Bone Marrow Aspiration to Evaluate Various Types of Hematological Disorders

Dr. Sumit Kumar[1], Dr. Anita Sharan[2], Dr. Prakash Roplekar[3]

[1]Resident, Department of Pathology, Dr. D. Y. Patil Medical College, Hospital & Research Centre, Sector 7, Nerul, Navi Mumbai, Maharashtra, India

[2]Associate Professor, Department of Pathology, Dr. D. Y. Patil Medical College, Hospital & Research Centre, Sector 7, Nerul, Navi Mumbai, Maharashtra, India

[3]Professor and Head, Department of Pathology, Dr. D. Y. Patil Medical College, Hospital & Research Centre, Sector 7, Nerul, Navi Mumbai, Maharashtra, India

Abstract: Hematological disorders are frequent in all age groups and most of them present with anemia. Bone marrow aspiration is useful and cost effective diagnostic procedure for diagnosis of both neoplastic and non-neoplastic hematological diseases. This study was done to emphasize the crucial role of Bone Marrow Aspiration in diagnosis of hematological disorders. This was a retrospective study carried out in a period of 1 year (July 2016-August 2017). Bone marrow examination of 65 cases of suspected hematological disorders on peripheral blood smear was carried out and clinical history was recorded. We studied total 65 patients among them most common red blood cell pathologies were megaloblastic anemia (56%) followed by mixed erythroid hyperplasia (11%), iron deficiency anemia (6%), normoblastic maturation (6%). All the 5 patients of platelet disorders were diagnosed as Idiopathic Thrombocytopenic purpura (ITP). Among WBC pathologies Acute Leukemia (6%) and other Miscellaneous like aleukemic leukemia, leucoerythroblastic reaction & haemophagocytic lymphohistocytosis. Megaloblastic anemia was found to be the most common finding in RBC pathology, in WBC pathology acute leukemia was the most common and among platelets ITP.

Keywords: Bone marrow, Hematological Disorder, megaloblastic anemia, leukemia

INTRODUCTION

Anemia is common worldwide and particularly so in developing countries. Hematological disorder in any age group usually presents with anemia. The spectrum of hematological disorders is different in the developing world than the developed countries [1].

Most of the time the diagnosis can be arrived by detailed clinical examination and few simple investigations however without bone marrow examination the diagnosis is usually not a confirmatory [1].

For bone marrow examination clinical findings, complete blood count, peripheral blood picture and other laboratory investigations are must [2].

It is useful in diagnosis of variety of hematological and non-hematological disorders. The hematological disorders include acute leukemia, myeloproliferative neoplasm (MPN), hemato-lymphoid neoplasm, nutritional deficiency diseases. On the other hand, non-hematological disorders include infectious diseases infiltrating the bone marrow such as tuberculosis, parasitic infections and metastatic deposits [3].

MATERIAL & METHODS

The study was retrospective observational cross-section study carried out over a period of 1 year from June 2016 to July 2017 at tertiary care hospital.

65 patients based on simple random sampling were selected whose bone marrow was done for the evaluation of various hematological disorders.

Clinical history including presenting complaints, local examination findings, dietary habits and alcohol with drug history were taken. Hematological findings (peripheral smear findings) biochemical findings along with other relevant investigations were recorded.

Detailed Clinical history, complete blood count and peripheral smear finding was taken for all the cases and were correlated with the aspiration findings.

All bone marrow aspirations that were sent to department of pathology for diagnosis were included in the study. Aspirates smear heavily diluted with blood in which no opinion possible were excluded.

RESULTS

Out of a total of 65 patients studied- RBC Pathology (77%), WBC Pathology (15%) and then Platelet Pathology (8%).

The age ranged from 6 months to 80 years with median age of 34.5 years. Commonest presentation was pancytopenia (38.3% of cases) followed by bicytopenia (22% of cases).

RBC pathology - 50 cases (77% of total)
- Megaloblastic Anemia (56%)- was the most important cause
- Iron Deficiency Anemia (11%),

- Hyper cellular Marrow with Erythroid Hyperplasia (6%),
- Normoblastic Maturation (4%)- Least common.

WBC pathology - 9 cases (15% of total) consist of-
- Acute Myeloid Leukemia (60 %)- Most common

One case of each (10%) –
- Aleukaemic Leukemia,
- Chronic Myeloid Leukemia
- Leucoerythroblastic reaction and
- Chronic Lymphoid Leukemia.

Platelet pathology 6 cases (8% of total) was Idiopathic Thrombocytopenic Purpura.

Table-1: Gender wise distribution of the Hematological disorder

Gender wise distribution	Total	Percentage
Male	38	58.4
Female	27	41.9
Total	65	100

Table-2: Age wise distribution

Age Range of Patient (Years)	Total	Percentage
0-1	6	9.2
1-10	9	13.8
11-20	10	15.3
21-30	7	10.7
31-40	11	16.9
41-50	8	12.3
51-60	6	9.2
61-70	4	6.1
71-80	4	6.1

Table-3: Comparison with other studies

|	**Present Study**	Anjum *et al.*, Gomal Journal of Medical sciences 2014 [4]	Parajuli *et al.*, Journal of Pathology,Nepal 2014 [5]	P. Shridevi *et al.*, IOSR journal 2016 [6]	Amrish *et al.*, Journal of evoltion of med sci [7]	Bhaglaxmi *et al.*, Intrnl jounal of medical sciences [8]	Sujata *et al.*, Nepal Pathology Journal 2012 [9]
RBC Pathology Most common Cause	Megaloblast Anemia	Megaloblastic anemia	Erythroid hyperplasia	Megaloblastic Anemia	Megaloblastic Anemia	Megaloblastic anemia	Erythroid Hyperplasia
Least common cause	Normoblastic anemia	Micronormoblastic anemia	Micronormoblastic anemia	------	--------	Normoblastic anemia	Microcytic anemia
WBC Pathology Most common cause	Acute myeloid Leukemia	Acute myeloid Leukemia	Acute myeloid Leukemia	Acute myeloid Leukemia	Acute myeloid Leukemia	Acute myeloid Leukemia	Acute myeloid Leukemia
Least common cause	--------	Chronic Myeloid leukemia	Lymphoma	Multiple Myeloma	Chronic Myeloid leukamia	-------	Acute Myeloid Leukemia
Platelet Pathology	ITP	ITP	ITP	ITP	ITP	ITP	ITP
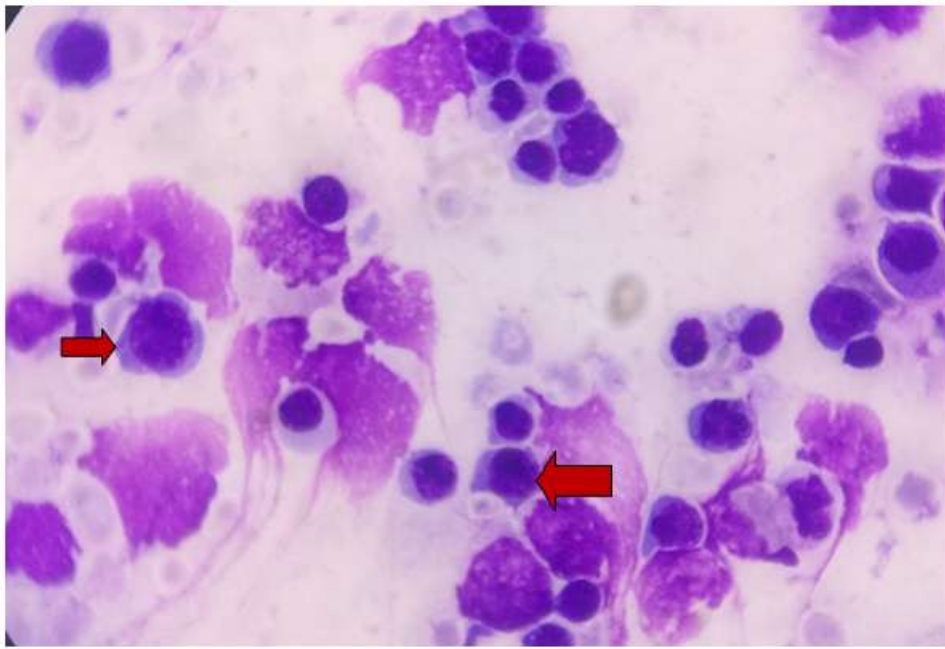
Fig-1: Bone Marrow showing megaloblasts (100X, oil immersion)
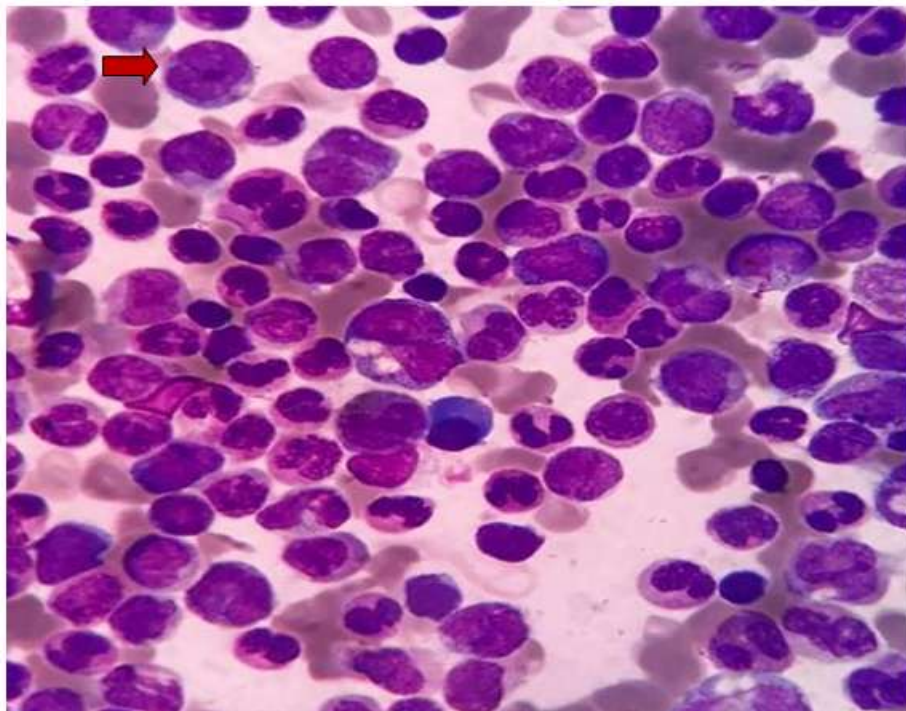

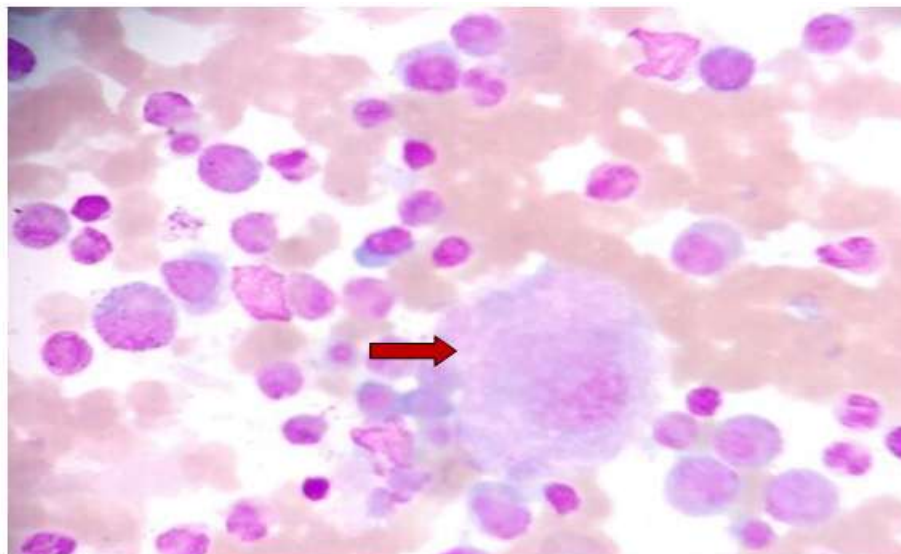**Fig-2: Bone marrow aspirate for Acute myeloid Leukemia**

Fig-3: Bone Marrow for Idiopathic Thrombocytopenic purpura

DISCUSSION

The spectrum of hematological disorders is wide ranging from anemias to hematological malignancies. Bone marrow aspiration is a key investigation for hematological disorders.

Blood disorders are very common ranging from anemias to hematological malignancies. Bone marrow aspiration is a key investigation for hematological disorders.They are employed for diagnosing megaloblastic anemia, leukemia, hodgkins lymphoma to multiple myeloma along with typing anemia, evaluation of cytopenia and pyrexia of unknown origin. It confirms the clinically suspected disease and usually sufficient to diagnose nutritional anemia, leukemia and Idiopathic Thrombocytopenic purpura (ITP).

Majority (17%) of the patients included in this study were between 50-60 years of age with 62 males(55%) and 38 females (41%) with male to female ratio of 1.6:1 showing a male predominance. The male to female ratio in the present study was comparable to that of Gilotra M *et al*., [10] where cases of >50 years were 48;among them 34 were males and 14 were females with M:F ratio of 2:1 (Refer Table-2).

Majority of the bone marrow studied were hypercellular followed by normocellular while few hypocellular similar to Aarthi *et al*.

The commonest indication of Bone marrow was pancytopenia (50 %) followed by bicytopenia (36%) [11] similar to our study. Among Pancytopenia megaloblastic anemia is the most important cause.

In our study megaloblastic anemia was the commonest cause of pancytopenia and was the commonest finding in BMA similar to the study by Gayathri *et al*.

All the three parameters were considered RBC, WBC and platelet and corresponding hematological disorder

In this study the most common hematological disorder of RBC pathology was megaloblastic anemia similar to Srikanth et al which is characterised by hyper cellularity with megaloblastic erythroid hyperplasia displaying megaloblast having sieve like chromatin, nuclei-cytoplasmic asynchrony and basophilic cytoplasm. M:E ratio will be reversed. Myeloid and megakaryocytes series can show certain alterations but were normal in our study.

Following that next important cause was followed by mixed erythroid hyperplasia (11%) displaying both micro and megaloblastic maturation follwed by iron deficency anemia (6%) which shows erythroid hyperplasia with micronormoblastic maturation follwed by normoblastic maturation(6%) seen in anemia of chronic disease.

In WBC pathology the most common cause acute myleoid leukamia as seen in Parajuli S *et al*., [5] the most common cause of bone marrow aspiration in wbc pathology was acute myeloid leukmia which shows hypercellular with more than 20 percent myeloblast along with mekagkaryocyte dypoiesis. Followed by that the next cause was aleukaemic Leukemia showing no blasts on peripheral smear, Chronic Myeloid Leukemia smear showing hypercellularity with M:E ratio 10:1, myeloblast less than 20 percent followed by Leucoerythoblastic reaction and Chronic Lymphoid Leukemia.

In Platelet pathology the most common seen is Idiopathic thormbocytopenic purpura similar to Sujata *et al*., [9] which is charcterised byincreased number of megakaryocytes showing hypogranularity of cytoplasm, vaculisation, hypolobulation and dense nuclear chromatin.

The study was compared to other studies and correlated for RBC, WBC and platelet pathology and similar results were obtained (Refer Table-3).

CONCLUSION

Bone marrow examination is an important step to arrive at the confirmatory diagnosis of wide varieties of hematological disorders.

The commonest cause of pancytopenia in our study was megaloblastic anemia. And most common hemtological malignacy as acute myeloid leukemia. The study provides a valuable insight into the causes of anemia or pancytopenia in various hematological disorders.

REFRENCES

1. Sajjan, N., Mathias, M., & Shetty, J. (2015). Comparative evaluation of bone marrow aspiration and bone marrow biopsy in haematological conditions. *Journal of Evolution of Medical and Dental Sciences-Jemds*, *4*(102), 16775-16778.
2. Nusrat, A., Turner, J. R., & Madara, J. L. (2000). Molecular physiology and pathophysiology of tight junctions. IV. Regulation of tight junctions by extracellular stimuli: nutrients, cytokines, and immune cells. *American Journal of Physiology*, *279*(1), G851-G857.
3. Yan, W., & Kang, M. S. (2002). *GGE biplot analysis: A graphical tool for breeders, geneticists, and agronomists*. CRC press.
4. Anjum, M. U., Noman, N., Shah, S. H., & Khaliq, M. A. (2014). Spectrum Of Hematological Disorders On Bone Marrow Aspirate Examination. *Gomal Journal of Medical Sciences*, *12*(4).
5. Parajuli, S., & Tuladhar, A. (2014). Correlation of bone marrow aspiration and biopsy findings in diagnosing hematological disorders-a study of 89 cases. *Journal of Pathology of Nepal*, *4*(7), 534-538.
6. Sarva, E., & Sridevi, P. V. (2016). A novel triple band planar microstrip patch antenna with defected ground structure. *Indian Journal of Science and Technology*, *9*(3).
7. Amrish, T., Meghana, M., & Naik, D. C. (2013). Thoraco-Omphalopagus: A Case Study. *Indian Journal of Anatomy*, *2*(2), 89.
8. Hammond, C. J., Snieder, H., Spector, T. D., & Gilbert, C. E. (2000). Genetic and environmental factors in age-related nuclear cataracts in monozygotic and dizygotic twins. *New England Journal of Medicine*, *342*(24), 1786-1790.
9. Pudasaini, S., Prasad, K. B. R., Rauniyar, S. K., Shrestha, R., Gautam, K., Pathak, R., ... & Shrestha, B. (2012). Interpretation of bone marrow aspiration in hematological disorder. *Journal of Pathology of Nepal*, *2*(4), 309-312.
10. Gilotra, N. A., Princewill, O., Marino, B., Okwuosa, I. S., Chasler, J., Almansa, J., ... & Russell, S. D. (2017). Efficacy of intravenous furosemide versus a novel, pH-neutral furosemide formulation administered subcutaneously in outpatients with worsening heart failure. *JACC: Heart Failure*, *6*(1), 65-70.
11. Ahmad, S. Q. (2011). Utility of bone marrow examination in a secondary care hospital. *Journal of Rawalpindi Medical College*, *15*(1), 40-41.