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ROLE OF BONE MARROW ASPIRATION IN HAEMATOLOGICAL AND NON HAEMATOLOGICAL DISORDERS - A RETROSPECTIVE STUDY IN A TERTIARY CARE CENTRE.

Medical Science

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ABSTRACT

Aim: To study the spectrum of haematological and non haematological disorders on bone marrow aspiration at a tertiary care centre in western odisha, India.

Materials and methods: Retrospective study was conducted in the Department of Pathology from January 2016 to December 2019. Data regarding bone marrow aspiration cytology were retrieved from haematology records.

Results: Total 264 cases were studied. The age range of patients was 9 months to 85 years.Male to female ratio was 1.16:1. Majority of patients were of age group 15 – 30 years (25%). Commonest indication for bone marrow was pancytopenia. Aplastic anaemia(29.54%) was the most common diagnosis followed by megaloblastic anaemia (16.28%). Common among the haematological malignancy was acute myeloid leukemia (9.09%).

Conclusion: Bone marrow aspiration is a useful method to diagnose various haematological and non haematological disorders. Different geographical areas have different presentation of haematological disorders.

KEYWORDS

Bone marrow aspiration, pancytopenia, hypoplasticanemia.

INTRODUCTION

Hematological disorders include a wide range of diseases ranging from anaemia of variable etiology to hematological malignancies. Detailed clinical history, physical examination & peripheral blood analysis are important tools for diagnosing haematological disorders. However, many a times bone marrow examination is needed to establish a definitive diagnosis. Bone marrow aspirations are able to detect causes related to anaemia of unknown origin, unexplained cytopenia and pyrexia of unknown origin. Inspection of bone marrow is considered one of the most valuable diagnostic tools for evaluating hematological disorders.[1]The procedure may be necessary for the diagnosis and management of hematological and to some extent non – hematological disorders, for staging, prognostication, and evaluation of therapeutic response in some cases.[2] Bone marrow aspirate is also used for immunophenotyping, cytogenetic and molecular genetic analysis.[3]

Bone marrow aspiration is an invasive, yet relatively safe procedure which can be performed on an outpatient basis.[4]The disease spectrum varies widely in different geographical location of the world. In India it also varies between different states being a very vast country and with different ethnic population.[4]The aim of this study is to find out spectrum of diseases diagnosed by bone marrow aspiration at a tertiary centre in our hospital over a period of four years.

METHODS

Retrospective study was conducted from January 2016 to December 2019 at the Department of Pathology of VSSIMSAR, Burla. A total of 264 patients were included. Clinical details, peripheral smear study and Bone Marrow Aspiration (BMA) findings were retrieved from the haematology record file. The bone marrow examinations were done by the conventional technique using Klima or Salah needle. The most common collection site was posterior superior iliac spine. In children, medial aspect of tibial tuberosity was the BMA site. Leishman's and iron stained slides along with special stains like myeloperoxidase (MPO), and Periodic Acid Schiff (PAS) were examined in the available cases. Inadequate aspirate samples with absence of particles, megakaryocyte or other precursors were reported as bloody aspirate and these along with dry tap were excluded from the study. Bone marrow biopsies were advised in such cases.

RESULTS

Bone marrow aspirations were performed on total 300 cases in four years,out of which 31 cases were inadequate for interpretation or diluted with blood. 5 cases were dry tap. These 36 cases were excluded from study. Hence, the study group consisted of total 264 cases.

The age ranged from 9 months to 85 years. The most common affected age group were 15 – 30 years (Table -1). 142 cases (53.78%) were males and 122 (46.21%) were females with the male to female ratio as 1.16:1.

The most common indication for BMA cytology was pancytopenia (49.62%), followed by unexplained anaemia (9.84%), bicytopenia (8.71%), multiple myeloma (7.57%), suspected leukemias (6.43%), and Immune thrombocytopenia (4.16%). Other less common indications were infections, lymphoma, pyrexia of unknown origin, unexplained thrombocytopenia, dimorphic anaemia, unexplained splenomegaly and others. (Table -2)

Bone marrow examination findings are given in Table 3. Anaemias were the most common haematological disorders in our study (48.46%). Among anaemias, aplastic anaemias were the most common findings followed by megaloblastic anemia. Among malignancies, acute myeloid leukemia was the most common. Different studies show variable incidence of haematological and non haematological disorders as shown in Table – 4.

Table 1: Age distribution.

Age group (in years)	Number of cases	Percentage (%)
< 15	50	18.93
15 - 30	66	25.00

31 - 45	51	19.31
45 - 60	57	21.59
> 60	40	15.15
Total	264	100

Table 2: Indications of bone marrow

Indications	Number of patients	Percentage (%)
Pancytopenia	131	49.62
Unexplained anaemia	26	9.84
Bicytopenia	23	8.71
Dimorphic anaemia	03	1.13
Thrombocytopenia	04	1.51
Immune thrombocytopenia	11	4.16
Suspected leukemia	17	6.43
? Non Hodgkin's Lymphoma	07	2.65
Hodgkin's Lymphoma	02	0.75
Myeloproliferative disorder	01	0.37
Unexplained splenomegaly	03	1.13
Pyrexia of unknown origin	06	2.27
Multiple myeloma	20	7.57
Infection	08	3.03
Solid tumours	01	0.37
Hemophagocytic lymphohistiocytosis	01	0.37
Total	264	100

Table 3: Disease diagnosed by bone marrow aspiration cytology

Bone marrow aspiration diagnosis	No. of cases	%
Aplastic Anaemia	78	29.54
Megaloblastic Anaemia	43	16.28
Iron deficiency Anaemia	04	1.51
Dimorphic Anaemia	03	1.13
Immune thrombocytopenia	09	3.40
Acute myeloid leukemia	24	9.09
Acute lymphoblastic leukemia	16	6.06
Multiple myeloma	15	5.68
Chronic lymphocytic leukemia	01	0.37
Myelodysplastic changes	06	2.27
Metastasis	03	1.13
Erythroid hyperplasia	31	11.74
Normal marrow	21	7.95
Hypersplenism	03	1.13
Haemophagocytic syndrome	02	0.75
Infection	01	0.37
Myeloid hyperplasia (reactive)	04	1.51
Total	264	100

Table 4: Comparison of different studies

Serial no.	Study	Number of cases	Age range	M:F	Common haematological disorder	Common haematological malignancy
1.	Jha et al[12] (2007)	148	1 – 79yrs	1.5:1	Hypoplastic anemia (29.05%)	AML 22 cases (13.51%)
2.	Pudasaini S et al[8](2012)	57	9 months – 75 yrs	1:1.1	Erythroid hyperplasia (21%)	AML (10.5%)
3.	Mahfuz H et al[19] (2013)	500	1 – 82yrs	1.42:1	Erythroid hyperplasia (37.5%)	ALL (39.3%)
4.	Elmadhoun WM et al[7] (2015)	112	1 – 87yrs	1:1	Hypoplastic BM/Aplastic anaemia (37.5%)	CML (7.1%)
5.	Marwah N et al[5](2017)	879	7months – 90 yrs	1.07:1	Erythroid hyperplasia (17%)	Acute leukaemia(11%)
6.	Khan SP et al[10](2018)	2131	1-80 yrs	1.9:1	MegaloblasticAnaemia(14.5%)	AML (13.2%)
7.	Gohil M et al[16] (2018)	113	2 days (youngest)	1.17:1	Dimorphic anaemia(18.58%) and MegaloblasticAnaemia (18.58%)	ALL (4.42%)
8.	Choudhary M et al[6] (2019)	350	2 – 75yrs	1.16:1	MegaloblasticAnaemia (17.14%)	AML (16.57%)
9.	Chowdhury MR et al[9](2019)	152	2 – 80yrs	1.6:1	Aplastic anaemia (15.13%)	AML (14.47%)
10.	Present Study (2020)	264	9 months –85yrs	1.16:1	Aplastic anaemia (40.6%)	AML (13.04%)

(AML= Acute Myeloid Leukemia, ALL = Acute Lymphoblastic Leukemia, CML= Chronic Myelogenous Leukemia)

6. DISCUSSIONS

Bone marrow examination is an important diagnostic tool in haematological practice. Nutritional anemias like megaloblastic anemia, dimorphic anemia and haematological malignancies are easily diagnosed by bone marrow aspirations. It is also helpful in diagnosing non-hematological disorders such as storage disorders and systemic infections.[5]

Total two hundred and sixty four cases were included in this study. The age range varied from 9 months to 85 years. Similar to our studies, other studies also show wide age range.[5, 6, 7]The most common age group undergoing BMA was 15 - 30 years. Male: Female ratio was 1.16:1. Similar results were reported by Choudhary M et al[6] (1.16:1), Elmadhoun WM et al [7](1:1), and Pudasaini S et al[8] (1.1:1). Some other studies show slight male predominance.Chowdhury MR et al[9] and Khan SP et al[10] show M:F ratio (1.6:1), and (1.9:1) respectively.

The most common indication for bone marrow study was pancytopenia (49.62%). Similar findings were reported by Elmadhoun WM et al[7] (38.4%), PudasainiS et al[8] (50%), and Chowdhury MR et al [9] (26.97%).Cytopenias generally result from accelerated peripheral destruction of blood cells as in autoimmune disease, underproduction, or maturation defects.[11]Many times the underlying cause was not found peripherally and bone marrow study was advised.

In our study aplastic anaemia with 78 cases (29.54%) was the most common finding in bone marrow aspiration. In all cases the marrow was hypocellular and all three lineages of cell were suppressed. BMA findings were correlated with peripheral blood smear which also showed pancytopenia. Similar studies were reported by Elmadhoun WM et al[7] (37.5%), Chowdhury MR et al[9] (15.13%), and Jha et al[12] (29.05%). However in some studies it has shown low incidence.[4, 5, 8] Khan SB et al[10] studied 2131 cases and found aplastic anemia in 2.8% cases only.[10]

Epidemiologically, aplastic anemia is found to be more common in developing countries than developed countries.[13]The factors responsible for high incidence of aplastic anaemia in Asian countries including India are lower socioeconomic status, high exposure to pesticides, chemicals, toxins and pathogens. [14, 15]In western odisha, most of the patients are farmers who belong to low socioeconomic status and with high exposure to pesticides. So, it might be one of the causes for aplastic anaemia. However, this needs to be studied and further evaluated.

In some studies, megaloblastic anaemia is the predominant finding in BMA by Gupta Aet al[4](31%), Choudhary M et al[6] (17.14%), Khan SP et al[10] ((14.5%), and GohilM et al[16](18.58%). Megaloblastic anemia is more common among people resorting to vegetarian diet, in pregnant woman and in growing children. This is more common in northern India.[4]Dimorphic anaemia(18.58%) was also commonest finding by Gohil M et al[16].

Jalaeikhoo H et al[17] studied 683 cases of pancytopenia and found acute myeloid leukemia (21.4%) as the common disorder followed by myelodysplastic syndrome (15%). Aplastic anemia accounted for 9.2% only. The variation in the frequency of various diagnostic entities causing pancytopenia has been attributed to differences in the methodology and stringency of diagnostic criteria, geographic area, period of observation, genetic differences and varying exposure to myelotoxic drugs.[18]

In our study, the most common haematological malignancy was acute myeloid leukemia (9.09%) followed by acute lymphoblastic leukemia (6.06%), multiple myeloma(5.68%), and chronic lymphocytic leukemia (0.37%). Cytochemistry like Myeloperoxidase and PAS were applied whenever required. Flow cytometry and cytogenetics were advised for subclassification based on WHO/REAL classification system. Our study was comparable to other studies by Pudasaini S et al[8], Choudhary M et al[6], Khan SP et al[10], and Chowdhury MR et al[9], which show acute myeloid leukemia as the predominant haematological malignancy in their studies.

Elmadhoun WM et al[7]reported CML (7.1%); whereas Gohil M et al [16](4.42%), and Mahfuz H et al[19] (39.3%) showed Acute Lymphoblastic Leukaemia as the most common malignant disorder in their study. In our studies Acute Lymphoblastic Leukaemia (6.06%) was the second commonest cause of haematological malignancy.

Some studies show erythroid hyperplasia as the commonest finding in bone marrow aspiration.Marwah N et al[5]reported 17%,Mahfuz H et al [19]37.5% and Pudasaini S[8]at al 21%.

Normal bone marrow findings were seen in 21 cases (7.95%). Pudasaini S et al[8]reported 10.5%, Choudhary M et al[6] 4.30%, and Khan SP et al[10] 6.8%.

We reported pyrexia of unknown origin as 2.27%. The role of bone marrow aspiration in pyrexia of unknown origin is well studied by Gupta R et al[20], who found only 16.5% as diagnostic.

In our study metastasis were seen in three cases (1.13%), which is much lesser than other studies. Choudhary M et al[6] reported 2.57%, Khan SP et al[10] 4.4%, Ghartimagar D et al[21](6%). Two cases (0.75) of Hemophagocytic lymphohistiocytosis (HLH) are found in our case. Gupta A et al[4]reported 1%.

In our studies, out of 300 cases 31 cases showed bloody aspirate. So, definite diagnosis was not made. In such cases bone marrow biopsy is helpful to assess cell type, cellularity, extent and pattern of tumor infiltration. Furthermore flow cytometry, immunophenotyping and other special investigations are needed for subclassification and confirmation of diagnosis. However, in most developing countries where these special investigations are not routinely done or unavailable, BMA is still considered as an essential and important diagnostic modality of many haematological and some non haematological conditions. The incidence of dry tap was low in our study as compared to other studies. [22,23]

CONCLUSION:

Bone marrow examination is useful investigation tool in clinical practice. It is safe and cost effective diagnostic procedure for the diagnosis of both neoplastic and non-neoplastic haematological diseases. The most common cause of pancytopenia in our study was aplastic anaemia. However, in a proportion of cases BMA sample cannot be obtained. In such cases BMB needs to be performed as a complete study. The study also provides the geographical variation of haematological and non haematological disorders.

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REFERENCES:

1. Bain BJ, Clark DM, Wilkins BS. Bone marrow pathology. 4th ed. Sussex: Wiley-Blackwell; 2010:14-16
2. Rock WA Jr., Stass SA, editors. Handbook of Hematologic Pathology. New York, NY: Marcel Dekker, Inc.; 2000. p. 1-26
3. Bain B J. Bone marrow aspiration. J ClinPathol 2001;54:657–663
4. Gupta A, Hashmi SA, Rajmohan KS, Khan ID. Disease spectrum in bone marrow aspiration cytology: study in a tertiary care centre in north India. International journal of scientific research; 2019;8:58 - 60
5. Marwah N, Bhutani N, Singh S, Kalra R, Gupta M, Sen R. The spectrum of haematological disorders from bone marrow aspiration cytology in a tertiary care centre. Int J Curr Res 2017; 9:44938-41.
6. Choudhary M, Kour B, Singh K. Pattern of Haematological Disorders on Bone Marrow Aspiration in A tertiary Care Centre in North India. International Journal of Science and Research2019; 8:1367 – 1369.
7. Elmadhoun WM, Noor SK, Ahmed MH, et al. Bone marrow aspiration in north Sudan: the procedure, indications and the diagnostic value. Int J Health Sci 2015; 9:435-9.
8. Pudasaini S, Prasad KBR, Rauniyar SK, Shreshtha R, Gautam K, Pathak R, et al. interpretation of bone marrow aspiration in haematological disorder. J Pathol Nepal.2012; 2:309-12.
9. Chowdhury MR, Rashid MH, Begum A. Diagnostic Role of Bone Marrow Examination in Detecting Haematological and Nonhaematological Disorders.Medicine Today, 2019; 31(01), 15 – 18.1
10. Khan SP, Geelani S, Akhter S, Bhat S, Hussain S, Manzoor F, etal. Bone marrow aspiration in haematological disorders: study at a tertiary care centre. Int J Res Med Sci 2018;6:2361-4
11. Adewoyin AS, Nwogoh B. Peripheral blood film - a review. AnnIb Postgrad Med 2014; 12:71-9.
12. 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.
13. Young NS, Abkowitz JL, Luzzatto L. New Insights into the Pathophysiology of Acquired Cytopenias. Hematology Am SocHematolEduc Program. 2000; 18 38.
14. Issaragrisil S, Andersn T, Chansung K et al. Association of aplastic anemia in Thailand with low socioeconomic status. Br J Haematol1995; 91:80–4.
15. Malhotra P, Gella V, Guru Murthy GS, Varma N, Varma S. High incidence of aplastic anemia is linked with lower socioeconomic status of Indian population. J Public Health (Oxf). 2016; 38(2):223-228.
16. Gohil M, Rathod K. Bone Marrow Aspiration Cytology Study in a Tertiary Care Center, Gujarat, India. Int J Sci Stud 2018; 5(10):11-14.
17. Jalaeikhoo H, Kashfi SM, Narimani A, Moghadam K, Rajaienejad M, Ariana M. Acute Myeloid Leukemia as the main cause of Pancytopenia in Iranian Population. Iranian J Pathol.2017; 12(3):265-271.
18. Ryan DH, Felgar RE. Examination of the marrow. In: Lichtman MA, Kipps TJ, Seligsohn U, Kaushansky K, Prchal JT. Lichtman MA, editor. William's Haematology. 7th ed., Vol. 3. New York: McGraw Hill; 2006. p. 21-31
19. Mahfuz H, Rahman MM, Bhyuian MN, Shaha D. Bone marrow morphological examination – An analysis of 500 cases. JAFMC Bangladesh. 2013; 9(2): 59-63.
20. Gupta R, Setia N, Arora P, Singh S, Singh T. Hematological profile in pyrexia of unknown origin: role of bone marrow trephine biopsy vis-à-vis aspiration. Hematology. 2008; 13(5):307–12.
21. Ghartimagar D, Ghosh A, Narasimhan R, Talwar OP. Patterns of hematological and nonhematological malignancies in bone marrow in a tertiary care hospital in Nepal-11 years study. NMCJ. 2012 Sep; 14(3):187-92. 12.
22. Perez VU, Wilson RG, Alberto BA. Clinical significance of dry marrowpuncture or dry tap. Rev Med Hered 1997; 8: 50-57.
23. Barua AR, Rahman J, T ariquzzaman, Barua D. Histomorphological patterns in 50 bone marrow aspiration failure cases. Bangladesh J Pathol 2010; 25: 18-22