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Original Research Article

A Case Series Describing the Clinical and Etiological Profile of Pancytopenia Cases in a Tertiary Care Teaching Institute

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Abstract

Pancytopenia is described as a decrease in all three blood cell lines (hemoglobin, leukocytes and platelets). Pancytopenia is a hematological manifestation of a wide spectrum of underlying pathologies, ranging from transient infections to malignancies. The following is a case series describing the clinical and etiological profile of various cases of pancytopenia and their respective treatment and outcomes. We retrospectively analyzed 6 adult cases of pancytopenia of varied etiologies presenting varied manifestations of an underlying pathology admitted to Yashwantrao Chavan Memorial Hospital, Pimpri, and Pune over a period of April 2024 to June 2025. Detailed clinical assessment, relevant laboratory tests and bone marrow studies wherever indicated were performed. Patients were followed up to assess outcomes.

Keywords: Pancytopenia, Vitamin B12, Aplastic Anemia.

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Introduction

Pancytopenia is a hematological condition characterized by the reduction of all three major blood cell lines: red blood cells (anemia), white blood cells (leukopenia), and platelets (thrombocytopenia). It is not a disease entity by itself but a manifestation of a wide range of underlying pathologies, including bone marrow failure syndromes, infiltrative diseases, infections, nutritional deficiencies, autoimmune conditions, and drug-induced toxicities. The clinical manifestations are often nonspecific and vary depending on the severity and rapidity of onset, necessitating a thorough diagnostic workup to determine the cause and guide management [1,2].

The spectrum of causes for pancytopenia varies significantly depending on geographic location, patient demographics, nutritional status, and access to healthcare. In developing countries, nutritional deficiencies such as megaloblastic anemia are frequently reported as the most common etiology, while aplastic anemia, leukemia, and other bone marrow disorders are more prevalent in developed settings [3,4]. Prompt diagnosis is crucial, as some underlying causes are reversible with appropriate treatment, whereas others may require long-term interventions such as immunomodulator therapy or bone marrow transplantation. Given this variability, institutional case series can provide valuable insights into regional trends in the etiology and clinical presentation of pancytopenia.

This study presents a case series from a tertiary care teaching hospital in India, aiming to evaluate the clinical features, laboratory parameters, and etiological distribution among patients presenting with pancytopenia. The study emphasizes the importance of bone marrow examination and highlights the need for early diagnostic and therapeutic approaches in resource-limited settings. [5,6]

Criteria for inclusion of patients for the study: All IPD patients diagnosed with pancytopenia between April 2024 to June 2025 i.e.

- Hemoglobin less than 12 g/dL in women and less than 13 g/dL in men
- WBC counts less than 4,000 per microliter for WBCs (or absolute neutrophil count less than 1,800 per microliter)
- Platelet counts less than 150,000 per microliter

Exclusion Criteria: Age less than 12 years old.

Case presentation

Case 1: 17y/M boy came to the emergency department with complaints of generalized weakness, breathlessness on exertion and easy fatigability. Patient had a history of predominantly consuming a vegetarian diet along with neglect from his guardians. Clinically, patient had hyperpigmentation of knuckles, pallor and mild icterus. Serum Vitamin B12 was done which was markedly reduced. Bone marrow biopsy showed megaloblastic changes. Patient was given B12 injectable and oral supplementation of multivitamin along with pure red blood cell transfusions.

Case 2: 22/F, a known case of seizure disorder taking phenytoin for treatment >10 years, came to the casualty with breathlessness at rest and bipedal edema. On examination, patient was tachycardic, tachypneic showed bipedal pitting edema and severe pallor.

Serum Vitamin B12 levels, serum iron and ferritin were within normal limits. Serum Phenytoin levels were on the higher side and serum folic acid was low. Patient was treated with pure red blood cell transfusion and folic acid supplementation and phenytoin was discontinued. Improved after discontinuation of phenytoin.

Case 3: 65-year-old female patient presented to the casualty with breathlessness on exertion with recurrent history of fever, cough and burning micturition, which used to resolve after medication and then recur, for the past few months. Patient's WBC count was 1800 cells/cumm, along with anemia and thrombocytopenia. Patient was transfused with pure red blood cells and antibiotics to treat infections and bone marrow studies were done after hematologist opinion was taken. Bone marrow studies revealed hypocellular marrow with the presence of megaloblastic change with dysplastic erythroid cells. Patient was started on immunomodulator therapy as advised by hematologist and oncologist opinion.

Case 4: 32-year-old male, chronic alcoholic, consuming country liquor daily for the last 12 years, came with complaints of abdominal distension, breathlessness and bipedal edema. Clinically, patient was tachycardic, exhibited severe pallor and bipedal pitting edema, along with dilated veins over the abdomen and fluid thrill and shifting dullness present on percussion of abdomen. Ultrasonography of the abdomen and pelvis revealed liver cirrhosis along with portal hypertension and splenomegaly and gross ascites. Lab reports were suggestive of pancytopenia. Bone marrow studies showed megaloblastic changes. Patient was transfused with random donor platelets and pure red blood cells.

Case 5: 16-year-old male came with complains of fever for two days. Routine work up revealed a hemoglobin level of 4.2, leukocyte count of 800 cells/cumm, and platelet count of 13000/cumm.

Bone marrow studies revealed a hypocellular marrow suggestive of aplastic anemia. Patient was transfused with pure red blood cells and random donor platelets. Patient was started on cyclosporine and eltrombopag after taking hematologist opinion.

Case 6: 27-year-old male presented with complains of fever with chills, intermittently every alternate day, followed by sweating, for the 5 days. Patient's routine lab revealed pancytopenia, raised LDH and increased retic count and peripheral blood smear showed plasmodium vivax trophozoite. Patient was started on antimalarial treatment and symptomatic management for fever and intravenous fluids to maintain hydration. Primaquine was given after ruling out G6PD deficiency to prevent relapse.

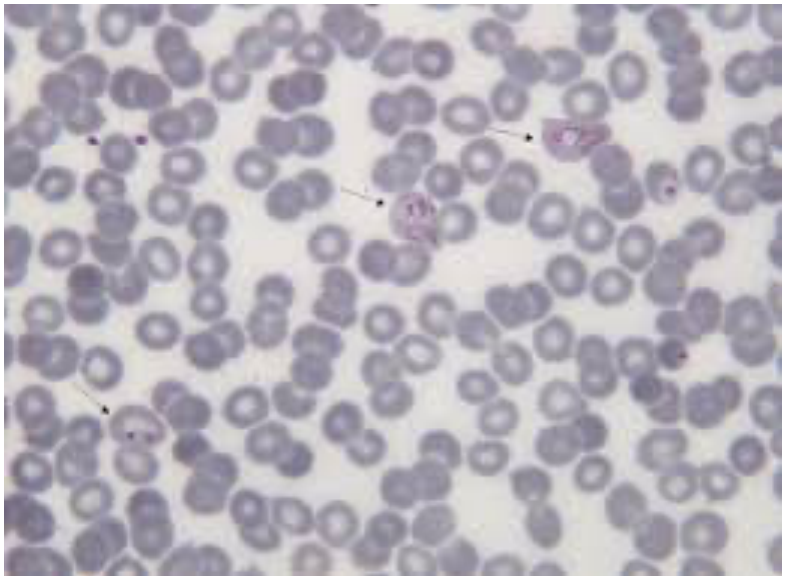

Figure 1: Peripheral blood smear shwoing trophozoite of plasmodium vivax.

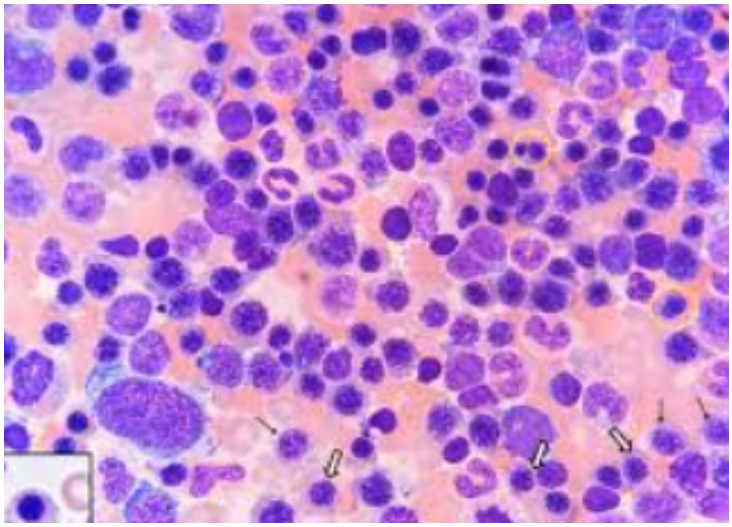

Figure 2: Bone Marrow Studies showing megaloblastic changes

Observations:

Table 1:

Patient No	Age	Sex	Hemoglobin/ WBC/Platelet	Etiology	Management	Diagnostic modality	Outcome
1	17	M	4.7/2.3/57000	Nutritional Vitamin B12 deficiency	Vit B12 supplementation and pure red blood cell transfusion	Bone marrow studies and Serum vitamin B12 level	Recovered and advised vitamin B12 supplementation
2	22	F	1.1/2.5/55000	Phenytoin induced megaloblastic anemia	Pure red blood cell transfusion and folic acid supplementation	Serum phenytoin levels and serum folic acid levels	Recovered and advised to stop offending drug (phenytoin) and started folic acid supplementation
3	65	F	6.5/1.8/89000	Myelodysplastic syndrome	Pure red blood cell transfusion and antibiotic administration	Bone marrow studies	Conservatively managed and sent for hematologist and oncologist opinion
4	32	M	5.8/3.1/18000	Pancytopenia secondary to liver cirrhosis	Pure red blood cell transfusion and RDP	USG (abdomen + pelvis), bone marrow studies	Optimized hemoglobin and given treatment for liver cirrhosis
5	14	M	4.2/0.8/13000	Aplastic anemia	Pure red blood cell transfusion, RDP infusion and started on cyclosporine and eltrombopag	Bone marrow studies	Optimized hemoglobin and referred for hematologist opinion
6	24	M	10.2/3.6/92000	Plasmodium vivax malaria	Antimalarial treatment and hydration	PBS for malarial parasite along with raised LDH and raised retic count	Recovered and given primaquine prophylaxis

Discussion

Pancytopenia is a hematological condition characterized by the simultaneous decrease in all three blood cell lines—erythrocytes, leukocytes, and platelets—manifesting with symptoms such as fatigue, infections, and bleeding tendencies. The etiologies are diverse, ranging from nutritional deficiencies and bone marrow failure syndromes to infections and infiltrative diseases. The current case

series highlights this broad spectrum of etiologies observed in a tertiary care hospital setting.

In our series, nutritional deficiency, particularly vitamin B12 deficiency, was seen in a 17-year-old male (Case 1). This aligns with prior studies reporting megaloblastic anemia as one of the most common causes of pancytopenia in developing countries [1]. The presence of hyperpigmentation of knuckles and icterus, along with megaloblastic changes on bone marrow examination, supports this etiology. Timely diagnosis and supplementation resulted in clinical improvement.

Case 2 illustrates drug-induced pancytopenia, associated with chronic phenytoin use. Phenytoin is known to cause folate deficiency due to impaired absorption and increased metabolism [7]. Although vitamin B12 and iron parameters were normal, low serum folic acid and elevated phenytoin levels confirmed the diagnosis. Discontinuation of the drug and folic acid supplementation led to hematological recovery, underlining the importance of reviewing medication history in pancytopenic patients.

Myelodysplastic changes in the elderly, as seen in Case 3, represent another etiology. The patient presented with persistent infections and hypocellular marrow with dysplastic erythroid precursors. This could represent evolving myelodysplastic syndrome (MDS), which is commonly associated with ineffective hematopoiesis in older adults [8]. Though definitive diagnosis requires cytogenetic analysis and long-term follow-up, such cases must be evaluated promptly due to the risk of progression to acute leukemia.

Chronic alcoholism (Case 4) may contribute to pancytopenia through multiple mechanisms including direct bone marrow suppression, folate deficiency, and hypersplenism secondary to alcoholic liver cirrhosis with portal hypertension. Splenomegaly leads to sequestration of blood cells, while liver dysfunction and megaloblastic marrow further contribute [9]. In such cases, addressing the underlying liver disease and abstinence from alcohol are crucial.

Case 5 presented with aplastic anemia, a life-threatening condition characterized by hypocellular marrow without abnormal infiltration or fibrosis. The patient was a young male with profound cytopenias and a markedly hypocellular marrow, consistent with idiopathic aplastic anemia. Immunosuppressive therapy with cyclosporine and thrombopoietin receptor agonist eltrombopag is a recognized treatment in resource-limited settings and where bone marrow transplant is not feasible [10].

Finally, Case 6 demonstrated pancytopenia due to malaria, specifically Plasmodium vivax infection. Malarial parasites can lead to peripheral destruction and dyserythropoiesis, contributing to cytopenias [11]. Although commonly associated with P. falciparum, severe hematological involvement is increasingly reported with P. vivax, particularly in endemic regions. Appropriate antimalarial therapy resulted in hematological recovery.

This case series underscores that pancytopenia is not a diagnosis but a manifestation of various underlying pathologies. A systematic approach involving detailed history, clinical examination, and targeted investigations such as bone marrow studies is essential for diagnosis and management. Our findings are in concordance with previous Indian studies where megaloblastic anemia, aplastic anemia, and infections were leading causes [1,5].

Conclusion

Pancytopenia is a common yet complex hematological presentation with a broad array of underlying etiologies ranging from nutritional deficiencies and drug toxicities to serious bone marrow pathologies and systemic infections. This case series emphasizes the need for a comprehensive diagnostic approach to determine the cause, as the prognosis and treatment vary significantly depending on the etiology.

Among the cases presented, nutritional deficiencies—particularly megaloblastic anemia—remained a prevalent and reversible cause, especially in younger individuals. Drug-induced cytopenias and infections such as malaria also featured as important, treatable contributors. On the other hand, cases of aplastic anemia and suspected myelodysplastic syndromes require long-term management and often specialist care, highlighting the importance of early identification and referral.

The findings of this series reaffirm the heterogeneity of pancytopenia and stress the importance of integrating clinical features with targeted investigations such as peripheral smear evaluation, vitamin assays, and bone marrow studies. Timely diagnosis and appropriate therapy can lead to significant clinical improvement, particularly in reversible causes. Therefore, awareness of regional patterns and common etiologies is vital for clinicians, especially in resource-limited settings.

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