

Original Research Article

Diagnostic utility of bone marrow aspiration in bicytopenia

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ABSTRACT

Background: Haematological diseases are frequently seen now a days in different age groups. Patients can present with a variety of presentations in form of cytopenia of a single lineage or in a dual combination or with pancytopenia. Our study focusses on the utility of bone marrow aspiration for diagnosis of bicytopenias by assessment of pattern of bicytopenias in peripheral smear examination.

Methods: This was a retrospective study that was conducted over a period of one year in a tertiary care institute of Northern India. Cases of bicytopenia were subjected to bone marrow aspiration and parameters such as cellularity, myeloid to erythroid ratio and cytomorphological details of the cells were documented.

Results: Study consisted of male predominance with maximum patients in the age group of 21-30 years. Most common bicytopenia was found to be anaemia with thrombocytopenia and normoblastic erythroid hyperplasia was the most common aetiology.

Discussion: The results of this study were similar to those in the earlier literature with the inference that bone marrow aspiration performed for all cases significantly helped in arriving at the diagnosis.

Conclusions: Bicytopenia is a good haematological indicator for many non-malignant and malignant diseases. Knowledge of its aetiologies can help in the diagnosis and efficient management of patients. Bone marrow study forms a cost-effective tool in interpretation of bicytopenia.

Keywords: Bicytopenias, Bone marrow aspiration, Hematological malignancy, Non hematological malignancy

INTRODUCTION

Haematological diseases are frequently seen now a days in different age groups. Patients can present with a variety of presentations in form of cytopenia of a single lineage or in a dual combination or with pancytopenia. Bone marrow assessment becomes an important part of the investigation of the disease process as it is often seen that just the total blood count and peripheral smear assessment can't bring the clinician near the finding and hence, it helps in establishing the final diagnosis thereby helping in planning the course of treatment.¹

Bicytopenia as the name suggests, refers to a pathology in which there is reduction of any two out of three cell lineages of haematopoietic cell lines (red blood cells, white blood cells and platelets). Bicytopenia may be a

separate entity or it could be the initial manifestation of development of pancytopenia.² These include a wide spectrum of diseases, which can range from transient marrow viral suppression to marrow infiltration by life threatening malignancies.³ Most of the studies on cytopenias have been done in western population. Not many studies have been done in developing countries which can provide an insight into evaluation of spectrum of aetiologies in bicytopenia. Henceforth this study has been carried out on bicytopenia so as to study not only the various aetiologies but also to figure out the most frequent combination of bicytopenia. It is important to assess whether these independent parameters can be interrelated for the disease causation, thus affecting the treatment as well. Bone marrow examination plays an important role in arriving at the diagnosis of the disease.⁴

Aims and objectives

Primary objective

Primary objective were to study the utility of bone marrow aspiration for diagnosis of bicytopenias by assessment of pattern of bicytopenias in peripheral smear examination

Secondary objectives

Secondary objectives were to study the epidemiological profile of bicytopenias in our region and to study the most common combination in cases of bicytopenias in our population.

METHODS

Duration

This was retrospective study that was conducted over period of 1 year in tertiary care institute of northern India.

Place of conduct of study

It was conducted in post-graduate department of pathology at government medical college Jammu from November 2021 to October 2022.

Sample size calculation

Sample size was 50 cases with a margin of 5% error maintaining the power of study more than 80%.

Inclusion criteria

All cases of bicytopenias determined by autoanalyser and confirmed by peripheral smear examination, irrespective of age and sex of the individual were included in study.

Exclusion criteria

All patients diagnosed as pancytopenias determined by autoanalyser and confirmed on peripheral smear examination. Patients with coagulation disorders. Patients with skin infections, osteomyelitis or with history of previous radiation therapy, a non-cooperative patient and cases with inadequate material or no marrow bit on bone marrow aspiration were excluded.

Informed consent was taken before the procedure from all the subjects.

Study procedure

A detailed clinical history and meticulous physical examination was performed prior to inclusion of the patients in this study. Various haematological investigations were performed for all cases including

complete blood count with haemoglobin, total leukocyte count, differential count, red blood indices, platelet count and reticulocyte count. All the findings were noted.

Bone marrow aspiration was done from posterior superior iliac spine under all aseptic precautions, using Salah's aspiration needle, after taking consent from the patient. Skin, subcutaneous tissue and periosteum overlying the selected site were infiltrated by 2% xylocaine (2-5 ml) after sensitivity testing. With boring movement, needle was passed perpendicularly into the cavity of the ilium at the centre of the posterior superior iliac spine. Stylet was removed when the bone was penetrated, 20 ml syringe was attached and 2 ml of marrow contents were sucked into the syringe. Concentration of aspirated marrow was achieved by delivering single drop of aspirate on to slides about 1 cm from one end. 3-5 cm long marrow smears were prepared using 2 cm wide smooth edged glass spreader. The marrow smears were air dried and stained with Giemsa stain.

For the retrospective study, the Giemsa-stained bone marrow aspiration smears were retrieved from the archives of the department. The faded smears were re-stained.

The following parameters were documented in the aspiration smears: Cellularity, myeloid to erythroid ratio and cytomorphological details of the cells.

All the above information gathered was noted in a well structured proforma, which included information regarding age, sex, clinical details, indication for bone marrow examination and the final diagnosis of bone marrow aspiration.

Statistical analysis

Data was presented in tables and descriptive statistics was used, variation using Chi-square of independence was used as appropriate. The level of significance was set at 5% ($p < 0.05$). Data obtained was analysed using SPSS software version 27.

RESULTS

Out of total 50 subjects, there was a significant male predominance with males to females ratio of 1.4:1 (Table 1).

There was a wide range of age group extending from 3 years to 78 years with a mean of 32.3 years (Table 2).

The most common clinical history elicited was weakness (82%), fatigue (64%) followed by pallor (58%) and fever (22%) and bleeding manifestations (18%) (Table 3).

In the present study, the most common bicytopenias observed in peripheral blood smear were anaemia with thrombocytopenia followed by thrombocytopenia with

leukopenia and anaemia with leukopenia as shown in (Table 4).

The bone marrow aspiration yielded cellular marrow in all 50 cases.

Table 1: Gender distribution.

Gender	N
Male	29
Female	21
Total	50

Table 2: Age distribution.

Age group (years)	N
<10	6
11-20	11
21-30	13
31-40	06
41-50	07
51-60	04
>60	03
Total	50

Table 3: Common presenting complaints in patients.

Symptoms	N
Weakness	41
Fatigue	32
Pallor	29
Fever	11
Bleeding manifestations	09

Table 4: Type of bicytopenias.

Bicytopenia in peripheral blood	N	Percentage (%)
Anaemia with thrombocytopenia	32	64
Anaemia with leukopenia	05	10
Thrombocytopenia with leukopenia	13	26

Table 5: Underlying aetiology in bicytopenias.

Aetiology	N	Percentage (%)
Normoblastic erythroid hyperplasia	16	32
Megaloblastic anaemia	08	16
Dimorphic anemia	06	12
Iron deficiency anemia	02	04
Acute lymphoid leukemia	08	16
Acute myeloid leukemia	10	20

The most common aetiology of bicytopenia in the present study in bone marrow aspiration was normoblastic

erythroid hyperplasia, followed by megaloblastic anaemia and iron deficiency anemia (Table 5).

DISCUSSION

This study was conducted in the post-graduate department of pathology at government medical college, Jammu over a period of one year. In this study, bone marrow aspiration was performed in both adults and children. Posterior iliac spine was the preferred site in adults while Tibia was also preferred in young children.⁵

The age group in the present study ranged from 3-78 years, with a mean age group of 32.3 years. Athar et al in their study showed the mean age of occurrence as 35 years.⁶ Saira et al reported the age of occurrence as 38.9 years.⁷ The slight variation in the mean age between the different studies can be attributed to the differing geographical areas and varied indications for the bone marrow study. Athar et al in their study showed the age range between 21-30 years.⁶ Ekwere et al showed similar findings.⁸

The male to female ratio in the present study has been 1.4:1, with slight male predominance. Niazi et al showed a male preponderance with the ratio being 1.5:1 and Singh et al showed male : female ratio of 1.4:1 which was in concordance with our study.⁸⁻¹⁰ In contrast to our study, Athar et al showed female predominance with male: female ratio of 1:2.⁶

Majority of patients presented with weakness (82%) and fatigue (64%). Other symptoms included pallor (58%), fever (22%) and bleeding manifestations (18%). Singh et al in their study showed the most common presenting complain as pallor (87.5%), followed by body weakness and headache (47.9%), lastly by fever (37.9%).¹⁰ These presenting complaints usually vary from person to person as the haematological disorders are wider and have different pathogenesis which is also influenced by the person's genetic makeup and individual immunity.

Majority of the patients presented with anaemia with thrombocytopenia in 64% of cases, followed by thrombocytopenia with leukopenia in 26% of cases and by anemia with leukopenia in 10% of cases. Saadia HD et al showed consistent findings.³ Anemia therefore represents a global problem, which is so commonly encountered, although it may be cumbersome at times to reach the cause. Nutritional anemias are predominantly present. The haematological and biochemical assessment namely complete blood count, peripheral smear examination, iron profile and vitamin B12 levels can aid in the prompt diagnosis and early treatment. Thrombocytopenia accompanying anaemia has been a majority bicytopenia observed in the present study. It is usually associated with megaloblastic anaemias. Megaloblastic anaemia has been known to induce dysmegakaryopoiesis. Dysmegakaryopoiesis is characterised by alterations in megakaryocyte maturation,

leading to dysplastic features in megakaryocytes. These dysplastic features can be in form of multiple separated nuclei, micro megakaryocytes or hypo granular form. The non dysplastic features seen in megakaryocytes can be in form of immature forms, cytoplasmic vacuolisation or budding. These immature forms are unable to mature into platelets, leading to thrombocytopenia.¹¹

The present study encountered megaloblastic anaemia to be predominantly associated with thrombocytopenia in 08 cases. There has been an attempt made to study the causal relation between anaemia and thrombocytopenia, thus anaemia can be attributed to cause thrombocytopenia, rather than the chance association of thrombocytopenia with anaemia.¹² In present study, the second most common combination was thrombocytopenia with leukopenia seen in 26% of cases.

The present study showed the majority of cases to be normoblastic erythroid hyperplasia followed by megaloblastic anemia. The results corresponds to the study by Singh et al which also showed similar picture.¹⁰ However study conducted in central India by Nigam et al and those by Singh et al, Anjum et al also showed predominantly megaloblastic marrow.^{1,13,14}

In the present study, 32 (64%) of 50 cases showed non malignant cases of haematological disorders and 18 (36%) case showed haematological malignancies. Megaloblastic anemia was the most common among non malignant hematological disorders, while haematological malignancies comprised predominantly of acute lymphoid leukemia and acute myeloid leukemia. Singh et al in their study, showed non-malignant haematological disorders in 53.6% and haematological malignancies in 46.4% of cases, which is quite similar to our findings.¹⁰ The bone marrow examination performed on children in the present study was eleven cases. Majority of them presented with anaemia and thrombocytopenia, seen in 07 (63.63%) out of eleven cases, while 04 (36.36%) cases showed thrombocytopenia with leukopenia. Nutritional anaemias have been the most common aetiology. The study conducted by Saadia et al showed that the most common bicytopenia in children was anemia with thrombocytopenia.³ The cause for this was acute lymphoblastic leukaemia followed by nutritional deficiency anaemia which is in concordance with our study. The nutritional anaemia mainly in form of iron deficiency anemia, should alert the pathologist to look for a parasitic infection, which is common in the Indian setup. An elaborate clinical history can thus aid in speedy and accurate diagnosis along with good morphological skills.^{15,16} In the present study, aspiration performed for all cases significantly helped in arriving at the diagnosis. Bone marrow examination can thus be performed on both adults and children. Bone marrow study in form of aspiration forms an invaluable asset in the diagnosis and aids in the clinical management of the patients.^{6,16,17}

Limitation

The study encountered limitations in terms of sample size.

CONCLUSION

Bone marrow study forms a cost effective tool in interpretation of bicytopenia. Bone marrow aspirations helps to know the cytomorphological details, thus plays a better role than trephine biopsies in studying the individual cells and is valuable in sub classifying anaemias and leukemias. However, the results should be interpreted with the complete blood counts and peripheral smear examination along with the clinical history and presentation to aid for further clinical management. Bicytopenia is a good haematological indicator for many non-malignant and malignant diseases. Knowledge of its aetiologies can help in the diagnosis and efficient management of patients.

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