

Research Article

Prospective study of bone marrow in haematological disorders

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ABSTRACT

Background: Bone marrow examination is useful in the diagnosis of both hematological and non-hematological disorders. The two most important techniques used for the diagnosis of hematological disorders are bone marrow aspiration and trephine biopsy which are complementary to each other. The present study is to evaluate the findings of bone marrow aspiration & trephine biopsy and their cytological and histological patterns in various hematological disorders. The aim of the study is to evaluate the clinical profile, spectrum, cytological and histological pattern of various hematological disorders reported in bone marrow aspiration and trephine biopsy respectively.

Methods: It was a cross-sectional study design with 105 patients who underwent bone marrow examination for evaluation of hematological disorders in the Department of pathology, Andhra Medical College during the period of 2012 to 2014.

Results: Among 105 cases studied, age of patients ranged from 1 to 68 yrs with mean age of 32.4 yrs and male predominance (1.5:1). Most of the patients presented with fever, shortness of breath, Easy fatigability and generalized weakness. The commonest physical findings were pallor followed by splenomegaly & hepatomegaly and in hematological parameters predominantly pancytopenia. Bone marrow aspiration was diagnostic in 53(50%) cases and trephine biopsy was diagnostic in 52(50%) cases. Anemias (50%) and leukemias (16%) are most common hematological disorders. Among the anemias, megaloblastic anemia is the most common (40%) cause of hematological non-malignancies. Among leukemias, acute myeloid leukemias are common cause of hematological malignancies.

Conclusion: The present study showed the usefulness of bone marrow aspiration and trephine biopsy in evaluation of the bone marrow in routine haematological disorders and also for understanding disease progression, for diagnosis and therapeutic evaluation. These are also helpful in planning further investigation and management.

Keywords: Bone marrow aspiration, Megaloblastic anemia, Pancytopenia, Trephine biopsy

INTRODUCTION

Bone marrow examination is useful in the diagnosis of both hematological and non-hematological disorders. The two most important techniques used for the diagnosis of hematological disorders are bone marrow aspiration and trephine biopsy. For bone marrow interpretation the history, clinical finding, peripheral blood picture and other laboratory findings are required.¹

Bone marrow aspiration (BMA) alone is usually sufficient to diagnose nutritional anaemias, most of the acute leukaemias and Immune thrombocytopenias. Trephine biopsy does provide important diagnostic information in patients with granulomatous disease, myelofibrosis and bone marrow infiltration. Bone marrow aspiration is useful in making out better individual cell morphology. Whereas biopsy is useful in bone marrow architectural pattern and distribution.³ The

aim of the study is to evaluate the spectrum, cytological and histological pattern of various hematological disorders reported in bone marrow aspiration and trephine biopsy respectively.

METHODS

The study is carried out in the department of pathology, Andhra medical college in a period of two years October 2012- September 2014. A cross-sectional study design was selected for this study. The study subjects were enrolled using convenient sampling method through screening patients admitted from the clinical departments. Written informed consent of all study subjects was obtained before undergoing the procedure.

Leishman stain is used routinely for bone marrow aspiration. Haematoxylin and eosin stain is used for trephine biopsy. For all the cases, peripheral smears, reticulocyte count, sickling test and complete hemogram were considered. Special stains PAS Stain (Periodic acid schiff) was done for all ALL, AML and gauchers disease. Block positivity is shown in ALL cases. In gauchers disease, gaucher cells showing wrinkled tissue paper appearance with PAS positivity. MGG stain (Maygrunwald-giems), reticulin stain and perl stain were used in this study. Reticulin stain was done in myelofibrosis and metastatic deposits. In myelofibrosis, trephine biopsy shows increase in reticulin network with coarse fibrils (Figure 5). Perl's stain was done in all cases for iron stores.

Bone marrow aspiration/Bone marrow biopsy procedure: In all our cases, we have taken material from the posterior superior iliac spine which is the most suitable and safe site for both aspiration and biopsy. Other sites- sternum and medial side of tibia. Salah needle was used for bone marrow aspiration. Jamshidi needle was used for bone marrow biopsy. Biopsy of length 2-2.5 cm was taken.

Complete blood count, peripheral smear examination, reticulocyte count, sickling test, bone marrow aspiration in all 105 cases of suspected hematological disorders were carried, among them trephine biopsy were done in 52 cases.

RESULTS

In the present study of 105 patients, bone marrow aspiration was performed on all 105 cases and trephine biopsy in 52 cases (Table 2). Among them 58 study subjects are males and 47 are females. The age range of study subjects are from 1-68 years and the mean age is 32.4 years. Bone marrow examination findings are given in Table 1.

In this study 50% of the study subjects have anemias and they are predominantly megaloblastic (Figure 1) followed by aplastic/ hypoplastic anemias (Figure 2). The three cases of others included two metastatic deposits and one storage disorder (Gaucher's Disease).

We encountered an interesting case of sickle cell anemia complaining of fever and shortness of breath since 3 months. She was on medication but did not show any response. In bone marrow aspiration we found sickle cells with megaloblastic maturation of erythroid series (Figure 8).

We also encountered an interesting case of 68 years old male patient presented with chest wall swelling, on cytology multiple myeloma was suspected and diagnosis was confirmed with bone marrow aspiration (Figure 6).

Table 1: Hematological disorders among study subjects.

Hematological disorders	Cases	%
Anemias	52	49.5%
Acute leukemias	17	16.2%
Myeloproliferative disorders	11	10.5%
Myelodysplastic syndrome	1	0.9%
Plasma cell dyscrasias	5	4.7%
Lymphoproliferative disorders	3	2.9%
Platelet disorders	7	6.7%
Others	3	2.9%
Normal Study	4	3.8%
Inconclusive	2	1.9%
Total	105	100%

Table 2: Table showing distribution of cases in Trephine Biopsy.

Trephine Biopsy Diagnosis	Cases	%
Erythroid Hyperplasia	24	46%
Aplastic/ Hypoplastic anemia	10	19%
Normal	7	13%
NHL deposits	3	6%
Myelofibrosis	2	4%
ALL	1	2%
Metastatic deposit	2	4%
Plasma cell dyscrasias	1	2%
Reactive thrombocytosis	1	2%
Inconclusive	1	2%
Total	52	100%

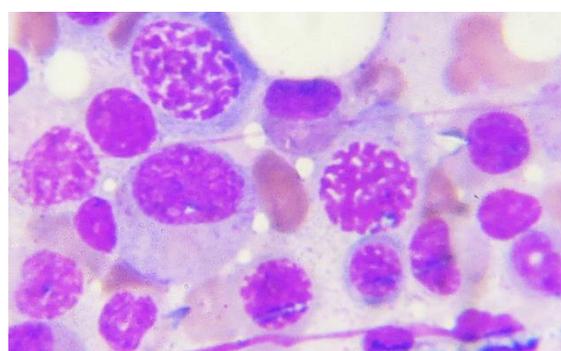


Figure 1: Photomicrograph of megaloblastic anemia; aspirate shows megaloblasts with sieve like chromatin (Leishman stain 1000x).

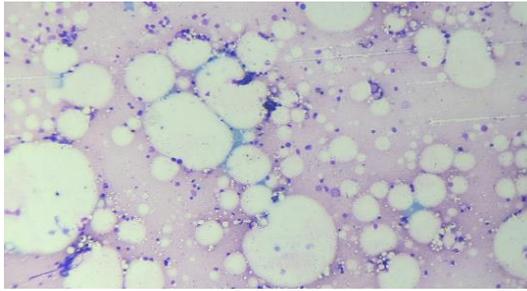


Figure 2: Photomicrograph of aplastic anemia: aspirate smear shows mainly fat with marked reduction in hematopoietic cells (Leishman stain 400x).

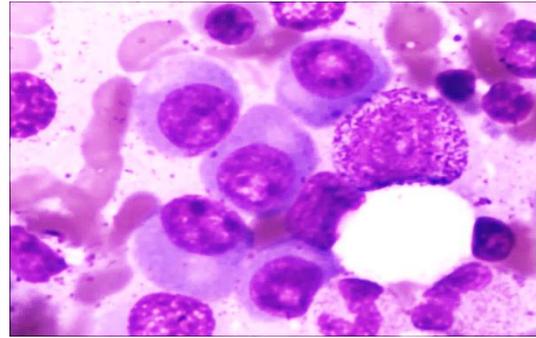


Figure 6: Photomicrograph of multiple myeloma: Marrow aspirate showing plasma cells with eccentric nuclei and basophilic cytoplasm with perinuclear hof (Leishman stain 1000x).

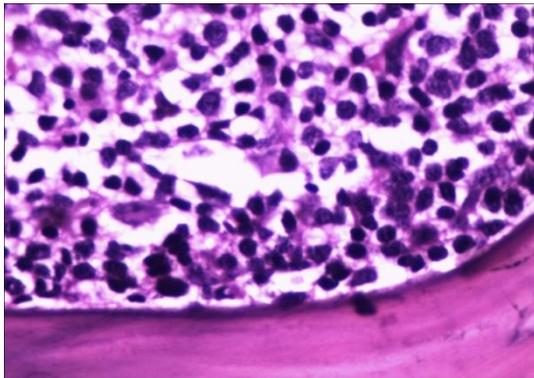


Figure 3: Photomicrograph of NHL deposits: trephine biopsy of metastatic deposits of lymphoma. (H&E 400X).

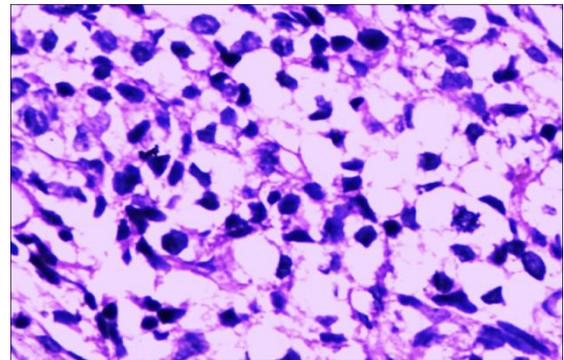


Figure 7: Photomicrograph of metastatic deposits: Trephine biopsy shows clusters of pleomorphic cells with clear cytoplasm and darkly stained nucleus. (H&E 400x).

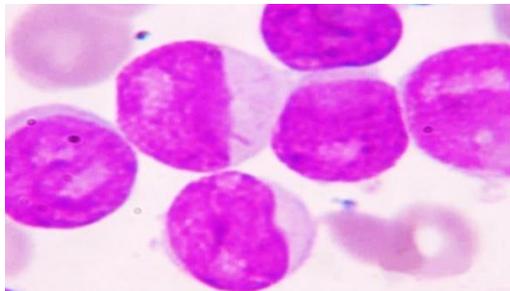


Figure 4: Photomicrograph of AML M3: aspirate smear shows promyeloblast with Auer rod (Leishman stain 1000x).

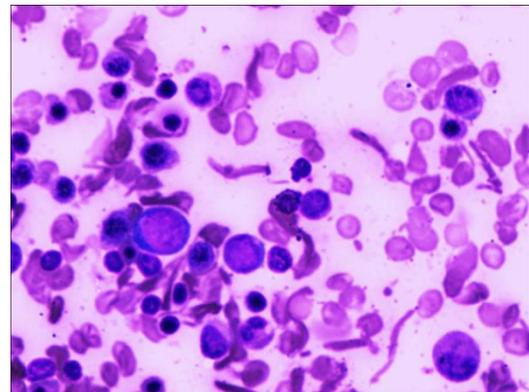


Figure 8: Bone marrow aspirate smear showing megaloblasts and sickle cells (Leishman stain 400x)

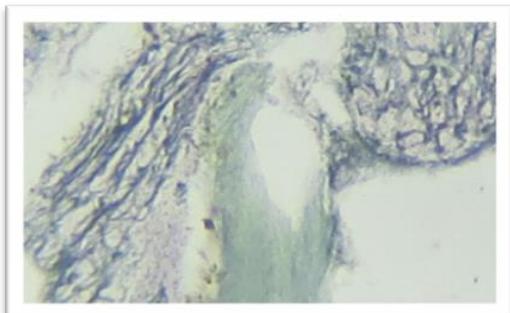


Figure 5: Photomicrograph of Myelofibrosis: Trephine biopsy shows increase in reticulin network with coarse fibrils (Reticulin stain 400x).

DISCUSSION

The spectrum of hematological disorders is very wide. Examination of the bone marrow is one of the most important diagnostic pillar in diagnosing hematological disorders. Bone marrow aspiration and trephine biopsy are the two procedures done for the diagnosis of hematological and non-hematological disorders. "Frequently it is a combination of clues gathered from examination of several different preparations that leads to

a correct diagnosis”² In the present study, aspiration was diagnostic in 53 (50.4%) cases and trephine biopsy was diagnostic in 52 (49.6%) cases. In the present study male to female ratio is 1. 2:1. The age range of the cases range between 1yrs to 68 yrs. similar results were observed in many studies by Tilak et al in 1999,⁸ Khodke et al. 2001,⁵ Khunger et al 2002 and Jha et al. in 2008⁴ except in Kumar et al. in 2001⁶ and Das et al. 2011⁷ where they excluded children in their study.

The commonest indication of BMA was pancytopenia. In some cases bone marrow biopsy can provide a corroborative evidence for bone marrow aspiration study. In the present study, 39 cases presented with pancytopenia (37%), the age range of these patients ranged from 2-65 years. The male to female ratio is 1.3:1.

Kumar et al.⁹ stated in his study bone marrow aspiration and biopsy should be performed simultaneously in pancytopenic patients when the diagnosis is elusive.

In present study bone marrow aspiration and trephine biopsy were performed

The commonest cause for pancytopenia was megaloblastic anemia (54%), followed by aplastic anemia (25.6%). The study results are similar with Gayatri et al.¹³ (74.04%, 18.26%)

According to recent studies by Chandra et al.¹⁰ 2011, Parajuli et al.¹¹ and Khan et al.¹² 2014 erythroid hyperplasia is the predominant diagnosis which were comparable to our study.

The finding of a dry tap should never be dismissed as being due to faulty technique and always needs a bone marrow biopsy. Trephine biopsy is necessary for making a diagnosis due to incomplete information provided by aspiration.

In present study, 12 cases of dry tap were mostly hypoplastic/aplastic marrow, myelofibrosis, subleukemic leukemia and marrow infiltration by metastatic tumors (Figure 7) and lymphomatous infiltrations (Figure 3).

In all 10 cases of hypoplastic anemia the marrow was hypocellular and all 3 lineages of cell were suppressed. BMA findings were correlated with peripheral blood smear which also showed pancytopenia (Figure 2). Bone marrow biopsy was done in these cases. Trephine biopsy showed reduced cellularity with fat cells occupying more than 75% of the marrow. There were nests of erythropoietic cells in the para trebicular region, with a relative increase in the number of lymphocytes and plasma cells.

Boon TH¹⁴ found macrocytic blood picture in 64% of patients and normocytic normochromic picture in 36% of patients. Relative lymphocytosis was seen in all the patients.

Among the 17 cases of acute leukemias who attended to radiotherapy department, 11 are AML cases (6males, 5 females) AML – M1 in 2 cases, AML –M2 in 2 cases AML-M3 (Figure 4) in 6 cases and AML M4 in 1 cases. Six cases were diagnosed as ALL. One case which presented with pancytopenia with subleukemic leukemia Trephine biopsy was done.

There were five cases of multiple myeloma, bone marrow aspiration was hypercellular with 80-90% of plasma cells infiltrating the marrow in three cases and in one case it showed normocellular, who are on chemotherapy in this case. Trephine biopsy was done. In all the cases biochemical investigations was done and confirmed the diagnosis as multiple myeloma.

CONCLUSION

Bone marrow examination is necessary to diagnose, prognosis, and/ or evaluate therapeutic response for a variety of hematologic and non-hematologic problems. Bone marrow aspiration & bone marrow biopsy are diagnostic procedures used routinely nowadays, easy procedure does not require sophisticated equipment's. Both the procedures are complementary to each other. The study shows the usefulness of bone marrow aspiration and trephine biopsy in evaluation of the bone marrow in routine hematology practice.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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