Original Research Article

Bone marrow aspiration in haematological disorders: study at a tertiary care centre

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ABSTRACT

Background: The bone marrow examination is an essential investigation for the diagnosis and management of many disorders of the blood and bone marrow. Bone marrow aspiration (BMA) alone is usually sufficient to diagnose nutritional anaemias, and most of the acute leukaemias. Aim was to study the spectrum of haematological disorders diagnosed on bone marrow aspiration.

Methods: This study was conducted in the Department of Clinical Haematology in Sher e Kashmir Institute of Medical Sciences, Kashmir for a period of 2 years from December 2015 to December 2017. Bone marrow examination of 2131 cases of suspected hematological disorders was carried out. Bone marrow was aspirated from posterior superior iliac spine under local anaesthesia. Aspirates of dry tap were excluded from the study. Aspiration smears where stained with Leishmann stain for morphological examination.

Results: A total of 2131 cases were included in this study. Male to female ratio in our study was 1.9:1. The age range of cases was from 1-80 years and the mean age was 47.3 years. Anemia was the most common haematological disorder in our study accounting for 25.6% of cases followed by acute leukaemia accounting for 22.3% and multiple myeloma (13.3%). Among anaemias, megaloblastic anaemia was most common followed by dual deficiency anaemia. Among leukaemias, acute myeloid leukaemia (13.2%) was more common than acute lymphoblastic leukaemia (9.1%).

Conclusions: Bone marrow aspiration cytology is a mildly invasive technique which can diagnose many hematological and non-hematologic diseases that can be confirmed by more advanced investigations viz. serological, biochemical or molecular. It is a highly informative test procedure performed for evaluating blood and blood related diseases in our environment.

Keywords: Anemia, Bone marrow aspiration, Leukaemia

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. Bone marrow aspiration (BMA) is an invasive procedure whereby spongy bone marrow is obtained through a needle aspiration for diagnostic evaluations especially cytology and stem cell harvest.\(^1\) Bone marrow examination was first done by Mosler in 1876 using a regular wood drill to aspirate bone marrow particles from a patient with leukaemia.\(^2\) Bone marrow aspiration (BMA) alone is usually sufficient to diagnose nutritional anaemias, and most of the acute leukaemias. In today’s practice, use of BMA is not limited to
evaluation of haematopoietic and non-haematopoietic marrow cells. BMA specimens are useful in further diagnostic assays including cytochemical/special stainings, immunophenotyping, microbiologic tests, cytogenetic analysis and molecular studies.\textsuperscript{1,2,5} Aim was to study the spectrum of haematological disorders diagnosed on bone marrow aspiration.

**METHODS**

This study was conducted in the department of Clinical Haematology in Sher e Kashmir Institute of Medical Sciences, Kashmir for a period of 2 years from December 2015 to December 2017. BMA were performed using a standard unit protocol as adapted from ICSH guidelines and other authorities.\textsuperscript{1,5} Written informed consent of all study subjects was obtained before undergoing the procedure. BMA was done from posterior superior iliac spine in all the patients with salah needle, the aspirate was drawn with a 20ml plastic syringe. Bone marrow smears were prepared immediately following aspiration. After being air dried these smears where stained with Leishmann stain for morphological examination. Iron stained (Perls stain) slides were examined in all the cases, Periodic Acid Schiff (PAS) stain, Sudan Black B(SBB) and Myeloperoxidase (MPO) stain was done wherever required. Aspirates of dry tap were excluded from the study.

**RESULTS**

A total of 2131 cases were included in this study. Male to female ratio in our study was 1.9:1. The age range of cases were from 1-80 years and the mean age was 47.3 years. Bone marrow examination are given in Table 1.

**Table 1: Categories of diseases diagnosed by bone marrow aspirate cytology.**

| Haematological disorder          | Cases (n) | %    |
|----------------------------------|-----------|------|
| Anemias                          | 550       | 25.6 |
| Megaloblastic anemia             | 310       | 14.5 |
| Iron deficiency anemia           | 70        | 3.2  |
| Dual deficiency anemia           | 170       | 7.9  |
| Acute leukaemia                  | 476       | 22.3 |
| Acute myeloid leukaemia          | 281       | 13.2 |
| Acute lymphoblastic leukaemia    | 195       | 9.1  |
| Aplastic anemia                  | 60        | 2.8  |
| Multiple myeloma                 | 285       | 13.3 |
| Normal marrow                    | 147       | 6.8  |
| Metastasis                       | 95        | 4.4  |
| Lymphoma infiltration            | 87        | 4.0  |
| Chronic lymphocytic leukaemia    | 80        | 3.7  |
| Myeloproliferative neoplasm      | 70        | 3.2  |
| Relapse of acute leukaemia       | 80        | 3.7  |
| Gauchers disease                 | 02        | 0.09 |
| Malaria                          | 02        | 0.09 |
| Leishmaniasis                    | 02        | 0.09 |
| Aparticulate                     | 100       | 4.6  |
| Myelodysplastic changes          | 95        | 4.4  |

Anemia was the most common haematological disorder in our study accounting for 25.6% of cases followed by acute leukaemia accounting for 22.3%. Among anemias, megaloblastic anemia (Figure 1) was most common followed by dual deficiency anemia.

Among leukaemias, acute myeloid leukaemia (Figure 2) was most common. Leukaemia was followed by multiple myeloma (Figure 3) constituting 13.3% of all cases.
DISCUSSION

Examination of the bone marrow is one of the most important pillar in diagnosing hematological disorders. The age range of cases were from 1-80 years and the mean age was 47.3 years with male to female ratio of 1.9:1. Similar results were seen by Niazi et al, in their study with patients in the age range of 1 to 75 years and male predominance (1.7:1). Male predominance was also seen by Adewoyin AS et al.7 Table 2 shows comparison of different studies regarding age and sex distribution.

Table 2: Comparison of age and sex distribution in different studies.

| Study               | Age (years) | M:F   |
|---------------------|-------------|-------|
| Pudasaini S et al10 | 9 m-75      | 1:1.1 |
| Egesie et al13      | 3-80        | 1.5:1 |
| Gayathri et al14    | 2-80        | 1.2:1 |
| Kibria et al12      | 3.5-80      | 1:0.59|
| Niazi et al7        | 1-75        | 1:7:1 |
| Jha et al15         | 1-79        | 1:5.1 |

In our study, Anemia was the most common haematological disorder (25.6%) with megaloblastic anemia being predominant accounting for 14.5%. In a similar study conducted by Atla BL et al, megaloblastic anemia was the most common finding (44.0%) followed by aplastic anemia (11.9%).8 Similar result was seen by Ranabhat S et al, with megaloblastic anemia being most common.9 Adewoyin AS et al, conducted a study where anemia constituted most common aspiration haematological disorder with combined (substrate) deficiency (26.1%) being the predominant one.7

Acute leukaemia was the second largest group accounting for 22.3% with acute myeloid leukaemia constituting 13.2%. Cytogenetic and flow cytometric investigations were advised to classify leukaemia based on WHO/REAL classification system. In a study conducted by Ranabhat S et al, malignancy was the second most common group after anemias diagnosed on BMA.9 Also, in that study among leukaemias, acute myeloid leukaemia was found to be the most common type of leukaemia. Pudasaini S et al, in their study, diagnosed acute leukaemia in 12.3% with acute myeloid leukaemia (10.5%) more common than acute lymphoid leukaemia (1.8%).10 Ghartimagar D et al, in his study found acute myeloid leukaemia (52%) to be more common than acute lymphoblastic leukaemia (10%).11 Acute myeloid leukemias were the common cause of haematological malignancies in a study conducted by Atla BL et al.8 Similar results are seen in some other studies.12,13

Multiple myeloma was the second most common malignant disorder seen in our study accounting for 13.3%. Our study was comparable to that of Ranabhat S et al.9 In their study, leukemia constituted 80% of malignant haematological disorders followed by multiple myeloma constituting 13.3%

Aplastic anemia is more common in developing countries than in developed countries. Aplastic anemia was seen in 2.8% of cases in our study. Comparable to our study, hypoplastic anemia was seen in 5.3% cases in a study done by Pudasaini et al.10 However in some studies it has shown high incidence.9 In the study of Atla et al, 19% cases had aplastic anemia.3 MDS was seen in 4.4% cases. Other series showed incidence of MDS ranging from 2% to 7.9%.12,14,16

In our study, metastatic deposits were seen in 4.4% of cases. Adewoyin AS et al, in their study had seen marrow carcinoma in 7.9% cases.7 D Ghartimagar et al in their study showed metastasis in 6%, normal marrow findings were seen in 6.8% cases.4 Normal marrow study was seen in 3.8% cases in the study of Atla et al,5 while 10.5% cases had a normal marrow in study by Pudasaini et al.10

CONCLUSION

Bone marrow aspiration cytology is a mildly invasive technique which can diagnose many hematological and non-hematologic diseases that can be confirmed by more advanced investigations viz. serological, biochemical or molecular. It is a highly informative test procedure performed for evaluating blood and blood related diseases in our environment. However, bone marrow sample cannot be obtained (dry tap) in a proportion of cases. In such cases, a bone marrow biopsy needs to be performed.

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