ISSN: 0975-3583,0976- VOL15, ISSUE 05, 2024

BONE MARROW STUDY IN A TERTIARY CARE HOSPITAL

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Received Date: 15/04/2024 Acceptance Date: 08/05/2024

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Abstract

Background: Bone marrow aspirate (BMA) and bone marrow biopsy (BMB) are necessary to diagnose bone marrow pathology. Bone marrow examination helps to find out information about hemopoietic tissue in various conditions.

Aim and objectives: To analyse the cause of haematological, non-haematological disorders and to interpret the bone marrow findings with various conditions.

Methods: A study of 51 patients over a period of one year (January 2023 to December 2023) was done in Central Clinical Laboratory (CCL), Pathology, PDU Medical College and Hospital, Rajkot, Gujarat, India. Three modalities peripheral smear(PS), BMA, and BMB were used for diagnosing haematological and non-haematological disorders were included in the study.

Results: Out of 51 cases studied 30(58.82%) were male and 21(41.1.3%) were female with age group ranging from 3 to 75 years. In both aspiration and biopsy most common findings were megaloblastic anaemia 17 (33.3%), Normochromic normocytic anaemia 2(4 %), Hypochromic microcytic anaemia 13(25.5%), Pancytopenia 3(6%), Dimorphic anaemia 3(6%), Myeloproliferative disorder 1(1.9%) and lymphoproliferative disorder 1(1.9%), leukaemia 4(7.8%).

Conclusion: Bone marrow examination is a diagnostic procedure to find haematological and non-haematological diseases. The final interpretation requires the integration of PS, BMA, and trephine biopsy findings with supplementary tests such as immunophenotyping, and molecular genetic studies in the context of clinical and diagnostic findings.

Keywords: Peripheral smear, Bone marrow aspirate, Bone marrow biopsy.

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Introduction

Bone marrow examination is a simple and cost effective procedure. Evaluation of haematological & non-haematological diseases after clinical history, physical examination & peripheral blood analysis is fundamental. This study was conducted to evaluate bone marrow samples received at a tertiary care centre in our hospital over a period of one year.

Methods

We evaluated a total number of 51 cases from January 2023 to December 2023 in the Central Clinical Laboratory, Department of Pathology, P.D.U Medical College & Hospital, Rajkot, Gujarat, India. Bone marrow aspiration was performed only in those patients who were advised to do so by their clinicians. Patients were of different age groups, both genders. Bone marrow aspiration was done under aseptic conditions. In each case a detailed history along with systemic, general and local examination and routine haematological investigation was carried out prior to bone marrow aspiration. Patients were explained about the procedure. Patients were informed about complications and written consent was taken. The patient is placed in the lateral decubitus position, the lower leg straight and the top leg flexed. The site is prepared, cleaned with an antiseptic (usually Betadine) scrub, and draped, exposing only the aspiration area. The skin and the area down to the periosteum are infiltrated with a local anaesthetic (eg, 1% Xylocaine). Approximately 10 cc of 1% Xylocaine is used. A skin incision is made with a small surgical blade, through which the bone marrow aspiration and needle are inserted. The bone marrow aspiration needle having a stylet is inserted. Once the needle contacts the bone, it is advanced by rotating clockwise and anticlockwise slowly until the cortical bone is penetrated and the marrow cavity is entered. Usually, a sudden loss of resistance is noted when the marrow cavity has been entered. Once inside the cavity, the stylet is removed and, using a 20-cc syringe, approximately 0.5cc of bone marrow is aspirated. Slides are made by fixing it with methanol after drying. The needle is removed and pressure is applied with gauze. BMA was performed by Salah's needle; smears prepared were stained with field & Leishman stain. Bone marrow aspiration in most of the cases performed from posterior superior iliac spine.

Inclusion criteria: It includes, who were suspected of having their bone marrow involvement by any haematological or non-haematological disorders. Complete blood count, coagulation profile, reticulocyte count and peripheral blood film (PBF) examination were done.

Exclusion criteria: Patients with severe thrombocytopenia or functional platelet defects, Prolonged Prothrombin time normalised ratio, Severe bleeding.

Results

From 2023, 51 patients were enrolled for the study

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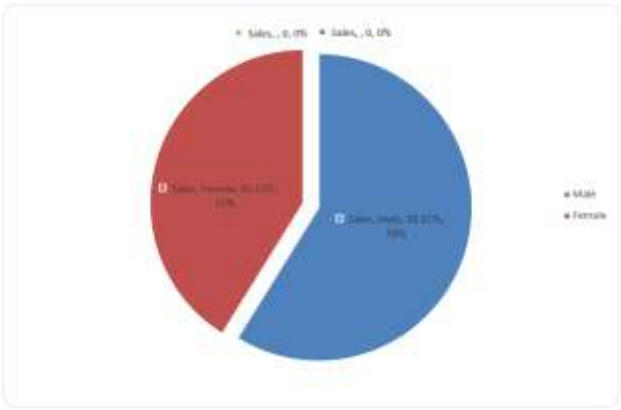

Chart 1: Male to Female Ratio

Chart no. 1 show male female ratio Out of 51 cases studied 30(58.82%)
were male and 21(41.1.3%) were female with age groups ranging from 3 to 75 years.

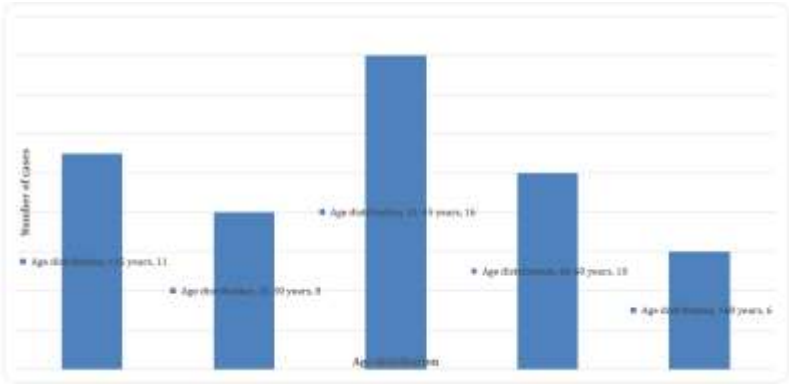

Chart 2: Age wise distribution of patients.

Chart no.2 shows age wise distribution of patients, most of the patients were in between 31-45 year of age group,

X axis- Age distribution of patients.

Y axis -Number of cases

Table 1: Clinical presentation of patients

Presenting signs/symptoms	Number of cases	Percentage (%)
Fever of unknown origin	6	28.5
Generalised weakness	25	21.4
Weight loss	02	17.0
Organomegaly	16	17.0
Others	02	16.0
Total	51	100

Table no.1 shows clinical presentation of patients in which the majority of the patients have generalised weakness, after that organomegaly was the second most common presentation. Other presenting symptoms were fever, weight loss etc.

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Table 2 Peripheral blood smear findings in cases

PERIPHERAL SMEAR FINDINGS	Bone marrow case	Percentage (%)
Dimorphic anaemia	3	6
Normochromic normocytic anaemia	16	31.8
Hypochromic microcytic anaemia	13	25.2
Pancytopenia	17	33.33
Myeloproliferative disease	1	1.9
Lymphoproliferative disease	1	1.9
Total cases	51	100

Table no 2 shows peripheral blood smear finding in case of bone marrow aspiration cases, in which most common was pancytopenia, second most common was normochromic normocytic anaemia, some peripheral smears shows hypochromic microcytic anaemia and dimorphic anaemia, also myeloproliferative and lymphoproliferative disorders like picture seen in 2 cases, respectively.

Table 3 Haematological Disorders aspirationin case.

Bone marrow aspiration finding	Number of cases	%
Dimorphic anaemia	3	5.8
Normochromic normocytic anaemia	2	4
Hypochromic microcytic anaemia	13	25.50
Leukaemia	4	7.8
ITP	7	13.6
Pancytopenia	3	06.00
Megaloblastic anaemia	17	33.3
Myeloproliferative disorder	1	1.9
Lymphoproliferative disorder	1	1.9
Total cases	51	100%

Table no 3 shows bone marrow aspiration findings in which most common was megaloblastic anaemia, after that hypochromic microcytic anaemia was second most common, other findings leukaemia, ITP, myeloproliferative and lymphoproliferative disorders were also seen.

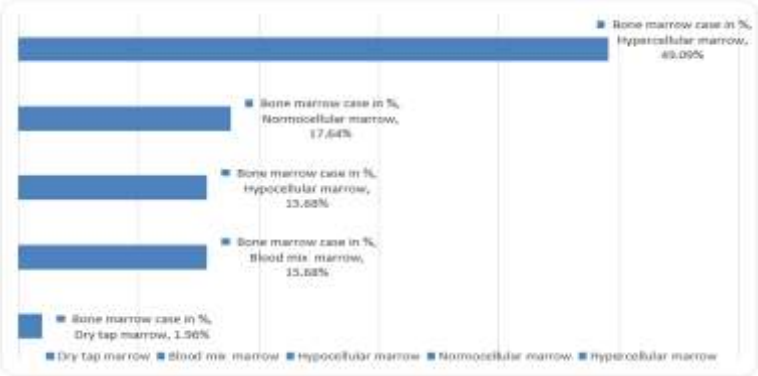

Chart 4: Cellularity of bone marrow

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Chart no 4 shows wide discrepancy between cellularity of the marrow. hyper cellular marrow 49.09%, Normocellular marrow 17.64%, Hypocellular marrow 15.68%, Blood mix marrow 15.68 %, dry tap 1.96%.

Table 4: Indications for bone marrow aspiration.

INDICATIONS	PERCENTAGE
Pancytopenia	35%
Anaemia	20%
Thrombocytopenia	15%
Malignancy	3%
Bicytopenia	17%
Miscellaneous	10%
Total cases	100%

Table no.4 shows indications of bone marrow aspiration in which pancytopenia was most common indication, second most common was anaemia and other ones are as mentioned in table respectively.

MEGALOBLASTIC ANAEMIA

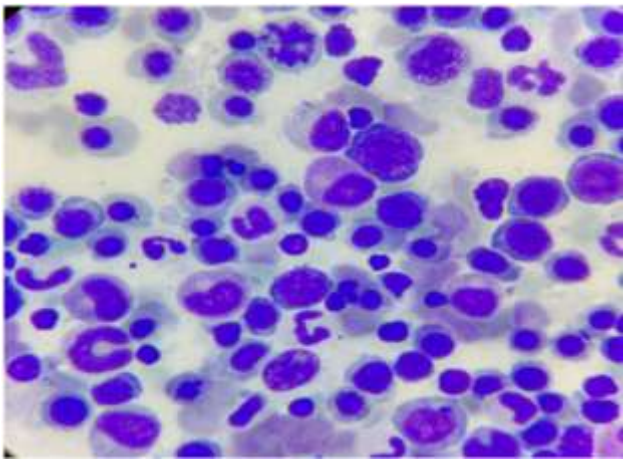

IMAGE 1: Bone marrow aspiration smear shows erythroid hyperplasia along with sieve-like nucleus megaloblast also seen.

CONGENITAL DYSERYTHROPOIETIC ANAEMIA

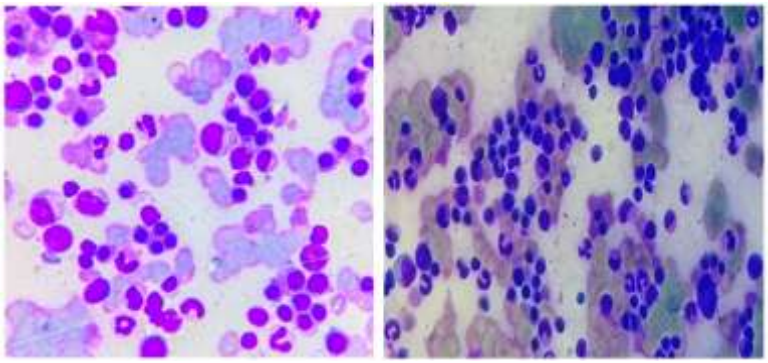

IMAGE 2 & 3: shows ineffective erythropoiesis & megaloblastic proliferation as well as binucleated and tri nucleated erythroblast seen possibility of congenital dyserythropoietic anaemia.

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CHRONIC LYMPHOPROLIFERATIVE DISORDER

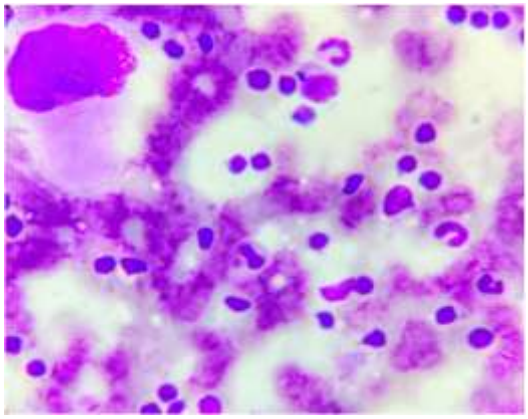

IMAGE 4: showing megakaryocytes along with many mature lymphocytes with precursor cells seen. Few myeloid cells are also seen to suggest the possibility of lymphoproliferative neoplasm.

ITP

ITP was seen in 7 cases (13.6 %) with maximum number of cases in the age group of 21-40 years and M:F ratio of 1:3 showing high female preponderance.

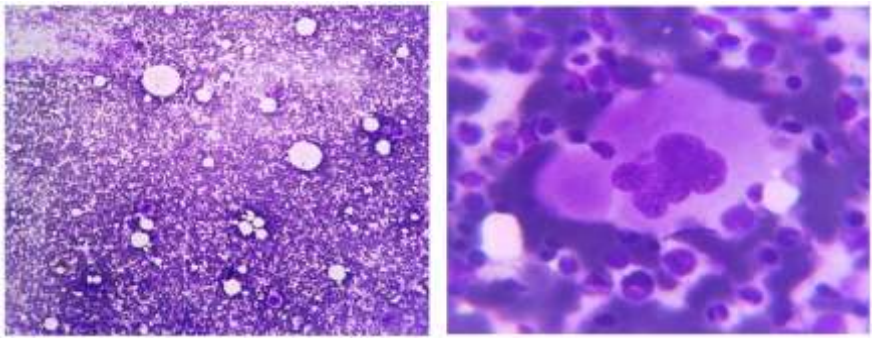

IMAGE 5: 10x view showing bone marrow aspirate

IMAGE 6:100x view showing hypolobated megakaryocyte with smooth cytoplasmic Border and reduced granularity.

with an increased **number of megakaryocytes.**

Discussion

The bone marrow is one of the body's largest organs, constituting 4.5% of the total body weight and weighs 3375 g in an average 75 kg individual. It is the principal site of haematopoiesis. The hematopoietic bone marrow is organized around the vasculature of the bone cavity. Its main function is to supply mature hematopoietic cells for circulating blood in a steady state as well as to respond to increased physiological or pathological demands. Bone marrow examination is used to diagnose, confirm, and/or stage hematologic disorders. It helps to evaluate cytopenia, thrombocytosis, leukocytosis , anaemias, and iron status. It is also helpful in non hematological disorders such as storage disorders and systemic infections. It is an ambulatory procedure performed under local anaesthesia with minimal morbidity. It is a safe and useful test in reaching the final diagnosis. Haematological disorders, both benign

ISSN: 0975-3583,0976- VOL15, ISSUE 05, 2024

and malignant, comprise a major health problem. They have a high mortality and morbidity. Both men and women can get involved at any age. Early diagnosis and treatment can save the patient. Hence, Bone marrow examination is an important test to diagnose both haematological and non-haematological malignancies, when the routine peripheral blood and other laboratory tests are not enough to conclude diagnosis. The present study determines the indications and the spectrum of disorders diagnosed by BMA examination.
The male to female ratio was 1.5:1 The age range was from 3 to 75 years

Comparison of age and sex with various studies:

STUDY NAME	AGE RANGE	M:F RATIO
Kumar K *et al.*	29 days to 75 years	1.02: 1
Pudasaini S *et al.*	39 months to 75 years	1.1: 1
Gilotra M *et al.*	41 years to 88 years	1.2 :1
Thiyagarajan P5 11	8 years to 90 year	1.3 :1
Sterling Hospital Vadodara	2 years to 80 years	1.25: 1
Present Study	3 years to 75 years	1.55: 1

In this study the most frequent indication of bone marrow examination was pancytopenia (35%), followed by Anaemia (20%) and Malignancy (3%). Other indications being thrombocytopenia and bicytopenia Similarly, by Pudasaini *et al.* [9] in 2012 in Nepal, Bashawari in 2002 at Saudi Arabia and study in tertiary care centre, Rajkot [6] showed pancytopenia as most common indication. While studies like Kumar *et al.* [8] reported anaemia (34.4%) to be the most common indication, Aljadeyeh *et al.* [14] reported anaemia (22.4%) as the most common indication of marrow examination.
Pancytopenia is apparently a very sinister finding, but in our study the most common diagnosis was Megaloblastic Anaemia (33.3% cases). It was same as study conducted by Gayathri and Rao[15] in 2011 in India as well as a study done at Rajkot [6]in which Megaloblastic Anaemia was the most common cause of pancytopenia and was the most common finding in BMA (22.5%cases).
Our study showed that nutritional anaemias were most common non-malignant disorders and megaloblastic anaemia is commonest among them. Similar findings were recorded by Okinda, N.A. *et al.*, Patel J *et al.* and Kibria SG *et al.*
Immune Thrombocytopenic Purpura (ITP) is an autoimmune disease. ITP is more common in females . In our study, total 7 cases (13.3%) were of ITP, among which 4 were females and 3 were males. In study of Nepal. [19] the female to male ratio was 1.6:1. The proportion of ITP cases in two studies found it to be 9.33% and 10.5%. International studies have shown the proportion to be 6.21%, 14.5% and 5%.
In this study, non-neoplastic diseases were 96%, while malignant cases 4%. Study of Nepal suggested non-neoplastic diseases consisting of 81.1% and neoplastic diseases consisting of 18.9%. In one study from Nepal, the incidence of neoplastic diseases was 19.3%. In our study, Leukaemia was the most common malignancy.

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Out of 4 cases, most common was Acute Myeloid Leukaemia (2 cases), followed by chronic Myeloid Leukaemia, and Acute Lymphoblastic Leukaemia one-one case each and like that Chronic Myeloproliferative disorder (CMPD) and Chronic Lymphoproliferative Disorder (CLPD) accounts for 2 cases one-one for each. In a Rajkot study [6] Acute Myeloid Leukaemia was the most common malignant disorder accounting for 4.1% cases. Similarly, Acute Myeloid Leukaemia was the most common disorder in one more study conducted by Atla BL *et al.*[20] in 2015 in India.

Conclusion

Bone marrow aspiration cytology is a minimal invasive, safe, relatively cheap technique which can diagnose many haematological and non-haematological diseases that can be confirmed by more advanced investigations, serological, biochemical or molecular. Whenever a bone marrow sample cannot be obtained (dry tap)in such cases a bone marrow biopsy needs to be performed.

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