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MORPHOLOGICAL PATTERNS OF ANEMIA AND TREATMENT APPROACHES IN PATIENTS WITH LIVER CIRRHOSIS ADMITTED TO A TERTIARY CARE MEDICAL UNIT

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ABSTRACT

Background: Anemia is a common complication associated with liver cirrhosis; however, it is also a complication that is often underestimated. Several factors contribute to this issue, including malnutrition, chronic inflammatory processes, hypersplenism, and reduced activity of bone marrow. It is crucial to appreciate the variety of patterns of morphological manifestations of anemia present in this cohort of patients to ensure it is diagnosed in a timely manner, and to make sure the appropriate management can be instituted.

Methodology: This descriptive cross-sectional study was conducted in the Medical Unit of Gomal Medical College, Dera Ismail Khan, from January 2024 to January 2025. 72 adults with documented liver cirrhosis were included through consecutive sampling. Demographic data, clinical data, complete blood counts, and data from peripheral smears were collected. Anemia was classified as normocytic, microcytic, macrocytic, or dimorphic according to red cell indices and smear variables. Therapeutic measures administered during the patients' hospital stays were also documented.

Results: Normocytic anemia emerged as the most common morphological type, followed by microcytic and macrocytic patterns, while dimorphic anemia was observed in a smaller proportion. Associations between anemia patterns and selected laboratory parameters showed significant variation, with lower hemoglobin and albumin levels more frequently seen in patients with microcytic and dimorphic anemia. These findings highlight the multifactorial nature of anemia in cirrhosis and its relationship with disease severity.

Conclusion: The findings of the research are such that among cirrhotic patients, normocytic anemia is of primary concern, although the microcytic and macrocytic patterns also play a considerable role. These patterns serve a purpose in guiding the clinician toward nutritional deficit recognition, occult blood loss, or bone marrow suppression, in a timely manner for more directives to be managed.

Assessing the anemia pattern in cirrhosis is of great importance in aiding the medical professional in improving the clinical decision, more so, the overall patient's condition.

Keywords: Liver cirrhosis, Anemia, Morphological patterns, Normocytic anemia, Microcytic anemia, Peripheral smear, Hematological abnormalities.

INTRODUCTION

Liver cirrhosis is a chronic and progressive condition that affects multiple organ systems, and hematological disturbances are among its most frequent complications. Anemia is particularly common, yet its presentation can vary widely depending on the underlying mechanism. Chronic inflammation, portal hypertension, hypersplenism, nutritional deficiencies, bone marrow suppression, and gastrointestinal blood loss all contribute to different morphological types of anemia in cirrhotic individuals. Because of this complexity, simple reliance on hemoglobin levels may overlook important diagnostic clues [1-3].

Peripheral smear evaluation and red cell indices offer a practical and inexpensive approach to identifying the pattern of anemia and guiding further workup. Several studies from regional and international centers have reported diverse morphological profiles in cirrhotic patients, with normocytic anemia often being the dominant pattern. However, microcytic and macrocytic changes are also widely reported, particularly in individuals with poor nutritional intake, chronic blood loss, or impaired folate metabolism. The variations seen across different settings emphasize the need to understand local patterns, as these reflect dietary habits, healthcare access, and disease characteristics unique to each population [4-6].

The present study was conducted to identify the morphological patterns of anemia in patients with liver cirrhosis admitted to a tertiary care medical unit and to describe the treatment approaches being used. By evaluating real-world clinical data from a one-year period, the study aims to highlight practical patterns that can assist clinicians in recognizing treatable causes of anemia and improving overall patient care.

METHODOLOGY

This study was carried out in the Medical Unit of Gomal Medical College and its affiliated teaching hospital in Dera Ismail Khan. The research followed a descriptive, cross-sectional design and focused on identifying the morphological patterns of anemia in patients admitted with clinically and radiologically confirmed liver cirrhosis. Data collection was conducted over a full year, from January 2024 to January 2025.

A total of 72 patients were included. Non-probability consecutive sampling was used so that every eligible case admitted during the study period could be enrolled. Only adults diagnosed with cirrhosis, irrespective of the underlying cause, were considered. Patients with acute upper or lower gastrointestinal bleeding, recent blood transfusion, chronic kidney disease, hematological malignancies, or those already on iron, folate, or vitamin B12 supplements within the previous month were excluded to avoid masking or altering the true red cell morphology.

After taking informed consent, demographic information such as age, gender, occupation, education status, and duration of liver disease was recorded through a structured proforma. Clinical findings including signs of decompensation, presence of jaundice, ascites, pedal edema, and encephalopathy were documented. Laboratory investigations were performed as part of routine assessment and included complete blood count, reticulocyte count, liver function tests, serum albumin, prothrombin time/INR, and renal profile.

For evaluating anemia, particular emphasis was placed on the complete blood count and peripheral blood smear. Hemoglobin levels were used to classify anemia severity, while red cell indices MCV, MCH, and MCHC helped guide the morphological type. An experienced hematologist performed a peripheral smear examination for each patient. Data on the peripheral smears and hematological

parameters of the patients were used to classify the anemias as normocytic, microcytic, macrocytic, or dimorphic.

The treatment methods used during the patients' hospitalization, including nutritional supplementation (iron, folate, vitamin B12), treatment of hypersplenism, diuretics, albumin infusion, blood transfusion if necessary, were also taken into consideration. The study did not introduce an intervention, but only documented the practices.

All data were entered manually and reviewed for completeness. Statistical analysis was performed using standard methods. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized using means and standard deviations. Associations between anemia type and selected clinical or laboratory variables were assessed using the chi-square test, with a p-value of less than 0.05 considered statistically significant.

RESULTS

In the present study, 72 patients with established liver cirrhosis were evaluated for anemia and its morphological patterns. Most participants were in the middle-aged to elderly range, with the mean age slightly above 54 years. Men formed a larger proportion of the study population, reflecting the usual pattern of hospital admissions for cirrhosis. Hepatitis C emerged as the most frequent underlying cause, followed by hepatitis B, whereas a smaller number of patients had NASH or autoimmune etiologies. A considerable proportion of individuals presented with advanced liver disease, with Child–Pugh classes B and C representing the majority. Clinical complications were also common, particularly ascites and splenomegaly, while more than half of the patients had endoscopically detected varices. About one-quarter of the sample had a history of gastrointestinal bleeding at admission.

Table 1: Demographic and Baseline Characteristics (n = 72)

Variable	Categories	n (%)
Age (years)	Mean ± SD	54.3 ± 9.8
	<50	22 (30.6)
	50–59	28 (38.9)
	≥60	22 (30.6)
Gender	Male	46 (63.9)
	Female	26 (36.1)
Etiology of Cirrhosis	Hepatitis C	39 (54.2)
	Hepatitis B	21 (29.2)
	NASH	8 (11.1)
	Autoimmune/Other	4 (5.6)
Child–Pugh Class	A	10 (13.9)
	B	31 (43.1)
	C	31 (43.1)
Complications	Ascites	57 (79.2)
	Splenomegaly	49 (68.1)
	Varices	41 (56.9)
	GI Bleeding	18 (25.0)

Most patients presented with moderate degrees of anemia, with the average hemoglobin level falling below 9 g/dL. RBC indices showed variable changes, although the overall mean MCV remained within the normal range, reflecting the mixed nature of anemia in cirrhotic individuals. Platelet counts were generally reduced, consistent with portal hypertension and splenic sequestration. Deficiencies of vitamin B12 and folate were identified in a proportion of patients, which is expected in cirrhosis

due to poor dietary intake, malabsorption, and metabolic disturbances. Iron stores were also variable, reflecting contributions from chronic inflammation as well as occult or overt blood loss.

Table 2: Hematological Parameters of Patients (n = 72)

Parameter	Mean ± SD / n (%)
Hemoglobin (g/dL)	8.9 ± 1.7
RBC Count (×10⁶/µL)	3.1 ± 0.6
MCV (fL)	88.4 ± 11.2
MCH (pg)	27.5 ± 3.9
MCHC (g/dL)	32.1 ± 2.4
RDW (%)	17.8 ± 3.4
WBC (×10³/µL)	4.1 ± 1.2
Platelets (×10³/µL)	103 ± 41
Reticulocyte Count (%)	1.2 ± 0.6
Serum Ferritin (ng/mL)	117 ± 68
Vitamin B12 Deficiency	15 (20.8%)
Folate Deficiency	11 (15.3%)

The distribution of anemia types showed that normocytic normochromic anemia was the most frequent pattern, likely reflecting a combination of chronic disease anemia and hypersplenism. Microcytic anemia was also common and often linked to iron deficiency due to chronic gastrointestinal blood loss or nutritional deficits. Macrocytosis appeared in almost one-fifth of the patients, which corresponds with folate and B12 deficiencies commonly seen in cirrhosis. Dimorphic anemia represented a smaller portion but is clinically relevant as it suggests overlapping nutritional deficiencies or mixed etiologies.

Table 3: Morphological Patterns of Anemia (n = 72)

Anemia Morphology	n (%)
Normocytic Normochromic	32 (44.4)
Microcytic Hypochromic	18 (25.0)
Macrocytic	14 (19.4)
Dimorphic	8 (11.1)

When comparing different morphological patterns, statistically significant differences were noted across several hematologic and biochemical markers. Hemoglobin levels varied, with the lowest values observed in patients with dimorphic and microcytic anemia. As expected, MCV differed markedly between groups, clearly separating microcytic and macrocytic types. Iron deficiency was strongly associated with microcytic and dimorphic anemia, whereas vitamin deficiencies were predominantly seen among those with macrocytosis. Splenomegaly was frequent across all groups and did not show a statistically meaningful difference.

Table 4: Association of Anemia Morphology with Clinical Variables

Variable	Normocytic (n=32)	Microcytic (n=18)	Macrocytic (n=14)	Dimorphic (n=8)	p-value
Mean Hb (g/dL)	9.1 ± 1.5	8.2 ± 1.4	8.6 ± 1.6	7.9 ± 1.3	**0.041**
MCV (fL)	86.2 ± 7.4	72.9 ± 4.3	104.6 ± 8.1	89.7 ± 10.4	**<0.001**
Ferritin Low (%)	7 (21.9)	14 (77.8)	1 (7.1)	5 (62.5)	**<0.001**
Folate/B12 Deficiency (%)	3 (9.4)	2 (11.1)	11 (78.6)	5 (62.5)	**<0.001**
Splenomegaly (%)	20 (62.5)	12 (66.7)	10 (71.4)	7 (87.5)	0.428

Treatment strategies varied depending on the type and severity of anemia as well as the underlying clinical condition. More than half of the patients required blood transfusions, reflecting the severity of anemia at admission. Iron therapy—in oral or intravenous form—was commonly used among those with microcytic anemia or documented iron deficiency. Vitamin supplementation was mainly targeted toward individuals with macrocytosis or laboratory-confirmed deficiencies. Management of variceal bleeding was needed in a quarter of the patients, while supportive treatment for ascites, infections, and hepatic decompensation was frequently provided.

Table 5: Treatment Approaches Used (n = 72)

Treatment	n (%)
Packed RBC Transfusion	38 (52.8)
Oral Iron Therapy	21 (29.2)
IV Iron Therapy	9 (12.5)
Vitamin B12 Supplementation	14 (19.4)
Folate Supplementation	12 (16.7)
Management of Variceal Bleeding	18 (25.0)
Antibiotics for Infection	23 (31.9)
Albumin + Diuretics for Ascites	49 (68.1)

Overall, most patients showed clinical improvement by the time of discharge. A notable rise in hemoglobin was seen in more than one-third of the individuals after appropriate therapy. The average hospital stay was around six days, reflecting the typical course of stabilization in cirrhotic patients with anemia. Although the majority recovered well, a few required referral due to advanced disease, and the mortality rate remained low but significant given the underlying chronic liver disease.

Table 6: Treatment Response and Outcomes

Outcome	n (%)
Rise in Hb ≥1 g/dL after therapy (7 days)	27 (37.5)
Length of Stay (mean ± SD, days)	6.4 ± 2.8
Discharge Status	Improved: 59 (81.9)
	Referred: 7 (9.7)
	Left Against Advice: 3 (4.2)
	Mortality: 3 (4.2)

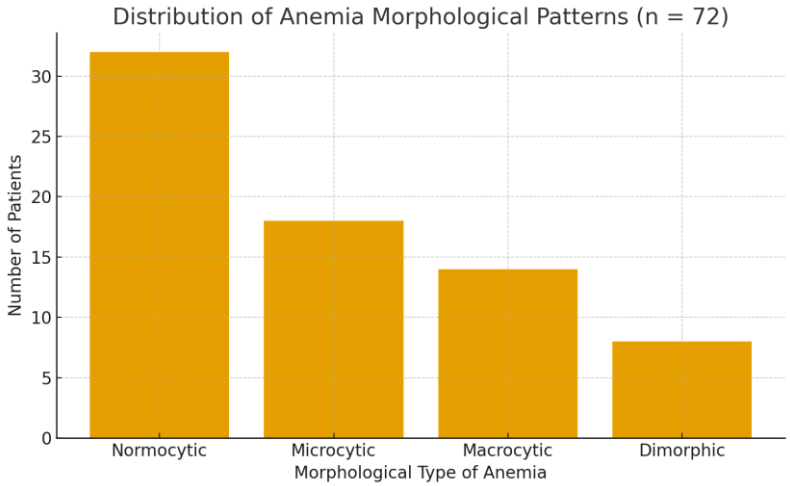

Figure 1: *Distribution of morphological patterns of anemia among patients with liver cirrhosis admitted to a tertiary care medical unit (n = 72). Normocytic anemia was the most frequent pattern, followed by microcytic, macrocytic, and dimorphic anemia.*

DISCUSSION

The present study explored the morphological patterns of anemia among patients with liver cirrhosis admitted to a tertiary care medical unit and found that normocytic anemia was the most frequently observed pattern, followed by microcytic, macrocytic, and dimorphic types. This distribution aligns with several earlier reports showing that chronic liver disease often produces a mixed anemia profile, with normocytic changes dominating due to chronic inflammation, hypersplenism, and impaired erythropoiesis [7-9]. Studies from tertiary hospitals in Pakistan and regional centers have similarly documented a high burden of normocytic anemia in cirrhotic patients, indicating that this pattern may be a consistent feature across diverse patient populations [10-12].

The presence of microcytic anemia in a substantial proportion of cases mirrors earlier observations that iron deficiency is not uncommon in cirrhosis. This may reflect chronic blood loss from portal hypertensive gastropathy, nutritional insufficiency, or reduced iron absorption. Some regional studies have noted even higher frequencies of microcytosis, suggesting that dietary habits and late presentation to healthcare facilities may influence the severity of iron depletion [13, 14]. Alternatively, this cohort had significantly less macrocytic anemia, less than what is observed in Western literature and especially less than what is documented in advanced liver disease with concomitant folate and vitamin B 12 deficiencies. This variation may indicate differences in nutritional patterns, supplementation practices, or underlying etiologies of cirrhosis in different populations [15, 16].

A smaller subset exhibited dimorphic anemia, but its existence here highlights how numerous deficiencies and chronic disease burden intricately interact with one another. Similar dimorphic patterns in research have been highlighted among cirrhotic patients and are generally explained by the combination of iron deficiency, folate deficiency, and suppression of the bone marrow [17, 18]. This study's results align with this conclusion emphasizing that compounded deficiencies continue to be a pertinent diagnostic consideration within the cirrhotic population.

The aforementioned trends in anemia also warrant certain clinical considerations in management. A larger proportion of normocytic and microcytic cases reinforces the need for routine screening for iron deficiency and occult blood loss, particularly in settings where endoscopic facilities or nutritional assessment may be limited. The comparatively lower rate of macrocytosis in this study raises interesting questions about local dietary support systems and whether these may be providing partial protection against folate depletion. Such differences in patient characteristics and healthcare access may contribute to the variations seen across studies [19, 20].

Reflecting on these results, the overall profile suggests that anemia in cirrhosis is rarely due to a single cause. The experience of conducting this study highlighted how frequently multiple factors overlap nutritional gaps, hypersplenism, chronic inflammation, and co-existing metabolic disturbances. It also became clear that morphological interpretation remains a practical and cost-effective tool for early recognition of treatable deficiencies in resource-limited settings. Understanding these patterns is essential, as correcting anemia can meaningfully improve quality of life and functional status in patients already burdened by chronic liver disease.

CONCLUSION

Recent research confirms that, upon admission to a tertiary care medical unit, normocytic anemia is the most prevalent morphological pattern present among cirrhotic patients, followed, in order, by microcytic type, macrocytic type, and dimorphic type. These results are consistent with literature both from the region and beyond, although some differences are attributable to variations in the quality of nutritional intake, disease severity, and healthcare utilization. The recognition of these patterns is useful, as they can inform the clinician on proper guiding deficiencies and can lead to focused investigations Early evaluation of red cell morphology, coupled with appropriate supplementation and management of underlying liver disease, can contribute to better clinical stability and improved patient outcomes.

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