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Diagnostic Role of Bone Marrow Examination in Detecting Haematological and Nonhaematological Disorders

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Abstract

Introduction: *Bone marrow study has wide application in clinical medicine. It is important test not only for diagnosis of haematological diseases but also for various systemic illnesses. The aim of this study is to determine the indications, the spectrum of haemotological and non haematological disorders diagnosed by using this procedure.* ***Materials & Methods:*** *It was a prospective study comprising 152 patients who underwent bone marrow examination for evaluation of haematological and nonhaematological disorders in the Department of Haematology, Enam Medical College Hospital during the period of 2012 to 2017.* ***Results:*** *In our study male to female ratio was 1.6:1 and common age group was >45years (n-65, 42.76%). Most common indications for bone marrow examination were pancytopenia (26.97%, n-41) and diagnosis of leukaemia/myeloproliferative neoplasm (25.66%, n-38). 90.13% (n-137) marrows were pathological. Non-malignant conditions were 40.79% (n-62) and malignant conditions were 49.43% (n-75). Non malignant haematological condition were 33.55% (n-51), malignant haematological conditions were 47.37% (n-72). Most common nonmalignant haematological conditions were aplastic anaemia (15.13%, n-23) and immune thrombocytopenic purpura (9.87%, n-15). Visceral leishmaniasis was found 3.29% (n-5). Acute myelogenous leukaemia (14.47%, n-22) and multiple myloma (11.18%, n-17) were the most common malignant haematological condition. Secondary deposit was found 1.97% (n-3).* ***Conclusion:*** *Bone marrow examination is a simple invasive procedure for diagnosis of both haematological and nonhaematological diseases when routine investigations failed to reach the final diagnosis.*

Keywords: *Bone marrow examination, Haematological disease, Nonhaematological disease.*

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Introduction

Bone marrow is an extremely cellular connective tissue that fills the medullary cavities of bone. It is composed of haemopoietic cells, marrow adipose tissue and supportive stromal cells. On gross inspection, it may have a red or yellow color. Red marrow is actively engaged in the production of blood cells and represents the active or haemopoietic marrow. Yellow (fatty) marrow is inactive, and its principal cellular components are fat cells. Progressive differentiation and maturation of the primitive stem cells results in specific marrow cell type i.e. Leucocytes, Erythrocytes and Platelets[1]. Haematological and nonhaematological diseases affecting the bone marrow may be primarily or a secondarily spread to the marrow. In both cases the normal marrow cellular architecture is damaged or displaced. The pattern of disorders affecting the marrow is quite different in developing countries than from developed countries [2, 3]. In most of the cases, diagnosis can be arrived at by a detailed history, physical examination and few simple investigations. But in certain cases bone marrow examination is required for the confirmation of diagnosis. Bone marrow aspiration and trephine biopsy are important test not only for haematological diagnosis but also for various systemic illnesses including pyrexia of unknown origin, granulomatous diseases, storage disorders, haemophagocytic syndrome, histiocytosis, leishmaniasis and even resistant cases of malaria can be diagnosed through

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marrow examination [4]. These are simple relatively safe invasive procedure carried out routinely in hospital even in presence of severe thrombocytopenia.

This study was carried out with the aim to explore the role of this invasive procedure in ascertaining the diagnosis of haematological and non haematological diseases in our clinical setup.

Materials and Methods

This prospective study was done in the department of haematology, Enam Medical College Hospital (EMCH) from July 2012 to December 2017. A total of 152 cases were included in this study. Clinical parameters were assessed, peripheral blood smear along with necessary haematological investigations were done. Than Bone marrow aspiration was done thereafter. When aspirated material was inadequate or dry tap, trephine biopsy was done. Data was collected and subsequently analyzed.

Results

In this study a total of 152 bone marrow aspirates (BMA) and/or biopsy were done. The age range of the study subjects were 2 years to 80 years and the mean age of the patients was 40.66 years. Most common age group undergoing BMA was >45 years (Table I).

Table I: Age distribution of the patients.

Age group	No. of patients	Percentage (%)
< 15 years	16	10.53%
15- 30 years	43	28.29%
31- 45 years	28	18.42%
>45 years	65	42.76%

Among them 61.84% (n-94) were male, 38.16% (n-58) were female and male to female ratio was 1.6:1. Most common indications for BMA cytology examination were pancytopenia (26.97%, n-41) and diagnosis of leukaemia/myeloproliferative neoplasm(mpn) (25.66%, n-38). Other indications are summarized in table II.

Table II: Indications for bone marrow examination.

Clinical condition	Number	(%)
Anaemia	14	9.21%
Fever of unknown origin	17	11.18%
Pancytopenia	41	26.97%
Bicytopaenia	9	5.92%
Thrombocytopaenia	11	7.24%
Bodyache,Backache with high ESR	19	12.50%
Leuco-erythroblastic blood picture.	2	1.32%
Diagnosis & management of Leukaemia and mpn	39	25.66%

90.13% (n-137) marrows were pathological and 9.87% (n-15) were normal. Non-malignant conditions were 40.79% (n-62) and malignant conditions were 49.43% (n-75). Non malignant haematological condition were 33.55% (n-51), malignant haematological conditions were 47.37% (n-72).

Most common nonmalignant haematological conditions were aplastic anaemia (15.13%, n-23) and immune thrombocytopenic purpura (9.87%, n-15). Visceral leishmaniasis was found 3.29% (n-5).

Acute myelogenous leukaemia (14.47%, n-22) and multiple myloma (11.18%, n-17) were the most common malignant conditions. Secondary deposit was found 1.97% (n-3). Table III show the different non-malignant and malignant conditions.

Table III: Bone marrow examination findings.

Non Malignant condition		
Megaloblas tic anaemia	4	2.63%
Erythryoid hyperplasia	9	5.92%
Aplastic anaemia	23	15.13%
Immune thrombocytopenia purpura	15	9.87%
Myeloid hyperplasia	4	2.63%
Myelodysplastic syndrome	5	3.29%
Hypersplenism	2	1.32%
Normal reactive marrow	15	9.87%
Visceral leish maniasis	5	3.29%
Total	*82*	*53.95%*
Malignant condition		
Acute lymphoblastic leukaemia (ALL)	12	7.89%
Acute myelogenous leukaemia (AML)	22	14.47%
Chronic lymphocytic leukaemia (CLL)	1	0.66%
Chronic myelogenous leukaemia (CML)	9	5.92%
Multiple myeloma/plasmacytosis	17	11.18%
Myelofibrosis	1	0.66%
Essential thrombocythemia	3	1.97%
Polycythaemia rubra vera	2	1.32%
Bone marrow secondary's	3	1.97%
Total	70	46.05%

Discussion

Bone marrow examination is an important and simple test for diagnosis of both haematological and nonhaematological diseases in all age group of patients. The age range of our study subjects were 2 years to 80 years and the mean ages of the patients were 40.66 years. Mean age found by in Gandapur ASK et al[5], Pudasaini S et al[6], Atla Bl et al[7], Kibria SG et al[8], Mahfuz H, et al.[9] were 40, 37.9, 32.4, 27.05, 28.2 years in their respective studies. The most common age group undergoing BMA was >45years (42.76%) and lowest age group < 15 years (10.53%) in this study. In studies done by Pudasaini S et [6],

Kibria SG et al[8], Mahfuz H, et al.[9] the majority of the patients were between 31 – 45 years (42.1%), 10-19 years (23.16%), 21-40 years (33.8%). In the present study 61.84% (n-94) of the patients were male, 38.16% (n-58) were female and male to female ratio was 1.6:1. Male to female ratio 2:1, 1:0.59, 1: 0.70, 1.2:1 were seen by, Gandapur ASK et al.[5] Kibria SG et al[8], Mahfuz H et al[9]. Ekwere TA et al [10].

In our study most common indications for BMA cytology examination were pancytopenia (26.97%, N-41) and diagnosis of leukaemia/myeloproliferative neoplasm (25.66%, n-38). This is similar to that of the studes done by Pudasaini S et al.[6] Ahmed et al.[11]. However pancytopenia was the third common indication in the studes done by Gandapur ASK, et al. (22.80%)[5], Bashawri LA et al. (11.9%) [12] .

In the present study 90.13% (n-137) of the marrow was pathological and 9.87% (n-15) were normal. Among the pathological condition non-malignant conditions were 40.79% (n-62) and malignant conditions were 49.34% (n-75). Non malignant haematological conditions were 33.55% (n-51), malignant haematological conditions were 47.37% (n-72). In a large study carried out over a period of 25 years by Hyun BH [13], 22% of their patients had nonmalignant haematological problems while 30% had haematological malignancies. In a study by Mahfuz H, et al.[9] in bangladesh 22.4% patients had non malignant haematological conditions and 64.2% had haematological malignancy. These findings do not correlate with our findings because large numbers of cases reviewed in both studies.

Among the non malignant condition, aplastic anaemia was seen in 15.13% (n-23) in our study, when compared to other studies done by, and Pudasaini S et al.[6], Kibria SG et al.[8], Mahfuz H et al.[9], Sreedevi P et al.[14] it was 5.3%, 10.74%, 8%, 9.3%. Variation of these findings due to aplastic anaemia has a pattern of geographic variation opposite to that of leukemia, with higher frequency in the developing world than in the industrialized West [15].

ITP was 9.87% (n-15) in this study. Our result were comparable with study carried out by Gandapur ASK, et al.[5], (8.90%) Atla BL et al.[7] (9.52%), but higher than Kibria SG et al.[8] (6.21%), Mahfuz H et al.[9] (4.8%), Ekwere TA, et al.[10] (6.5%) .

5.92% (n-9) patients showed erythroid hyperplasia in our study. 20.9%, 8.4% 19.6% and 14% cases of erythroid hyperplasia was seen in studies done by Mahfuz H et al.[9], Sreedevi P et al.[10] Jha et al.[16] and Khodke, et al.[17], which were higher than our study. Our study showed megaloblastic anemia was present in 2.63% (n-4) cases. Our finding was lower than other studies done by Pudasaini S et al.[6] (12.3%), Mahfuz H et al.[9] (8%), Ahmed SQ et al.[11] (11%) and Khodke K et al.[17] (6.5%). We avoided bone marrow examination in suspected cases of megaloblastic anaemia because it is not an essential test for diagnosis.

Out of 72 malignant haematological conditions acute leukaemia was 22.37% (n-34). Among the acute leukaemia, acute myeloblastic leukaemia (AML) was 14.47% (n-22) and acute lymphoblastic leukaemia (ALL) was 7.89% (n-12). Other studies also showed that acute leukemia is the commonest hematological malignancy and AML is more common than ALL [6,16,18,19]. In our country Hossain MS, et al.20 showed that AML 28.3% and ALL 14.1%. This finding is higher than our finding because it is a multicenter national level study.

9.87% (n-15) of our patients diagnosed as a case of myeloproliferative neoplasm (MPN). Among them chronic myelogenous leukaemia (CML) 5.92% (n-9), essential thrombocythaemia (ET) 1.97% (n-3), polycythaemia vera 1.32% (n-3), myelofibrosis 0.66% (n-1). Manju, et al.[21] showed 8.57% MPN and 5.71% CML . 10.5% MPN seen by Atla BL et al.[7] and 7.4% CML seen by Mahfuz H, et al.[9] which were near similar to our study.

Multiple myeloma (MM) was 11.18% (n-17) in our study. The finding in the present study were parallels with Ekwere TA, et al. [10] (8.1%), Hossain MS et al.[20] (10.5%) study.

Myelodysplastic syndromes (MDS) were 3.3%, 3%, 4.5% in, Gandapur ASK et al.[5] Mahfuz H et al [9], Hossain MS et al. [20] studies which are similar to our study 3.29% (n-5).

Among the nonhaematological conditions, 3.29% (n-5)% leishmaniasis, 1.23% (n-2) hypersplenism, 1.97 % (n-3) bone marrow secondaries were found in our study. Visceral leishmaniasis were 1.8%, 2.82% in Pudasaini S, et at.[6], Kibria SG et al.[8], studies. Hypersplenism was 0.96% and bone marrow secondaries was 2.6% in Gandapur ASK, et al.[5], study . Bone marrow secondary's was 1.4% also seen by Mahfuz H, et al.[9], study.

Conclusion

Bone marrow study is a time-tested, reproducible procedure used for the evaluation of haematological and nonhaematological conditions. When routine investigations fail to reach the final diagnosis, this can help in the diagnosis of the disease and subsequently can positively modify the outcome of the disease. This study shows that bone marrow examination is a useful diagnostic tool in the diagnosis of various non hematological diseases in addition to hematological disorders and malignancies.

Conflict of Interests: None.

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