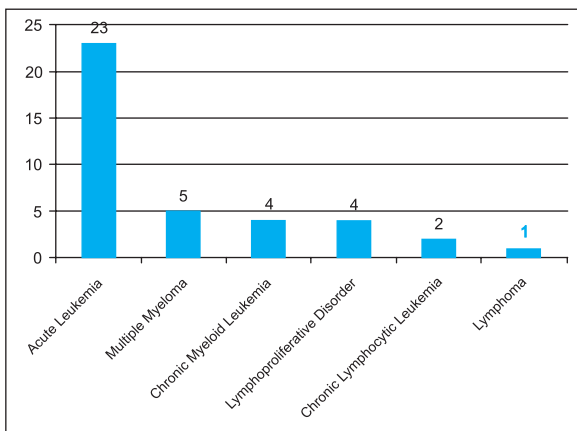


Figure 2: Frequency of malignant hematological disorders based on bone marrow aspirate examination. (n=39)

DISCUSSION

Hematological disorders include a wide range of diseases ranging from nutritional anemias to hematological malignancies. Bone marrow aspiration plays a very important role not only in determining the cause of disease but also help in establishing a definitive diagnosis. It's a relatively safe procedure which can be performed on outpatient basis.

This study shows that nutritional deficiency anemias were very common non-malignant hematological disorder. Among these, megaloblastic anemia had the highest frequency. Rahim et al⁶ also showed that megaloblastic anemia is more frequent in Pakistan. But in their study they have shown that iron deficiency anemia is least frequent. Contrary to

this, our study has shown that it's the second most common type of anemia followed by mixed deficiency anemia. This could be due to the fact that mostly iron deficiency anemia is treated on outpatient basis and bone marrow examination is not routinely done to confirm its diagnosis. Secondly, this pattern could be due to the geographical distribution as our study was conducted in Abbottabad.

In our study 39 (25%) cases of hematological malignancies were found. Out of these cases, 23 (58.97%) were of acute leukemia. This shows that acute leukemia is the most common hematological malignancy in our patients. There were eight (34.78%) cases of acute lymphoblastic leukemia while six (26.08%) were of acute myeloid leukemia. Nine (39.13%) cases were of acute leukemia but these were difficult to characterize into any of the groups. Such cases require further advanced investigations.

There were four (15.38%) cases of visceral leishmaniasis. Visceral leishmaniasis can present as anemia, pancytopenia and myelofibrosis.¹⁸ Although there incidence is low, but hemoparasites can be a cause of hematological disorders and they should be specifically looked for while examining the bone marrow aspirate.^{16,18}

There were 12 (7%) cases which were dropped from analysis due to inconclusive report, either due to improper technique or inadequate sample. Bone marrow aspiration is a routine procedure in a hematology laboratory. However, it requires adequate skill and expertise. Otherwise, it can lead to failure of procedure, inadequate sample or complications.^{6,8,15,17} Therefore, this group of patients requires trephine biopsy and other investigations to confirm the diagnosis.

There was one case (1.28%) of Gaucher's disease and one (1.28%) of hemochromatosis. Bone marrow involvement is common in storage disorders. They can present as hematological abnormalities and bone marrow aspiration helps in confirming the diagnosis.¹⁹

Bone marrow aspiration is a very useful tool for the diagnosis of hematological disorders. But, the results should be interpreted in association with clinical presentation of patient and other blood tests e.g. complete blood count and peripheral film. It should be carried out by a hematologist and patient should be followed after the procedure to ensure safety.

CONCLUSION

Megaloblastic anemia was the most common disease among non-malignant hematological disorder followed by iron deficiency anemia. Among malignant hematological disorders, acute leukemias

were most common. Bone marrow aspiration is very helpful in arriving at the correct diagnosis and ascertaining the cause of disease.

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CONFLICT OF INTEREST

Authors declare no conflict of interest.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

None declared.