Research Article

A study of absolute reticulocyte counts in patients with pancytopenia

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Abstract

Pancytopenia is a common hematological condition with diverse etiologies, ranging from bone marrow suppression to peripheral destruction. Bone marrow examination is the gold standard for diagnosing the underlying cause; however, it is invasive and resource-intensive. Reticulocyte indices, including absolute reticulocyte count (ARC), play a pivotal role in assessing marrow erythropoietic activity. The aim of the study was to find the significance of absolute reticulocyte count as a surrogate marker for bone marrow examination in patients with pancytopenia. This was a prospective observational study of 126 patients ≥ 18 years of age with pancytopenia - Hb <9g/dL, WBC count <4000/µL and platelets less than 1,00,000/µL, admitted in our hospital from 1st July, 2023 to 31st October 2024. Patient's characteristics like age, sex, hematological parameters like Hb, RBC count, WBC count, Platelet count, MCV, RDW, LDH, Reticulocyte count, ARC were analyzed. Majority of the patients belonged to the age group 40 to 65. Mean age of the population was 52.47(±16.26). Female preponderance was noted in our study. Aplastic anemia was the commonest cause of pancytopenia in our population followed by Myelo Dysplastic Syndrome(MDS) and megaloblastic anemia. High mean ARC(ARC≥100×109/L) was noted in patients with hypersplenism and acute leukemia. Normal mean ARC(50-99.99×109/L) was noted in patients with SLE and disseminated TB. Very low mean ARC (<25×109/L) was noted in patients with aplastic anemia, hypoplastic MDS and drug induced pancytopenia. Low mean ARC (25-49.99×109/L) was noted in patients with megaloblastic anemia, dual deficiency and MDS.

Keywords: Pancytopenia, Bone marrow study, reticulocyte count, absolute reticulocyte count.

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1. Introduction

Pancytopenia is a hematologic condition characterized by a simultaneous reduction in all three peripheral blood cell lines—red blood cells, white blood cells, and platelets1. It is diagnosed when hemoglobin (Hb) levels are <9g/dL, platelet count is <100,000 per μL, and leukocyte count less than 4000 per μL2. It is not a disease entity but a triad of findings that may result from several disease processes that may or may not involve the bone marrow. Underlying pathology determines management and prognosis of patients; hence it is extremely important to study the etiology of pancytopenia3. Reticulocytes are immature red blood cells (RBCs) produced in the bone marrow and released into the peripheral blood, where they mature into RBCs within one to two days. An increase or decrease in reticulocyte count can be an indicator of erythropoiesis activity or failure, especially relative to anaemia and bone marrow dysfunction4. ARC is calculated by multiplying the reticulocyte count percentage by the RBC count. The normal reticulocyte counts ranges from 0.5% to 2.5%, while the normal ARC ranges between 50–100 × 10^9/L.5A methodical approach that includes history, clinical examination, complete blood count, reticulocyte count, peripheral blood film, and bone marrow study is essential for identifying the underlying cause6. In this study, the significance of absolute reticulocyte count (ARC) as a guide for deciding the need for bone marrow examination in patients with pancytopenia is explored, aiming to establish its reliability as a non-invasive and cost-effective initial investigation in the workup of pancytopenia patients.

1.1. Methods

This was a prospective observational study of patients ≥ 18 years of age with pancytopenia - Hb <9g/dL, WBC count <4000/μL and platelets less than 1,00,000/μL, not on chemotherapy, admitted at Kauvery Medical Centre and Hospital, Tennur from 1st July, 2023 to 31st October 2024. Sufficient clinical data like age, sex, chief complaints, physical findings were obtained from these patients. Complete hemogram, peripheral smear and reticulocyte count were done in all patients. Test for reticulocyte count was done on the day of admission to avoid any treatment related alterations in reticulocyte count. Reticulocyte count was obtained by manual method.

Absolute reticulocyte count was calculated in all these patients using the formula7

- **ARC (thousand/μL) = Reticulocyte % X RBC count (million/μL) X 10)**

Bone marrow study was done in almost all cases except in patients with pancytopenia due to nutritional cause. Based on the final diagnosis, an approach to pancytopenia with ARC as an important evaluating parameter along with other lab parameters was derived.

Statistical analysis was performed using SPSS, (Version 20.0). The continuous variable will be expressed as Mean and Standard Deviation. Categorical variables will be expressed as frequency and percentage.

2. Results

The mean Age was 52.47 (± 16.26) ranging from 21 to 88 years. Among the subjects, 67 (53.17%) were in 40 - 65 years, 33 (26.19%) were in 18 - 40 years and 26 (20.63%) were in > 65 years.

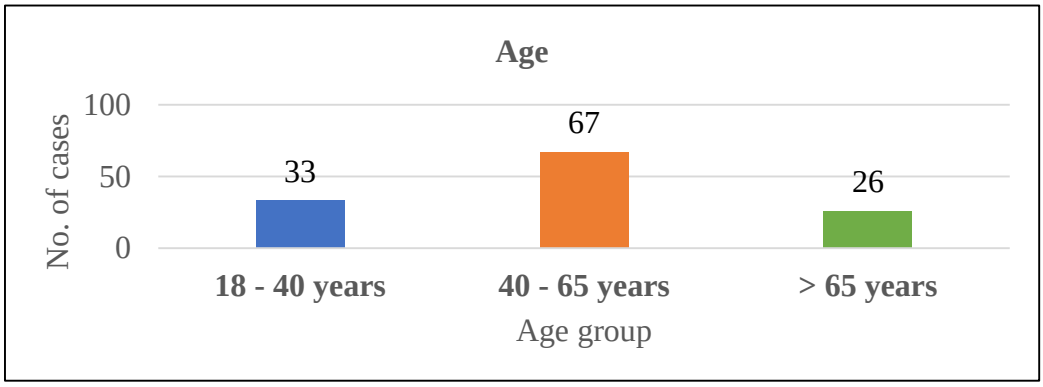

Fig (1): Bar chart illustrating the distribution of patients among various age groups

Among the subjects, 70 (55.56%) were females and 56 (44.44%) were males.

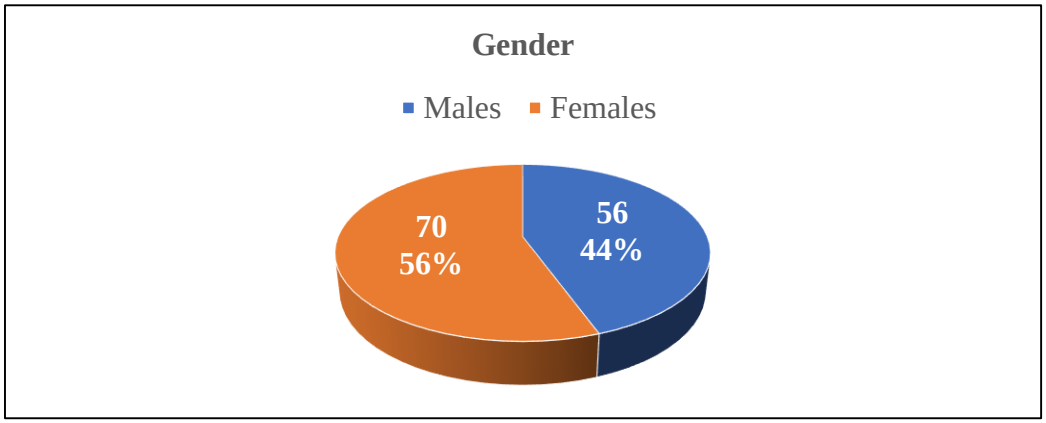

Fig (2): Pie chart depicting the distribution of males and females in our population

Among the subjects, 34 (26.98%) had aplastic anemia, 22 (17.46%) had MDS, 22 (17.46%) had megaloblastic anemia, 11 (8.73%) had drug induced pancytopenia, 8 (6.35%) had dual deficiency, 7 (5.56%) had SLE, 6 (4.76%) had disseminated TB, 6 (4.76%) had hypoplastic MDS, and 4 (3.17%) had acute leukemia. CLD related pancytopenia, hypersplenism and metastasis group had 2(1.59%) patients each.

Table 1: Distribution of patients among various causes of pancytopenia

Diagnosis	Frequency	Percent %
Aplastic Anemia	34	26.98
Megaloblastic anemia	22	17.46
Dual deficiency	8	6.35
Myelodysplastic Syndrome	22	17.46
Hypoplastic MDS	6	4.76
Drug induced	11	8.73
Disseminated TB	6	4.76
SLE	7	5.56
Acute Leukemia	4	3.17

CLD related	2	1.59
Hypersplenism	2	1.59
Metastasis	2	1.59
Total	126	100.00

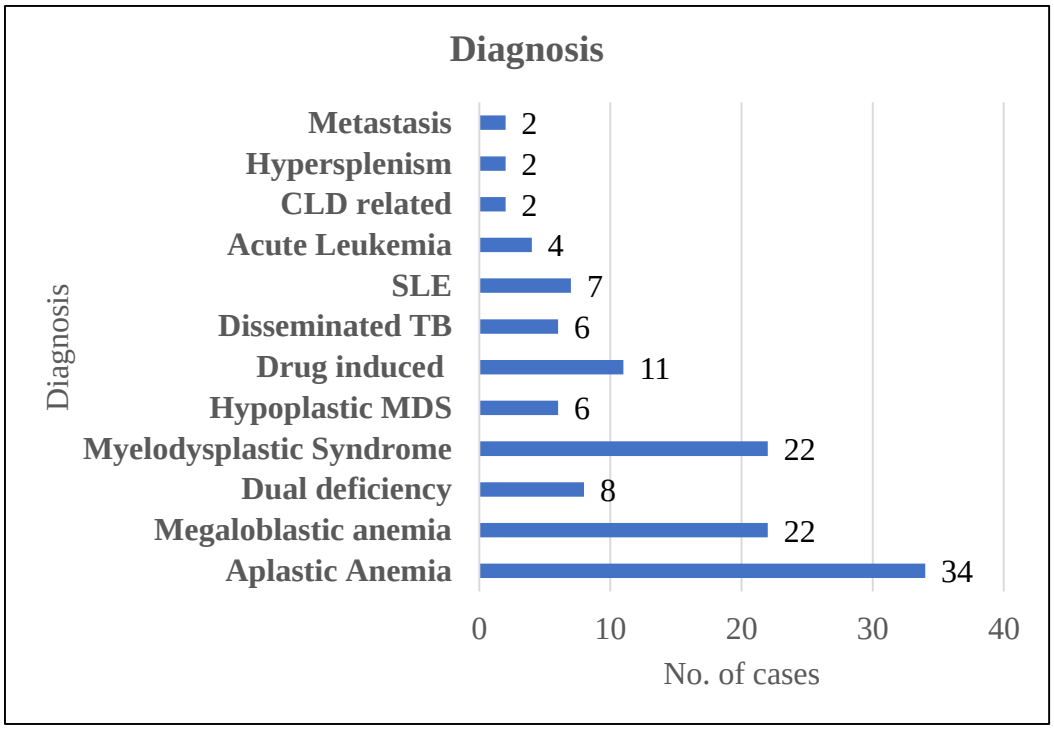

Fig (3): Bar chart depicting the distribution of causes of pancytopenia

Hypersplenism (141.00 x109/L) and acute leukemia (105.93 x109/L) showed the highest mean ARC. SLE (80.34 x109/L) and disseminated TB (68.22 x109/L) showed normal mean ARC. Low mean ARC was seen in megaloblastic anemia (30.50 x109/L), dual deficiency (31.14 x109/L), MDS (33.63 x109/L) and metastasis (47.90 x109/L) cases. Very low mean ARC was seen in drug-induced cases (20.55 x109/L), hypoplastic MDS (12.53 x109/L), and aplastic anemia (11.84 x109/L) cases.

Table 2: Descriptive statistics of ARC in our study

ARC (x109/L)	Mean	S.D.	Minimum	Maximum
Aplastic anemia	11.84	6.88	1.4	27.6
Megaloblastic anemia	30.50	10.86	10.8	53.6
Dual deficiency	31.14	9.78	15.8	45.1
Myelodysplastic syndrome	33.63	13.03	4.3	68.9
Hypoplastic MDS	12.53	7.18	1.5	22.5
Drug induced	20.55	9.17	4.6	39.1
Disseminated TB	68.22	15.00	49.0	93.7
SLE	80.34	28.08	47.9	127.5
Acute Leukemia	105.93	8.17	98.0	113.2

CLD related	29.51	12.32	20.8	38.2
Hypersplenism	141.00	46.78	107.9	174.1
Metastasis	47.90	5.92	43.7	52.1

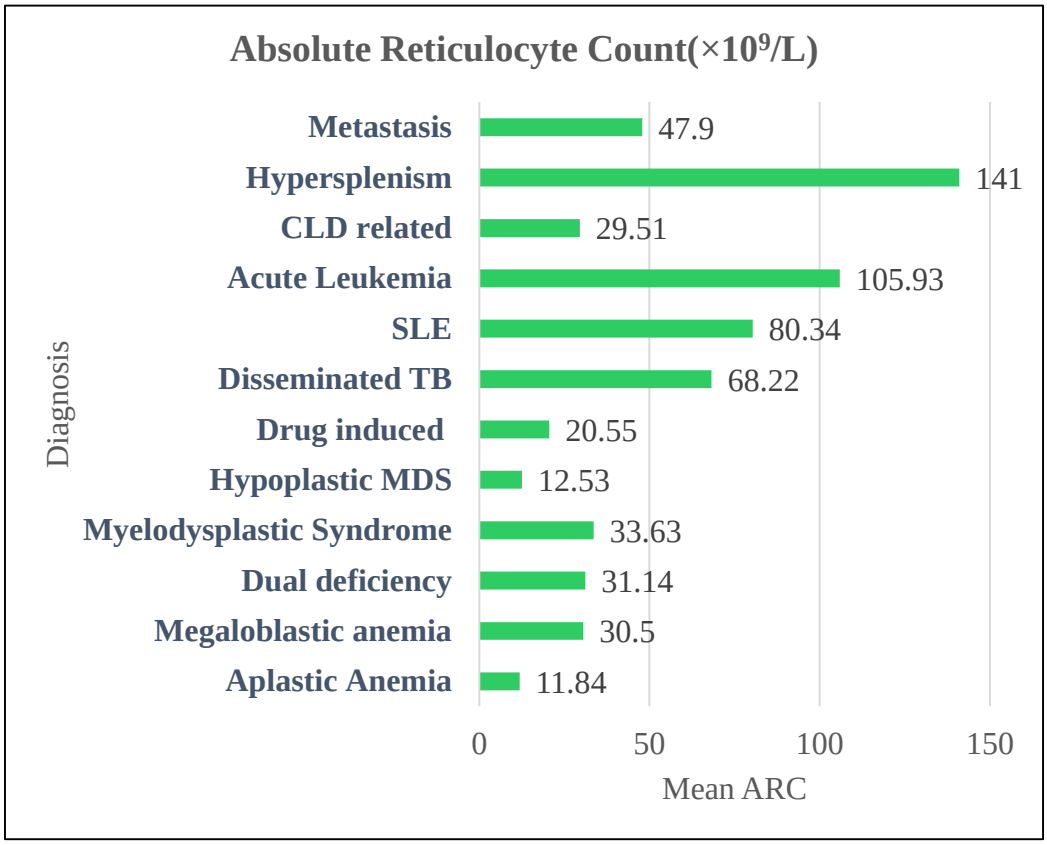

Fig (4): Bar chart representing the mean ARC among various causes of pancytopenia

Aplastic anemia (97.1%), hypoplastic MDS (100%) and drug-induced cases (72.7%) predominantly showed ARC below 25×109/L. Among CLD-related cases, 50% had ARC < 25×109/L and 50% had ARC in 25-49.99×109/L range. Megaloblastic anemia (72.7%), dual deficiency (75%), and myelodysplastic syndrome (81.8%) mostly fell into the 25–49.99 x 109/L range of ARC. Disseminated TB (83.3%) and SLE (71.4%) showed normal ARC with most cases in the 50–99.99 x 109/L range. Notably, acute leukemia (50%) and hypersplenism (100%) showed high ARC (≥100 x 109/L).

Table 3: Frequency of various causes of pancytopenia among the stratified levels of ARC

Diagnosis		Absolute Reticulocyte Count				Total
		< 25 x 10^9/L	25 – 49.99 x 10^9/L	50 – 99.99 x 10^9/L	≥ 100 x 10^9/L	
Aplastic Anemia	Count	33	1	0	0	34
	%	**97.1%**	2.9%	0.0%	0.0%	100.0%
	Count	5	16	1	0	22

Megaloblastic anemia	%	22.7%	**72.7%**	4.5%	0.0%	100.0%
Dual deficiency	Count	2	6	0	0	8
	%	25.0%	**75.0%**	0.0%	0.0%	100.0%
Myelodysplastic Syndrome	Count	3	18	1	0	22
	%	13.6%	**81.8%**	4.5%	0.0%	100.0%
Hypoplastic MDS	Count	6	0	0	0	6
	%	**100.0%**	0.0%	0.0%	0.0%	100.0%
Drug induced	Count	8	3	0	0	11
	%	**72.7%**	27.3%	0.0%	0.0%	100.0%
Disseminated TB	Count	0	1	5	0	6
	%	0.0%	16.7%	**83.3%**	0.0%	100.0%
SLE	Count	0	1	5	1	7
	%	0.0%	14.3%	**71.4%**	14.3%	100.0%
Acute Leukemia	Count	0	0	2	2	4
	%	0.0%	0.0%	50.0%	50.0%	100.0%
CLD related	Count	1	1	0	0	2
	%	50.0%	50.0%	0.0%	0.0%	100.0%
Hypersplenism	Count	0	0	0	2	2
	%	0.0%	0.0%	0.0%	**100.0%**	100.0%
Metastasis	Count	0	1	1	0	2
	%	0.0%	50.0%	50.0%	0.0%	100.0%
Total	Count	58	48	15	5	126
	%	46.0%	38.1%	11.9%	4.0%	100.0%

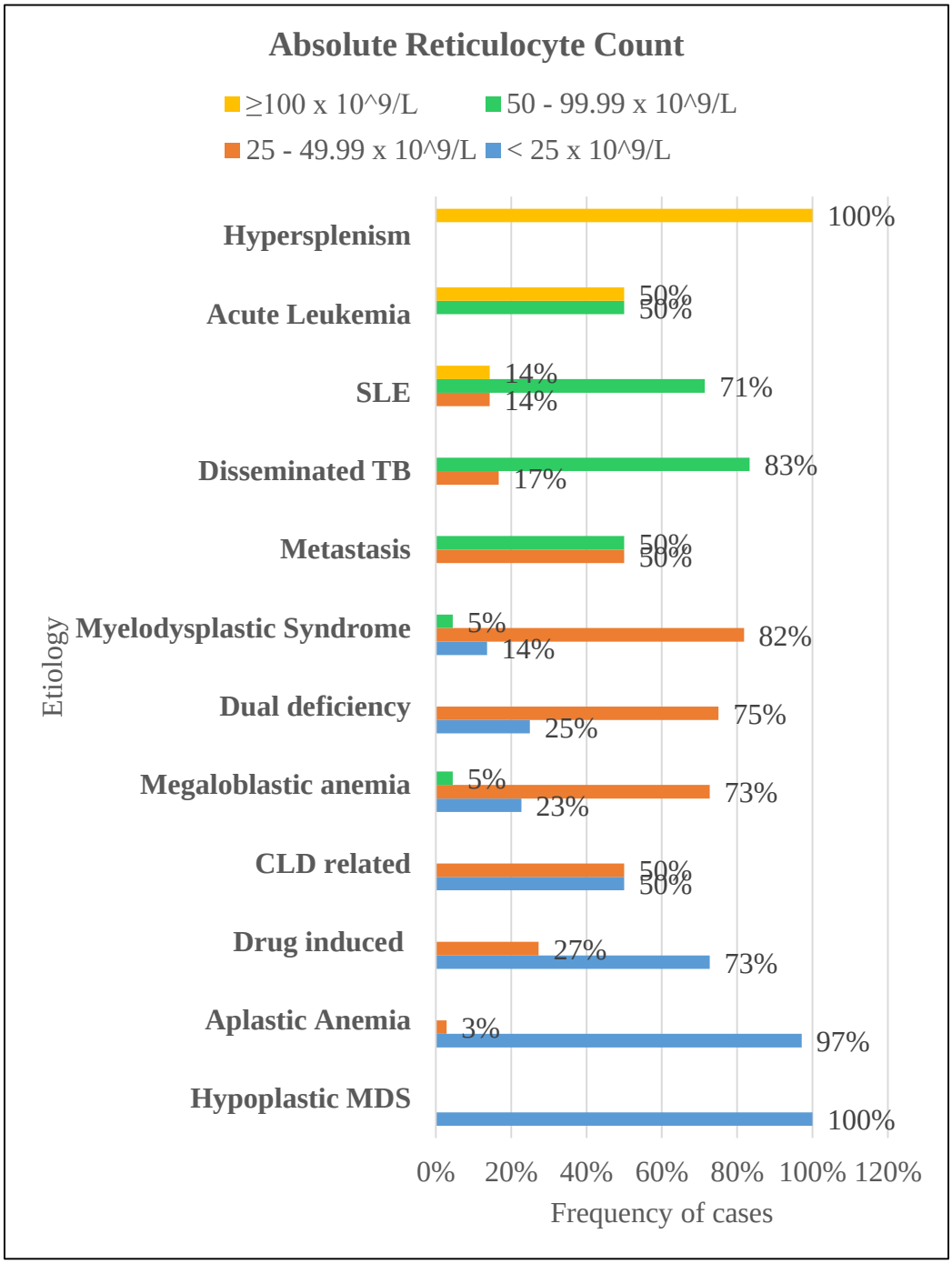

Fig (5): Bar diagram depicting the frequency of various causes of pancytopenia among the stratified levels of AR

Hypersplenism (8.30%) and acute leukemia (4.20%) showed the highest mean reticulocyte counts. SLE (3.89%), metastasis (2.75%) also showed elevated counts. Drug-induced cases (0.77%), hypoplastic MDS (0.67%), and aplastic anemia (0.59%) showed relatively lower counts. Megaloblastic anemia (1.42%), dual deficiency (1.36%), CLD (1.45%), MDS (1.68%) and disseminated TB (2.04%) had normal mean reticulocyte count.

Table 4: Descriptive statistics of reticulocyte count in our study

Reticulocyte Count (%)	Mean	S.D.	Minimum	Maximum
Aplastic Anemia	0.59	0.27	0.1	1.4
Megaloblastic anemia	1.42	0.43	0.9	2.2
Dual deficiency	1.36	0.29	0.9	1.8
Myelodysplastic Syndrome	1.68	0.90	1.1	4.5
Hypoplastic MDS	0.67	0.45	0.1	1.4
Drug induced	0.77	0.32	0.2	1.2
Disseminated TB	2.04	0.41	1.7	2.7
SLE	3.89	3.20	1.9	10.9
Acute Leukemia	4.20	0.45	3.8	4.8
CLD related	1.45	0.21	1.3	1.6
Hypersplenism	8.30	6.36	3.8	12.8
Metastasis	2.75	0.49	2.4	3.1

The hemoglobin levels in pancytopenia patients vary across conditions, with the lowest mean observed in metastasis (4.80 g/dl) and hypersplenism (5.45 g/dl). In contrast, disseminated TB (8.27 g/dl) and drug-induced cases (7.66 g/dl) showed relatively higher means, suggesting milder anemia. Aplastic Anemia had the lowest minimum Hb of 2.8 g/dl.

With regards to WBC counts, Aplastic anemia had the lowest mean (2002.94/μL) followed by drug-induced cases with 2045.45/μL, indicating most pronounced leukopenia. CLD-related cases had the highest mean of 3300/μL followed by acute leukemia and myelodysplastic syndrome with 3000/μL each, suggesting less severe leukopenia.

Metastasis (1.79 million/μL), aplastic anemia (1.94 million/μL), and hypoplastic MDS (1.93 million/μL) showed very low mean RBC count. Disseminated TB (3.36 million/μL), drug-induced cases (2.67 million/μL) and acute leukemia (2.65 million/μL) showed better mean RBC count. Conditions like Megaloblastic anemia (2.25 million/μL) and myelodysplastic syndrome (2.28 million/μL) presented with intermediate values.

Metastasis (12,500/μL), CLD-related (15,000/μL), and aplastic anemia (18,735/μL) showed very low mean platelet count. This was followed by acute leukemia (31,750/μL), drug-induced cases (40,818/μL), and hypoplastic MDS (42,500/μL). Conditions like myelodysplastic syndrome (47,590/μL), Megaloblastic anemia (50,045/μL), dual deficiency (53,500/μL), and SLE (55,000/μL) showed intermediate values.

Megaloblastic anemia (113.95 fL) and CLD-related cases (105.40 fL) showed the highest mean MCV. Aplastic anemia (88.08 fL), MDS (92.55 fL), hypoplastic MDS (91.32 fL), and SLE (89.01 fL) presented with borderline mean MCV. Dual deficiency (81.46 fL), drug-induced cases (84.75 fL), acute leukemia (85.60 fL), hypersplenism (81.65 fL), metastasis (81.00 fL), and disseminated TB (79.55 fL) showed normal or low normal mean MCV.

Electrical injuries strike with both violence and silence—a flash, a fall, and the sudden stillness of a heart. In the Emergency Department, these events demand both science and

composure. Mortality in electrocution is primarily due to ventricular fibrillation and asystole precipitated by direct myocardial depolarization. Prompt defibrillation and uninterrupted CPR determine outcomes. This case illustrates how early recognition, algorithmic action, and coordinated teamwork turned a cardiac arrest into a story of revival.

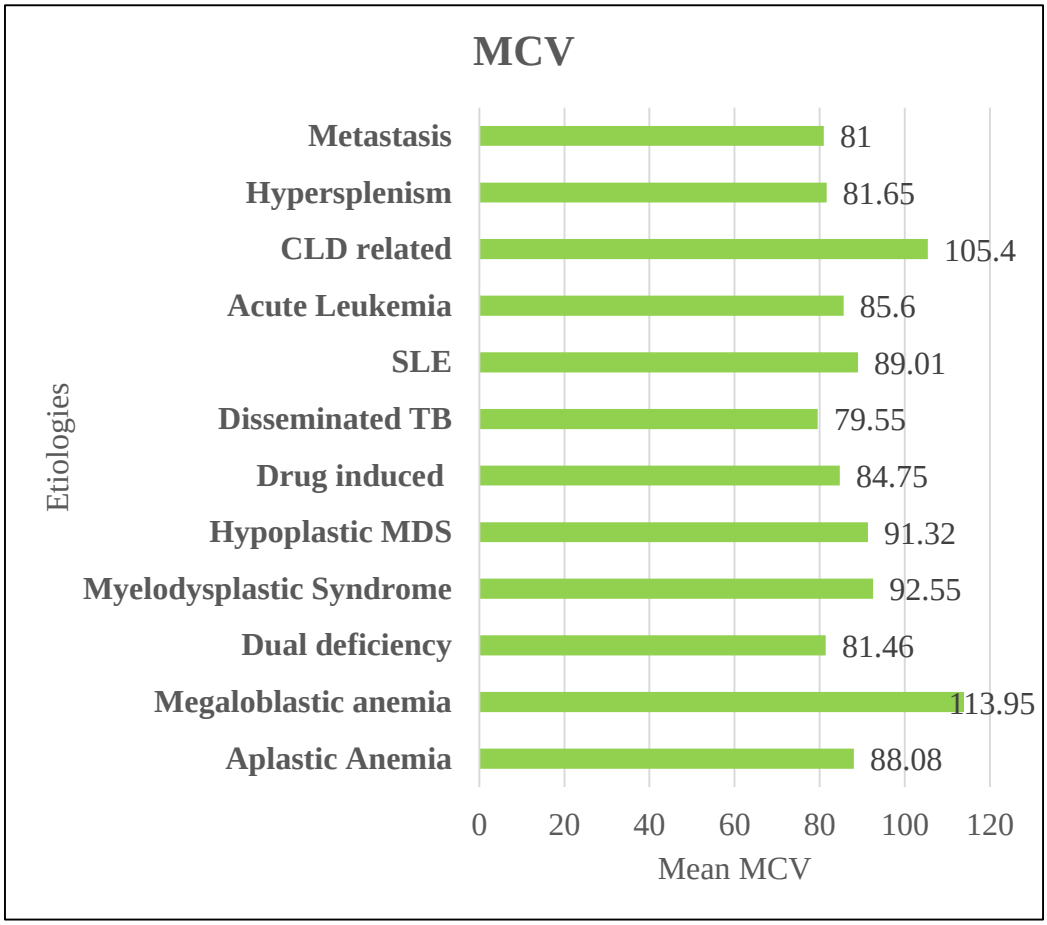

Fig (6): Bar chart representing the mean MCV among various causes of pancytopenia

Dual deficiency (28.09%) and hypersplenism (26.20%) showed the highest mean RDW. Megaloblastic anemia (20.94%), acute leukemia (21.15%), and myelodysplastic syndrome (20.24%) also showed elevated mean RDW. Aplastic anemia (18.47%), drug-induced cases (18.44%), disseminated TB (18.40%), and metastasis (19.60%) exhibited relatively lower RDW.

Table 5: Descriptive statistics of RDW in our study

RDW (%)	Mean	S.D.	Minimum	Maximum
Aplastic Anemia	18.47	4.61	13.7	34.1
Megaloblastic anemia	20.94	6.00	14.8	34.4
Dual deficiency	28.09	5.53	22.8	39.7
Myelodysplastic Syndrome	20.24	4.56	14.2	29.9
Hypoplastic MDS	20.13	3.52	16.7	24.9
Drug induced	18.44	5.95	13.3	31.9
Disseminated TB	18.40	2.96	14.3	23.5

SLE	19.71	4.98	14.2	28.1
Acute Leukemia	21.15	1.98	18.2	22.4
CLD related	20.20	2.26	18.6	21.8
Hypersplenism	26.20	7.07	21.2	31.2
Metastasis	19.60	1.41	18.6	20.6

Metastasis (1431.50 U/L) and Megaloblastic anemia (1280.73 U/L) showed the highest mean LDH levels. Hypersplenism (756.00 U/L), acute leukemia (725.50 U/L), and CLD-related cases (624.50 U/L) also exhibited elevated levels. Aplastic anemia (199.44 U/L) and drug-induced cases (234.45 U/L) showed low mean LDH.

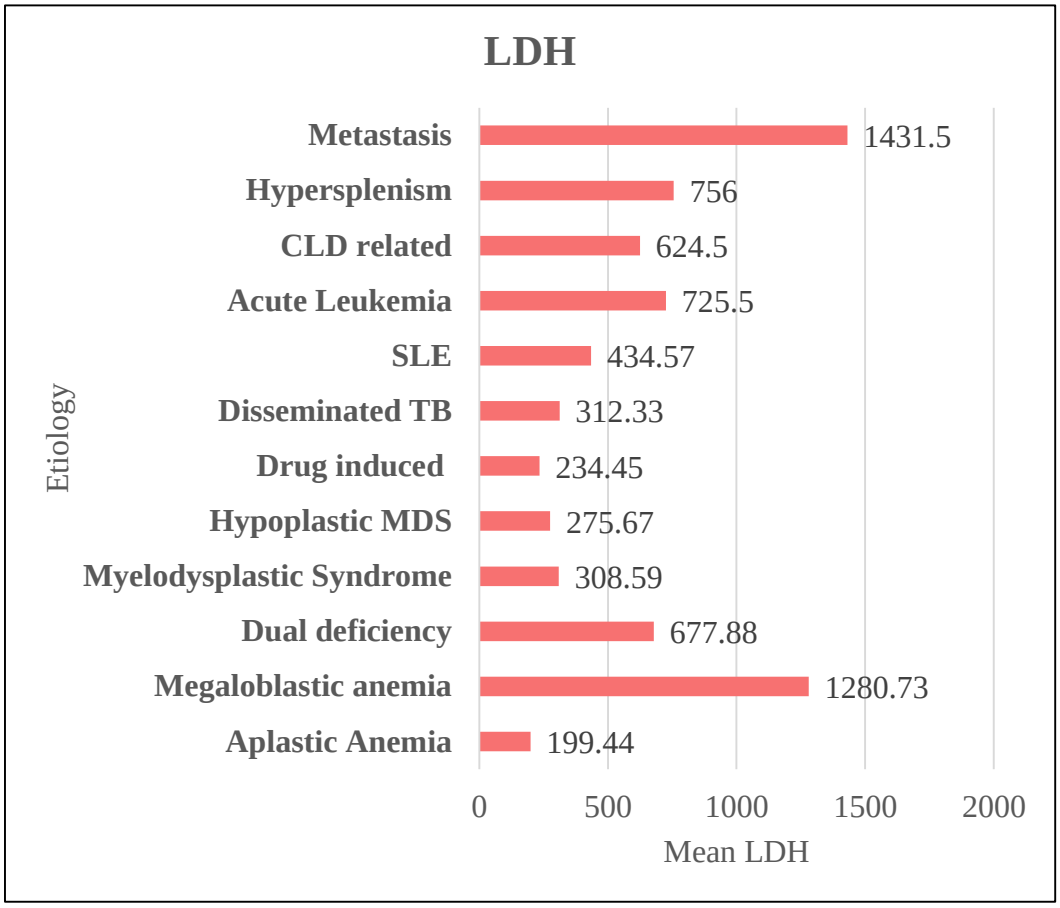

Fig (7): Bar chart representing the mean LDH level among various causes of pancytopenia

3. Discussion

Out of 126 patients, maximum patients ie, 67(53.17%) belonged to age group 40-65 followed by age group 18 to 40 with 33 patients accounting to 26.19%. The mean age of population in our study was 52.47(±16.26) ranging from 21 to 88 years. Female preponderance was seen in our study which was similar to the studies conducted by Jain et al8 (44% males and 56% females), Vargas-Carretero CJ et al9(46.8% males and 53.2% females) and Shaikh et al10(43% males and 57% females). In our study among the 126 patients, 70(55.56%) were females and 56(44.44%) were males. Male: Female ratio was 1:1.25 in our study.

Aplastic anemia was observed to be the most common cause of pancytopenia in our study. The various causes of pancytopenia in our study were aplastic anemia (26.98%), MDS (17.46%), megaloblastic anemia (17.46%), drug induced (8.73%), dual deficiency anemia (6.35%), SLE (5.56%), hypoplastic MDS (4.76%), disseminated TB (4.76%), aute leukemia (3.17%), metastasis (1.59%), hypersplenism (1.59%) and CLD related cases (1.59%).

Dual deficiency (75%), SLE (85.7%) and hypersplenism (100%) had female preponderance among pancytopenia patients whereas other diagnosis did not have any specific gender preponderance. Dual deficiency (100%) was exclusively seen in younger age group (18 to 40 years). Megaloblastic anemia and hypoplastic MDS had broader distribution. SLE was more commonly seen in females aged less than 65 years. The offending drug causing pancytopenia in all the drug induced cases in our study was methotrexate.

MDS if taken as a single diagnosis would account for the second most common cause of pancytopenia in our study. However, hypoplastic MDS was represented as a separate group since they share morphological and clinical features of both MDS and aplastic anemia.11

Like in our study, aplastic anemia was the most common cause of pancytopenia in the following studies: Kumar et al.2(2001), Niazi and Raziq12(2004), Gupta et al.13(2008), Santra and Das14(2010), Dasgupta et al.15(2015) and Tariq et al.16(2016).

Hypersplenism (141.00 x109/L) and acute leukemia (105.93 x109/L) showed the highest mean ARC, indicating increased red cell turnover or heightened marrow activity. 50% cases of acute leukemia and 100% cases of hypersplenism had ARC>100 x109/L. Patients with SLE (80.34 x109/L), disseminated TB (68.22 x109/L) showed normal mean ARC, reflecting normal marrow function with peripheral destruction of cells. 83.3% cases of disseminated TB and 71.4% cases of SLE had ARC in the normal range (50-99.99 x109/L). Low mean ARC was seen in aplastic anemia (11.84 x109/L), hypoplastic MDS (12.53 x109/L) and drug-induced pancytopenia cases (20.55 x109/L), pointing to impaired marrow activity. 97.1% cases of aplastic anemia, 100% cases of hypoplastic MDS and 72.7% cases of drug induced pancytopenia had ARC< 25 x109/L. Mean ARC was low normal in CLD related cases (29.52 x109/L), megaloblastic anemia (30.50 x109/L), dual deficiency (31.14 x109/L) and MDS (33.63 x109/L). 72.7% cases of megaloblastic anemia, 75% cases of dual deficiency and 81.8% cases of MDS had ARC in 25-49.99 x109/L range. Our findings of mean ARC in megaloblastic anemia, dual deficiency, MDS, aplastic anemia and acute leukemia were fairly similar to the values obtained in the study conducted by Subhashree et al.5

Hypersplenism (8.30%) and acute leukemia (4.20%) showed the highest mean reticulocyte count. Increased phagocytic activity in hypersplenism leads to increased RBC destruction resulting in compensatory marrow erythropoiesis33. SLE (3.89%), metastasis (2.75%) also showed elevated mean reticulocyte count. Drug-induced cases (0.77%), hypoplastic MDS (0.67%), and aplastic anemia (0.59%) showed relatively lower mean reticulocyte counts, pointing to reduced marrow function or ineffective erythropoiesis. Mean reticulocyte counts were 1.36% in dual deficiency, 1.42% in megaloblastic anemia, 1.68% in MDS and 1.45% in CLD patients with pancytopenia in our study. The lowest mean Hb was seen in metastasis (4.80g/dL) and hypersplenism (5.45g/dL). Aplastic anemia had the lowest minimum Hb of 2.8g/dL. Disseminated TB (8.27 g/dl) and drug-induced pancytopenia cases (7.66 g/dl) showed relatively higher means. The same pattern was observed with RBC count. With regards to WBC count, in our study, aplastic anemia had the lowest mean (2002.94/µL) followed by drug-induced cases with 2045.45/µL suggesting more pronounced leukopenia. CLD-related cases have the highest mean of 3300/µL

followed by acute leukemia and myelodysplastic syndrome with 3000/μL each, suggesting less severe leukopenia. Metastasis (12,500/μL), CLD-related (15,000/μL), and aplastic anemia (18,735/μL) showed very low mean platelet count. Aplastic anemia presented with the lowest mean Hb, RBC count, WBC count and platelet count in the pancytopenia studies.

In our study, high mean MCV was noted in megaloblastic anemia(113.95fL) followed by CLD related cases(105.40fL) and MDS (92.55fL). All the patients with megaloblastic anemia and CLD related pancytopenia in our study had MCV above 100fL indicating macrocytosis.

MDS, hypoplastic MDS, aplastic anemia and SLE had MCV in the normo to macrocytic range. Patients with metastasis, acute leukemia, disseminated TB, dual deficiency, hypersplenism and drug induced pancytopenia in our study had MCV in the micro to normocytic range.

Dual deficiency (28.09%) and hypersplenism (26.20%) showed the highest mean RDW, indicating significant red cell size variation. Megaloblastic anemia (20.94%), acute leukemia (21.15%), and myelodysplastic syndrome (20.24%) also showed elevated mean RDW. Aplastic anemia (18.47%), drug-induced cases (18.44%), disseminated TB (18.40%), and metastasis (19.60%) exhibited relatively lower mean RDW, suggesting less variation in red cell size. Increased RDW with normal MCV denote mixed nutritional deficiency while increased RDW with raised MCV denote megaloblastic anemia.

Metastasis (1431.50 U/L) and Megaloblastic anemia (1280.73 U/L) showed the highest mean LDH levels. Hypersplenism (756.00 U/L), acute leukemia (725.50 U/L), and CLD-related cases (624.50 U/L) also exhibited elevated levels, suggesting increased cell destruction. Aplastic anemia (199.44 U/L) and drug-induced cases (234.45 U/L) showed the lowest mean LDH.

The above discussion is presented in table form. Refer table 6.

Table 6: Approach to pancytopenia based on ARC, history, clinical findings, lab parameters like MCV, RDW, LDH and peripheral smear.

ARC<25×10^9/L	**ARC - 25-49.99×109/L**	**ARC - 50. 99.99×109/L**	ARC≥100×109/L
Aplastic anemia, hypoplastic MDS: • Normal or high normal MCV. • Normal LDH **Drug induced pancytopenia:** • Low normal MCV • Normal LDH. • History of intake of myelosuppression drugs.	**Megaloblastic anemia** • Elevated MCV. • Increased RDW. • Elevated LDH. • Low vitamin B12 or folate levels. • Peripheral smear showing megaloblastic picture. **Dual deficiency:** • Normal or low normal MCV. • Increased RDW. • Variable LDH.	**Disseminated TB** **SLE:** Constitutional symptoms.	**Hypersplenism:** • Raised LDH. • Raised RDW. • Gross splenomegaly. **Acute leukemia:** • Raised LDH. • Raised RDW. • Atypical cells on peripheral smear

	• Low vitamin B12 and ferritin levels. Dimorphic picture on peripheral smear **MDS:** • Normal to high normal MCV. • Variable RDW and LDH. Normal vitamin B12, folate and ferritin levels. • Dysplasia on peripheral smear.		

4. Limitations

- Sample size was limited and larger studies are needed to draw stronger and reliable conclusions.
- Our study population could not represent the entire spectrum of causes of pancytopenia.
- Lack of comparison group is also limitation for our study.
- Furthermore, the study did not assess long term outcomes or the impact of different treatment modalities which could have provided a better understanding of the role of ARC in assessing the therapeutic responses.

5. Summary and Conclusion

Our study focused on the need for bone marrow study for patients with pancytopenia. Based on above findings, patients with very low(<25×109/L) or high ARC(≥100×109/L) can be counselled to undergo bone marrow study to rule out aplastic anemia, hypoplastic MDS (very low ARC) and acute leukemia (high ARC). Patients with low ARC (25×109/L – 49.99×109/L) with macrocytosis and mild LDH elevation can be given a clinical trial of parenteral B12 and folate supplementation and if there is no response and pancytopenia persists, they need to be counselled to undergo bone marrow study to rule out MDS.

Pancytopenia, because of its diverse etiologies pose a difficulty in diagnosing its cause. Though bone marrow aspirate and biopsy are essential for a definitive diagnosis in evaluating the etiology of pancytopenia, several patients especially the elderly are reluctant for the procedure. An approach to pancytopenia based on ARC levels along with correlation to history, clinical findings and parameters like MCV, RDW, serum LDH, vitamin B12, folate and ferritin levels and peripheral smear findings can help us in narrowing down the diagnosis of cause of pancytopenia. If a bone marrow study is essential based on the algorithm derived, the patient can be counselled for the same. Hence including ARC into the diagnostic protocol can enhance the accuracy of pancytopenia diagnosis and patient care.

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