

# Comparative study of bone marrow aspiration and bone marrow clot sections in various haematological disorders

Upasana Uniya<sup>1</sup>, Yogesh Patle<sup>2\*</sup>, Hanisha Jain<sup>3</sup>

<sup>1,2</sup>Assistant Professor, Department of Pathology, People's College of Medical Science & Research Centre, Bhopal, Madhya Pradesh, INDIA.  
<sup>3</sup>Senior Resident, ESIS Hospital, Delhi, INDIA.

Email: [drygpatele1983@gmail.com](mailto:drygpatele1983@gmail.com)

## Abstract

**Introduction:** During the last two decades, bone marrow examination has become an indispensable adjuvant to diagnose the malignant diseases of the blood and other body systems. This will obviate the need for many other expensive and time-consuming investigations. When both the procedures for bone marrow examination i.e. aspiration and clot section done simultaneously, can yield a good diagnostic material which will be helpful for more accurate diagnosis. **Aims and Objectives:** This study was aimed to assess the diagnostic value of the BMA and Bone Marrow Clot Sections and role of both the procedures to reach final diagnosis when done simultaneously. **Methods:** The present study was done on 80 cases in which complete peripheral blood smears, bone marrow and cell blocks was available were included in the study. Bone marrow aspiration was performed, Cell block was prepared and stained with hematoxylin and eosin stain, smears were stained with Leishman stain. **Results:** Comparison was done between bone marrow aspirate smears stained by Romanowsky group of stains i.e. Leishman and paraffin embedded cell block section stained by Hematoxylin and Eosin stain. Out of 80 cases, there were 60 cases (75%) of anaemias, 9(11.2%) platelet disorders, 6(7.5%) Acute Leukaemias, 2(2.5%) Lymphoproliferative disorders, 1(1.2%) MDS, 1(1.2%) Leishmaniasis and 1(1.2%) hypersplenism. **Conclusions:** The advantage of both the procedures done together provided more material and enabled us to study the cytomorphology of the cells, with the pattern of distribution of the cells depending on the cases and help in more accurate diagnosis.

**Key Words:** bone marrow aspiration, romanowsky stains, paraffin embedded clot sections, and H&E stain.

## \*Address for Correspondence:

Dr. Yogesh Patle, Assistant Professor, Department of Pathology, People's College of Medical Science & Research Centre, Bhopal, Madhya Pradesh, INDIA.

Email: [drygpatele1983@gmail.com](mailto:drygpatele1983@gmail.com)

Received Date: 03/02/2016 Revised Date: 12/03/2016 Accepted Date: 02/04/2016

Access this article online	
Quick Response Code:	Website: <a href="http://www.statperson.com">www.statperson.com</a>
	Volume 6 Issue 2

## INTRODUCTION

The bone marrow is one of the body's largest organs. The hematopoietic bone marrow is organized around the vasculature of the bone cavity. The main function of the bone marrow is to supply mature hematopoietic cells for

circulating blood in a steady-state as well as to respond to increased physiologic or pathologic demands. During the last two decades, bone marrow examination has become an indispensable adjuvant to diagnose the malignant diseases of the blood and other body systems.

Some studies<sup>1-4</sup> in the literature indicate that trephine biopsy is more sensitive and reliable than aspirate for detection of bone marrow metastasis. However, other studies<sup>5-10</sup> state that for most hematological malignancies, aspiration alone is sufficient and ensure more clear cellular details than trephine biopsy. Recent advances in the treatment of hematologic malignancies have been paralleled by renewed interest on the part of pathologists and hematologists in methods of obtaining and preparing bone marrow for diagnostic studies. Bone marrow aspirate is a cytologic preparation of bone marrow cells obtained by aspiration of marrow and a smear of the cells.

Bone marrow aspirate smears are primarily used for the assessment of differential count, maturational status, morphologic details, myeloid-to-erythroid (M:E) ratio. Bone marrow aspirated cell blocks provide a better and more detailed estimate of bone marrow cellularity. They are particularly useful for patients with aplastic / hypoplastic marrow. Aspiration of the marrow has been utilized from cytologic assessment, with analysis directed toward morphology and obtainment of differential cell count. Bone marrow cellularity is expressed as the percentage of a section that is occupied by hemopoietic cell.<sup>11</sup> In H&E stained sections of bone marrow from cell block, the more mature stages of the erythroid and myeloid cells, adipocytes and megakaryocytes can be identified. However lymphoid cells as well as immature progenitor cells cannot be reliably identified. The use of H&E and Romanowsky group of stains in the bone marrow analysis are very important and allow for studies of marrow's overall cellularity, detection of focal lesions and extent of infiltration by various pathological entities. Bone marrow studies aid in the diagnosis, staging and monitoring of several diseases. These procedures are also valuable for follow up of patients undergoing chemotherapy, bone marrow transplantation and other forms of medical treatment.<sup>1,2</sup> Involvement of marrow by metastatic tumour, have an effect on clinical treatment and prognosis. Similarly involvement of the marrow by

granulomatous lesion especially tuberculous granulomas may be easily identified in bone marrow clot sections. Moreover in cases where malignancies are not clinically suspected, bone marrow aspirations and biopsies have been useful in detecting non-hematologic malignancies. This study was conducted to evaluate the complementary role of both the procedures done simultaneously and to see the advantages and disadvantages of these procedures.

### MATERIALS AND METHODS

The present study included a consecutive marrow samples from 80 patients attending hematology OPD or ward of Hospital, Bhopal in which complete peripheral smears, bone marrow and cell blocks was available. The selection of cases was based on the clinical examination and peripheral blood smear of patients in which a hematological disorder was suspected.

**Inclusion criteria** were unexplained anemia, splenomegaly, hepatomegaly and lymphadenopathy, Pancytopenia, leucopenia and leucocytosis, unexplained thrombocytopenia and thrombocytosis, Leukaemia, Myeloproliferative disorders, Lymphoproliferative disorders, Plasma cell dyscrasias.

**Exclusion criteria** were the cases which were bleeding severely, like haemophilic patient and patient having platelet count less than 10,000.

### OBSERVATIONS

The present study was conducted for comparison between bone marrow aspirate smears stained by Leishman and paraffin embedded cell block section stained by Hematoxylin and Eosin stain. Total 80 cases were selected in which complete peripheral smears, bone marrow aspirate and cell blocks were available. The findings obtained are as follows:-

**Table 1:** Distribution of various Hematological disorders

Disorders	No.of cases	Percentage
Anaemias	60	75%
Platelet disorders	09	11.2%
Acute leukemias	06	7.5%
Lymphoproliferative disorders	02	2.5%
Myelodysplastic disorders	01	1.2%
Leishmaniasis	01	1.2%
Hypersplenism	01	1.2%
<b>Total</b>	<b>80</b>	<b>100%</b>

**Table 2:** Distribution of Hematological Disorders according to sex

Disorders	Total no. of cases	Male		Female	
		No	%	No	%
Megaloblastic anaemia	46	32	69.5	14	31.5
Idiopathic Thrombocytic Purpura	09	06	66.6	03	33.3
Acute Lymphocytic Leukemia	04	02	50	02	50
Acute Myeloid Leukemia	02	02	100	00	0.0
Lymphoproliferative Disorders	02	01	50	01	50
Myelodysplastic Syndrome	01	00	0.0	01	100

**Table 3:** Distribution of Hematological Disorders according to age

Disorders	0-10	11-20	21-30	31-40	41-50	51-60	Total
Megaloblastic	01	13	14	07	07	04	46
AML	00	00	01	00	00	01	02
ALL	02	00	00	01	00	01	04
LPD	00	00	00	00	00	02	02
KDS	00	01	00	00	00	00	01
ITP	03	05	01	00	00	00	09
<b>Total</b>	<b>06</b>	<b>19</b>	<b>16</b>	<b>08</b>	<b>07</b>	<b>08</b>	<b>64</b>

**Table 4:** Various Components Seen In H&E Stain Blocks And Romanowsky Stained Bone Marrow Aspirate Smears

Disorders	Hypercellular		Normocellular		Hypoplastic	
	H&E Stains	Romanowsky stains	H&E stains	Romanowsky stains	H&E stains	Romanowsky stains
Blasts	-	06	-	74	-	-
Promyelocytes	-	-	-	80	-	-
Myelocytes	-	25	-	55	-	-
Metamyelocytes	-	35	-	45	-	-
Megakaryocytes	09	04	71	73	-	03
Eosinophilic precursors	78	70	02	10	-	-

## RESULTS

By Romanowsky group of stains and Hematoxylin and Eosin stained cellblocks, diagnosis of various hematological disorders was made. Out of 80 cases studied there were 60 cases (75%) of anaemia, 9 (11.2%) platelet disorders, 6 (7.5%) Acute Leukaemias, 2 (2.5%) Lymph proliferative disorders, 1 (1.2%) MDS, 1(1.2%) Leishmaniasis and 1 of (1.2%) hypersplenism. Maximum cases 40 were in age group of 11-50 years of age in megaloblastic anaemia. 32 (69.5%) cases in megaloblastic anaemia showing male preponderance.

The cellularities analyzed on bone marrow aspiration showed maximum 84.3% were hypercellular marrow. Cell blocks help in better appreciation of hypocellular / acellular marrow. Megakaryocytic and Eosinophilic precursors are better identifiable in H and E stained block.

## DISCUSSION

The purpose of this work is to compare efficacy of bone marrow aspiration smears and to assess the role of paraffin embedded cell block of bone marrow aspirates in bone marrow examination. The cases diagnosed as megaloblastic anemia showed that male female ratio was 2:1 and the commonest age group was 21 to 30 years. This is in variance with studies of Kuperan and Rajashekhar Swamy<sup>6</sup> where the commonest age group was 31 – 40 years with male female ratio of 1.3:1.

Pizzuto J Ambriz<sup>7</sup> found in their study that between 40 – 45 years Male to female ratio was 1:2.3. In the current study all the patients of Idiopathic Thrombocytopenic Purpura were in age group of 10 – 30 years and Male to female ration of 2:1 showing male preponderance

Jaishree Sharma and Shobha Mohindroo<sup>8</sup> found that acute leukemia showed male preponderance 20 (55.5%) which is in consonance with the current study with male preponderance 04 (66.66%)

Sitalakshmi *et al*<sup>9</sup> found that acute leukaemias were diagnostic on aspiration alone; trephine biopsy provided additional useful information. In current study we found that acute leukaemias were diagnostic on aspiration alone, clot section should be used as an adjunction to bone marrow aspiration to increase the diagnostic yield. We found that 69.5% cases of megaloblastic anemia in the bone marrow were diagnosed by Bone marrow aspiration alone.<sup>12</sup>

Rozman C *et al*<sup>10</sup> studied 329 patients, 208 (63.22%) cases were males and 121(36.78%) females. The mean age was 64.7 years. Bone marrow was infiltrated by 50% or more lymphocytes. In current study of one male patient aged 60 years peripheral smear showed absolute lymphocytosis. Bone marrow was infiltrated by 80% lymphocytes.

We felt that Bone marrow aspiration smears and paraffin embedded clot sections are still very useful tools in diagnosis of unsuspected non haematological malignancies, where patients present with different clinical features. We are in close agreement with the study by Ozkalemkas *et al*.<sup>13</sup> who studied 19 cases of unsuspected non hematologic malignancy in BMA and BMB and found it useful as a short cut in evaluation of such cases.

A prospective study was conducted by Manas Mahury, Tricot G and Kini *et al*<sup>12</sup> over 144 patients coming in the department of pathology, Kasturba Medical College, Mangalore. The aspirates were studied to assess the

number and morphology of the megakaryocytes in non MDS related thrombocytopenia and evaluate their significance when compared to changes in MDS. The bone marrow aspiration smears were stained with leishman stain and examined under light microscope. Their results shows morphological changes of megakaryocytes in bone marrow aspirates can improve the diagnostic accuracy for a wide range of hematological disorders thereby enabling proper therapeutic interventions.

One of the study concluded that trephine sections provide useful information about pattern of involvement and fibrosis which was not forth coming from aspiration smears and trephine imprints in chronic leukemias.<sup>14</sup>

Dee JW<sup>15</sup>, Valdivieso M, Drewinko B studied the comparison of the efficacies of closed trephine needle biopsy, aspirated paraffin embedded clot section, and smear preparation in the diagnosis of bone marrow involvement by lymphoma. the study analyzed the morphologic patterns of bone marrow involvement. trephine biopsy was superior to aspiration in most instances. In some cases however, paraffin embedded clot sections and smears was diagnostic, whereas the biopsy section appeared negative.

## CONCLUSION

Hematoxylin and Eosin stained cell blocks are particularly helpful in hypo cellular marrow aspirate. Megakaryocytes and eosinophilic precursors can be better appreciated in cell block sections. Cell blocks can be stored and used for specialized procedure like immunohistochemistry. The study concludes that preparations of aspirate and clot sections are easy, rapid and complementary to each other in majority of the lesions. The advantage of both the procedures done together enabled us to study the cytomorphology of the cells along with the pattern of distribution of the cells depending on the cases, hence help in making the diagnosis more accurately.

## REFERENCES

1. Riley RS, Hogan TF, Pavot DR, Forysthe R, Massey D, Smith E, Wright L, Jr, Ben-Ezra JM. A pathologist's perspective on bone marrow aspiration and biopsy; Performing a bone marrow examination. *J Clin Lab Anal.* 2004; 18:70–79. doi: 10.1002/jcla.2008.

2. Islam A. Bone marrow aspiration prior to bone marrow core biopsy using the same bone marrow biopsy needle. A good or bad practice. *J Clin Pathol.* 2007;60:212–215. doi: 10.1136/jcp.2006.037341.
3. Hyun BH, Gulati GL, Ashton JK. Bone marrow examination : techniques and interpretation. *Hematol Oncol Clin North Amer* 1988;2:513-523.
4. Riley RS, Hogan TF, Pavot DR, et al. A pathologist perspective on bone marrow aspiration and biopsy: Performing a bone marrow examination. *J Clin Lab Anal.* 2004;18 (2) :70-90.
5. Brain BJ. Bone Marrow Evaluation. *J Clin Pathol* 2001; 54: 737-742.
6. Kuperan P, Rajshekhar swamy. Megaloblastic anaemia- A review from university hospital Kuala Lumpur. *Ann Acad Med Singapore.* 1998;17(2):261-266.
7. Pizzuto J, Ambriz R. Therapeutic experience on 934 adults with idiopathic thrombocytopenic purpura: Multicentric trial co-operative Latin American Group on Hemostasis and thrombosis. *Blood* 1984;64:1179-1183.
8. Jaishree Sharma, Shobha Mohindroo. FAB classification of Leukaemia: A cytochemical study. *Indian J Pathol Microbiol* 2004;47(3):336-339.
9. Sitalaxmi S, Anuradha Srikrishna, Shantal Devi, Prema Damodar, Betty Alexander. The Diagnostic utility of bone marrow trephine biopsies. *Indian J Pathol Microbiol* 2005;48(2):173-176.
10. Rozman C, Monserrat E, Rodriguez-Fernandez JM, Ayats R, Vallespi T, Parody R et al. Bone marrow Histologic Pattern- The Best Single prognostic parameters in CLL: A multivariate survival analysis of 329 cases. *Blood* 1984; 64(3) :642-648.
11. Alteration in cellularity of bone marrow. Bone marrow cellularity- general. *Ann Clin Lab Sci* 2004;34:307.
12. Pasquale D, Chikkappa G. Comparative evaluation of bone marrow aspirate particle smears, biopsy imprints and biopsy sections. *Am J Hematol.* 1986;22:381–389. doi: 10.1002/ajh.2830220407.
13. Ozkalemkas F, Ali R, Ozkocaman V, Oselik T, Ozanu OH, et al. The bone marrow aspirate and biopsy in the diagnosis of unsuspected non hematologic malignancy. A clinical study of 19 cases. *BMC Cancer.* 2005;1(5):144. doi: 10.1186/1471-2407-5-144.
14. Varma N, Dash S, Sarode R and Marwaha N. Relative efficacy of bone marrow trephine biopsy sections as compared to trephine imprints and aspiration smears in routine hematological practice. *Indian J Pathol Microbiol* 1993; 36(3):215-226.
15. Dee JW, Valdivieso M, Drewinko B. Comparison of the efficacies of closed trephine needle biopsy, aspirated paraffin embedded clot section, and smear preparation in the diagnosis of bone marrow involvement by lymphoma. *Am J Clin Pathol* 1976;65:183-94.

Source of Support: None Declared  
Conflict of Interest: None Declared