ORIGINAL ARTICLE

DIAGNOSTIC IMPORTANCE OF BONE MARROW EXAMINATION IN HAEMATOLOGICAL MALIGNANT AND NON-MALIGNANT DISORDERS

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Background: Bone marrow examination is regarded as one of the most important diagnostic procedure to assess various haematological disorders. The uses and advantages of bone marrow aspiration are numerous. This study was conducted with the aim to evaluate the frequency of involvement of bone marrow with malignant and non-malignant haematological and other clinical disorders and to observe the significance of bone marrow in establishing primary diagnosis of the same condition. **Methods**: This was descriptive carried out at the Department of Pathology, Women Medical College, Abbottabad. A total of 570 successful bone marrow examinations were performed. Patients of all age groups and genders were included in the study. After history, clinical examination and blood complete counts, bone marrow was aspirated from posterior superior iliac spine, sternum or tibia. Smears were made, stained and examined under microscope. **Results:** Total numbers of cases were 570. Ages ranged from 6 months to 70 years. Male to female ratio was 2:1. The common clinical presentation for bone marrow examination were progressive pallor, fever of unknown origin and bleeding. Total numbers of non-malignant haematological conditions were 417 (73.2%) while the numbers of malignant conditions were 153 (27.8%). **Conclusion**: Bone marrow examination remains a simple, reliable and effective technique in the diagnosis of many important clinical conditions. It is a reliable accessible tool for diagnosing various haematological malignant and non-haematological conditions. The importance of bone marrow examination is further highlighted in cases where routine investigations fail to reach a conclusive diagnosis. Treatable conditions like visceral leishmaniasis and malaria are diagnosed and the result is decreased mortality from these diseases.

Keywords: Bone marrow, anaemia, leukaemia, haematological malignancy
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INTRODUCTION

Bone marrow examination is regarded as one of the most important diagnostic procedure to assess various haematological disorders.[1] The uses and advantages of bone marrow aspiration are numerous. Metastatic deposits, degree of cellularity, fibrosis and assessment of dry taps can easily be determined.[2] It is a useful technique not only in the diagnosis of different blood disorders but also for various systemic illnesses including pyrexia of unknown origin, granulomatous diseases, storage disorders, haem phagocytic syndrome, histiocytosis, leishmaniasis and even resistant cases of malaria can be diagnosed through marrow examination.[3]

The new onset of pancytopenia often creates a diagnostic dilemma to the treating physician and leads to bone marrow biopsy and aspiration.[4] It is mandatory to perform microscopic examinations of bone marrow aspirates during the diagnosis of many neoplastic haematopoietic disorders.[5] The aspiration smear allows cytological examination of bone marrow cells. This can help in early diagnosis of the disease and can positively modify the outcome of the disease and its subsequent management.[6–8] Marrow biopsy by surgical trephine is an older procedure than needle aspiration. Advantages are diagnosis of metastatic deposits, degree of cellularity, fibrosis and assessment of dry taps. Touch imprints were useful for studying cell morphology where aspiration yielded dry tap.[2] The present study was conducted to explore the role of this invasive procedure in ascertaining the diagnosis of haematological malignant, non-malignant and non-haematological disorders like leishmaniasis, malaria and storage diseases as well as others in our clinical setup.

MATERIAL AND METHODS

It was a descriptive study conducted from January 2007 to December 2012 at the Department of Pathology, Women Medical College, Abbottabad. A total of 570 successful bone marrows were aspirated and analysed. Patients of all age groups and gender were included. After routine haematological investigations bone marrows were aspirated. Smears were made, stained and examined. All these patients were referred to our haematology department for diagnosis of different clinical and haematological conditions. Most of the patients presented with progressive pallor, fever of unknown origin and bleeding.

RESULTS

A total of 570 bone marrow biopsies or aspirations were included. Age group ranged from 6 months to 70 years with a mean age of 40 years. Children under the age of 15

years were 175 (30.7%) while 395 (69.3%) were adults. Male to female ratio was 2:1. Non-malignant haematological conditions were 417/570 (73.2%) while the numbers of malignant conditions were 153/570 (27.8%). Among the non-malignant conditions 50/417 (12.0%) cases were found to be have visceral leishmaniasis while 4/417 (0.96%) patients had different storage disorders. Out of the non-malignant haematological disorders 131/417 (31%) had megaloblastic anaemia while 79/417 (19%) subjects were having iron deficiency anaemia. Out of the total of 153/570 (26.8%) malignancies, 44/153 (28.6%) had acute lymphoblastic leukaemia, 26/153 (16.9%) had Non Hodgkin lymphoma while 25 (16.3%) were having acute myelogenous leukaemia. Table-1 refers to the different clinical conditions requiring bone marrow examination. Table-2 A and B show the different non-malignant and malignant haematological conditions encountered.

Table-1: Indications for bone marrow examination

Clinical condition	Number	Percentages (%)
Anaemia	200	35.08
Fever of unknown origin	140	24.56
Pancytopenia	130	22.80
Visceromegaly	40	7.01
Bleeding	35	6.14
Unexplained weight loss	15	2.63
Unexplained weakness	10	1.75
Total cases	570	-

Table-2: Results of bone marrow examination (n=570)

A: Non Malignant disorders		
Non Malignant Haematological Disorders	**n**	**(%)**
Anaemia		
Iron deficiency anaemia	79	19
Megaloblastic anaemia	131	31
Mixed deficiency	2	0.5
Haemolytic Anaemia	10	2.4
Sideroblastic anaemia	2	0.5
Anaemia of chronic disorders	17	04
Aplastic anaemia	10	2.4
Idiopathic thrombocytopenia purpura	37	8.9
Myeloid hyperplasia	7	1.7
Myelofibrosis	5	1.2
Hypersplenism	4	0.96
Eosinophilia	2	0.5
Hypoplastic marrow	30	7.2
Normal reactive marrow	24	5.8
Non Haematological disorders		
Visceral leishmaniasis	50	12
Storage disorders	4	0.96
Malaria	3	0.72
Total	417/570	73.2%
B: Malignant disorders		
Malignant Disorders	**n**	**%**
Leukaemia		
Acute lymphoblastic leukaemia	44	28.7
Acute myelogenous leukaemia	25	16.3
Chronic lymphocytic leukaemia	15	9.8
Chronic myelogenous leukaemia	19	12.4
Lymphoma: Hodgkin's lymphoma	5	3.3
Non-Hodgkin's lymphoma	26	16.9
Multiple myeloma/plasmacytosis	10	6.5
Myelodysplastic syndrome	5	3.3
BM secondaries	4	2.6
Total	153/570	27.8%

DISCUSSION

In our study of malignant/non-malignant haematological disorders 73.2% were non-malignant haematological conditions while 27.8% cases were having different haematological malignancies. In a large study carried out over a period of 25 years by Bong Hak Hyun 22% of their patients had non-malignant haematological problems while 30% had haematological malignancies. Our finding are almost similar to their data regarding the frequencies of haematological malignancies.[6] Our study correlates well with other national studies carried out by Shaheen and her co-workers in an army setup in Rawalpindi and Madood ul Manan and his co-workers in Abbottabad.[7,8] The difference in our finding and those reported by Hyun regarding the occurance of non-malignant haematological disorders is most likely due to the presence of different anaemias in different racial, geographical and socioeconomic setup.

Regarding the occurrence of acute leukaemia (45%) our findings are similar to those reported by Gupta and his co-workers from India (50%) and other national studies.[2,7–9] We observed that among the haematological disorders 251/570 (44%) patients had different types of anaemias while 103/570 (18%) bone marrow aspirates revealed leukaemia. Our results are comparable with a study carried out in Rawalpindi although our anaemic patients had a higher frequency than leukemic patients. In a study carried out by Hyun the bone marrow aspirates showed higher frequency of different anaemias (19.6%) as compared to leukaemia (15%).[6]

One interesting observation in our findings was the highest occurrence of megaloblastic anaemia's, i.e., 131/417 (31.4%) among our non-malignant haematological disorders found in bone marrow aspirates. Similar findings were reported by Shaheen and her associates 12/37 (32%), Madood ul Manan and co-workers 128/412 (30.7%). Afzal and his colleagues also reported highest frequency of megaloblastic anaemia among the non-malignant haematological disorders.[7-11] Out of a total of 570 successful bone marrow aspirates in our study 22.9% patients (131/570) showed megaloblastic anaemias. On the other hand Hyun from Korea (Seoul) and Bashwari from Kingdom of Saudi Arabia reported 39/1000 (3.9%), 66/1813 (3.6%) lower percentages of the same condition respectively.[6,10] The possible reasons for higher frequency of megaloblastic anaemia in our setup is dietary factor (lack of Vitamin B12) due to poverty and the presence of *Helicobacter pylori* in unsafe drinking water leading to atrophic gastritis and B12 deficiency megaloblastic anaemia. Among the non-haematological problems

8.7% patients (50/570) had leishmaniasis. 0.7% (4/570) had storage disorders and 0.5% (3/570) were having malarial parasite in bone marrow. In a study carried out at Karachi Syed reported leishmaniasis in 6.3% (4/63) and storage diseases in 11.1% (7/63) cases.[10] The higher percentage of leishmaniasis in Hazara Division Abbottabad has also been reported by Manan M *et al*.[2,12] The disease is prevalent in this area of Hazara. The role of bone marrow in the diagnosis of malaria has also been reported in a previous study carried out in the same province (D.I. Khan) by Khan *et al*.[13]

CONCLUSIONS

We conclude that bone marrow aspiration is an invasive procedure but it is accepted by the patients. It is a simple and valuable diagnostic tool in the diagnosis and management of various important parasitic infections, leukaemia, types of anaemias, lymphomas, storage disorders and different plasma cell dyscrasias. Where routine investigations fail to reach a conclusive diagnosis, this can help in early diagnosis of the disease and can positively modify the outcome of the disease and its subsequent management.

AUTHOR'S CONTRIBUTION

MuM, SN: Performed all the bone marrow aspirations, MuM, ASKG: Evaluation of aspirate. ASKG, SN, MR: Data collection and analysis, write-up of manuscript

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