

COMPARISON OF DIAGNOSTIC ACCURACY OF BONE MARROW ASPIRATE AND TREPHINE BIOPSY PROCEDURE

Tooba Fateen,¹ Rajia Liaqat,² Asima Naz³

Abstract

Objective: The objective of this study was to compare the diagnostic accuracy of bone marrow aspirate and trephine biopsy procedure.

Methodology: This cross sectional study was carried out for twelve months in Department of Haematology and Transfusion Medicine, of the Nawaz Sharif Social Security Hospital, Multan Road Lahore. Total 100 subjects with haematological indication for the bone marrow aspirate and trephine biopsy procedure for all ages were included in the study. According to inclusion criteria selected patients were subjected to bone marrow biopsy procedure in bone marrow biopsy room of the Haematology Department of the same hospital. Bone marrow aspirates and trephine biopsies were taken from posterior iliac crest under fully aseptic technique and local anesthesia. Bone marrow aspi-

rate slides were made and after fixation in ethanol, they were stained with Giemsa stain and observed under microscope for results. The trephine biopsy sections were examined microscopically and results were recorded according to findings.

Results: The mean age of patients was 40.46 ± 19.20 years and age range 1 year to 84 years. Keeping Bone Marrow Trephine Biopsy as gold standard, the sensitivity of Bone Marrow Aspirate was 67.09% and specificity was 38.1%. While, the positive predictive value was 80.3% and negative predictive value was 23.53%. The overall diagnostic accuracy of Bone Marrow Aspirate, keeping Trephine Biopsy as gold standard was 61%.

Conclusion: Bone Marrow Trephine Biopsy has higher diagnostic accuracy and is more reliable and sensitive procedure compared to Aspirate. Therefore it should be a mandatory procedure along with bone marrow aspirate for patients seeking diagnosis through bone marrow examination.

Keywords: Bone Marrow Aspirate, Trephine Biopsy Procedure, Sensitivity, Specificity.

Fateen T.¹
Assistant Professor of Pathology
University of Lahore

Liaqat R.²
Assistant Professor of Pathology
University of Lahore

Naz A.³
Assistant Professor of Pathology
University of Lahore

Introduction

Bone marrow is an inevitably important examination tool for evaluation of various diseases and it may also play a role in establishing the final diagnosis of a particular disorder. This examination procedure is opted for investigating a number of hematological and non-hem-

atological disorders. Not only can a suspected disease be confirmed using bone marrow analysis, but it may also provide diagnosis for previously unsuspected diseases.¹ The three essentially involved procedures for conducting bone marrow examination are Bone Marrow Aspirate (BMAs), touch imprints examination and Bone Marrow Trepine Biopsy (BMTB).¹

However, most commonly used methods are the Bone Marrow Aspirate (BMAs) and Bone Marrow Trepine Biopsy (BMTB).² All procedures provide important findings by specifying involvement of bone marrow by atypical cells, plasma cells, as well as other morphological characteristics. This could be very critical for taking diagnostic decisions and for optimum clinical management of patients.³

Although number of comparative studies has been conducted comparing the diagnostic accuracies and clinical significance of Bone Marrow Aspirate (BMAs) and Bone Marrow Trepine Biopsy (BMTB), the results are varying. The reasons for which could be comparisons limited to particular disorders in different conditions and for different outcomes. Studies by G.A. Hamid and Burke JS have favored Bone Marrow Trepine Biopsy (BMTB) in its reliability and authenticity compared to Bone Marrow Aspirate (BMAs) and is considered as a gold standard over all other procedures of bone marrow analysis.^{2,4} Whereas, some studies favor other procedures over biopsy.⁵ One study considered the combined evaluation of both Bone Marrow Aspirate (BMAs) and Bone Marrow Trepine Biopsy.³ We, therefore, aimed to compare the diagnostic accuracy of bone marrow aspirate and trephine biopsy procedure.

Subjects and Methods

This cross sectional study was carried out for twelve months in Department of Haematology and Transfusion Medicine, of the Nawaz Sharif Social Security Hospital, Multan Road Lahore. Total 100 subjects with haematological indication for the bone marrow aspirate and trephine biopsy procedure for all ages were included in the study. Patients having no indication for the procedure and patients who were on some kind of treatment for any haematological disorder were excluded. Demographic data of the patients including name, age, gender etc was noted after taking informed consent from the patients or from parents / guardian of patients in case of paediatric patients. According to inclusion criteria selected patients were subjected to

bone marrow biopsy procedure in bone marrow biopsy room of the Haematology Department of the same hospital. Bone marrow aspirates and trephine biopsies were taken from posterior iliac crest under fully aseptic technique and local anesthesia. Bone marrow aspirate slides were made and after fixation in ethanol, they were stained with Giemsa stain and observed under microscope for results. Trepine biopsies were fixed in formalin for 24 hrs, decalcified in 10% Nitric acid, processed in histopathology section and stained with haematoxylin – eosin. The trephine biopsy sections were examined microscopically and results were recorded according to findings.

Results

The mean age of patients was 40.46 ± 19.20 years and age range was 1 – 84 years. Presenting complaints like fever, weakness and pains were observed in 30%, 33% and 16% respectively. Reported signs were Pallor in 20%, lymphadenopathy in 10%, hepatosplenomegaly in 2%, malignancy in 23% and bleeding petechie in 13% of the patients. The complete blood count (CBC) readings showed that majority of patients (48%) had pancytopenia, whereas 11% were normal, 9% had Leucocytosis and Thrombocytosis, 13% had anemia, 4% had only leucocytosis, 10% had thrombocytopenia, 4% had bicytopenia and 1% had thrombocytopenia and anemia.

Table 1: Comparisons and Diagnostic Accuracy of Bone Marrow Aspirate Taking Bone Marrow Trepine as Gold Standard.

		Bone Marrow Trepine		Total
		Positive	Negative	
Bone Marrow Aspirate	Positive	53	13	66
	Negative	26	8	34
Total		79	21	100

Sensitivity	67.09% (56.15, 76.45)
Specificity	38.1% (20.75, 59.12)
Positive Predictive Value	80.3% (69.16, 88.11)
Negative Predictive Value	23.53% (12.44, 40)
Diagnostic Accuracy	61% (51.2, 69.98)

Table 2: Comparison of Diagnosis and Bone Marrow Aspirate.

Diagnosis	BM Aspirate		Total
	Positive	Negative	
Acute Leukemia	15	3	18
	22.7%	8.8%	18.0%
BM infiltration	1	8	9
	1.5%	23.5%	9.0%
CLL	3	0	3
	4.5%	.0%	3.0%
Hypocellular BM	0	10	10
	.0%	29.4%	10.0%
ITP	1	6	7
	1.5%	17.6%	7.0%
Megaloblastic anemia	22	0	22
	33.3%	.0%	22.0%
CML	9	0	9
	13.6%	.0%	9.0%
MDS	6	0	6
	9.1%	0%	6.0%
Others	6	0	6
	9.1%	0%	6.0%
Reactive Bone Marrow	3	0	3
	4.5%	0%	3.0%
Normal BM	0	7	7
	0%	20.6%	7.0%
Total	66	34	100
	66%	34%	100.0%

Patients underwent both Bone Marrow Aspirate and Trepine Biopsy. Bone Marrow Aspirate showed 66% positive cases compared to 79% shown by Trepine Biopsy cases. Among all patients, the diagnostic

Table 3: Comparison of final diagnosis and BM trephine.

Diagnosis	BM Trepine		Total
	Positive	Negative	
Acute Leukemia	16	2	18
	20.5%	9.1%	18.0%
BM infiltration	9	0	9
	11.5%	.0%	9.0%
CLL	3	0	3
	3.8%	.0%	3.0%
Hypocellular BM	10	0	10
	12.8%	.0%	10.0%
ITP	6	1	7
	7.7%	4.5%	7.0%
Megaloblastic anemia	18	4	22
	23.1%	18.2%	22.0%
CML	9	0	9
	11.5%	.0%	9.0%
MDS	3	3	6
	3.8%	13.6%	6.0%
Others	5	2	7
	6.32%	9.1%	7.0%
Reactive Bone Marrow	0	3	3
	0%	13.6%	3.0%
Normal BM	0	6	6
	0%	28.5%	6.0%
Total	79	21	100
	79%	21%	100%

consensus was found 53% cases as positive and 8% for negative by the two procedures. Keeping Bone Marrow Trepine Biopsy as gold standard, the sensitivity of Bone Marrow Aspirate was 67.09% and specificity was 38.1%. While, the positive predictive value was

80.3% and negative predictive value was 23.53%. The overall diagnostic accuracy of Bone Marrow Aspirate, keeping Trepine Biopsy as gold standard was 61%.

Discussion

Bone marrow examination is a valuable tool in evaluation and diagnosis of various disorders. The comparative studies of different bone marrow procedures are equally important in order to identify the most reliable tool and increase the efficiency of the procedure by choosing the best one. Also, the better option can help reduce the time, costs and diagnostic errors and improve the health outcomes of the patients. This is why we conducted this study with primary objective of comparing the diagnostic accuracy of Bone Marrow Aspirate with Bone Marrow Trepine Biopsy, keeping later one as gold standard.

Chandra S. and Chandra H. compared the efficacy of all three types of bone marrow examination i.e. are Bone Marrow Aspirate (BMAs), touch imprint cytology and Bone Marrow Trepine Biopsy (BMTB) and stated that biopsy remains to be a gold standard. The diagnostic accuracy of bone marrow aspirate was 77.5%.¹ Similarly, Hamid and Hanbala considered BMTB to be highly sensitive compared to BMA in detection of neoplastic diseases.² We too, in our study kept BMTB as gold standard.

Musolino et al, compared diagnostic accuracy of BMA and comparative role of both BMA and BMTB in detection of bone marrow in non-Hodgkin lymphomas. The agreement among the diagnosis result of two procedures was 80% which was much higher compared to 53% observed in our study. The overall sensitivity for bone marrow aspiration was 69% compared to 67.09% and specificity was 86% which was very high compared to 38.1% in our study.⁶

In our study, Bone Marrow Aspirate showed 66% positive cases compared to 79% shown by Trepine Biopsy. Donald et al. also compared the diagnostic accuracy of BMA and BMTB and found aspirate to be positive in 33% cases compared to 100% in biopsy. Their study reported much lower diagnostic accuracy for BMA compared to our study i.e. 33% vs. 61%.⁷ Many studies suggest that the effectiveness of biopsy may be better due to greater ability to detect granulomas,⁸ which otherwise are very difficult to be detected by aspirate, or even touch imprint. The possible

reason behind this difficulty in granulomas⁸ detection on aspirate may be the focal involvement.⁸ In nutshell, Trepine Biopsy has been supported well by our data similar to international studies.

Conclusion

Bone Marrow Trepine Biopsy has higher diagnostic accuracy and is more reliable and sensitive procedure compared to Aspirate. For patients seeking diagnosis through bone marrow examination bone marrow trephine biopsy should always be done along with bone marrow aspirate.

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