Original Paper

BONE MARROW MORPHOLOGICAL EXAMINATION – AN ANALYSIS OF 500 CASES

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Abstract

Introduction: Examination of peripheral blood film (PBF) and biopsy of the bone marrow are an indispensible adjunct to the study of diseases of the blood and may be the only way in which a correct diagnosis can be made. Marrow can be obtained by needle aspiration, percutaneous trephine biopsy or surgical biopsy. Morphological examination of the bone marrow by an experienced haematologist can provide very useful information important for many haematological and non-haematological disorders.

Objective: The aim of the study was to diagnose both haematological and non-haematological disorders by only morphological bone marrow examination in a district town distant from the capital city where sophisticated diagnostic facilities are not available.

Methods: This cross sectional type of descriptive study was carried out in Combined Military Hospital (CMH), Jessore and different private and public hospitals. Five hundred cases taken as a non-probability purposive sampling method were included in this study irrespective of age and sex from January 2009 to June 2011. Bone marrow was aspirated from posterior superior iliac spine and first piece of the body of the sternum taking aseptic precautions and after infiltrating local anaesthesia. Only two cases required percutaneous trephine biopsy. After aspiration bone marrow smears were stained and examined under microscope.

Results: There were 294 (58.8%) male and 206 (41.2 %) female out of 500 cases. The age of the patients ranged from one year to 82 years. Haematological malignancy were 321 cases (64.2%), non-malignant haematological and non-haematological diseases were 112 (22.4%) and 56 (11.2%) cases respectively and normal active marrow were from 11 (2.2%) cases. Among 321 haematological malignancies, Acute Lymphoblastic Leukaemia (ALL) and Acute Myeloblastic Leukaemia (AML) were 126 (39.3%) and 99 (30.8%) respectively and Chronic Myeloid Leukaemia (CML) were 37 (11.5%). Out of 112 non-malignant haematological cases, erythroid hyperplasia was found in 42 (37.5%) cases in which micronormoblastic erythroid hyperplasia was 33 (29.5%) and megaloblastic erythroid hyperplasia was 9 (8.0%) cases. Aplastic anaemia/progressive marrow failure was diagnosed in 40 (35.7%) cases. Two (1.8%) cases were diagnosed as myelofibrosis. Non-haematological diseases were 56 of which 49 (87.5%) cases were secondary reactive marrow & only seven (12.5%) cases were secondary metastatic deposits in the bone marrow.

Conclusion: Morphological examination of bone marrow aspirate is a key to the diagnosis of many diseases especially the haematological disorders. Microscopic examination of bone marrow aspirate by an experienced haematologist may solve many

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diagnostic difficulties faced in day to day clinical practice. Therefore, for the betterment of both patients and physicians more emphasis should be given to become well conversant in reporting a bone marrow aspirate by the haematologists.

Key-words: Bone marrow, Haematological malignancy, Non-haematological malignant disorders, Non-haematological disorders.

Introduction

Haematological disorders are quite frequent in our population. Without bone marrow examination, the diagnosis is usually not confirmed. Bone marrow examination is an established diagnostic modality in the evaluation of various haematological disorders, where many disorders can be finally diagnosed[1]. Bone marrow is done for the evaluation of unexplained cytopenias and malignant conditions like leukaemias, lymphomas and storage disorders. Trephine biopsy is usually performed where there is dry or blood tap or hypoplasia/aplasia suspected on aspiration. Though it is an invasive but relatively safe procedure, it is done frequently by the haematologist even in presence of severe thrombocytopenia. Haematological disorders are quite frequent in all age groups and spectrum of disorders relatively different in the developing world than the developed countries[2]. The present study was undertaken with a view to establish the morphological diagnosis of haematological disorders on bone marrow examination in a secondary level hospital where cytochemistry and immunophenotyping facilities are not available.

Materials and Methods

This cross sectional type of descriptive study was carried out during January 2009 to June 2011 in Combined Military Hospital (CMH) Jessore and private clinics at Jessore town. Five hundred cases selected as a non probability purposive sampling method (that underwent successful bone marrow aspiration) were included in this study. After taking proper aseptic precautions and infiltration of two milliliters local anesthetic agent ((2% Xylocane) bone marrow was aspirated either from first piece of the body of the sternum or from the posterior superior iliac spine. In case of children under two years of age, bone marrow was aspirated from the medial aspect of tibia just below the tibial tuberosity. Before performing the procedure patients were thoroughly briefed about the steps. About two milliliters marrow particle were aspirated and immediately taken into Ethylene Diamine Tetra-acetic Acid (EDTA) containing either test tube or petri dish. Three to five bone marrow smears were made both from marrow particles and marrow blood. These smears were stained with Leishman stain. Stained slides were examined by Olympus CH20 microscope for morphological diagnosis of haematological and other disorders. The report was finalized considering clinical features, findings of peripheral blood film and full blood count.

Results

A total of 500 bone marrow aspirates were examined using Olympus CH20 for morphological diagnosis of haematological and non-haematological disorders. Out of 500 cases 294 (58.8%) were male and 206 (41.2%) were female. Male to Female ratio was 1: 0.70 (Table-I).

Table-I: Sex distribution of the patients (n= 500)

Sex	Number of patients	Percentage (%)
Male	294	58.8
Female	206	41.2
Total	**500**	**100**

In this study, the age of the patient ranged from one year to 82 years. The mean age of the patients was 28.2 years and mean ±SD was 28.2±23.3 years. The patients in this study were grouped into five categories on the basis of age. Most of the patients were in the age group of 21–40 years (33.8%) (Table-II).

Table-II: Age distribution of the patients (n= 500)

Age in years	Number of patients	Percentage
<2 years	05	1
-210 years	145	29
11-20 years	130	26
21- 40 years	169	33.8
>41 years	51	8.2
Total	**500**	**100**

Out of 500 cases in this present study, haematological malignancy were 321 cases (64.2%), non-malignant haematological and non-haematological diseases were 112 (22.4%) and 56 (11.2%) cases respectively and normal active marrow were 11 (2.2%) cases (Table-III).

Table-III: Disease pattern on bone marrow morphological examination (n = 500).

Diseases	Number of patients	Percentage (%)
Haematological malignancy.	321	64.2
Non malignant haematological diseases	112	22.4
Non haematological diseases	56	11.2
Normal active marrow	11	2.2
Total	**500**	**100**

In this study, among 321 haematological malignancies, Acute Lymphoblastic Leukaemia (ALL) and Acute Myeloblastic Leukaemia (AML) were 126 (39.3%) and 99 (30.8%) respectively and Chronic Myeloid Leukaemia (CML) were 37 (11.5%) (Table-IV).

Table-IV: Distribution of haematological malignancies (n = 321).

Haematological malignancy	Number of patient	Percentage (%)
Acute Lymphoblastic Leukaemia (ALL)	126	39.3
Acute Myeloblastic Leukaemia (AML)	99	30.8
Chronic Myeloid Leukaemia (CML)	37	11.5
Multiple myeloma (MM)	16	5.1
Myelodisplastic Syndrome (MDS)	15	4.7
Lymphoproliferative disorders	15	4.7
Chronic Lymphocytic Leukaemia (CLL)	15	4.7
Myeloproliferative disorders	07	2.2
Chronic Myelomonocytic Leukaemia (CMML)	01	0.3
Total	**321**	**100**

On the basis of bone marrow morphological findings, FAB (French-British-American) classification was done. Out of 126 cases of Acute Lymphoblastic leukaemia, 48 (30.1%) cases were ALL-L_1,76 (60.3%) cases were ALL-L_2 and only 2 (1.6%) cases were ALL-L_3. In cases of Acute Myeloblastic Leukaemia, 37 (37.4%) cases were AML-M_1 followed by AML-M_4 cases of 20 (15.9 %). No cases of AML-M_6 & AML-M_7 were detected in this study (Table-V and Table-VI).

Table-V: FAB pattern of Acute Lymphoblastic Leukaemia (ALL) (n=126).

Acute Lymphoblastic Leukaemia	Number of patient	Percentage (%) among ALL
ALL-L_1	21	16.6
ALL-L_2	102	81.0
ALL-L_3	3	2.4
Total	**126**	**100**

Table-VI: FAB pattern of Acute Myeloblastic Leukaemia (AML) (n=99).

Acute Myeloblastic Leukaemia	Number of Patient	Percentage (%) among AML
AML-M_0	12	12.1
AML-M_1	37	37.4
AML-M_2	16	16.2
AML-M_3	05	5.1
AML-M_4	20	20.2
AML-M_5	09	9.1
AML-M_6	0	0
AML-M_7	0	0
Total	**99**	**100**

Out of 112 non-malignant haematological cases, erythroid hyperplasia was found in 42 (37.5%) cases in which micronormoblastic erythroid hyperplasia was 33 (29.5%) and megaloblastic erythroid hyperplasia was 9 (8.0%) cases. Aplastic anaemia/progressive marrow failure was diagnosed in 40 (35.7%) cases. Two (1.8%) cases were diagnosed as myelofibrosis by trephine biopsy (Table - VII).

Table-VII: Distribution of non-malignant haematological diseases (n=112).

Non-malignant haematological disease	Number of Patient	Percentage (%)
Aplastic anaemia	40	35.7
Erythroid hyperplasia	42	37.5
Immune thrombocytopenic purpura	24	21.4
Visceral leishmaniasis	03	2.7
Myelofibrosis	02	1.8
Malaria	01	0.9
Total	**112**	**100**

In this study, non-haematological diseases were 56. Out of these 56 cases, the majority of 49 (87.5%) cases were secondary reactive marrow & only seven (12.5%) cases were secondary metastatic deposits in the bone marrow (Table-VIII).

Table-VIII: Distribution of non-haematological diseases (n=56).

Non-haematological disease	Number of the patient	Percentage (%)
Secondary reactive marrow	49	87.5
Secondary deposits in bone marrow	07	12.5
Total	**56**	**100**

Discussion

The spectrum of haematological disorders is very wide. Bone marrow examination is a useful test in reaching the final diagnosis. Haematological malignancy constitutes the most common type (64.2 %) of disorders diagnosed morphologically by bone marrow examination. Among these cases Acute Lymphoblastic Leukaemias constitute the highest number (25.2%) followed by Acute Myeloblastic Leukaemia (19.8%). This study correlates with the findings of Rahim F et al who found 17.9% ALL and 17.0% AML[3]. Baggs et al also found that ALL was the commonest (31.3%) of all leukaemias followed by AML[4]. Yousuf MA et al also found the same findings of ALL being 39.3%, followed by AML which is 27.4 %[5]. In this study, Chronic Myeloid Leukaemia constitutes third most common type (7.4%) of haematological malignancy, which also correlates with finding of Rahim F et al[3]. Advani et al[6] reported 9% CML in 1126 patients whereas Maula[7] et al found CML of 12.8% among all leukaemias. In this study, second most common haematological malignancy was multiple myeloma of 3.2% and Myelodysplastic syndrome of 3% which correlates with the study of Kibria SG et al[8].

Non-malignant haematological disorders constitute the second most common type of disorders required bone marrow examination for diagnosis, of which erythroid hyperplasia of both micro- and megaloblastic (37.5%) was most common, the finding is almost similar to the findings carried out by Rahim et al[3] and Kibria SG et al[6]. Aplastic anaemia (35.7%) and Idiopathic Thrombocytopenic Purpura (21.4%) were the second and third most frequent type of disorders among non-haematological disorders which is also similar to the study of Rahim el al[3], who reported 14.2% aplastic Anaemia & Kibria SG et al[6] reported 10.7% aplastic anaemia.

Conclusion

Bone marrow examination is an important step to arrive at the confirmatory diagnosis of various haematological disorders. Haematological malignancies such as leukaemias, lymphomas, myeloproliferative disorders and multiple myeloma essentially need bone marrow examination; likewise many non-malignant disorders such as aplastic anaemia, Immune Thrombocytopenic Purpura also require bone marrow examination. This study reveals a spectrum of disease where bone marrow examination is required to reach a diagnosis.

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