Original article:

Study of Bone Marrow Biopsy in Various Hematological Disorders in Western Rajasthan

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Abstract:

Background: Bone marrow is considered to be an organ with architecture and components intact in their natural spatial context. The aim of this study to compared the findings of peripheral blood film, bone marrow aspiration smears and bone marrow trephine biopsy sections.

Materials & Methods: In this prospective study patient admitted with suspected hematological disorder interrogated in detail for history and a thorough physical examination was done of each patient. Peripheral blood film examination for cell morphology was performed after staining with Giemsa stain.

Results: The mean age of males was 38.5 years and of females was 30.6 years. In this study megaloblastic anemia was the most common hematological disorder (15.65%) followed by aplastic anemia (13.9%) and iron deficiency anemia (11.3%) with nutritional anemia (11.3%). Bone marrow trephine biopsy is informative in all cases where as aspiration smear is informative in 90.9% cases. Superiority of biopsy is distributed in various hematological disorders.

Conclusion: Bone marrow trephine biopsy sections are more informative than aspiration smears alone especially in cases of myelofibrosis and aplastic anemia.

Keywords: Bone Marrow Aspiration, Trephine Biopsy, Hematological Disorders.

INTRODUCTION

Hematological disorders are quite common in population ranging from very common condition like iron deficiency anemia to relatively rare congenital disorders like Blackfan Diamond syndrome and Fanconi's anemia. Similarly the spectrum of hematological disorder is relatively different in developing than developed World.[1]

Bone marrow examination is now widely used in the investigation and follow up of many disease processes and some time it may be the only mean to diagnose a variety of hematological and non hematological disorders.[2,3]

Bone marrow is considered to be an organ with architecture and components intact in their natural spatial context. There are complex structural and hormonal interrelations between the cellular and tissue element is reflected much earlier and changes are more conspicuous in the marrow than in peripheral blood.[4]

Several sites may be used for bone marrow aspiration and bone marrow biopsy.[5] In part the site chosen reflect the normal distribution of bone marrow with age of the patient. At birth hematopoietic marrow is found in all the bones

of the body. However in adults hematopoiesis is limited to the axial skeleton and proximal portion of extremities.[6]Thus younger children may have bone marrow examination from the sternum at the second intercostals space or from either anterior or posterior iliac crest area. Biopsy from iliac spine may be technically difficult in subjects who are obese[7] and immobile and puncture of sternum may be necessary. However unless the needle is correctly inserted in the sternum there is danger of serious consequences.[8]

The bone marrow biopsy section provides better representation of the marrow. The great value of trephine biopsy is that it can provide information about the large piece of marrow, at the same time morphological feature of individual cells can be identified by making an imprint from the material obtained.[9] The major strength of a trephine biopsy is in visualization of topography of the bone marrow particularly abnormal clustering or abnormal location of cells, assessment of bone marrow stroma and visualization of bone trabeculae.

Originally limited to the instances of previously unsuccessful aspiration (dry top), bone marrow biopsy has gained popularity in the last decades an now its indications almost overlap with those for an aspiration. Bone marrow biopsy is a safe procedure.[10]

The aim of this study to compared the findings of peripheral blood film, bone marrow aspiration smears and bone marrow trephine biopsy sections.

MATERIALS & METHODS

This study was carried out in the department of pathology, Dr. S.N. Medical College, Jodhpur.In this prospective study patient admitted with suspected hematological disorder interrogated in detail for history and a thorough physical examination was done of each patient. Hematological investigations like hemoglobin estimation, total and differential leucocyte count, platelet count, reticulocyte count and ESR estimation and serum LDH level estimation done on each patient. Peripheral blood film examination for cell morphology was performed after staining with Giemsa stain.

Bone Marrow Aspiration

Bone marrow aspiration and biopsy taken from superior iliac spine under proper sterile condition with Jamshidi needle. The patient placed in lateral decubitus position. The skin at the site of biopsy shaved if found necessary and cleaned with betadine solution and drapped. The skin, subcutaneous tissue and periosteum in the area of biopsy anaesthetized with a local anaesthetic like 2-5 ml of 2% lignocaine using a 24 gauge needle. After local anaesthetic had taken effect a small cut made in the skin overlying biopsy site and the marrow aspiration needle, with aobturator in place inserted through the skin, subcutaneous tissue and bone cortex with a slight rotating motion. After the entrance of needle in to the bone marrow cavity, the needle obturator removed and needle attached to 10-20 ml syringe.

Aspiration of marrow achieved by rapid suctioning with the syringe so that 2-3 ml of bloody fluid achieved. If no marrow obtained the needle rotated and suction applied again. The marrow aspiration needle removed and pressure applied to the site with gauze until bleeding stopped. Smear were made quickly bedside to avoid clothing and remaining aspiration marrow delivered into a containing appropriate amount of (EDTA) to used later for making more smears.

Smear were thoroughly dried and fixed by immersing in a jar of methanol for 15-20 minutes. After fixing smears were stained with Giemsa stain which allow excellent morphological detail and allow differential counts to be performed.

Bone marrow smears than examined under low power for:

1. Assessment of cellularity
2. Presence of megakaryocytes.
3. Presence of any clumps of abnormal cells.

The smears were than examined under high power:

1. To find out any maturation abnormality
2. To perform differential count
3. To find out any morphological abnormality

Prussian blue staining done on the smear and iron content of the marrow assessed.

Bone Marrow Biopsy

Bone marrow biopsy specimen fixed in 10% formal saline and subjected to decalcification if needed. The biopsy then processed in routine histological processor and embedded in paraffin. This section (3-4μm) cut and subjected for Hematoxylin& Eosin staining. Reticulin stain also done when indicated.

RESULTS

Our study showed that the out of 115 patients 62 (53.9%) were male and 53 (46.08%) were female with male to female ratio being 1.7:1. The mean age of males was 38.5 years and of females was 30.6 years (table 1).

In this study megaloblastic anemia was the most common hematological disorder (15.65%) followed by aplastic anemia (13.9%) and iron deficiency anemia (11.3%) with nutritional anemia (11.3%). In hematological malignancy ALL (11.3%) was most common malignancy followed by CML (9.56%), lymphoproliferative disorder (6.08%), AML (5.2%) and multiple myeloma (5.2%). Bone marrow findings were inconclusive in 3.47% patients. There was 2.6% patients of myelodysplastic syndrome (table 2).

Bone marrow trephine biopsy is informative in all cases where as aspiration smear is informative in 90.9% cases. Superiority of biopsy is distributed in various hematological disorders (table 3).

Table 1: Age & Gender wise distribution of studied group.

Age group	Male	%	Female	%	Total	%
≤ 10 yrs	1	1.61	0	0	1	0.86
11-20 yrs	16	25.80	16	30.18	32	27.82
21-30 yrs	7	11.29	19	35.84	26	22.6
31-40 yrs	11	17.74	9	16.98	20	17.39
41-50 yrs	8	12.9	3	5.66	11	9.56
51-60 yrs	10	16.12	1	1.88	11	9.56
61 yrs&above	9	14.51	5	9.43	14	12.17
Total	62	53.91	53	46.08	115	100

Table 2: Frequency & Gender wise distribution of various hematological disorders.

Hematological disorders	Male	%	Female	%	Total	%
Iron deficiency anemia	4	30.8	9	69.2	13	11.3
Megaloblastic anemia	13	72.2	5	27.8	18	15.6
Nutrition anemia	5	38.5	8	61.5	13	11.3
Aplastic anemia	5	31.2	11	68.7	16	13.9
Hemolytic anemia	0	0	3	100	3	2.6
ALL	6	46.2	7	53.8	13	11.3
AML	4	66.7	2	33.3	6	5.2
CML	5	45.4	6	54.6	11	9.6
Inconclusive bone marrow	4	100	0	0	4	3.5
Lymphoproliferative disorder	6	85.7	1	14.3	7	6.1
Myelodysplastic syndrome	3	100	0	0	3	2.6
Myelofibrosis	1	100	0	0	1	0.9
Multiple myeloma	5	83.3	1	16.7	6	5.2
Polycythemia vera	1	100	0	0	1	0.9
Total	62	53.91	53	46.1	115	100

Table 3: Various hematological disorders diagnosed by bone marrow biopsy as compared to bone marrow aspiration.

Hematological disorders	n	B.M. Aspiration	B.M. Biopsy	%
Iron deficiency anemia	13	12	13	92.3%
Megaloblastic anemia	18	18	18	100%
Nutrition anemia	13	13	13	100%
Aplastic anemia	16	13	16	81.2%
Hemolytic anemia	3	3	3	100%
ALL	13	11	13	84.6%
AML	6	6	6	100%
CML	11	11	11	100%
Lymphoproliferative disorder	7	5	7	71.4%
Myelodysplastic syndrome	3	2	3	66.6%
Myelofibrosis	1	0	1	0%
Multiple myeloma	6	6	6	100%
Polycythemia vera	1	1	1	100%
Total	111	101	111	90.9%

DISCUSSION

Our study showed that the out of 115 patients 62 (53.9%) were male and 53 (46.08%) were female with male to female ratio being 1.7:1. The mean age of males was 38.5 years and of females was 30.6 years. This is in accordance with previous study by Franco-Garcia et al[11] and Bernal P' erezet al.[12]

In this study megaloblastic anemia was the most common hematological disorder (15.65%) followed by aplastic anemia (13.9%) and iron deficiency anemia (11.3%) with nutritional anemia (11.3%). In hematological malignancy ALL (11.3%) was most common malignancy followed by CML (9.56%), lymphoproliferative disorder (6.08%), AML (5.2%) and multiple myeloma (5.2%). Bone marrow findings were inconclusive in 3.47% patients. There was 2.6% patients of myelodysplastic syndrome.This is in accordance with previous study by Franco-Garcia et al[11], Bernal P' erezet al[12] and NadeemIkram et al.[13]

Disorders more common in females were iron deficiency anemia (69.2% v/s 30.8%), nutritional anemia (61.5% v/s 38.5%) and hemolytic anemia (100% v/s 0%). Results are concordant with MuhmmadIdriset al.[14] and ManoharPradhan et al.[15]

In this study we found that bone marrow aspiration smear alone are somewhat less informative and bone marrow trephine biopsy needed to make a confirmatory diagnosis. In our study bone marrow smear alone were able to make a diagnosis in 90.9% cases only. Similarly Nanda et al[16] also found that bone marrow aspiration smears were sufficient to make diagnosis in 88.6% cases only. In remaining 11.4% cases trephine biopsy was found to be necessary for making a diagnosis due to incomplete information provided by aspiration or its inability to give a correct diagnosis. Lukas Graf et al[17] also studied the comparative efficacy of bone marrow aspiration smear and bone marrow biopsy and found that aspiration smears alone were sufficient to make diagnosis in 80.5% cases only. Verma et al[18] also found bone marrow trephine sections more informative than aspiration smears in significant number of cases. Bone marrow aspiration smears were found sufficient to make diagnosis in cases of megaloblastic anemia, nutritional anemia, hemolytic anemia, AML, CML and multiple myeloma. Similarly Sabharwalet al[19] found that aspiration and biopsy usually complement each other with aspirated smears begin primarily useful for cytological diagnosis and biopsy sections mainly for histologic diagnosis as cellularity, fibrosis and architectural patterns.

CONCLUSION

The present study concluded that hematological disorders are quite common in population and bone marrow examination is simple and easier approach to diagnose hematological disorders. Bone marrow trephine biopsy sections are more informative than aspiration smears alone especially in cases of myelofibrosis and aplastic anemia.

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