

Original Article

## Diagnostic Outcome of Bone Marrow Aspiration– An Experience from Tertiary Care Hospital

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### Abstract

**Background:** Bone marrow examination is a useful tool not only in determining the cause of disease but also helpful in establishing definitive diagnosis in most of the cases. It is relatively safe procedure which can be performed on outpatient basis.

**Objectives:** To study the spectrum of lesions on bone marrow aspiration.

**Methods:** The study was conducted in the department of hematopathology in collaboration with department of clinical hematology, Sher-I –Kashmir Institute of medical sciences (SKIMS), Soura, Srinagar. The study was conducted over a period of 4 years from Jan 2010- Dec 2014. It was a 3 years retrospective and 1 year prospective study. Retrospective data was collected from record section of department of hematopathology. For prospective cases patients were enrolled for the procedure after screening from clinical departments.

**Results:** In present study 5287cases of bone marrow aspirations were done over a period of 4 years. Malignant cases (33.55%) outnumbered benign cases (26.78%). Nutritional anemia was the commonest lesion among benign cases. Acute leukemia's was commonest lesion among malignant cases.

**Conclusion:** Bone marrow examination is a valuable test in diagnosis hematological disorders and to some extent in nonhematological disorders.

**Keywords:** Bone marrow, Spectrum, Aspiration.

### Introduction

The bone marrow evaluation may either confirm clinically suspected disease or may provide the previously unsuspected diagnosis.<sup>1,2</sup> Bone marrow aspiration is useful in appreciating individual cell morphology. Whereas biopsy is useful in bone

marrow architectural pattern and distribution. Bone marrow biopsy (BMB) is more sensitive in picking up focal lesions, assessing marrow cellularity and grading fibrosis. Marrow reserve is better appreciated on BMB. Bone marrow aspiration (BMA) is usually sufficient individually

to diagnose nutritional anemias, Acute leukemia's, myelodysplasia, myeloma and Parasitic infestations. Trepine biopsy provides important diagnostic information in patients with granulomatous disease, myelofibrosis, bone marrow secondaries, lymphoma infiltration, storage disorders, Aplastic anemia and Myeloproliferative neoplasms.

### Material and Methods

The study was conducted in the department of hematopathology in collaboration with department of clinical hematology, Sher-I –Kashmir Institute of medical sciences (SKIMS), Soura, Srinagar. The study was conducted over a period of 4 years from Jan 2010- Dec 2014. It was a 3 years retrospective and 1 year prospective study. Retrospective data was collected from record section of department of hematopathology. For prospective cases patients were enrolled for the procedure after screening from clinical departments. Most of the cases were from clinical hematology department. Written informed consent was taken before the procedure. The procedure was done under local anesthesia (Inj. 2% xylocaine). PSIS was the most common site used for the procedure followed by ASIS and sternum. For aspiration we used Salah 16 G needle Aspirate slides were stained with leishman stain. Perls stain for iron stores was done in all cases. In all leukemia cases we performed myeloperoxidase, sudan black B and PAS staining.

### Results

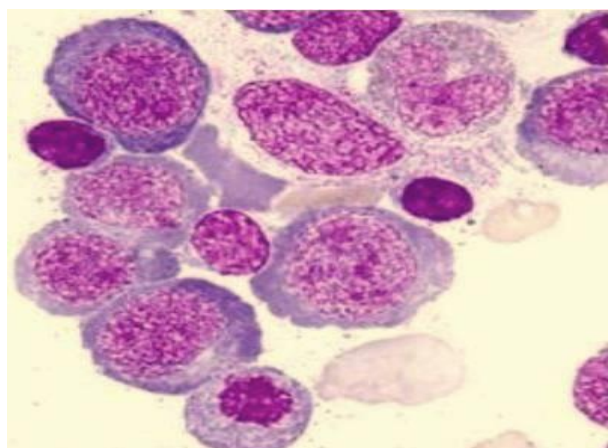
In present study 5287 cases of bone marrow aspirations were done over a period of 4 years. The age ranged from 3 months to 90 years with median age of 35 years. Males outnumbered females with M:F of 1.6:1. Among the total cases evaluated 33.55% were malignant and 26.78% were benign cases. 12.63 % of cases were known cases of acute leukemias on treatment to document remission. Among these 12.63% of cases, 85.32% of cases were in remission. 18.98% of cases had no specific pathology and 8.03% of cases were inadequate to make opinion. Among benign cases dual deficiency anemia was the most common finding (45.19%) followed by megaloblastic anemia (28.24%) (Fig-1). 3 cases of leishmaniasis (Fig-3) and 5 cases of malarial parasite infestation (Fig-2) were also noted. We also diagnosed a case of congenital dyserythropoietic anemia on bone marrow aspirate. Table 1 shows pattern of benign lesions on bone marrow aspiration. Among malignant cases acute myeloid leukemia (Fig-5) was the most common lesion (29.36%) cases followed by acute lymphoblastic leukemia (23.11%) and multiple myeloma (18.32%) (Fig-7). Table .2 shows pattern of malignant lesions on bone marrow aspiration. The yearly distribution of malignant cases over a period of 4 years showed increasing trend with 308 cases of malignant lesions registered in 2010 and 417 cases registered in 2014.

**Table 1:** Pattern of benign lesions on bone marrow aspiration

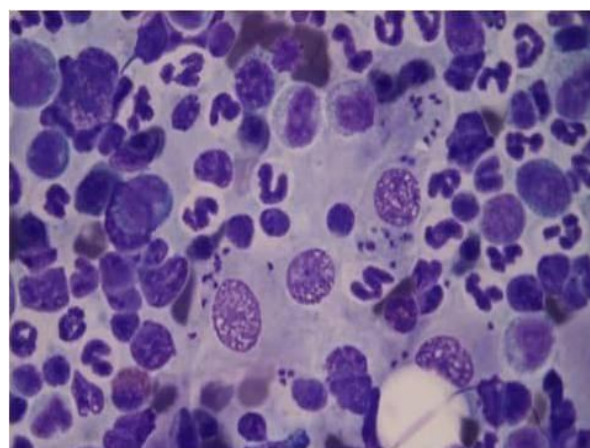
Diagnosis	No of cases	Percentage of cases among benign lesions
Dual deficiency anemia	640	45.19%
Megaloblastic anemia	400	28.24%
Aplastic anemia	75	5.29%
ITP	73	5.15%
Hypersplenism	65	4.59%
Secondary hemophagocytosis	55	3.88%
Iron deficiency anemia	40	2.82%
Anemia of chronic disease	38	2.68%
Post viral myelosuppression	10	0.70%
Malarial parasite	05	0.35%
Primary HLH(FIG-4)	05	0.35%
Pure red cell aplasia	05	0.35%
Leishmania	03	0.21%
CDA	01	0.07%
Congenital sideroblastic anemia	01	0.07%
Total	1416	100%

**Table 2:** Pattern of Malignant lesions on bone marrow aspiration

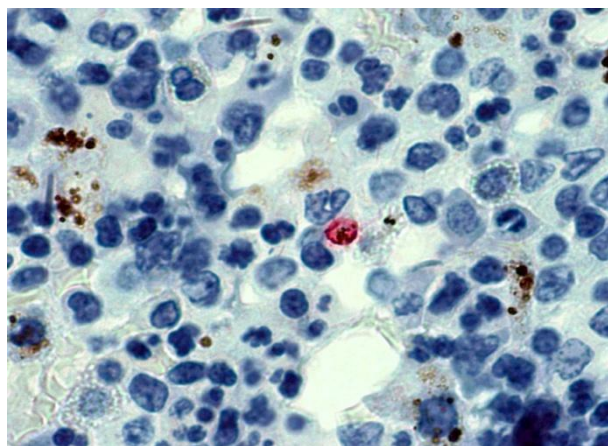
Diagnosis	Subclass	No of cases(percentage)
AML		521 ( 29.36)
AML- MO	AML with minimal differentiation	5 (0.28 )
AML-M1	AML without maturation	150 (8.45)
AML-M2	AML with maturation	225 (12.68)
AML-M3	Acute promyelocytic leukemia	80 (4.50)
AML-M4	Acute myelomonocytic leukemia	45 (2.53)
AML-M5	Acute monoblastic/monocytic leukemia	10 (0.56)
AML-M6	Acute erythroid leukemia	4 (0.22)
AML-M7	Acute megakaryoblastic leukemia	02 (0.11)
ALL		410 (23.11)
Multiple myeloma		325 (18.32)
CML		140 (7.89)
MDS		120 (6.76)
NHL infiltration		95 (5.37)
CLL		80 (4.50)
Metastasis		55 (3.10)
	Neuroblastoma	15 (0.84)
	PNET	06 (0.33)
	Ewings sarcoma	05 (0.28)
	Round cell tumor -unclassified	05 (0.28)
	Rhabdomyosarcoma	05 (0.28)
	Metastasis from lung	14 (0.78)
	Metastasis from Breast	05 (0.28)
Essential Thrombocythaemia		13 (1.73)
Myelofibrosis		10 (0.56)
Burkitts lymphoma		05 (0.28)
Total		1774(100)



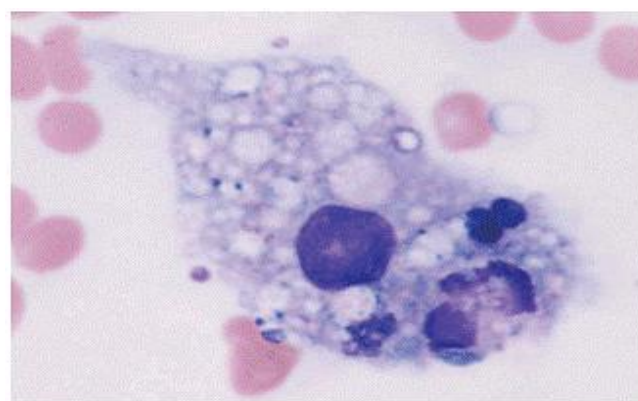
**Fig-1:** Showing megaloblastic erythroid hyperplasia in case of megaloblastic anemia.



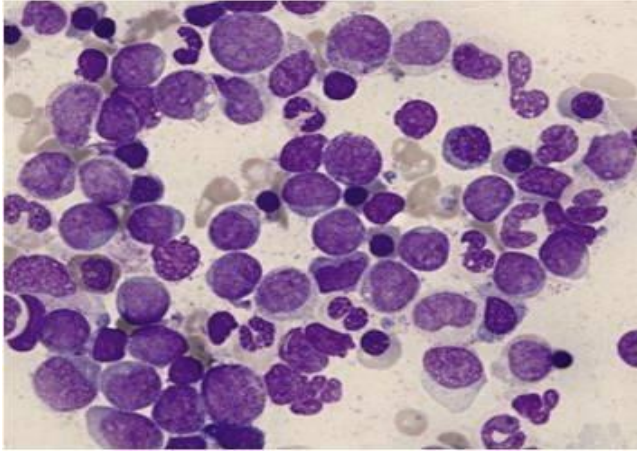
**Fig- 3:** Bone marrow aspirate smear showing intracellular LD bodies in visceral leishmaniasis.



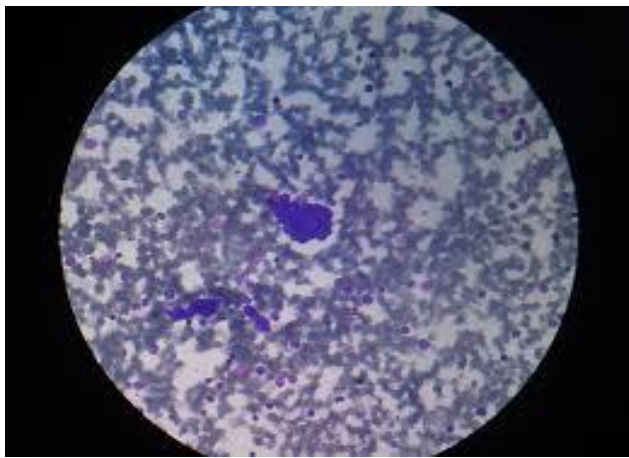
**Fig:2:** Bone marrow aspirate in a case of malaria showing hemozoin pigment.



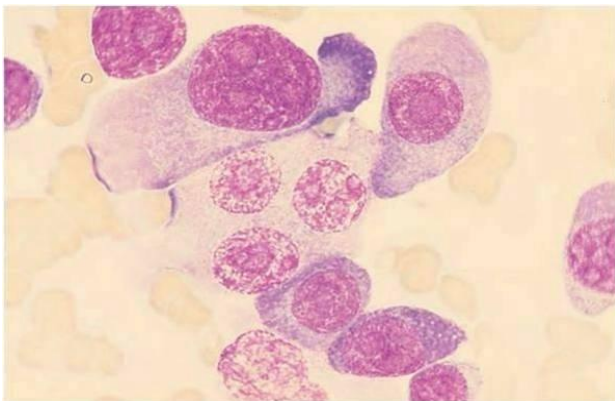
**Fig-4:** Bone marrow aspirate smear showing hemophagocytosis in a case of hemophagocytic lymphohistiocytosis.



**Fig-5:** Bone marrow aspirate smear replaced by blasts in a case of AML.



**Fig-6:** Bone marrow biopsy touch imprints: Showing clustering of metastatic deposits from a Round cell tumor.



**Fig-7:** Bone marrow aspirate in a case of myeloma showing plasmacytosis with many immature plasma cells.

### Discussion

Bone marrow aspiration is carried out for mainly cytological assessment but also for

immunophenotyping, cytogenetic, molecular genetics. In the present study we evaluated 5287 cases of bone marrow aspiration over a period of 4 years. Aspiration was adequate for diagnosis in (91.96%) of cases. Males outnumbered females with M:F of 1.6:1 which is similar to the study conducted by shano Naseem (2010)<sup>3</sup>. Dual deficiency anemia was the most common finding among benign cases followed by megaloblastic anemia in our study. The high prevalence of dual deficiency is explained by nutritional deficiencies in rural areas, pregnant women and elderly population. Most of the studies from India have reported megaloblastic anemia as the most common finding. According to Gayathri and Rao<sup>4</sup> showed megaloblastic anemia as the most common cause of pancytopenia in their study. Among malignant cases leukemia was the most common finding in our study followed by plasmacytosis (18.3%). The commonest presentation in myeloma patients was generalized weakness followed by bone pains. Bone pains was also the second most common symptom in a study done by M.Gupta et al<sup>5</sup>. Plasma cell concentration ranged from 8% to 86%. Neoplastic plasma cells are diagnosed based on morphology, protein electrophoresis and immunophenotyping.

Neoplastic plasma cells usually constitute 10-20% of all nucleated cells but may reach upto 50%.<sup>6,7,8</sup>. We found 3.10% of cases with metastatic lesions involving marrow. Among metastatic lesions neuroblastoma was the tumor overall (0.84%) metastasizing the bone marrow and the commonest tumor in pediatric age group metastasizing the bone marrow followed by PNET (0.33%). Brahmhatt B et al<sup>9</sup> in their study also found neuroblastoma to be common tumor involving marrow in pediatric age group. In adults carcinoma lung was most common tumor involving bone marrow. Among epithelial malignancies metastasis from lung was the most common finding followed by breast. Types of anemias in malignant lesions are divided into iron deficiency anemia, hemolytic anemia and hypoproliferative anemias and anemia of chronic

disease. Metastatic lesions were commonly associated with anemia of chronic disease in our study followed by pancytopenia. Among staging marrows for lymphoma cases 5.35% had bone marrow infiltration with follicular lymphoma infiltration being most common lymphoma involving marrow. Commonest myeloproliferative lesion in our study was chronic myeloid leukemia (7.89%) followed by essential thrombocythemia and myelofibrosis. Most common presentation in myeloproliferative neoplasm was massive splenomegaly. 6.76% cases were labelled as myelodysplastic syndromes. All cases of myelodysplastic syndrome presented with pancytopenia not responding to VIT. B12 and Folate trials. Bone marrow examination is not required to make diagnosis of Chronic lymphocytic leukemia except in cases with cytopenias. In our study we found 4.50% cases of CLL. Most of these cases were already diagnosed cases of CLL on treatment who presented with sudden onset cytopenias.

In our study imprint smears were taken in most of the cases and 2 cases of metastatic lesions were picked up on imprint smears owing to aparticulate nature of the aspirate. (Fig-6)

**Conflicts of interest:** None

### Conclusion

Bone marrow examination is an important, rapid and cost effective tool in diagnosis of hematological and non hematological diseases.

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