



THE ROLE OF BONE MARROW ASPIRATION AND TREPHINE BIOPSY IN BONE MARROW INVOLVING DISORDER

Haematology

Dr. Rashmi Sharma

Professor, Department of Pathology, JLN Medical College, Ajmer (Rajasthan)

Dr. Geeta Pachori

Senior Professor, Department of Pathology, JLN Medical College, Ajmer (Rajasthan)

Dr. Akhilesh Bharadwaj

Resident Medical Officer, Mayo College, Ajmer (Rajasthan)

Dr. Sarla Mahawar

Senior Professor, Department of Biochemistry, JLN Medical College, Ajmer (Rajasthan)

Dr. Dipen Tanwani*

Post Graduate Resident, Department of Pathology, JLN Medical College, Ajmer (Rajasthan) *Corresponding Author

ABSTRACT

Introduction : Bone marrow examination is an important diagnostic tool to evaluate various bone marrow disorders including both neoplastic and non neoplastic. Bone marrow examination involves use of bone marrow aspiration and trephine biopsy. **Objective :** To study various bone marrow involving disorders and comparing the findings of bone marrow aspiration with biopsy so that relevance and complementary role of both the procedures can be evaluated. **Material and Methods :** A study was conducted in Department of Pathology, JLN Medical College, Ajmer from January 2021 to December 2023. Bone marrow aspiration was performed on 410 cases including a comparative evaluation with trephine biopsy in 49 cases. Morphological examination of bone marrow was done in correlation with other clinical and haematological findings and importance of bone marrow examination was established. **Results :** Anaemia was seen in 250 (74.63%) cases out of 410 aspirations received with dimorphic anaemia being most common diagnosis seen in 118 (35.22%) cases followed by megaloblastic anaemia seen in 78 (23.28%) cases. 49 (14.63%) cases of leukaemia was diagnosed out of which chronic myelocytic leukaemia was most prevalent with 19 (5.67%) cases. Rest of the cases included pancytopenia, immune thrombocytopenia, plasma cell dyscrasia, polycythemia, etc. In 49 cases trephine biopsy was available including 13 (34.22%) cases of dimorphic anaemia and 6 (15.79%) cases of various leukaemia. In most of the cases bone marrow aspiration and trephine biopsy were complimentary to each other. **Discussion/Conclusions:** Bone marrow aspiration and biopsy are complimentary to each other in diagnosing bone marrow involving disorders. If done together these procedures enable us to achieve a definitive diagnosis, which in turn has a tremendous impact on the management of patients.

KEYWORDS

Bone marrow aspirate, Bone marrow biopsy, Marrow diseases

Introduction

Bone marrow examination is an important diagnostic tool to evaluate various bone marrow pathologies including both neoplastic and non-neoplastic haematological disorders. The bone marrow evaluation may either confirm clinically suspected disorder or may provide the previously unsuspected diagnosis.^{1,2}

Bone marrow examination may be performed by two methods: aspiration and trephine biopsy. Aspiration provides information about the numerical and cytological features of marrow cells and trephine biopsies provide information of spatial relationship between cells and overall bone marrow structure.

Bone marrow aspiration and biopsy are indispensable and diagnostically interdependent procedures. When both the procedure is performed simultaneously, they complement each other to aid in diagnosis, improving the sensitivity and specificity.^{3,4} This study was conducted in our institute to see the advantages and disadvantages of the procedure and to evaluate the complementary role of both the procedure when done simultaneously.

Material and Methods

Present study was conducted in Department of Pathology, Jawahar Lal Nehru Medical college, Ajmer (Raj) from January 2021 to December 2023. Patients suspected of having their bone marrow involvement by any neoplastic and non neoplastic disorders were included in the study. The relevant history and clinical examination was recorded and informed consent was taken. Clinical parameters like complete haematological count, coagulation profile, peripheral blood smear, reticulocyte count, etc. were also assessed prior to bone marrow examination. Posterior iliac crest was the preferred site for bone marrow examination.

Bone marrow aspiration alone was performed by Salah's needle. Smears prepared were stained with leishman stain. Bone marrow aspiration and biopsy simultaneously were taken by Jamshidi's biopsy

needle in 49 patients. Specimen were fixed in 10% formalin, decalcified in 10% formic acid-5% formaldehyde and processed with paraffin wax embedding. Sections were stained with hematoxylin and eosin stain. Other special stain such as PAS, reticulin were done wherever needed. Whenever a bone marrow biopsy was taken, an imprint smear was made simultaneously to get the correct morphology of cell in the sampled area of bone marrow. Bone marrow aspiration and biopsy findings were analysed in context of clinical findings, other laboratory investigations and diagnosis reached.

Results

In present study 410 patients were subjected to bone marrow aspiration out of which 49 cases had also done bone marrow biopsy simultaneously. Among the study subjects 211 were male and 199 were females with male female ratio of 1.06 :1. The age range from Maximum patients were from age group of 10-19 years. Table (1)

Table 1: Age Distribution of the Patients

Age Group (years)	Male	Female	Total
00-09	26	14	40
10-19	43	44	87
20-29	25	26	51
30-39	32	32	64
40-49	22	26	48
50-59	13	19	32
60-69	26	27	53
70-79	18	8	26
80-89	5	3	8
90-99	1	0	1
Total	211	199	410

Out of 410 bone marrow aspiration sample received 75 were inadequate for opinion. Out of the remaining 335 cases anaemia was seen in 250 (74.63%) cases with Dimorphic anaemia being the most

common diagnosis seen in 118 (35.22%) cases followed by megaloblastic anaemia in 78 (23.28%) cases. Leukaemia was diagnosed in 51 (15.22%) cases out of which chronic myelocytic leukaemia was most prevalent with 19 (5.67%) cases followed by acute lymphoblastic leukaemia seen in 13 (3.87%) cases. Other diagnosis is illustrated in Table (2).

Table 2: Distribution of Cases in Bone Marrow Aspiration

DIAGNOSIS	NUMBER OF CASES	PERCENTAGE OF CASES
Dimorphic Anaemia	118	35.22
Megaloblastic Anaemia	78	23.28
Normocytic Normochromic Anaemia	29	8.66
Microcytic Hypochromic Anaemia	21	6.27
Hemolytic Anaemia	3	0.90
Aplastic Anaemia	1	0.30
Pancytopenia with hypercellular marrow	13	3.87
Pancytopenia with hypocellular marrow	2	0.60
Immune Thrombocytopenia	3	0.90
Acute Lymphoblastic Leukaemia	13	3.87
Chronic Lymphocytic Leukaemia	7	2.09
Acute Myeloblastic Leukaemia	12	3.58
Chronic Myelocytic Leukaemia	19	5.67
Plasma Cell Dyscrasis	3	0.90
Polycythemia	2	0.60
Metastasis	1	0.30
Normal Marrow	10	2.99
Total	335	100.00

49 cases of trephine biopsy were studied out of which 11 were inadequate for opinion. Of the remaining 38 cases included 13 cases (34.22%) of dimorphic anaemia and 6 (15.79%) cases of leukaemia. Others are depicted in Table (3).

Table 3: Distribution of Cases in Bone Marrow Trephine Biopsy

DIAGNOSIS	NUMBER OF CASES	PERCENTAGE OF CASES
Dimorphic Anaemia	13	34.22
Megaloblastic Anaemia	5	13.17
Microcytic Anaemia	2	5.26
Normocytic Anaemia	1	2.63
Pancytopenia with hypocellular marrow	7	18.42
Pancytopenia with hypercellular marrow	2	5.26
Lymphoproliferative Disorder	1	2.63
Acute Lymphoblastic Leukaemia	2	5.26
Acute Myeloblastic Leukaemia	2	5.26
Chronic Lymphocytic Leukaemia	2	5.26
Fungus	1	2.63
Total	38	100.00

Trephine biopsy (38 adequate cases) when compared with aspiration findings showed overall accuracy of 94.74% while sensitivity was 96.88% and specificity was 83.33%. Table (4)

Table 4: Sensitivity and Specificity

Sl. No.	Bio-psy	Cases	Aspiration Benign	Aspiration Malignant	False Negative	False Positive	Sensitivity (%)	Specificity (%)	Overall Accuracy (%)
1	Benign	32	31	01	0/32	1/32	96.88	83.33	94.74
2	Malignancy	06	01	05	1/6	0/6			

Discussion

Bone marrow is one of the most widely distributed organs of the body.⁵ 410 cases of aspiration was studied along with 49 cases of trephine biopsy from January 2021 to December 2023 at Jawahar Lal Nehru Medical College, Ajmer (Rajasthan). Male to female ratio in this study was 1.06:1 which was comparable to Shastry et al.⁵ and Vahini et al.⁶ with 1.04:1 and 1.1:1 respectively.

The study had dimorphic anaemia as most common diagnosis seen in 118 (35.22%) cases followed by megaloblastic anaemia in 78 (23.28%) cases similarly Thiagarajan et al.⁷ had dimorphic anaemia in 48 (31.37%) and megaloblastic anaemia in 31 (20.26%) cases also Birare et al.⁸ had dimorphic anemia in 46 (33.33%) cases and megaloblastic anemia in 36 (26.09%) cases. Comparatively Mehnaz Choudhary et al.⁹ had megaloblastic anemia in 60 (17.14%) cases and dual deficiency anemia in 45 (12.85%) cases and Patel et al.¹⁰ also had megaloblastic anemia in 30 (20%) cases and dimorphic anemia was in 17 (5.66%) cases.

Most common leukaemia in this study was chronic myelocytic leukaemia 19 (5.67%) cases followed by acute lymphoblastic leukaemia in 13 (3.87%) cases similarly Patel et al.¹⁰ had chronic myelocytic leukemic in 8 (5.33%) cases followed by 2 (1.33%) cases each of chronic lymphocytic leukemic and acute myeloblastic leukemic. Comparatively Rathod et al.¹¹ had acute myeloid leukaemia in 35 (6.11%) cases and chronic myelocytic leukaemia in 21 (3.67%) cases and Chandra et al.¹² had 54 (9.56%) cases of acute myeloid leukemia and 29 (5.13%) cases of chronic myeloid leukemia.

In our study Hypercellular Pancytopenia was seen in 13 (3.87%) cases and Hypocellular Pancytopenia was in 2(0.60%) cases similarly Goyal et al.¹³ had hypercellular pancytopenia in 44 (9.80%) cases and hypocellular pancytopenia in 13 (2.89%) cases and Lakhey et al.¹⁴ had hypocellular pancytopenia in 16 (29.60%) cases and hypercellular pancytopenia in 19 (35.18%) cases.

In this study 9 (2.70%) cases were of rare disorders including immune thrombocytopenia, plasma cell dyscrasis, polycythemia and metastasis similarly Khatik et al.¹⁵ had these cases in a total of 8 (5.94%) cases including immune thrombocytopenia, multiple myeloma and metastasis.

There is a good positive correlation in findings of bone marrow aspiration and bone marrow trephine biopsy in 36 cases and in 1 case each of trephine biopsy was diagnosed as benign and malignant in contrast to the corresponding aspiration findings. In aspiration the cells which are usually identified as megaloblast in their corresponding trephine biopsy showed multiple blasts which could have been mistaken for leukemic¹⁶ and vice versa.

The overall accuracy of the present study was 94.74% similarly Khatik et al.¹⁵ showed an overall accuracy of 89.33%. Figure 1- 4 shows the bone marrow aspiration and trephine biopsy findings of most common conditions in the study.

Conclusion

Bone marrow aspiration and trephine biopsy are very important diagnostic and useful tool for the study of various bone marrow disorders. Aspiration gives morphology of cells whereas trephine biopsy gives a good picture regarding distribution of cells, grading of fibrosis, pattern of infiltration with lymphoma and granulomatous lesions. Both these procedures should be done concurrently as they play important role in providing findings essential for making final diagnosis.

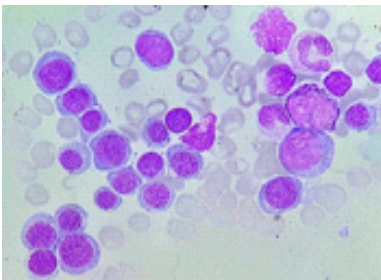


Figure 1 - Aspiration showing Megaloblastic Anaemia in Leishman Stain (100X magnification)

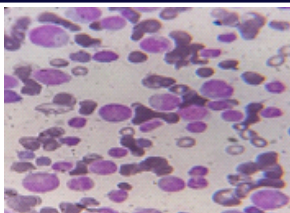


Figure 2 - Aspiration showing Chronic Myelocytic Leukaemia in Leishman Stain (100X magnification)

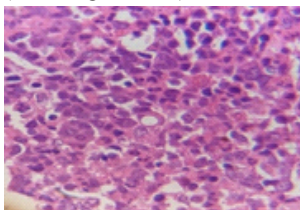


Figure 3 - Trephine biopsy showing Combined Deficiency Anaemia in H&E Stain (100X magnification)

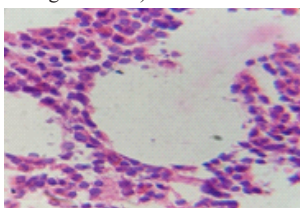


Figure 4 - Trephine biopsy showing Chronic Lymphocytic Leukaemia in H&E Stain (100X magnification)

REFERENCES

- Chandra S, Chandra H, Saini S. Bone marrow metastasis by solid tumour – probable hematological indicators and comparison of bone marrow aspirate touch imprint and trephine biopsy. *Hematology* 2010; 15:368-72.
- Nanda A, Basu S, Marwaha N. Bone marrow trephine biopsy as an adjunct to bone marrow aspiration. *J Assoc Physician India* 2002; 50:893-5.
- Bates I, Burthem J. Bone marrow biopsy. In: Bain BJ, Bates I, Laffan MA, Lewis SM, editors. *Dacie and Lewis practical Hematology*. 11th edition 2012. P 123-37.
- Atla BL, Anem V, Dasari A. Prospective study of bone marrow in haematological disorders. *Int J Res Med Sci* 2015; 3:1917-21.
- Shastry S, Kolte S. Spectrum of hematological disorders observed in one hundred and ten consecutive bone marrow aspirations and biopsies. *Medical Journal of Dr. D.Y. Patil University* (2012) 5 (2):118-121.
- Vahini G, Renuka I.V. Interpretation of Bone Marrow Trephine Biopsies in Hematological Disorders with Special Emphasis on Morphological Patterns in Lymphomas. *Indian Journal of Pathology and Oncology* 2015; 2(4):240-250.
- Thiyagarajan P, Suresh TN, Anjanappa R et al. Bone-marrow spectrum in a tertiary care hospital: Clinical indications, peripheral smear correlation and diagnostic value. *Medical Journal of Dr. D.Y. Patil University* 2015 8(4):490-4.
- Birare SD, Jain N, Abhang RS. A study of hematological indices and bone marrow morphology in patients presenting with anemia. *Indian Journal of Pathology and Oncology* (2019) 6(2):266-274.
- Mehnaz Choudhary et al. Pattern of Haematological Disorders on Bone Marrow Aspiration in a Tertiary Care Centre in North India. *IJSR* 2019 8(4); 1367-69.
- Patel J, Popat VC. Spectrum of haematological disorders observed in consecutive 150 cases on bone marrow examination. *Int J Res Med*. 2014; 3(2):139-141.
- Rathod KB, Wahane N, Nakate L, Kulkarni D. Study of haematological disorders detected by bone marrow examination at tertiary care hospital. *J Diagn Pathol Oncol* 2019; 4(3):180-184.
- Chandra S, Chandra H. Comparison of bone marrow aspirate cytology, touch imprint cytology and trephine biopsy for bone marrow evaluation. *Hematology Reports* 2011; 3 (22): 65-68.
- Surbhi Goyal, Usha Rani Singh and Usha Rusia. Comparative Evaluation of Bone Marrow Aspirate with Trephine Biopsy in Hematological Disorders and Determination of Optimum Trephine Length in Lymphoma Infiltration. *Mediterr J Hematol Infect Dis* 2014; 6.
- Lakhey A, Talwar OP, Singh VK. Clinico-hematological study of pancytopenia. *Journal of Pathology of Nepal* (2012) Vol. 2, 207-210.
- Khatik DK, Mishra D, Choudhary M. A Relevance Study of Bone Marrow Aspiration and Bone Marrow Biopsy in Hematological and Non Hematological Disorders. *JMSCR* (2017) 5(04); p 20900-20908.
- Bain BJ, Clark DM, Lampert IA & Wilkins BS (2001). *Bone Marrow pathology* 3rd edition. Blackwell Science, Oxford; p 372-373.