Section: Pathology

Original Research Article

BONE MARROW ASPIRATION AND TREPHINE BIOPSY STUDY IN CASES OF PANCYTOPENIA

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ABSTRACT

Background: Pancytopenia is defined as simultaneous presence of anaemia, leukopenia and thrombocytopenia. Pancytopenia has various underlying etiologies. Accurate diagnosis is needed for proper management of patient as few etiologies are life threatening.

Materials and Methods: Prospective study conducted over 18 months. Total 115 cases were included in study. After routine investigations for pancytopenia, bone marrow aspiration and trephine biopsy were done from posterior superior iliac spine.

Results: Study population ranging from 4 years to 65 years with M:F ratio 1.2: 1. Among 115 cases of pancytopenia, megaloblastic anaemia was the predominant etiology accounting for 39% cases followed by acute leukemia in 24% cases. Aplastic anaemia (13%), myelodysplastic syndrome (05%), myelofibrosis (03%), Secondaries in marrow (03%), ITP (06%), Multiple myeloma (03%), Lymphoma infiltration (02%) Gaucher's disease and Tuberculosis each (01%) were noted. Pallor followed by fever, splenomegaly and bleeding tendencies were common clinical presentation.

Conclusion: Though, pancytopenia is common clinical condition, it can lead to life threatening situation. For management of pancytopenia, diagnosis of underlying etiology is needed. Along with clinical and routine haematological examination, bone marrow aspiration and trephine biopsy are very helpful to arrive at accurate diagnosis.

Keywords: Pancytopenia, Anaemia, Leukemia, Bone marrow aspiration, Trephine biopsy, Pallor.

INTRODUCTION

Pancytopenia is defined as simultaneous presence of anaemia, leukopenia and thrombocytopenia. Pancytopenia is a clinical outcome that results due to either primary or secondary affection of bone marrow.[1] Pancytopenia is relatively common condition. Various contributing factor are responsible for the development of pancytopenia and that involved the ineffective or reduced haematopoiesis and increased destruction by either sequestration or destruction by antibodies.[2] Bone marrow cellularity varies depending upon the cause of pancytopenia. Marrow is hypocellular in primary production defect while in case of ineffective erythropoiesis, increased peripheral utilization or destruction of cell and bone marrow with malignant infiltration are associated with hypercellular and normocellular marrow.[3] The clinical presentation of pancytopenia mainly attributable to anaemia or thrombocytopenia. Leukopenia may result in repeated infections presented as fever. Thus, pallor, easy fatiguability, bleeding and weight loss.[4] The pattern of diseases leading to pancytopenia is variable in different population groups with geographic variation with their difference in age pattern, nutritional status, and prevalence of infective disorders. It is very essential to know the etiology of pancytopenia because severity of pancytopenia depends on the underlying etiology. Few etiologies are treatable like megaloblastic anaemia and few are life threatening like MDS, and Leukemia.Thus, in addition to routine haematological investigation, bone marrow aspiration and trephine biopsy are important to know the underlying etiology of pancytopenia. This

study was undertaken to find out the prevalent etiologies of pancytopenia and its phenotypic characteristics on peripheral blood smear, bone marrow aspiration and trephine biopsy in each case.

MATERIALS AND METHODS

The present study was prospective study, carried out in the department of Pathology, at tertiary care teaching hospital in Maharashtra. Study duration was 18 months from January 2023 – June 2024. All cases with pancytopenia (Hemoglobin< 10gm/dl, Total Leukocyte Count < 4000/mm3 and Platelet Count < 150,000/mm3) were included in study. Total 115 cases were studied. Clinical details were obtained. Previously diagnosed cases and Chemotherapy or Radiotherapy induced pancytopenia cases and cases with recent history of blood transfusion were excluded. 2 – 3 ml of blood was collected by venipuncture under all aseptic precaution in a EDTA bulb. Samples were processed by an automated haematology analyzer and complete blood count details were noted. Bone marrow aspiration and Trephine biopsy performed at the same setting from posterior superior iliac spine using Jamshidi needle under local anaesthesia (2% lignocaine) using all aseptic precautions. Bone Marrow aspiration slides were prepared and stained with Leishman stain. Biopsy was processed as per Hammersmith protocol using acetic acid zinc formalin as fixative, decalcification by 10% formic acid and 05% formaldehyde. Further processing done as per routine histopathology processing with routine Haematoxylene and Eosin stain. Special stains were performed wherever required. Slides were examined and reported considering the adequacy of biopsy, Cellularity and topography and abnormality. All the findings were noted and analyzed.

RESULTS

Total 115 cases were studied during the study period of 18 months. The youngest case was 04 years old female child and oldest one was 65 years male. 68 were male and 47 were female with M:F ratio was 1.2: 1. Maximum cases belonged to 3 rd decade of life accounting for 24% followed by 2 nd decade of life (19%) (Table 1).

Clinically, pallor was the commonest presentation found in all cases, followed by fever in 56 cases. Fatigue was complained by 47 cases. Splenomegaly and Hepatomegaly was found among 34 and 18 cases respectively. Bleeding tendencies like gum bleeding, epistaxis was noted among 20 cases. 14 cases had petechiae and weight loss was observed among 12 cases. Cervical Lymphadenopathy was found among 11 cases while 05 cases had jaundice. Clinical presentation of cases shown in Table 2. Among the causes of Pancytopenia (Table 3), Megaloblastic Anaemia was the predominant condition accounting for 39% cases followed by Acute Leukemia (24%),Further subdivision of Acute leukemia were done by using special stains like Myeloperoxidase stain (MPO) and Periodic Acid Schiff (PAS) .Block positivity was evident among 14% cases of Acute leukemia and they were lebelled as Acute Lymphoblastic lekemia (ALL) While MPO Positivity was seen among 10% cases of Acute Leukemia and they were termed as Acute Myeloblastic Leukemia (AML).Thus Acute Lymphoblastic lekemia (ALL) 14% were predominate over Acute Myeloblastic leukemia (AML)10%. 04 cases had secondaries in bone marrow, of which 02 cases had metastasis from Breast carcinoma, 01 each from Squamous Cell Carcinoma of Lung and Prostatic Adenocarcinoma. Aplastic anaemia was relatively common finding encountered during the present study. Aplastic anaemia was found to affect wide range of age group, ranging from paediatric to elder group of patients.

Of the cases, presented with lymphadenopathy, 02 cases diagnosed as Non-Hodgkin's Lymphoma infiltrating the marrow. Immune Thrombocytopenic Purpura affecting 06% cases, mainly seen paediatric and adolescent age group. Plasma cell abnormality i.e. Multiple Myeloma was noticed among 03 cases. Non-Hodgkin's Lymphoma and Multiple Myeloma affect the cases from 3 rd and 4 th decade of life.

One case each of Gaucher's disease and Tuberculosis affecting bone marrow was found during the study. Strong PAS positivity seen in Gaucher;s cells and Tuberculosis was confirmed by TB-PCR test. Both affected cases were from paediatric age group. The youngest case of 04 yrs had Acute Lymphoblastic Leukemia while oldest case of 68 yrs male had secondaries from prostatic carcinoma.

Degree of anaemia was assessed among study population. 67% cases had haemoglobin level between 4 – 8 gm/dl, 20% had haemoglobin below 4 gm/dl while 28% cases had haemoglobin between 8 – 10 gm/dl.

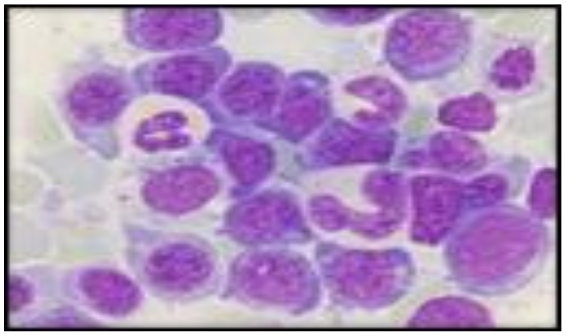

Figure 1a: BMA (Megaloblastic Anemia) shows Erythroid hyperplasia with Megaloblastic. erythropoiesis with Sieve like chromatin.

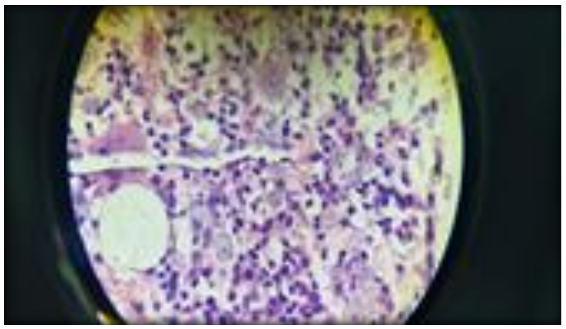

Figure 1b: BM Biopsy (Megaloblastic Anemia) shows several early megaloblasts. With prominent nucleoli with late megaloblasts.

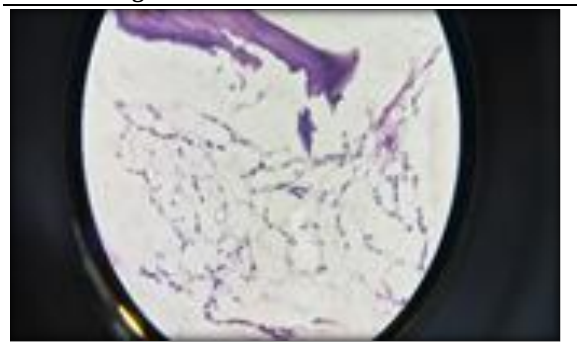

Figure 1c: BM Biopsy (Aplastic Anemia) shows marked hypocelluarity, with marked. reduction in hematopoetic precursors along with increase in number of lymphocytes and plasma cells and fat spaces.

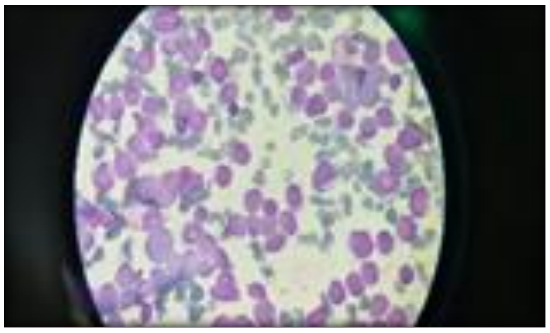

Figure 1d: BMA (Acute myeloid Lekemia) shows myeloid hyperplasia with myeloblasts.

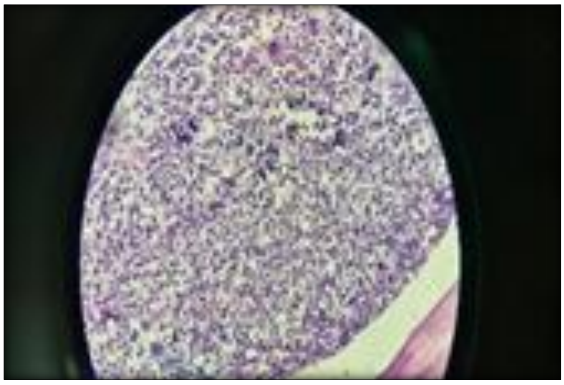

Figure 1e: BM Biopsy (Acute myeloid Lekemia) shows replacement of hematopoetic marrow and fat spaces by Blast cells.

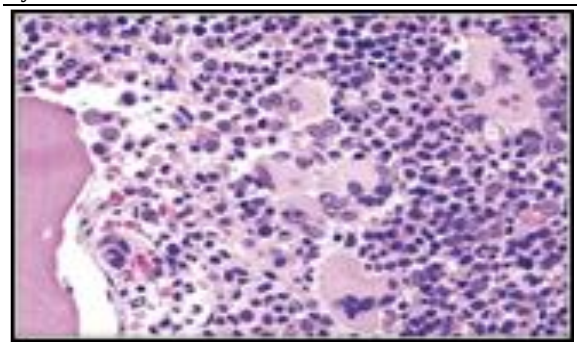

Figure 1f: BM biopsy (MDS) shows aggregate of Dysplastic Megakaryocytes and few megakaryocytes seen in paratrabecular location

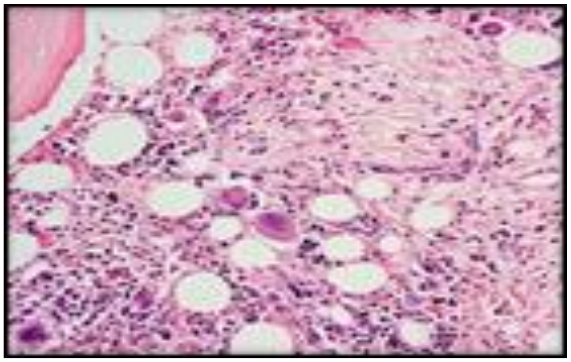

Figure 1g: BM Biopsy (Myelofibrosis) shows marked collagen fibrosis with reduction in all haematopoetic cell lineages along with clustering of megakaryocytes with varyping morphology

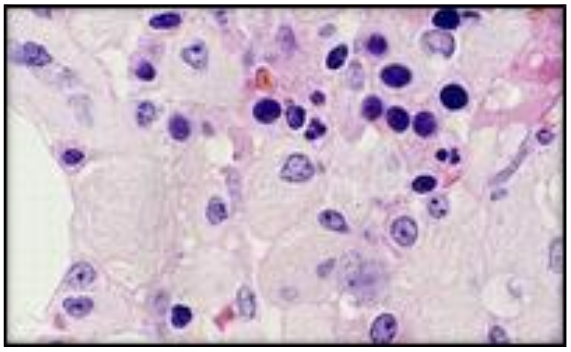

Figure 1h: BM Biopsy (Gaucher Disease) showing sheets of large macrophages with Abundant pale cytoplasm with crumpled tissue paper texture

Table 1: Distribution of cases according to age group and gender (n=115)

Sr. No.	Age Group in Year	Male	Female	Total No. of Cases
01	0 - 10	06 (05%)	04 (03%)	10 (09%)
02	11 – 20	10 (09%)	12 (11%)	22 (19%)
03	21 – 30	17 (15%)	11 (10%)	28 (24%)
04	31 – 40	10 (09%)	10 (09%)	20 (17%)
05	41 – 50	12 (11%)	03 (02%)	15 (13%)
06	51 – 60	08 (06%)	04 (03%)	12 (11%)
07	61 – 70	05 (04%)	03 (02%)	08 (07%)
Total		68 (59%)	47 (41%)	115 (100%)

Table 2: Frequency of Clinical Presentation among Study Population

Sr. No.	Clinical Features	Frequency	Percentage (%)
01	Pallor	115	100%
02	Fever	56	49%
03	Fatigue	47	41%
04	Splenomegaly	34	30%
05	Hepatomegaly	18	16%
06	Bleeding	20	17%
07	Petechiae	14	12%
08	Weight loss	12	10%
09	Lymphadenopathy	11	09%
10	Jaundice	05	04%

Table 3: Bone Marrow Findings among Study Population (n=115)

Sr. No.	Diagnosis	No. of Cases	Percentage
01	Megaloblastic Anaemia	45	39%
02	Aplastic Anaemia	15	13%
03	Acute Lymphoblastic Leukemia	16	14%
04	Acute Myeloblastic Leukemia	12	10%
05	Myelodysplastic Syndrome	06	05%
06	Myelofibrosis	03	03%
07	Metastatic	04	03%
08	Immune Thrombocytopenic Purpura	07	06%
09	Multiple Myeloma	03	03%
10	Lymphoma Infiltration [NHL]	02	02%
11	Tuberculosis	01	01%
12	Gaucher's Disease	01	01%

DISCUSSION

Though, Pancytopenia is relatively common haematological condition encountered in clinical practice, still it remains as diagnostic challenge for Clinician as well as Pathologist. Pancytopenia has varied clinical presentation. In view of therapeutic decision, the diagnosis of exact etiology of pancytopenia is must. Along with the routine clinical and haematological examination, Bone Marrow examination is needed for accurate diagnosis. Bone marrow aspiration along with the Trephine biopsy has great value of diagnostic accuracy.

In our study, M:F ratio was 1.2: 1, which is comparable with some studies,[6,7,8] while few studies showed female preponderance.[9] Thus, pancytopenia is more common in male patients.

In a study by Ojha S. et al,[10] and Keisu M. et al,[11] neoplastic etiologies predominate over megaloblastic anaemia as the cause of pancytopenia. In our study, megaloblastic anaemia was the commonest cause of pancytopenia. This finding is in concordance with the findings of Dagdia et al,[12] Javalgi et al,[13] Raphael et al,[14] and Gayathri et al,[15] Singh et al,[16] who found aplastic anemia as the most common cause of pancytopenia. In our study, Aplastic anaemia was relatively 2 nd most common cause of pancytopenia. In present study, most common clinical manifestation was pallor. Similar results were seen in Yokus et al,[17] study and Basak et al,[18] study.

CONCLUSION

Pancytopenia is common clinical finding with variable clinical presentation. Accurate diagnosis of etiology of pancytopenia is challenging task. Management of pancytopenia depends on accurate diagnosis of underlying etiology. Though, most of the conditions are diagnosed using clinical and routine haematological examination but at certain extent bone marrow aspiration and trephine biopsy is must to arrive at final diagnosis.

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