ejpmr, 2017,4(07), 236-240

SJIF Impact Factor 4.161

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

BONE MARROW ASPIRATION: A DIAGNOSTIC TOOL IN UNDERSTANDING THE BROAD- SPECTRUM OF HEMATOLOGICAL DISORDERS: A 15-YEAR STUDY

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Article Received on 11/05/2017 **Article Revised on 01/06/2017** **Article Accepted on 22/06/2017**

ABSTRACT

Aims: Hematological disorders have various trends of presentation that usually demands bone marrow examination to reach definite diagnosis and further management. Anemia is the commonest hematological disorder. The aim of the study was to know the prevalence of various hematological disorders. **Methods:** This was a retrospective and prospective study carried out at teaching medical college and hospital in western Maharashtra, over a period of fifteen years. (January 2002 - March 2017). Bone marrow examination of 2022 cases was carried out. All the details of the patients were obtained from the record in the department of pathology. **Results:** Out of 2022 cases of bone marrow aspiration, 59.55% of males and 40.45% females and normal cellularity in 8.902%, Megaloblastic anemia in 27.942% cases, microcytic anemia in 23.244% cases, dimorphic pattern in 31.552%. There were 1.285% cases of malarial parasite on BMA analysis. Aplastic/hypoplastic marrow 4 cases. Only single case of Non-Hodgkin's Lymphoma was seen as well polycythemia Vera and Sickle cell disease. Acute Myeloid leukemia in 0.840%, acute lymphoblastic leukemia in 0.445% cases. Chronic myeloid leukemia in 0.494% while chronic leukamoid leukemia was infrequent. Multiple myeloma in 0.544% cases. **Conclusion:** Bone marrow examination plays a vital role in understanding and diagnosing variety of hematological disorders and non-hematological disorders.

KEYWORDS: Bone marrow examination, diagnostic role, hematological disorders.

INTRODUCTION

Bone marrow examination is a remarkable diagnostic procedure in hematology. It is an elementary and comparatively harmless procedure carried out in hospitals in order to attain the diagnosis and further management of hematological as well to unveil few non-hematological disorders. Therefore this procedure is quiet helpful in understanding the staging, prognostication and assessing the therapeutic response in few disorders.[1,2]

Primary or secondary diseases can garble the normal architecture of the bone marrow. Anemia is usual presentation in most of the cases whether hematological or secondary. Hence, a detailed description of morphology of the marrow elements may provide us adequate explanation for unjustified cytopenias, leukemia, and other hematological disorders including metastases to the bone marrow.[1,3,4]

Anemia is the commonest hematological disorder worldwide, particularly faced by developing nations. The spectrum of hematological disorders is relatively different in the developing world than the developed countries.[2] Hematological disorders in any age group usually presents with anemia.[1,5] Most of the time the diagnosis can be achieved by detailed clinical examination and few basic laboratory investigations. However without bone marrow examination, the definitive diagnosis cannot be commented.[6,7]

Bashawri LA, identified pancytopenia, leukemia, staging of lymphoma among others as the major indications for bone marrow aspiration[8] Similarly a study conducted in Nigeria by Egesie et al, identified anemia as a major indication for BMA.[1]

The purpose of this study is to acknowledge the prevalence of Hematological disorders commonly diagnosed using this procedure.

MATERIALS AND METHODS

This was a retrospective and prospective study done at the tertiary care center in western Maharashtra, over a

period of Fifteen years (January 2002 - March 2017). Bone marrow examination of 2022 cases of suspected hematological disorders was carried out. PBS along with other necessary hematological and clinical parameters was also noted from the record file. Leishman stained slides along with Perls' stain and Periodic Acid Schiff (PAS) stain wherever indicated. Aspirates of inadequate material or dry tap were excluded from the study. A specially designed and well-structured proforma was used in data collection. Information extracted from the records include; age, sex, indications for BMA, and the final diagnosis from BMA over the stated period. The data obtained was analyzed using STATA software version 10.

RESULTS

A total number of 2022 patients were included in this study aged between 4 months to 90 years. Out of which 59.55% (n=1204) were males and 40.45% (n=818) were females with M: F of 1.4:1. Maximum number of patients (n=864) of hematological disorder who underwent BMA was in the age group of 20- 40 Years. Table 1 shows the age distribution of the patients.

Table: 1 Age distribution of the patients subjected to bone marrow examination.

Age Group	No. Of Patients	Percentage (%)
0-10 years	90	4.451
11-20 years	326	16.122
21-30 years	432	21.364
31-40 years	432	21.364
41-50 years	294	14.540
51-60 years	194	9.59
61-70 years	180	8.902
71-80 years	70	3.46
81-90 years	4	0.197

Table2. Shows the sex-wise distribution of the patients exposed to bone marrow examination, 59.55% (n=1204) were found to be males.40.45% (n=818) were females.

Table 2: Sex-wise distribution of the cases subjected to bone marrow examination

Sex	Total no.	Percentage (%)
Male	1204	59.55
Female	818	40.45

Maximum number of BMA cytology came out to be hypercellular i.e. 37.50% (n=722) followed by normocellular which was noted in 35.70% (n=722) and lastly hypocellular reported in 27.25% (n=551) of cases, as seen in Table 3.

Table 3: Cellularity of the bone marrow aspirate smears among the cases.

Cellularity of the marrow	No. Of Patients	Percentage (%)
Hypercellular	749	37.05
Normocellular	722	35.70
Hypocelullar	551	27.25
TOTAL	2022	100

Bone marrow aspiration revealed broad spectrum of hematological disorders (Table 4). Dimorphic pattern was the most common finding seen in 31.552% (n=638) cases. Micronormoblastic pattern of maturation was seen in 23.244% cases (n=470) cases. Megaloblastic changes were seen in 27.942% cases (n=565). Megaloblastic anemia (27.942%) was more common than microcytic anemia (23.244%). Malarial parasite was noted in 1.285% (n=26) cases.

Table 4: Various hematological disorders diagnosed on bone marrow aspiration results of the cases.

BMA diagnosis	No. of cases	Percentage (%)
Normal marrow	180	8.902
Megaloblastic anemia	565	27.942
Microcytic anemia	470	23.244
Dimorphic anemia	638	31.552
Malaria	26	1.285
Hypoplastic/Aplastic anemia	4	0.197
ITP	09	0.445
Storage diseases	05	0.247
Metastasis	04	0.197
Thalassemia	03	0.148
Polycythemia Vera	01	0.049
Sickle cell Disease	01	0.049
Eosinophilia	02	0.098
AML	17	0.840

ALL	09	0.445
CML	10	0.494
CLL	03	0.148
Multiple Myeloma	11	0.544
Non- Hodgkin's Lymphoma	01	0.049

ITP: idiopathic thrombocytopenic purpura, AML: acute myeloid leukemia, ALL: acute lymphoblastic leukemia, CML: chronic myeloid leukemia, CLL: chronic leukemic leukemia.

Aplastic /hypoplastic bone marrow was reported in 4 cases, in all these cases the marrow was hypocellular and all 3 lineages of cell were suppressed. Idiopathic Thrombocytopenic Purpura was noted in 0.445% (n=9) cases. Storage disorders was seen in pediatric age group, primarily Gauchers disease was the only diagnosis made in 5 cases. Metastasis was also reported (n=4). Already diagnosed cases of thalassemia, through Hb electrophoresis were also subjected to BMA examination; diagnosis was reconfirmed in 3 cases. Non-Hodgkin's Lymphoma was observed in only one case so as polycythemia vera and sickle cell disease. Acute Myeloid leukemia was seen in 0.840% cases (n=17) and acute lymphoblastic leukemia was noted in 0.445% (n=09) cases. Chronic myeloid leukemia was seen in 0.494%(n=10) while chronic leukamoid leukemia was seen in only 3 cases. Plasma cell disorder chiefly comprised of multiple myeloma 0.544% (n=11).

Table 5. Shows the comparison of age and sex distribution in different studies, which are similar to our results.

Table: 5 Comparison of age and sex distribution in different studies.

Study	Age (months-years)	M: F
Egesie et al[1]	3-80	1.5:1
Kibria et al[2]	3.5-80	1:0.59
Niazi et al[4]	1-75	1.7:1
Pudasaini et al[5]	9-75	1.1:1
Timothy et al[6]	2-75	1.2:1
Jha et al[7]	1-79	1.5:1
Gayathri et al[9]	2-80	1.2:1
Shilpa et al[10]	3-70	2.4:1
Sreedevi et al[11]	6days -70	1.1:1
Ahmad et al[12]	8-106	1.1:1
Present study	4-90	1.4:1

DISCUSSION

Hematological disorders are classified into a broad range. To the best of our knowledge the current study is with the largest sample size and extensive time period of 15 years. The study was conducted to understand the common indications and diagnosis of hematological disorders, with the advent of Bone marrow aspiration examination.

Our study corresponds to several other studies; most common age frequency was between 2nd to 4th decades. Niazi et al had a majority of population in the range 1-30 years.[4] Age range (4 months to 90 years) as well as the sex ratio (M: F=1.4:1) of subjects undergoing BMA evaluation is similar to other studies.[5,9,12] Hence, BMA cytology can be done in all the age groups.

Diagnostic accuracy of BMA in analyzing the hematological disorder in our study is remarkably high (96.7%) and similar to other studies.[1] Egesie *et al*. used this diagnostic tool to classify and understand the causes of anemia in most (96.8%) of the cases.[1] Hence, bone marrow examination plays vital role in knowing the root cause of hematological disorders up to a certain level.

We have not came across to any pathology of suspected hematological disorder in 8.902% (n=180) cases. The bone marrow aspirates in these cases were normocellular. Bashawri et al. and Damulak et al. revealed higher values of 14.4% and 38% respectively in their studies.[8,13] Raised values of such observations in their study shows that some non-hematological condition may exhibit hematological features, indicating some restriction to this procedure.

Anemia was found to be the most common indication for BMA procedure in our study followed by leukemia and pancytopenia. (Table 4) Dimorphic pattern was the most common finding seen in 31.552% (n=638) cases. Micronormoblastic pattern, which is pathognomic of Iron deficiency anemia, mainly effecting females, was seen in 23.244% cases (n=470) cases. Megaloblastic changes in BMA indicating Megaloblastic (Vitamin b12/ folic acid deficiency) anemia was prevalent in males comprising 27.942% cases (n=565). Megaloblastic anemia (27.942%) was more common than microcytic anemia (23.244%) similar to Timothy et al., Damulak et al. and Tripathy et al.[6,13,14] These studies have also shown anemia to be the most common reason for BMA examination. Pudasaini et al. reported distinguished

observations and Bashawri et al. as they found pancytopenia and leukemia, the most common indication for the procedure.[5,8]

Thalassemia (n=3), sickle cell anemia (n=1), eosinophilia (n=2) and polycythemia vera (n=1) was quiet infrequent in this study as these cases are usually diagnosed with different diagnostic methods but any other primary lesion at the bone marrow can be always detected through BMA cytology along with such disorders.[24]

Malarial parasites were observed in 1.285% (n=26) of cases out of which plasmodium falciparum was more common in comparison to ovale. As the study was conducted in western Maharashtra, due to least geographical prevalence of leishmaniasis, we couldn't find a single case of leishmaniasis, filariasis or any other case of hemoparasite except malaria was seen. Pudasaini et al. found similar results; fortunately he encountered a single case of Leishmaniasis in his study.[5] Santra et al. revealed corresponding results.[15] Similar studies showed 2.82%, 1.2%, and 0.67% of leishmaniasis.[2,4,7] The maximum number of cases (14%) was seen in a study done by Khodke et al.[16]

Pediatric age group reflected storage disorders in the form of Gauchers disease; minimum age was 4 months in our study. Total 5 cases were present in our study similar results were noted in the past also.[23]

Only 9 cases were reported as Idiopathic thrombocytopenic Purpura (ITP). Pudasaini et al reported 14% of cases reviewed in their studies, which was quiet high as compared to our results.[5] Past literature has tried to reveal that the bone marrow examination is not informative in cases with isolated thrombocytopenia. In a study by Jubelirer et al. no underlying or occult malignancy was reported in 86 patients with isolated thrombocytopenia reviewed.[17] Also, in a related study, no underlying hematological disease was found in 61 patients and presented exclusively with isolated thrombocytopenia.[18]

Furthermore, some studies have shown that bone marrow examinations are unreliable and frequently non-diagnostic in ITP.[19,20] Perhaps, the inconsistencies in bone marrow findings in ITP and the reasons documented in the studies above may have accounted for the low request for BMA cytology in cases of isolated thrombocytopenia by physicians at our setup. The advantage of bone marrow examination in thrombocytopenic cases is to exclude other hematological diseases i.e. leukemia in young and myelodysplastic syndrome in elder was disclosed by Mahabir et al.[19] This assumption was corroborated in a study in which 74% of Pediatric hematologists were with the view that bone marrow examination is important in acute Childhood ITP, and the main reasons cited was the need to remove other hematological disorders such as leukemia, dysmyelopoietic syndrome and aplastic anemia.[21]

The current study has revealed that the acute leukemias (1.285%) were the most frequently diagnosed hematological malignancy from BMA examinations at our center. 17 cases (0.840%) were of AML and 9 cases (0.445%) were ALL. CML was seen in 0.494%(n=10) while CLL was seen in only 3 cases and only single case of NHL was detected in reviewing the aspirates. Other studies have reported similar findings with AML and CML being more common than ALL and CLL.[1,6,7,9]

Plasma cell disorder chiefly comprised of multiple myeloma in 0.544% (n=11) cases. Kibria et al and Timothy et al reported 9.04% and 8.1% cases of multiple myeloma respectively.[2,6] Whereas Laishram et al. showed less number of cases.[22]

Metastatic deposits were noted in 4 cases. The most common malignancy to metastasize was carcinoma breast (n=2) followed by prostatic carcinoma (n=1) and malignant melanoma (n=1) similar to past literature.[25,26,27]

CONCLUSION

Bone marrow aspiration examination is relatively safe procedure. BMA is an important step to arrive at the confirmatory diagnosis of broad-spectrum hematological disorders and non-hematological disorders. In a developing nation like ours it can be an easy and cost effective procedure in order to combat the nutritional anemia. So, that the morbidly and mortality associated with hematological disorders can be aptly managed.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Egesie OJ, Joseph DE, Egesie UG, Ewuga OJ. Epidemiology of anemia necessitating bone marrow aspiration cytology in Jos. Niger Med J., 2009; 50: 61-1.
2. Kibria SG, Islam MDU, Chowdhury ASMJ et al. Prevalence 0f Hematological Disorder: A Bone Marrow Study of 177 Cases In A Private Hospital At Faridpur. Faridpur Med. Coll. J., 2010; 5: 11-3.
3. Laishram S, Shimray R, Sharma AB, Pukhrambam G, Singh AM, Sharma LDC. Neoplastic lesions in the bone marrow: a 10-year study in a teaching hospital. JIACM., 2008; 9: 175-8.
4. Niazi M, Raziq FI. The incidence of underlying pathology in pancytopenia- an experience of 89 cases. JPMI, 2004; 18: 76-9.
5. Pudasaini S, Prasad KBR, Rauniyar SK, Shrestha R, Gautaam K, Pathak R et al. Interpretation of bone marrow aspiration in haematological disorders. Journal of pathology of Napal, 2012; 2: 3099-312.
6. Timothy AE, Mabel Benson IE, Olugbemi OM, Indications and Spectrum of Haematological Disorders from Bone Marrow Aspiration

Examination: A Three Year Review Study. GJHBT, 2015; 2: 4-8.
7. Jha A, Sayam G, Adhikari RC, Panta AD, Jha R. Bone marrow examination in cases of Pancytopaenia. J Nepal Med Assoc, 2008; 47: 12-17.
8. Bashawri LA. Bone marrow examination. Indications and diagnostic value. Saudi Medical Journal, 2002; 23: 191-6.
9. Gayathri BN, Rao KS. Pancytopenia: a clinic hematologicl study. J Lab Physicians, 2011; 3: 15-20.
10. Shilpa P, Pooja N, Nailesh S. Diagnostic role of bone marrow aspiration and trephine biopsy in hematological practice. Gujarat Medical Journal, 2015; 70: 37-41.
11. Sreedevi P, R Satyanarayana. Spectrum of Hematological Disorders Detected By Bone Marrow Aspiration in a Span of 3 Months Period. IOSR-JDMS, 2016; 15(4): 52-56.
12. Ahmed SQ, Khan OU, Zafar N. Utilization of bone marrow examination in a secondary care hospital. JRMC, 2011; 15: 40-41.
13. Damulak OD, Damen JG. Diagnostic outcome of bone marrow aspiration in a new centre in Nigeria. Glo Adv Res J Med Sci., 2012; 1(7): 166-171.
14. Tripathy S, Dudani S. Comparative Evaluation of Simultaneous bone marrow aspiration and trephine biopsy. Experience from routine Haematology practice. Indian Journal of Clinical Practice, 2013; 24: 5.
15. Santra G, Das B K. A cross-sectional study of the clinical pro le and aetiological spectrum of pancytopenia in a tertiary care centre. Singapore Med J., 2010; 51: 806-12.
16. Khodke K, Marwah S, Buxi G, Yadav RB, Chaturvedi NK. Bone Marrow Examination in Cases of Pancytopenia. JIACM, 2001; 2: 55-9.
17. Jubelirer SJ, Harpold R. The role of bone marrow examination in the diagnosis of Idiopathic Thrombocytopaenic Purpura: Case series and literature review. Clin Appl Thromb Hemost, 2012; 8(1): 73-76.
18. Westerman DA, Grigg AP. The diagnosis of Idiopathic Thrombocytopaenic Purpura in adults: Does bone marrow biopsy have a place? Med J Aust., 1999; 170(5): 216-217.
19. Mahabir VK, Ross C, Poporic S, Sur ML, Bourgeois J, Lim, *et al*. A blind study of bone marrow examination in patients with Primary Immune Thrombocytopaenia. Eur J. Haematol, 2013; 90(2): 121-126.
20. Neunert C, Lim W, Crowther M, Cohen A, Solberg L, Crowther MA. American Society of Haematology 2011 evidence based practice guideline for immune thrombocytopaenia. Blood, 2011; 117: 4190-4207.
21. Calpin C, Dick P, Poon A, Feldman W. Is bone marrow aspiration needed in acute childhood Idiopathic Thrombocytopaenic Purpura to rule-out Leukaemia? Arch. Pediatr Adolesc Med., 1998; 152: 345-347.
22. Laishram S, Shimray R, Sharma AB, Pukhrambam G, Singh AM, Sharma LOC. Neoplastic lesions in bone marrow. A 10-year study in a teaching hospital. JLAC M., 2008; 9: 175-178.
23. Kumar R, Sangwan L, Peter R, Bansal S, Malik T. Prevalence and aetiology of nutritional anaemia in children aged 6 month to 60 month in Fatehabad district of Haryana. Journal of Basic and Applied Sciences, 2014; 4(1): 317- 321.
24. Rock WA Jr, Stass SA, eds. Handbook of Hematologic Pathology. New York, NY: Marcel Dekker, Inc., 2000; 1-26.
25. Clifton JA, Philip RJ, Ludovac E, *et al*. Bone marrow and carcinoma prostate. Am J M Sci., 1952; 224: 121–30.
26. Motulsky AG, Rohn RJ. The bone marrow in metastatic malignant melanoma. J Lab Clin Med., 1953; 41: 526–33.
27. Leland J, MacPherson B. Hematologic findings in cases of mammary cancer metastatic to bone marrow. Am J Clin Pathol, 1979; 71: 31-5.