

## ORIGINAL RESEARCH

### **A Comparison of the Effectiveness of Bone Marrow Aspiration (BMA), Bone Marrow Imprint (BMI) and Bone Marrow Biopsy (BMB) in Patients Suffering from Acute Leukaemia at Tertiary Care Center**

<sup>1</sup>Neeraj Verma, <sup>2</sup>Yogesh Kumar Gupta, <sup>3</sup>Madhuri Agarwal, <sup>4</sup>Manish Kumar Singhal, <sup>5</sup>Akansha Jain

<sup>1,2</sup>Associate Professor, Department of Pathology, SMS Medical College, Jaipur, Rajasthan, India

<sup>3,4</sup>Associate Professor, Department of Pathology, Government Medical College, Bharatpur, Rajasthan, India

<sup>5</sup>Consultant Pathologist, SRL Diagnostics, Jaipur, Rajasthan, India

#### **Correspondence:**

Manish Kumar Singhal

Associate Professor, Department of Pathology, Government Medical College, Bharatpur, Rajasthan, India

**E mail:** [drmanish21@gmail.com](mailto:drmanish21@gmail.com)

#### **ABSTRACT**

**Background:** Bone marrow examination is an important tool in diagnosing and controlling hematological disorders. Bone marrow aspiration and trephine biopsy are compatible. Thus; compiled the current study to evaluate and compare the effectiveness of bone marrow aspiration, imprint and biopsy in patients with acute leukemia.

**Materials& Methods:** The present study was conducted in 50 clinically suspected patients of leukemia who attended inpatient and outpatient department of medicine, department of general pathology at SMS Medical College and Hospital, Jaipur, Rajasthan, India over a period of one year. All Patients with leukemia who underwent both bone marrow aspiration and bone marrow trephine biopsy examination were included in the present study. We analyzed all the results by SPSS software. One way ANOVA was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

**Results:** The age of the patients ranged from 6 months to 70 years with male to female ratio of 1.5:1. In three cases, dry tap was observed, which was further diagnosed with BMI and BMBx. Diluted marrow was observed in two cases which was further diagnosed with BMI and BMBx. Findings of BMI and BMBx were in concordance with each other in 100 percent of the cases.

**Conclusion:** Bone marrow aspiration, imprint and biopsy are complementary to each other with aspiration smears being primarily used for cytological diagnosis and biopsy sections mainly useful to identify histological features like architectural pattern and fibrosis.

**Keywords:** BMI, BMBx, BMA, Acute Leukaemia.

#### **INTRODUCTION**

Bone marrow biopsy is an important tool in diagnosing and controlling hematological disorders. Bone marrow examination is a daunting task in a clinical armamentarium for an

unexpected diagnosis when other test results appear impractical or inconsistent during the testing process.<sup>1</sup>

Leukemia testing is a task that everyone, from doctors to specialists, do. Important steps to assess these conditions include the integration of clinical data with laboratory studies. Bone marrow aspiration and trephine biopsy are compatible. The aspiration was useful in studying cell morphology and finding different cell numbers. It is also useful for additional cytometric flow, immunophenotyping, molecular and cytogenetic studies. Trephine biopsy is important when an aspirate produces a dry or blood tap as it provides information on the structures, cells, fibrosis and pattern of irregular penetration.<sup>2,3</sup>

Today, examples of aspirate and trephine biopsy are considered complementary and, when both are available, provide an in-depth study of the bone marrow. However, biopsy is a painful procedure, and its processing takes at least 48-72 hours. Therefore, performing trephine biopsies in all patients may be less expensive in terms of clinical and laboratory staff time, efforts, and patient discomfort.<sup>4</sup>

With the advent of new technologies such as flow cytometry, immunohistochemistry (IHC) and molecular techniques integrated analysis is helping to achieve more accurate and informative diagnostic data in some challenging diagnostic situations.

Under all septic safety measures bone marrow aspiration was performed. Adequate local anesthesia is essential to reduce pain. The small amount of bone marrow needed in the indicated tests should be burned because the higher the bone marrow volume, the more cleansing the peripheral blood becomes. It is useful to aspire to about 0.25 ml of bone marrow and the films should be distributed immediately. After complete suspension the staining slides are formed and tested microscopically.<sup>5,6</sup> Thus; compiled the current study to evaluate and compare the effectiveness of bone marrow aspiration, imprint and biopsy in patients with acute leukemia.

## **MATERIALS & METHODS**

The present study was conducted in 50 clinically suspected patients of leukemia who attended inpatient and outpatient department of medicine, department of general pathology at SMS Medical College and Hospital, Jaipur, Rajasthan, India over a period of one year.

Clinical details and informed consent were obtained in all cases. Blood samples for hematological and other relevant investigations were drawn from study population after obtaining an informed consent in writing from the patients and or their close relatives. All Patients with leukemia who underwent both bone marrow aspiration and bone marrow trephine biopsy examination were included in the present study.

## **COLLECTION OF SAMPLES**

For complete blood count and PBF examination 2ml blood sample was collected in Ethylene diaminetetraacetic acid (K2-EDTA) anticoagulant vial. CBC was performed on Sysmex XN1000 & APVIA 2120i cell counter after proper pre calibration of the machines and running low and high control checks.

## **BONE MARROW EXAMINATION**

Bone marrow examination included both aspiration and trephine biopsy in all the cases. The bone marrow aspiration and biopsy material were simultaneously obtained by using a single Jamshidi needle from right/left posterior superior iliac crest under local anesthesia under strict aseptic precautions as per standard procedure.

Posterior superior iliac spine (PSIS) was the preferred site. Imprints were prepared and biopsy was put in 10% formalin. Aspiration and imprint smears were air dried and stained with Leishman-Giemsa (LG) stain. Cytochemical stains like Periodic Acid Schiff (PAS),

Myeloperoxidase (MPO), Sudan black were done in cases of hematological malignancies and Perl Prussian blue for assessment of iron stores was done in cases of anemia.

Biopsy specimen was fixed in 10% formalin overnight and then decalcified in 10% formic acid for 2 to 3 hours. It was processed routinely and Haematoxylin-Eosin (H & E) staining was done. Reticulin and Perls' Prussian blue stain were done.

### STATISTICAL ANALYSIS

We analyzed all the results by SPSS software. One way ANOVA was used for assessment of level of significance. P- value of less than 0.05 was taken as significant.

### RESULTS

The age of the patients ranged from 6 months to 70 years with male to female ratio of 1.5:1. Majority of the cases were more than 30 years of age. 60 percent of the cases were males while remaining 40 percent were females (table 1). In three cases, dry tap was observed, which was further diagnosed with BMI and BMBx. Diluted marrow was observed in two cases which was further diagnosed with BMI and BMBx. Findings of BMI and BMBx were in concordance with each other in 100 percent of the cases (table 2).

**Table 1: Age and gender distribution of cases**

Age Group (In Years)	Male	Female	Total
<b>0 to 10</b>	3 (10%)	1 (5%)	4 (8%)
<b>11 to 30</b>	3 (10%)	1 (5%)	4 (8%)
<b>31 to 50</b>	12 (40%)	16 (80%)	28 (56%)
<b>51 and above</b>	12 (40%)	2 (10%)	14 (28%)
<b>Total</b>	30 (60%)	20 (40%)	50 (100%)

**Table 2: Comparison of bone marrow aspiration, bone marrow imprint, bone marrow biopsy findings in acute leukemia**

Type	Bone marrow aspiration	Bone marrow imprint	Bone marrow biopsy
<b>AML</b>	30	30	30
<b>Hypocellular ALL</b>	15	20	20
<b>Dry tap</b>	3	0	0
<b>Diluted marrow</b>	32	0	0

### DISCUSSION

Bone marrow examination remains a cornerstone in the diagnosis of various hematological disorders. The comparative evaluation of BMA and BMB is essential to determine the diagnostic utility of both the procedures in various hematological diseases. Age and sex distribution of our study was comparable with other studies, Tripathy and Dulani<sup>3</sup>, Mahajan et al<sup>2</sup>, Kaur et al<sup>7</sup>, Aljadayeh et al.<sup>8</sup> However, Mahajan et al<sup>2</sup> and Aljadayeh et al<sup>8</sup> included in their studies patients only above 18 years of age.

Parajuli S et al<sup>9</sup> compared the role of bone marrow aspirate and trephine biopsy to formulate an effective and rapid method for diagnosing wide spectrum of hematological diseases. They found, out of the 89 cases selected for study; bone marrow aspiration revealed diagnostic materials in 75 cases and 14 cases were inconclusive for a definite diagnosis. The diagnostic accuracy of the bone marrow aspiration cytology was 84.26%. Eighty-eight cases were diagnosed on trephine biopsy of bone marrow with diagnostic accuracy of 98.87%. Both the aspiration cytology and trephine biopsy complement each other for evaluating any haematological disorder. Though cellular morphology is better understood in marrow aspirates and is equally effective to biopsy in diagnosing various anemias and leukemias;

however, it is the histopathological study of trephine biopsy that gives well preserved marrow architecture with its all cellular and stromal components.

In our study the diagnostic yield of BMA and BMI & BMB were 90%, and 100% & 100% respectively. Only slight difference was observed between the five with yield of BMB being higher followed by BMA. This is in contrast to a study done by Chandra and Chandra where the diagnostic yield of BMB was 99.2% followed by BMA (77.5%).<sup>10</sup> However, Aljadayeh et al<sup>8</sup> reported a diagnostic yield of BMB as 91.80% and of BMA 76.20 %.

Our findings on aspiration were satisfactory. However, there was an added advantage of biopsy regarding the pattern of involvement of the marrow. Thus, our findings were agreeable with those of, Mahajan et al<sup>2</sup> where 6 out of these 10 cases revealed a packed marrow pattern on bone marrow biopsy and had given a dry tap on aspiration. Kaur et al<sup>7</sup> who confirmed added advantage of biopsies over aspiration in this case.

## CONCLUSION

Bone marrow aspiration, imprint and biopsy are complementary to each other with aspiration smears being primarily used for cytological diagnosis and biopsy sections mainly useful to identify histological features like architectural pattern and fibrosis. However, future studies are recommended for better exploration of this field of pathology.

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