ORIGINAL RESEARCH PAPER

Pathology

KEY WORDS: Bone marrow aspiration, hematological disorders, hematological spectrum, Megaloblastic Anemia

SPECTRUM OF HAEMATOLOGICAL DISORDERS IN BONE MARROW ASPIRATION AT TERTIARY CARE HOSPITAL, JORHAT

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ABSTRACT

Anemia is a common symptom of haematological disorders in people of all ages .The spectrum of haematological disorders differs significantly between developing and industrialized countries. The primary use of bone marrow aspirate is for cytological examination. It enables study into the cellularity of the bone marrow as a whole, the detection of specific lesions, and the amount of infiltration by various disease entities. **Aims & objective:** The aim of the study is to evaluate the spectrum of haematological disorders reported in bone marrow aspiration and to know the age and sex incidence. **Materials and methods:** This prospective study is an observational study was conducted over a one-year period on 73 patients and the spectrum of hematological disorders was studied on bone marrow aspiration smears. **Conclusion:** A thorough examination of the bone marrow is essential for diagnosing haematologic disorders. It is a simple and cost effective procedure which can be performed routinely without using any specialized equipment or a need of general anaesthesia

INTRODUCTION

Anemia is a common symptom of haematological disorders in people of all ages. Anemia is common around the world, although it is more prevalent in developing countries [1].The spectrum of haematological disorders differs significantly between developing and industrialized countries [2]. In most cases, a full clinical examination and simple testing are sufficient to make a diagnosis. In certain cases, only a bone marrow examination can confirm the diagnosis. A bone marrow picture, as well as a peripheral blood smear and clinical symptoms, can aid in making a definitive diagnosis. Bone marrow aspiration is useful in explaining cytopenias and in diagnosing leukemias as individual cell structure is better understood with bone marrow aspiration . Bone marrow examination is also used to diagnose and stage neoplasms and storage disorders [3].

The primary use of bone marrow aspirate is for cytological examination. It enables study into the cellularity of the bone marrow as a whole, the detection of specific lesions, and the amount of infiltration by various disease entities[4].

Bone marrow aspiration specimens are also valuable for other studies such as molecular studies, cytogenetics, cytochemistry, flow cytometry/ Immunophenotyping and microbiological studies [5,6].

AIMS AND OBJECTIVE

The aim of the study is to evaluate the spectrum of haematological disorders reported in bone marrow aspiration and to know the age and sex incidence.

MATERIALS AND METHODS

This prospective study was conducted over a one-year period in the department of pathology at Jorhat Medical College and Hospital. A total of 73 cases were included in this study who were clinically suspected of haematological disorders and had undergone bone marrow aspiration in the department of pathology of Jorhat Medical College and Hospital (JMCH).The research design chosen for this study was cross-sectional.The Patient's age, sex and other clinical details were retrived from the hospital data. Each and every case was examined clinically and relevant history was taken. The relevant investigations and peripheral blood smears were performed in all cases. Written informed consent was obtained from all the study subject before undergoing the bone marrow aspiration procedure. The bone marrow aspiration samples were collected from the study group and respective smears were prepared. All the smears were reviewed for morphological details and findings and the data recorded.

We followed Bain methods for peripheral blood smear preparation and staining [7].

Bone marrow aspiration procedure as per ICSH guidelines [8].

After explaining the procedure and obtaining consent, the patient was placed in a left or right lateral decubitus posture with their knees flexed. The patient was warned of the procedure's potential for pain.

Sterile latex gloves were used to inspect and palpate the patient's back in order to locate the anatomical landmark of the posterior iliac crest. The targeted spot was cleansed with povidone-iodine solution and marked by producing a shallow imprint on skin. After cleansing the chosen site and surrounding skin with povidone iodine, the centre area of the chosen site was cleansed with a sterile isopropyl soaked swab. After the skin had dried, a 2% lignocaine local anaesthetic was used to numb the overlying skin, subcutaneous tissue, and periosteum of the chosen site of the posterior iliac crest. A bone marrow aspiration needle with a stylet was introduced into the skin, subcutaneous tissue, periosteum, and bone cortex with constant pressure and twisting action. When the marrow cavity was accessed, there was a sudden decrease in resistance. The stylet was then removed, and a 10 or 20 mL syringe was connected to the needle hub with a strong, push, twist action. A little amount of bone marrow (0.2 to 0.5 mL) was aspirated. The aspiration needle was then withdrawn, and cotton pads were used to provide pressure to the location until the bleeding ceased.

Immediately following the process, smears of the aspirated material were gently made.

After the procedure, a pressure bandage was applied, and the patient was told to check the area often and report any bleeding. These aspiration smears were dried, fixed, and stained with MGG stain and Leishman stain. The entire procedure was carried out in an aseptic condition.

INCLUSION & EXCLUSION CRITERIA

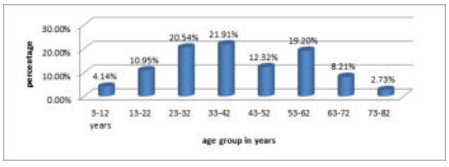
All clinically suspected cases of hematological disorders where bone marrow aspiration is indicated and adviced by clinician were included in the study while patients with no consent, pregnant women, patients taking anticoagulant medications and children below 3 years of age were excluded.

OBSERVATION AND RESULTS

This study included 73 patients who had undergone bone marrow aspiration, of which 40(54.79%) were males and 33(45.20%) were females, with a M : F ratio of 1.21:1,(Figure1)

In the present study, the age group of the patients was from 3 years to 82 years. The maximum number of cases (21.91%) were in the age group of 33-42 years, followed by 23-32 years and 53-62 years and are shown in Figure 2, with graph .

FIGURE 2: AGE DISTRIBUTION



Megaloblastic Anemia was the most common finding in the present study (52.05%) followed by chronic myeloid leukemia noted in 6.84% cases .The spectrum of the haematologic disorders on bone marrow aspiration in the present study are shown in Table 1.

Non-malignant haematological disorders accounted for 51(69.86%) cases in the current study. The most common was Megaloblastic anemia [Fig.3] (52.05%) , with a M:F ratio of 1.23:1, followed by Dimorphic anemia (5.47%) and hypocellular marrow[Fig. 4] (5.47%) with a M:F ratio of 3:1 and 0.3:1 respectively. Iron deficiency anemia [Fig.5] was seen in 4.10% cases with the M:F ratio of 2:1.We encountered one case of ITP[Fig. 6] in a 23 year female patient who presented with red pupuric spots on legs since 6 months and bleeding gums since 3 months. We also encountered one case of Essential thrombocythemia [Fig.7] in a 33 year male patient who presented with pain in abdomen since 1 month and with a spleenomegaly on ultrasonography finding .

Hematologic malignancy was detected in (19.17%) cases of 73 patients investigated. Chronic myeloid leukaemia (CML) [Fig. 8] was the most common malignant haematological disorder in the current study, accounting for 6.84% of all cases and 35.71% of all malignancies with the M:F ratio of 1.5:1. Acute myeloid leukemias [Fig.9] (5.47%) were the next most common malignancies in this study with the M: F of 1:1, followed by Plasma cell dyscrasia [Fig. 10] in (2.73%) cases. Others included 1 cases of lymphoproliferative disorder (1.37% overall; 7.14% of malignancies), and 1 cases of Acute Lymphoblastic leukaemia[Fig.11] (1.37% overall; 7.14% of malignancies).The current study also revealed one cases of metastatic secondary deposits (1.37% overall; 7.14% of malignancies) which was suspected to be of primary origin from a ovary.This case was seen in a 62 yr female patient who presented with pain in abdomen and lower limb weakness. Her CT scan report showed multiple lytic lesions involving vertebra and pelvic bone .

Normal marrow study was observed in 6.84% cases, while 3 cases yielded unsatisfactory smear and was given advice of repeat aspiration.

Table 1: Spectrum of hematological disorders diagnosed on bone marrow aspiration.

Diagnosis	No. of cases	Percentage
Megaloblastic Anemia	38	52.05%
Chronic myeloid leukemia	5	6.84%
Dimorphic anemia	4	5.47%
Hypoplastic Marrow	4	5.47%
Acute myeloid leukemia	4	5.47%
Iron deficiency anemia	3	4.10%
Plasma cell dyscrasia	2	2.73%
Acute lymphoblastic leukemia	1	1.37%
Essential thrombocythemia	1	1.37%
Immune thrombocytopenic purpura	1	1.37%
Lymphoproliferative disorder	1	1.37%
Secondary deposists	1	1.37%
Normal bone marrow study	5	6.84%
Inadequate smear	3	4.10%
TOTAL	73	100%

In present study the bone marrow aspirate is hypercellular in 51(69.86%) cases followed by hypocellular bone marrow and Normocellular bone marrow in 11(15.06%)cases and 8(10.95%)cases respectively.

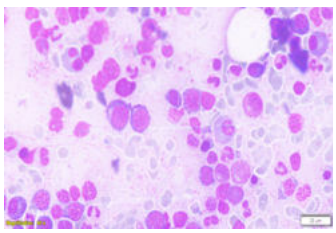


Fig 3: Megaloblastic Anemia showing erythroid hyperplasia with many megaloblast displaying sieve like chromatin and nuclear maturation lagging behind cytoplasmic maturation.(Giemsa,40X)

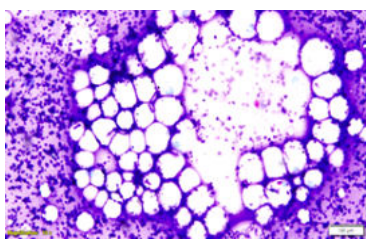


Fig 4: Hypoplastic marrow-Bone marrow aspiration showing hypocellular bone marrow containing fat fragments(Giemsa,10x).

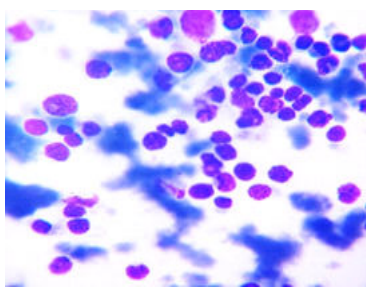


Figure 5: Iron Deficiency Anemia –Bone marrow aspirate showing micronormoblastic maturation.(Giemsa,40x).

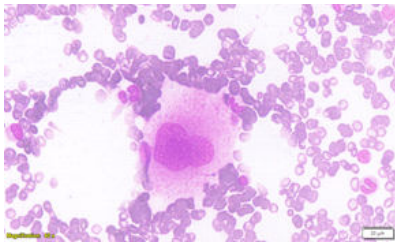


Figure 6: Immune Thrombocytopenia-Bone marrow aspirate showing immature megakaryocyte having unlobated nuclei with smooth borders in a scant amount of cytoplasm which lacks the azurophilic granules.(Giemsa,40x)

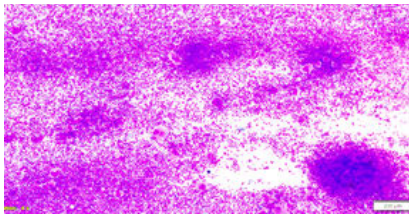


Figure 7: Essential Thrombocythemia - Megakaryocytes are arranged in loose clusters.(Giemsa,4x)

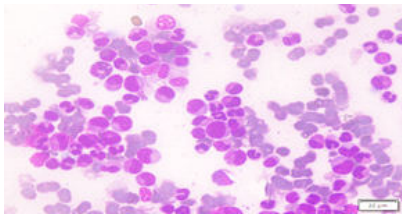


Fig 8: Chronic Myeloid Leukemia-Bone marrow aspirate showing myeloid series with all stages of maturation, predominance of myelocytes seen.(Giemsa,40x)

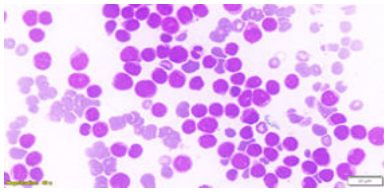


Figure 9: Acute Myeloid Leukemia –Bone marrow aspirate showing myeloblast with high N/C ratio , cleaved nucleus and open chromatin with prominent nucleoli .(Giemsa,40x)

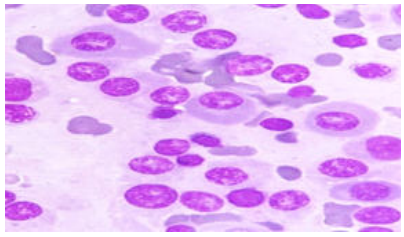


Figure 10: Plasma cell Dyscrasia-Bone marrow aspirate showing plasma cells with eccentric nuclei, basophilic cytoplasm and perinuclear hof.(Giemsa,40x).

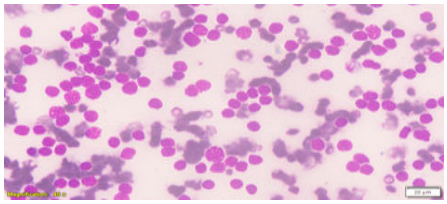


Figure 11: Acute Lymphoblastic Leukemia-Bone marrow aspirate showing lymphoblast having high N/C ratio,scant cytoplasm ,open chromatin and inconspicuous nucleoli(Giemsa,40x)

DISCUSSION

In the present study, out of 73 cases studied, there were 40 males (54.79%) and 33 females (45.20%).The male to female ratio was 1.21:1 showing male preponderance.The age group of the patients in the present study who underwent bone marrow aspirations ranged from 3 years to 82years. The mean age in the present study was 40.25 (±17.45) years and the most common age group was 33- 42 years.

This finding was comparable to the findings of Pudasani S et al [9] , in which the majority of the patients were between the ages of 30-45 years and M. Atchyuta et al. [3] in which the most common age group was 31- 40 years. Gayathri et al. [10] conducted a study in which the age range was from 2 years to 80 years and the M:F ratio was 1.2:1, which was similar to the current study findings. Study conducted by Reshma et al. [11 also] showed age range from 2years-80 years, with the male preponderance which was also similar to the present study. The mean age in the present study was 40.25 (±17.45)years which is compareable with the study done by Reshma et al and Khan SP et al [12].

In the present study the most common non malignant haematological disorder was found to be Megaloblastic Anemia found in 38(52.05%) cases, while chronic myeloid leukemia was the most common malignant hematological disorder contributing 5(6.84%) cases which matches with the study done by Arshad et al.(2021)[13] in which they found megaloblastic anemia(31%) as the most common non malignant haematological disorder while chronic myeloid leukemia as the most common malignant haematological disorder. Similar findings were seen in the studies done by M. Atchyuta et al.(2018)(3), and Bagale P. et al.(2018)[14] .

This appears to reflect a higher prevalence of nutritional anaemia in Indian subjects, while small variations in the prevalence of different diagnostic entities for haematological disorders across studies have been explained by methodological differences, different geographic location, and different time period of observation, genetic variations, and varying exposure to myelotoxic agents, among other factors.

CONCLUSION

The spectrum of the haematologic disorders in our study revealed that nonmalignant disorders were more common than hematologic malignancies.Megaloblastic anaemia was the most common haematological disorders among these non-malignant hematologic disorders, followed by dimorphic anaemia and hypoplastic marrow. Among haematological malignancies, chronic myeloid leukaemia was the most common, followed by acute myeloid leukaemia. And the males are likely to suffer more from haematological disorders than female.

Hence for the diagnosis, prognosis, and treatment response of various haematological and non-hematological disorders, aspiration of bone marrow is crucial. A thorough examination of the bone marrow is essential for diagnosing haematologic disorders. It is a simple and cost effective procedure which can be performed routinely without using any specialized equipment or a need of general anaesthesia.

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