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Etiological Spectrum and Clinical Profile of Patients Admitted with Pancytopenia

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Authors' contributions

This work was carried out in collaboration among all authors. Author HPSD designed the study and wrote the protocol. Author SK performed the statistical analysis and wrote the first draft of the manuscript. Author GSD managed the analyses of the study. Authors DG and BG managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The etiological spectrum and clinical profile of admitted patients presenting with pancytopenia were studied.
Study Design: This was a prospective study conducted on 200 patients presenting to the Department of Medicine, Department of Oncology and the Allied Specialities of Medicine, Dayan and Medical College and Hospital, Ludhiana and were found to have pancytopenia during hospital stay.
Results: Mean age of the patients was 45.69 ± 17.05 years with maximum number of patients (23%) in the age group of 51-60 years and 119 patients were males and 81 patients were females. Most common physical finding was pallor (95%), followed by splenomegaly (22%) and hepatomegaly (17%). Total of 107 patients were vegetarians (53.5%) and 93 patients (46.5%) were non-vegetarians. Mean hemoglobin was 7.16 ± 2.04 g/dl, mean total leucocyte count was 2.51 ± 1.02 x 10^3/cu. mm, mean platelet count was 54885.37 x 10^3/ul ± 40320.96 and mean the absolute neutrophil count was 1.59 x 10^3 /cu.mm ± 0.84. Ten patients of pancytopenia were

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because of tropical fever which included 4 cases of dengue, 3 cases of malaria, 2 cases of enteric fever and 1case of mixed infection (malaria + scrub typhus). Viral markers were positive in 14 out of the 63 patients tested. Out of these 14 patients, 4 were HBsAg reactive, 7 were HCV +ve and 3 were HIV +ve. Most common red blood cell picture on peripheral blood film was normocytic normochromic (34.5%), followed by mixed morphology (33.5%). Macrocytic and microcytic morphology was seen in 19.5% and 12.5% of the patients respectively. Hypercellular marrow was seen in 82 patients (42.9%), normocellular marrow was seen in 58 patients (30.3%) and hypocellular marrow was seen in 51 patients (26.7%). The most common cause of pancytopenia in this study was megaloblastic anemia in 59 patients (29.5%), the 2nd common cause was leukemias in 28 patients (14%) and the 3rd cause was aplastic anemia in 22 patients (11%). Drug induced pancytopenia was seen in 21 patients (10.5%) and hypersplenism in 9 cases (4.5%).

Conclusion: This study has helped us in knowing the various etiologies of pancytopeniain this hospital. Megaloblastic anemia was the most common etiology in this study followed by leukemiasand aplastic anemia. The study helped us in understanding of the age and gender distribution, the hematological parameters, the peripheral blood film in pancytopenia and the bone marrow picture in these patients.

Keywords: Pancytopenia; etiological spectrum; clinical profile.

1. INTRODUCTION

The term pancytopenia refers to reduction in all the three cell lines that is red cells, white cells and platelets. It is in itself not a disease but a triad of a number of disease processes. The presenting symptoms are usually attributable to anemia, leucopenia and thrombocytopenia which include mild progressive weakness and fatigue, attributable to anemia, predisposition to various infections because of neutropenia and haemorrhage from skin, nose or gums due to thrombocytopenia. The severity of pancytopenia and underlying pathology determine the management and prognosis of the patients. Physical findings and peripheral blood picture provide valuable information in the work up of pancytopenic patients and help in planning investigations for bone marrow samples. Bone marrow evaluation is an invaluable diagnostic procedure in practice of medicine which usually confirms the diagnosis of cytopenia suspected from the clinical features and peripheral blood examination or may occasionally give a previously unsuspected diagnosis. Previous studies in India have stressed the importance of megaloblastic anemia as a major cause of pancytopenia. Westudied the various causes of pancytopenia and their clinical profile at this tertiary care centre of Punjab.

2. MATERIALS AND METHODS

The etiological spectrum and clinical profile of patients presenting with pancytopenia was studied. This was a prospective study conducted on 200 indoor patients presenting to the Department of Medicine, Department of Oncology and the Allied Specialities of Medicine, Dayan and Medical College and Hospital, Ludhiana who were found to have pancytopenia during hospital stay.OPD patients were not included in the study because of paucity of data. Institutional ethical committee approval for the study was taken.

2.1 Methods of Collection of Data

2.1.1 Inclusion criteria

Presence of all of the following:-

- Age≥ 18 yrs.
- Hb< 13 g/dl in men and Hb< 12 g/dl in women.
- TLC< 4000/cu mm.
- Platelets< 150000/microliter.

2.1.2 Exclusion criteria

- Age< 18 yrs.
- Patient on chemotherapy for oncological malignancies.
- Patients of pancytopenia previously enrolled in this study and got re-admitted, were excluded.

2.1.3 Method of data collection

All the patients included in this study were assessed as follows-

1. Detailed history of presenting complaints, relevant past, personal, drug history and family history was taken and findings of general and systemic examination were recorded.

2.2 Laboratory Investigations

The results of following routine investigations were recorded: Complete blood count, ANC, Peripheral blood film, renal function tests, liver function tests, Serum folate level, Serum B12 level, Ultrasound Abdomen, Bone marrow aspiration and biopsy. Other investigations including ESR, LDH, ANA, dsDNA, Tropical fever serology, Viral markers, chest X-Ray etc. were done as required.

2.3 Statistical Analysis

Data were described in terms of range, mean ± standard deviation (±SD) and percentages as appropriate. All statistical calculations were done using SPSS (Statistical Package for the Social Science) SPSS 21 version statistical program for Microsoft windows.

3. OBSERVATIONS AND RESULTS

In this study, out of 200 patients, 119(59.5%) were males and 81(40.5%) patients were females. Most of the patients were between the 51-60 age group which included a total of 46 patients (23%). There were 35(17.5%) patients in the age group 31-40and 34(17%) patients in the age group of 21-30. Least patients were in the age group >70 which included 12 patients (6%).Out of 200 patients, 107(53.5%) patients were vegetarians and 93 patients(46.5%) were non-vegetarians.

In this study the most common general physical finding was pallor which included 190 patients (95%). The 2nd and 3rd most common findings on general physical finding were splenomegaly (44 patients,22%) and hepatomegaly (34 patients, 17%) respectively.

In this study, 43 patients(21.5%) had a past drug history related to pancytopenia. Out of these 43 cases taking various drugs, 21 patients were labelled as drug induced pancytopenia on the basis of bone marrow examination. Rest of the 22 cases had other causes of pancytopenia. Among the 21 patients of drug induced pancytopenia, drugs which caused pancytopenia

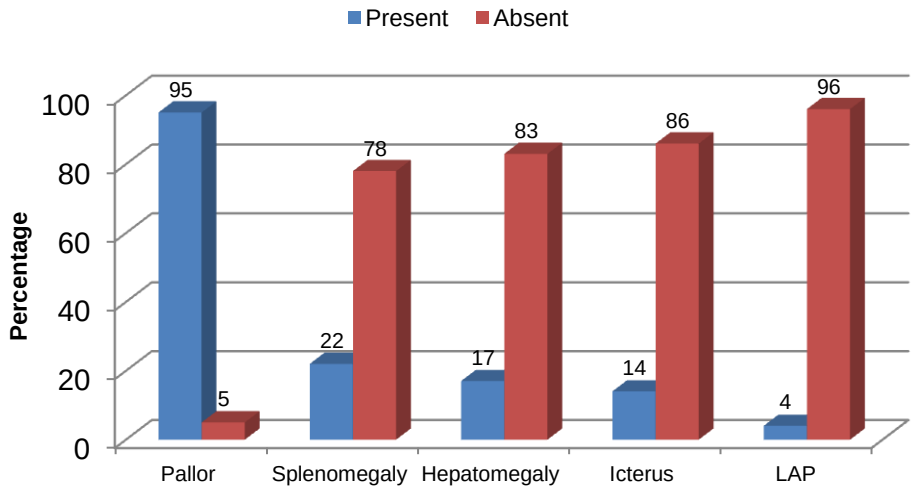

Fig. 1. Physical findings

Table 1. Mean Hb, TLC, Platelet count, MCV, MCH and MCHC of the study population(n=200)

Variables	Mean	SD
Hb(g/dl)	7.16	2.04
TLC(10^3/cu.mm)	2.51	1.02
Platelet count(10^3/ul)	54885.37	40320.96
MCV (fl)	93.77	14.45
MCH (pg)	31.22	5.02
MCHC (g/dl)	33.19	1.66
ANC (10^3/cu.mm)	1.59	0.84

were methotrexate in 12 patients, azathioprine in 3 patients, combination of methotrexate and indigenous medication in 2 patients and 1 each of 6-Mercaptopurine, NSAID's, ART and combination of methotrexate (MTX) and leflunomide. The most common drug being used by the patients in this study group was methotrexate which was being taken by 17 patients. Out of the 14 patients who were taking methotrexate alone, drug induced pancytopenia was found in 12 patients, 2 patients were diagnosed with megaloblastic anemia and macrophage activation syndrome and 1 patient was taking leflunomide along with MTX. The 2nd most common used drug was indigenous drugs which were used by 10 patients.

The mean haemoglobin level of the study population in this study was 7.16 g/dl with a standard deviation of 2.04. Mean TLC value was $2.51x10^3$/cu.mm with a standard deviation of 1.02. Mean platelet count was 54885.37 x 10^3/ul with a standard deviation of 40320.96. The mean ANC value was 1.59 $x10^3$/cu.mm with a standard deviation of 0.84.

Most common RBC picture on PBF was normocytic normochromic (34.5%), followed by mixed morphology (33.5%).Abnormal cells were seen in the PBF of 14 patients(7%).

Out of 200 patients bone marrow biopsy was done in 191 patients. Out of 191 patients, hypercellular marrow was seen in 82 patients (42.9%), normocellular marrow was seen in 58 patients (30.3%) and hypocellular marrow was seen in 51 patients (26.7%).

The most common cause of pancytopenia in this study was megaloblastic anemia. There were total of 59 patients of megaloblastic anemia which constituted 29.5% of the total patients. The 2nd most common cause of pancytopenia in this study was leukemias in 28 patients which constituted 14% of the total patients. The various types of leukemias included in this study were B-cell acute lymphoblastic leukemia, acute myeloid leukemia, hairy cell leukemia and acute promyelocytic leukemia. The 3rd most common cause of pancytopenia in this study was a plastic anemia in 22 patients which constituted 11% of the total patients.

Drug induced pancytopenia was also an important cause of pancytopenia which constituted 21 patients (10.5%). Hypersplenism was seen as a cause of pancytopenia in 9 cases (4.5%). Out of these 9 cases, 3 cases had an underlying hepatitis-C, 2 cases were of alcoholic liver disease with one patient having both hepatitis-C and alcoholic liver disease. 1 case was a known case of hepatitis-B, 1 case was of tuberculosis and in 2 cases cause of hypersplenism could not be ascertained. Tropical fever and multiple myeloma were also notable causes of pancytopenia in this study with 10 patients(5%) and 9 patients(4.5%) respectively. 6 patients each (3%) of MDS and lymphoma presented with pancytopenia in this study. 5 patients (2.5%) each of tuberculosis and haemolytic anemia also presented with pancytopenia in this study.

Out of the4 cases of macrophage activation syndrome, 1st patient was a k/c/o Down's syndrome with psoriasis and sepsis with blood culture positive for Klebsiella,2nd patient had disseminated tuberculosis, 3rd patient had Type 2 Diabetes Mellitus and sepsis with blood culture positive for *Acinetobacter* and the 4thpatienthad enteric fever with blood culture positive for *Salmonella typhi*.

Out of 200 patients, 173 (86.5%) patients were discharged, 20 patients (10%) were discharged against medical advice and there were a total of 7(3.5%) deaths in this study. Out of the 7 deaths in this study, 2 patients each had aplastic anemia and drug induced pancytopenia; and 1 case each of hypersplenism (due to decompensated CLD), multiple myeloma and precursor B-cell acute lymphoblastic leukemia.

Table 2. PBF description of the study population (n=200)

(A)RBC picture	**No. of patients**	**Percentage**
Normocytic Normochromic	69	34.5
Macrocytic	39	19.5
Microcytic	25	12.5
Mixed	67	33.5
(B)Atypical cells	14	7

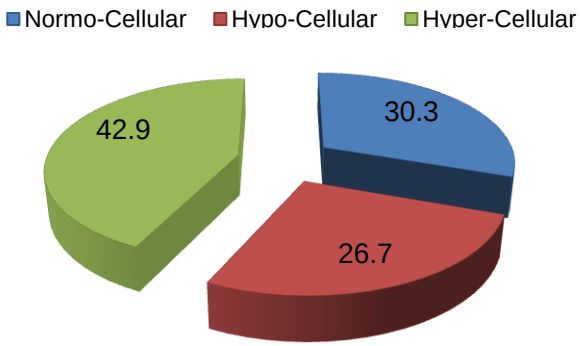

Fig. 2. Bone marrow cellularity of the study subjects

Table 3. Causes of pancytopenia in the study population (n=200)

Diagnosis	No. of patients	Percentage
Megaloblastic anemia	59	29.5
Leukemias	28	14
Aplastic anemia	22	11
Drug induced pancytopenia	21	10.5
Tropical fever	10	5
Hypersplenism	9	4.5
Multiple myeloma	9	4.5
Lymphomas	6	3
MDS	6	3
Tuberculosis	5	2.5
Hemolyticanemia	5	2.5
MAS(Macrophage activation syndrome)	4	2
SLE	2	1
Histoplasmosis	2	1
Myelofibrosis	2	1
Cirrhosis of liver (HCV+ve)	1	0.5
Hereditary spherocytosis	1	0.5
Thalassemia	1	0.5
PNH	1	0.5
HIV	1	0.5
Waldenstrom'smacroglobulinemia	1	0.5
Lymphoproliferative disorder	1	0.5
Sarcoidosis	1	0.5
Mets from carcinoma prostate	1	0.5
Pure red cell aplasia	1	0.5
Total	**200**	**100**

Table 4. Etiology of megaloblastic anemia (n=59)

Etiology	No. of cases	Percentage
B12 Deficiency	16	27.1
Folate Deficiency	4	6.8
B12+ Folate Deficiency	14	23.7
Drug induced	1	1.7
Alcoholism	8	13.6
Hepatitis B	1	1.7
CLD (NASH)	1	1.7
Cause not identified	14	23.7
Total	**59**	**100**

4. DISCUSSION

Pancytopenia is an important clinico-hematological entity encountered in this day-to-day clinical practice. The present study was conducted to analyse the etiological spectrum and clinical profile of patients with pancytopenia. 200 admitted patients of pancytopenia were enrolled in the study.

In this study, out of 200 patients, 119(59.5%) were males and 81(40.5%) patients were females. Male: Female ratio was 1.47:1. Most of the patients were between 51-60 age group which included a total of 46 patients (23%). Most of the patients were housewives which included 63(31.5%) patients, 37(18.5%) patients were farmers, 35(17.5%) patients were businessman and 33 patients (16.5%) were students.

Out of 200 patients, 43 patients had a history of previous drug intake for a known illness, however out of these patients, 21 cases (10.5%) were eventually found to have drug induced pancytopenia on bone marrow biopsy and rest of the cases of pancytopenia were not directly attributable to the drug intake. The most common drug used by the study population in this study was Methotrexate which was being used by 17 patients. A.Y.N Lim et al. in 2005 studied methotrexate induced pancytopenia and found that pancytopenia is a late manifestation of methotrexate intake. In their study they found that methotrexate was used most commonly by patients of rheumatoid arthritis and psoriatic arthritis [1]. In this study also, rheumatoid arthritis and psoriasis were common in patients taking methotrexate. In a study done by Jyotsana et al. in 2018 found that drug induced pancytopenia was seen in 3.1% of the cases out of 32 cases of pancytopenia [2].

In this study, out of 200 patients, 107(53.5%) patients were vegetarians and 93(46.5%) patients were non-vegetarians. Among the 59 patients of megaloblastic anemia, 55.9% were vegetarians and 44.1% were non-vegetarians. While among non-megaloblastic patients, 53.2% were vegetarians and 46.8% were non-vegetarians which was not significantly different among two groups. In a study done by Jyotsana et al. in 2018 they found that most of the patients were vegetarians (71.9%). They also found that macrocytic anaemia was predominantly observed in vegetarian patients (86.67%) [2].

The mean haemoglobin level of the study population in this study was 7.16 g/dl with a standard deviation of ± 2.04. Mean TLC value was 2.51 x 10^3/cu.mm with a standard deviation of ±1.02. Mean platelet count was 54885.37 x 10^3/cu.mm with a standard deviation of ±40320.96.The mean ANC value was 1.59 x 10^3/cu.mm with a standard deviation of ± 0.84. In a study done by Santra G et al. in 2010, they found the mean haemoglobin concentration was 5.90 ± 1.90 g/dl. The mean leucocyte count was 2633/cumm. The mean platelet count was 45.20 ± 38.60 × 10^3/cu mm. The mean ANCwas 705.40 ± 530.10/cu mm which was lower than this study [3].

The mean Hb, TLC and platelets according to etiology were analysed. It was found that the least mean Hb was found in hemolytic anemia. In megaloblastic anemia the mean Hb was 6.6 g/dl and in MDS was 6.3 g/dl. In leukemia, aplastic anemia, drug induced pancytopenia, multiple myeloma, MAS and SLE it ranged between 7.2-7.8 g/dl. In lymphoma, TB, tropical fever and hypersplenism it ranged between 8.1-8.9 g/dl. The mean TLC was least in drug induced pancytopenia (1.4 x10^3/cumm), followed by MDS (1.7x10^3/cumm) and MAS (1.8x 10^3/cumm). In rest of the cases it ranged between 2-3.9 x 10^3/cumm. The least mean platelet count was found in MDS (30166.6/ul) followed by MAS (44000/ul), drug induced pancytopenia (44857.1/ul), leukemia (46535.7/ul) and aplastic anemia (49181.8/ul). In rest of the cases it was >50000/ul.

Mean Hb, TLC and platelets in 59 patients of megaloblastic anemia were 6.6 g/dl, 2.8 x 10^3/cu.mm and 57492.8/ul respectively. Mean Hb, TLC and platelets in 28 patients of leukemias were 7.2 g/dl, 2.4 x 10^3/cu.mm and 46535.7/ul respectively. Mean Hb, TLC and platelets in 22 patients of aplastic anemia were 7.3 g/dl, 2.3 x 10^3/cu.mm and 49181.8/ul respectively. Dhaval Doshi et al. in 2012 studied 100 cases of pancytopenia and found that in megaloblastic anemia the mean haemoglobin (Hb) was 5.6 ± 1.7 g/dl, mean WBC count was 2735 ± 4152 and mean platelet count was 52250±24213. In leukemia, mean Hb was 4.1 ± 1.4, mean TLC was 1110 ± 0 and mean platelets were 27000 ± 0. In aplastic anemia mean Hb was 2.1 ± 0, mean TLC was 1406 ± 1362 and mean platelets were 24746 ± 1810 [4]. Hamid et al. in 2008 studied 75 patients of pancytopenia and found that mean Hb value in megaloblastic anemia patients was 5.5 ± 1.7, mean TLC was 2318.2 ±

686.8 and mean platelets were 60 ± 31.9. In acute leukemia, mean Hb was 5.5 ± 1.4, mean TLC was 1795 ± 1064.2 and mean platelets were 38.6 ± 26.1.In aplastic anemia, mean Hb was 5.5 ± 2.2, mean TLC was 1805 ± 968.5 and mean platelets were 46.4± 33 [5].

Thus, the patients of megaloblastic anaemia had higher Hb levels and similar WBC count when compared with the 2 studies quoted above. The platelet count was similar to Hamid et al. but Doshi et al. had a lower platelet count in megaloblastic anemia. The patients of leukemias had higher Hb levels, TLC and platelet count when compared with the 2 studies quoted above. The patients of aplastic anemia had higher Hb levels and TLC and the platelet count was similar to Hamid et al. but Doshi et al. had a lower platelet count.

In this study 70 patients (35%) had mild anemia. Out of these 38 patients were males with Hb value ranging from 8.1-12.9 g/dl and 32 patients were females with Hb value ranging from 8.1-11.9 g/dl. 102 patients (51%) had moderate anemiai.e. Hb between 5.1-8 g/dl. 28 patients (14%) had severe anemiai.eHb value <=5 g/dl. Mild reduction of the leucocytes was noted in 79 patients (39.5%) having a TLC count between 3001-3999. 62 patients (31%) had moderate reduction of the TLC and 59 patients (29.5%) had severe leucopenia. Most of the patients had a mild reduction of the platelets with 179 patients (89.5%) having a platelet count between 100001-150000. 12 patients (6%) had moderate thrombocytopenia and 9 patients (4.5%) had severe thrombocytopenia. The results were comparable to a study done by Priti Singh et al. in 2016. In their study majority of the patients (68.2%) had Hb values in the range of 5.1-7 gm%. Majority of the patients (82%) had a leukocyte count in the range of 1100-3000 cells/cumm. 9.1% of patients had values below 1000 cells. The platelet count varied from<5000-1,50,000/cumm. Most of the patients (41%) had a platelet count in the range of 76,000-1,00,000 cells/cumm. 13.7% patients had values in the range of 21,000-50,000 cells/cumm [6].

In this study 4 patients had dengue, 3 patientshad malaria, 2 patients were of enteric fever and mixed infection(malaria + scrub typhus) in 1 patient out of the 10 patients of pancytopenia due to tropical fever. Similarly, D. Kalyani and R. Sasank in 2017 studied profile of fever with pancytopenia and found dengue (33%) was the commonest underlying cause followed by malaria (20.5%). They had a high prevalence of malaria and dengue because the study profile included patients with febrile illness [7]. Thus, malaria, dengue and enteric fever are also important causes of pancytopenia in this subcontinent with prevalence ranging from 1.8-20.5%, 1.5-33% and 1.8-3% respectively.

Out of 200 patients, viral markers were done in 63 patients. Out of these 63 patients, 14 patients were found to have an underlying viral etiology. This included 7 patients (11.1%) of hepatitis C, 4 patients(6.3%) of hepatitis B and 3 patients(4.7%) of HIV. D. Kalyani and R. Sasank in 2017 stated that pancytopenia due to infections like HIV and tuberculosis are on the rise in the developing countries like India and should be kept in mind as causes of pancytopenia [7]. In a study done by Arvind Jain and ManjiriNaniwadekar in 2013, found HIV in 12% cases and viral hepatitis in 1.2% cases [8]. In a study done by Kishore Khodke et al. in 2001, they found they HIV was associated with 2% cases of pancytopenia [9].

In this study, PBF study was done in all the cases presenting with pancytopenia. The most common RBC morphology was normocytic normochromic seen in 69 patients (34.5%). Atypical cells were seen in 14 cases (7%). Similarly, most common RBC morphology was normocytic normochromic (46%) in a study done by SivaKumar and N. Kiruban and in 2016 [10]. Nikhil Goli et al. in 2016 also found that the most common picture of RBC's in the PBF study out of 44 cases of pancytopenia was normocytic normochromic, seen in 20 patients (45.4%) [11].

PBF picture was analysed in the three most common causes of pancytopenia in this study. Out of 59 cases of megaloblastic anemia, 31 patients (52.5%) had a macrocytic RBC morphology, followed by a mixed morphology in 23 patients (39%), normocytic morphology in 5 patients (8.5%). Out of 28 cases of leukemias, 12 patients (42.9%) had a mixed RBC picture, 10 patients (35.7%) had a normocytic normochromic picture, 5 patients (17.9%) had a microcytic picture and only 1 patient (3.6%) had a macrocytic RBC picture in the PBF study. Out of 22 cases of aplastic anemia, 14 patients (63.6%) had normocytic normochromic RBC morphology, 5 patients (22.7%) had mixed morphology, 2 (9.1%) patients had a microcytic morphology and only 1 patient (4.5%) had a macrocytic morphology in the PBF study.

Bone marrow biopsy was done in 191 patients out of the 200 patients. Out of these 191 patients, hypercellular marrow was seen in 81 patients(42.4%), normocellular marrow was seen in 59 patients(30.8%) and hypocellular marrow was seen in 51 patients(26.7%).Thus, cellular marrow(including normocellular and hypercellular marrow) was seen in 73.2% patients and hypocellular marrow was seen in 26.8% patients. Similar results were seen in the study done by Santra G, Das BK in 2010 in which they found cellular marrow to be more common (54.05%) than the hypocellular marrow (45.9%) [3].

In megaloblastic anemia, hypercellular bone marrow was most common which was seen in 48 patients (81.3%). Normocellular marrow was seen in rest of the 11 patients (18.6%). No evidence of hypocellular marrow was seen in any patient of megaloblastic anemia. In leukemias, the most common bone marrow biopsy finding was hypocellularity which was seen in 18 patients (72%). Hypercellular marrow was seen in 7 patients (25%) and 3 patients (10.7%) had normocellular marrow. In aplastic anemia, all the 22 patients had a hypocellular marrow on biopsy.

4.1 Etiology of Pancytopenia

The most common cause of pancytopenia in thisstudy was megaloblastic anemia. There were total of 59 cases of megaloblastic anemia which constituted 29.5% of the total cases. Studies which had megaloblastic anemia as the most common cause of pancytopenia are as follows:VijaiTilak and Raini Jain in 1999 did clinico-hematological analysis of 77 cases of pancytopenia and found that the most common cause of pancytopenia was megaloblastic anemia(68%) [12]. Savage et al. in 1999 studied 134 cases of pancytopenia and found that the most common cause of pancytopenia was megaloblastic anemia (35.8%) [13]. Anita P Javalgi and Vijay D Dombale in 2013 did clinico-hematological analysis of pancytopenia in a total of 106 patients and found that the most common cause of pancytopenia in their study was megaloblastic anemia (73.5%) [14]. Nadeem Ahmad et al. in 2018 studied clinical and etiological profile of pancytopenia and found that the most common cause of pancytopenia was megaloblastic anemia (34.84%) [15].

Pathak R et al. in 2012 studied 102 patients of pancytopenia and found that hypoplastic anemia (32.3%) was the most common cause of pancytopenia which did not match with this study findings [16]. Lakhey A et al. in 2012 did clinico-hematological study of pancytopenia in 54 cases and found that hypoplastic bone marrow was the most common cause of pancytopenia (29.6%) [17]. These findings do match with this current study.In a study done by Katherine Devitt et al. in 2013 in USA, of the total 132 patients of pancytopenia, the most common diagnosis was AML (26%). This study has high prevalence of leukemia than this study which has megaloblastic anemia as most common cause of pancytopenia, as nutritional deficiency is less common in USA [18].

The 2nd most common cause of pancytopenia in this study was leukemias. There were total of 28 cases of leukemia which constituted 14% of the total cases. The entities included B-cell ALL, Hairy cell leukemia and acute leukemia. This was in contrast to some studies which found aplastic anemia to be the 2nd most common cause and leukemias/malignant conditions to be the 3rd most common cause of pancytopenia. Nikhil Goli et al. in 2016 [11] and Kirpal Das Makheja in 2013 [19] found that after megaloblastic anemia, haematological malignancies as the next most common cause of pancytopenia which were in accordance to this study.

The 3rd most common cause of pancytopenia in this study was aplastic anemia. There were total of 22 cases each of aplastic anemia which constituted 11% of the total cases. Osama Ishtiaq in 2004 studied 100 cases of pancytopenia and found that aplastic anemia was the 3rd most common cause (37.5%) of pancytopenia [20]. However, in a study done by Vaidya S in 2015, aplastic anemia (31.32%) out of 83 cases was the 2ndcommonest cause of pancytopenia after megaloblastic anemia [21].

The variation in causes of pancytopenia observed among various studies could be due to differences in methodology as to which type of patients were recruited (eg. outdoor vs indoor), dietary and environmental factors as prevalence of tropical infections vary according to the geographical area.

The most common causes of megaloblastic anaemia were Vit. B12 deficiency followed by combined folate and Vit.B12 deficiency. In the series by Mehmet Ali Erkurt, 5% of the patients admitting with thrombocytopenia had megaloblastic anaemia. For this reason, if a patient presenting with thrombocytopenia has pancytopenia, the physician should suspect megaloblastic anaemia [22].

5. CONCLUSION

To conclude, this study has helped us in knowing the various causes of pancytopenia in this region. Megaloblastic anemia was the most common etiology in this study followed by haematological malignancies and aplastic anemia. The study helped us in understanding the age and gender distribution, the hematological parameters, the peripheral blood film in pancytopenia and the bone marrow picture of these patients and its significance in reaching to the diagnosis of pancytopenia.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

OPD patients were not included in the study because of paucity of data. Institutional ethical committee approval for the study was taken.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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