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A Prospective Study on the Prevalence of Morphological Patterns of Anemia in a Tertiary Care Unit

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Abstract
Background: *Anemia is a prevalent blood condition resulting from decreased red blood cells(RBCs), also called the RBC count or hemoglobin (Hb) concentration of the peripheral blood, below the normal level in proportion to age and sex. Anemia is prevalent in every age group and gender. Around one-third of people worldwide have anemia, which is a big public health problem affecting 1·62 billion people worldwide. It is estimated that anemia causes 5, 91,000 neonatal deaths and about 1, 15,000 maternal deaths worldwide each year.*
Aim*: This study analyses the prevalence of morphological patterns of anemia, causes and riskfactors of anemia, and treatment strategies in a tertiary care unit.*
Materials and method*: The prospective study analysed the medical records of 100 patients across various specialties in the tertiary care hospital in the period from January 2023 to September 2023.*
Results: *In a tertiary care unit, 100 cases were prospectively analysed from January to September 2023, a period of nine months. The study revealed 37% of patients were in the agegroup of 18–49 and 63% were between the ages of 50–99, of whom 58 were male and 42 were female, out of which 48% of patients presented a moderate grade of anemia. Normocytic normochromic anemia was the most prevalent morphological form of anemia, followed by microcytic normochromic anemia, microcytic hypochromic anemia, and macrocytic normochromic anemia, with prevalence rates of 57%, 24%, 9%, and 6%, respectively. Normocytic hypochromic anemia and macrocytic hypochromic anemia are found to be the least prevalent, with a prevalence rate of 2% each.*
Conclusion: *Morphological patterns of anemia reflect the underlying etiology, the study of which would ensure benefits in early detection and appropriate treatment. The study revealed normocytic normochromic anemia being the most prevalent morphological pattern of anemia,comorbidities, and advanced age as primary causes of anemia, which assist in proper investigation and treatment of underlying morbidities and proper dietary care in the elderly population. Iron deficiency anemia is a nutritional anemia that can be prevented by improving nutritional status, creating awareness, and educating people.*

Keywords: *anemia, morphological patterns of anemia, microcytic anemia, normocytic anemia, macrocytic anemia, hypochromic anemia, normochromic anemia, causes of anemia, treatment of anemia in a tertiary care unit*

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I. Introduction

Anemia is a prevalent blood condition resulting from decreased red blood cells (RBCs), also called the RBC count. In other words, it is also described as a reduced hemoglobin (Hb) concentration in the peripheral blood, below the normal level in proportion to age and sex.[1] Anemia exists in various forms, accounting for about 400 distinct types; each of them has a unique set of causes, remedies, and prognoses. Anemia affects the world's population, with an estimate of 1·62 billion people affected every year.[2] While anemia incidence is estimated to be 9% in wealthy countries; it is projected to reach 43% in developing countries.[3] Anemia majorly affects children and pregnant women, with estimates of global anemia prevalence ranging from 47% in children under the age of 5 to 42% in pregnant women to 30% in non- pregnant women aged 15 to 49 years.[4] Africa and Asia also account for more than 85% of theabsolute anemia burden in high-risk groups.[5] It is estimated that anemia causes 5,91,000 neonatal deaths and about 1,15,000 maternal deaths worldwide each year.[6] The effects of chronic anemia morbidity include cognitive impairment, increased susceptibility to infection, and loss of production due to diminished work capacity,[7] which also bears a significant economic crisis[8], the economic effect of anemia on human capital results in the loss of billions of dollars annually.

Under a microscope, the morphology of anemia describes how red blood cells appear, and this

information can be very helpful in determining the underlying cause of the illness. The size (MCV, mean corpuscular volume) and haemoglobin content (MCH, mean corpuscular hemoglobin) of red blood cells are the basis for multiple morphological categories ofanemia. Microcytic Anemia: Small Cells (Low MCV <80FL) in microcytic anemia, red blood cells are smaller than normal. This can be due to iron deficiency anemia, thalassemia, or lead poisoning.[9] Normocytic Anemia: Normal Sized Cells (Normal MCV 80–100FL) Normocytic anemia occurs when red blood cells are normal in size but lower in number. Causes include chronic diseases, kidney failure, and early anemia from chronic disorders. Macrocytic Anemia: High MCV >100FL, Large Cells Bigger-than-normal red blood cells are a hallmark of macrocytic anemia. Macrocytic anemia can result from many drug interactions, vitamin B12 insufficiency, and Folate inadequacy. Alcoholism, liver disorders, hypothyroidism, and medications like zidovudine and methotrexate are other causes of macrocytic anemia. Pale cells (low MCHC) are indicative of hypochromic anemia.Red blood cells with hypochromic anemia have lower haemoglobin contents than usual. . Iron-deficiency anemia is a common cause of hypochromic microcytic anemia. Normochromic anemia is defined as having a normal haemoglobin content, or normal mean corpuscular haemoglobin concentration, or MCHC. Anemia classified as normochromic occurs when the amount of haemoglobin in each red blood cell is within the usual range. Thiscan happen to many different kinds of anemia, including anemia brought on by long-term illnesses.

II. Objectives

The main aim of the research was to examine the prevalence of anemia's morphological patterns in a tertiary care setting, with the secondary goal of compiling information on various causes, risk factors, and treatment approaches.

III. Methodology

This prospective observational study comprised an analysis of 100 random medical records of 100 patients admitted across different specialties in a tertiary care unit in the period from January 2023 to September 2023. Patients who met the criteria were enrolled in the study.The first step involved the collection of baseline information such as demographic details likeage, sex, and weight, followed by detailed data collection from medical case records in SOAPformat.

Inclusion Criteria:

- Adult patients of both genders (i.e., male and female) from the age of 18 years

Exclusion Criteria:

- Patients below the age of 18 years
- Pregnant patients
- Physical trauma (i.e., blunt force and penetrating trauma), which results in acute bloodloss

IV. Results

A total of 100 patients were included in the study, out of which 58 were male and 42 were female (Table 1). Elderly people are found to be at high risk of developing anemia. The prevalence of anemia between the age groups of 50 and 99 is found to be 63%, and the prevalence of anemia between the age groups of 18 and 49 is found to be 37% (Table 2), depicted in Fig. 1.1.

Table 1: Gender distribution of patients enrolled in the study	
Male	58
Female	42

Table 2: Age group of participating patients	
Age group between 18-49	37
Age group between 50-99	63

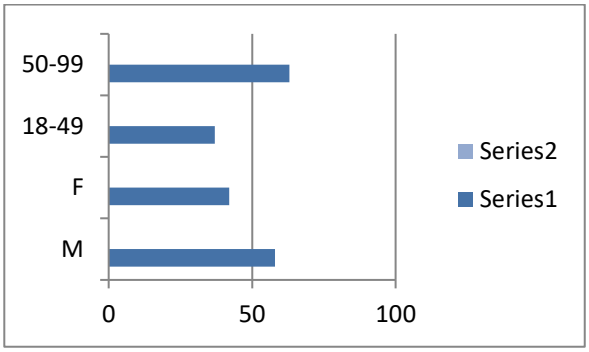

Fig. 1.1: Gender and age distribution of patients enrolled in the study

Out of 100 cases, it was observed that normocytic normochromic anemia is the most prevalent morphological form of anemia, followed by microcytic normochromic anemia, microcytic hypochromic anemia, and macrocytic normochromic anemia, with prevalence rates of 57%, 24%, 9%, and 6%, respectively. Normocytic hypochromic anemia and macrocytic hypochromic anemia are found to be the least prevalent, with a prevalence rate of 2% each, as shown in Fig. 1.2.

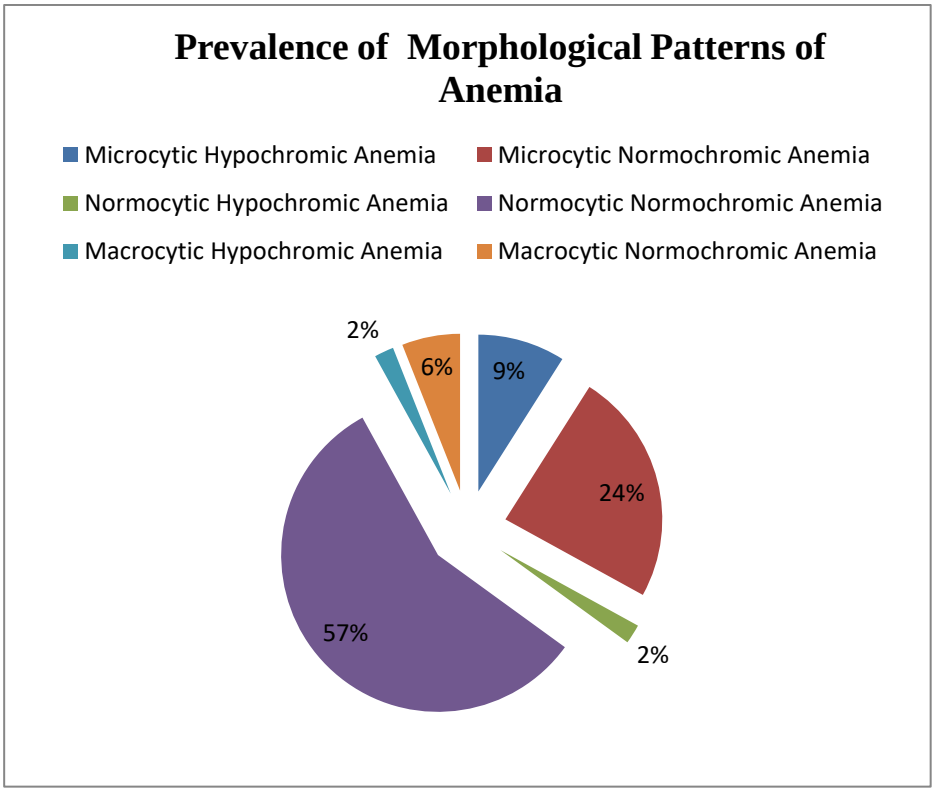

Fig. 1.2: Pie chart, representing the prevalence of morphological prevalence of anemia

A total of 100 patients were included in the study, and out of those 100 cases, elderly people were found to be at high risk of developing anemia. The prevalence of anemia between the age groups of 50 and 99 is found to be 63%, and the prevalence of anemia between the age groups of 18 and 49 is found to be 37%. Chronic comorbidities are found to be the main cause of anemia, with a prevalence rate of 85%. AOCD with multifactorial causes is found to be the most prevalent cause of anemia, with a prevalence rate of 48% and constituting 56% of the total comorbidity cause of anemia. DM, CKD, infections, and cancer were found to be the most contributing causes of anemia in the percentage of 81%, CKD 22%, infections 20.8%, and cancer 12.5%, respectively. DM alone is found to be the most prevalent chronic comorbidity of anemia, with a prevalence rate of 22% (Table 3).

Table 3: Causes & risk factors of anemia		
Sl.NO	Risk factors & Causes	Prevalence
01	AGE:	
	Adult [18-49]	37%
	Elder [50-99]	63%
02	Smoking	3%
03	Alcohol	8%
05	Presence of Chronic comorbidities	85%
	AOCD, MF [DM 81%, CKD 22%, CLD 12.5%, Cancer 12.5%, Chronic infections 20.8%, Hypothyroidism 12.5%, RA 4.15, RHD 2.0%]	48%
	DM	22%
	CKD	1%
	CANCER	2%
	Hypothyroidism	3%
	R-Arthritis	1%
	CLD	2%
	Infection	1%
	RVD	1%
	Hemorrhoid	2%
	AUB	1%
	IDA	1%
06	No Comorbidity	15%

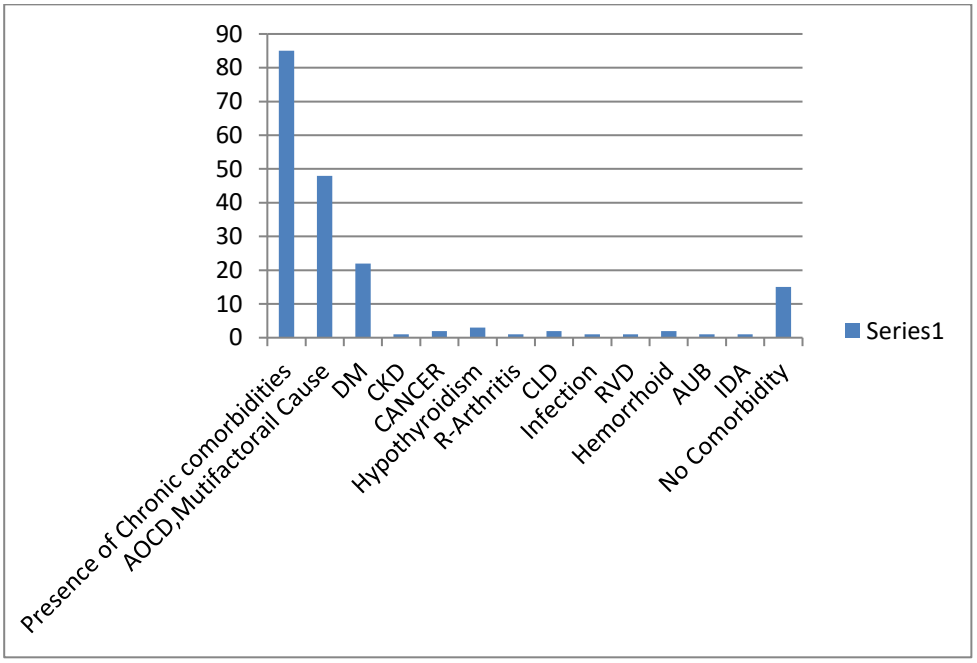

Fig. 1.3: Graphical representation of different causes of anemia

A total of 100 patients were included in the study. Out of 100 cases, the range of haemoglobin found among the patients was between 4 and 12.9. Out of 100 patients, 3 fall in the range of 4-4.9, 5 in 5-5.9, 8 in 6-6.9, 15 in 7-7.9, 18 in 8-8.9, 15 in 9-9.9, 17 in 10-10.9, 15 in 11-11.9, and 4 in 12-12.9, respectively. The maximum number of patients was found to be in the range of 8–8.9 Hb (Table 4).

Table 4: Hemoglobin variation among the patients enrolled in the study

Hemoglobin range of patients (mg/dl)	Number of patients.
4 – 4.9	3
5 – 5.9	5
6 - 6.9	8
7 – 7.9	15
8 – 8.9	18
9 – 9.9	15
10 – 10.9	17
11 – 11.9	15
12 – 12.9	4

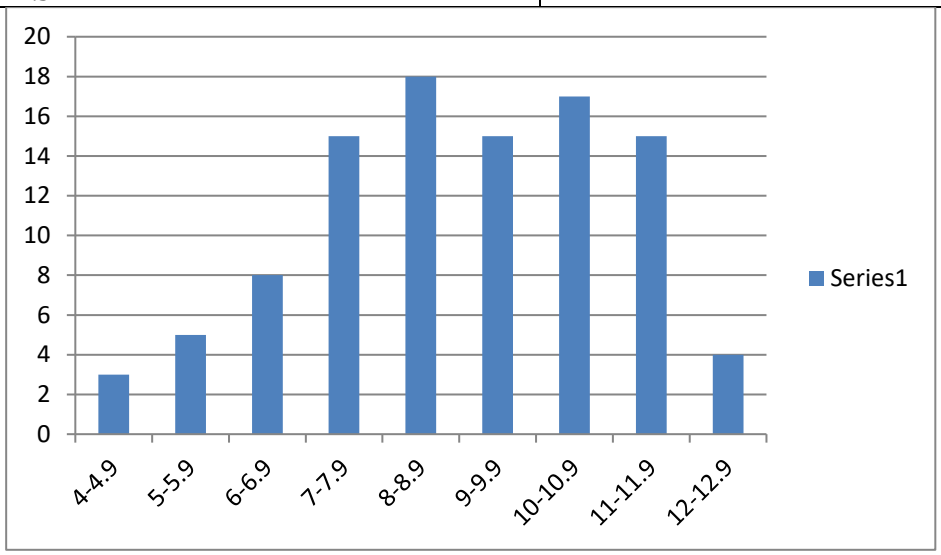

Fig. 1.4: Hemoglobin variation among the patients enrolled in the study

A total of 100 patients were included in the study. Out of 100 cases, very severe anemia was found to be absent in all cases; severe anemia was found to be present in 16% of cases; moderate anemia was present in 48%; and mild anemia was present in 17% of cases. The most common type of anemia has been identified as having a moderate grade (Table 5).

Table 5: Severity of anemia among the patients enrolled in study as per ICMR & WHO criteria

Grade of Anemia (ICMR & WHO classification)	Numbers of patients	%
Very severe < 4g/dl	-	-
Severe 4-6.9g/dl	16	16%
Moderate 7-9.9g/dl	48	48%
Mild 10-10.9g/dl	17	17%
Other(less than normal as stated in definition of anemia as per WHO)	19	19%
Total No. patients in study	100	100

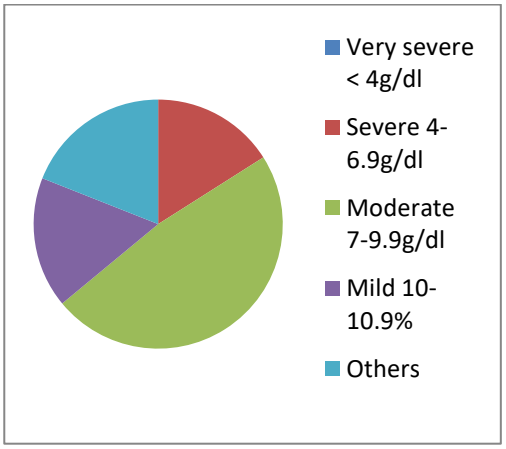

Fig. 1.5: Severity of anemia among the patients enrolled in the study

The study involved 100 patients in all. Depending on the degree of the anemia in each of the 100 instances, medical care was provided. The majority of the time, a combination of treatments was used to treat severe to moderate anemia, including blood transfusions, Erythropoietin, Zincovit, Zincofer, MVI, Folic Acid, V.B12, and Ferrisome; 30% of such a study's subjects received it. Instances of anemia brought on by CKD were given injections of erythropoietin in particular. Any one or a combination of Zincovit, Zincofer, MVI, V.B12, Folic acid, and Ferrisome was prescribed for mild anemia. 24 percent of individuals with moderate to mild anemia had no medical treatment for the condition, as shown in Fig. 1.6.

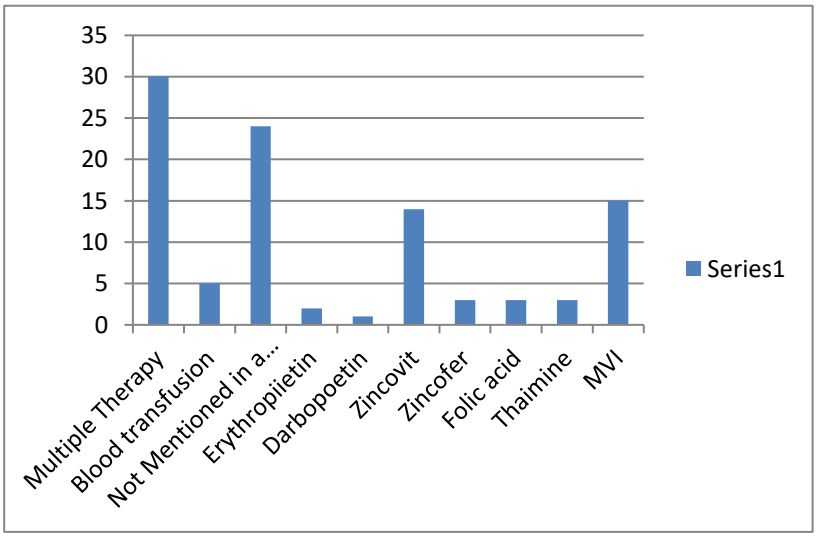

Fig. 1.6: Treatment strategies given in the management of anemia

V. Discussion

Studying the morphological type of anemia is the first step in determining the cause of anemia so that it can be properly treated. This information is helpful to the physician or hematologist as they continue to examine the patient. In our study, the result of the data analysis obtained showed a predominance of males amongst 100 patients. Males constituted 58% of the total patients, and females constituted 42% of the study subjects. The age of the patients in the present study ranged from 20 to 94 years. The majority of the patients (63%) belonged to the age group 50–94, and 37% of patients were in the age group 20–49, which signifies that elderly people are found to be at high risk of developing anemia, which is in concordance with a study carried out by Carlo Zaninetti [10], which showed a predominance of males over females among 500 patients: 254 males and 246 females. The prevalence was higher in the elderly, particularly anemia, which was present in 62% of the ≥65 year's old males vs. 44.1% of the < 65 years old males and in 60.1% of the ≥65 year's old females vs. 53.5% of the < 65 years old

females, without significant gender diversity. A similar study was carried out by Dr. Faiza Hafiz [11] which showed a predominance of females amongst 100 patients. Females constituted 55% of the total patients with female to male ratio of 1.22:1. Similar sex distribution result was obtained in the study of Jadhav MV et al [12] female to male ratio of 1.25:1 and Singhal S et al [13] in which 64.9% females were affected with anemia. The age of the patients in the present study ranged from 20 to 94 years. The majority of the patients (63%) belonged to the age group 50–94, and 37% of patients were in the age group 20–49, which was found to be different from the study carried out by Dr. Faiza Hafiz [11], which showed the majority of the patients (58%) belonged to the age group of 21–40 years. This difference might be because of the presence or absence of other comorbidities.

In the study, 48 patients had moderate anemia, 16 had severe anemia, and 17 had mild anemia. So, the most common type of anemia has been identified as having a moderate grade. A study done by Abhimanyu Sharma [14] also revealed similar findings: 73 patients had moderate anemia, 18 had severe anemia, and 8 patients had mild anemia, further supported by the study done by Kouli et al.[15] Most common morphological type of anemia observed was normocytic normochromic anemia followed by microcytic normochromic anemia with a prevalence rates of 57% & 24% respectively, which was in concordance to study, done by Dr. Faiza Hafiz[11] which showed majority of the patients (40%) showed normocytic normochromic anemia followed by microcytic hypochromic anemia seen in 29% cases. This finding was also similar to the study carried by Kaur H et al [16] in whichnormocytic normochromic anemia was the predominant type seen in 56% cases. Microcytic hypochromic anemia 46.50% was the predominant type of anemia seen in study by Patel S et al.[17] Mukaya JE et al [18] in his study of 165 cases of anemia had Microcytic Hypochromic anemia (54%) the most common morphological type of anemia followed by Normocytic normochromic anemia (31%). Besides advanced age, chronic comorbidities accounted for 85% of the anemia cases in our patients, with AOCD with multifactorial etiology accountingfor 56% of these cases. The most common multifactorial etiologies of anemia were found to be DM, CKD, chronic infections, cancer, CLD, hypothyroidism, rheumatoid arthritis, and rheumatic heart disease, with respective percentages of 81%, CKD 22%, chronic infections 20.8%, 12.5%, 12.5%, 12.5%, 4.15%, and 2.0%. With a prevalence incidence of 22%, DM alone was found to be the most predominant chronic comorbidity cause of anemia. In a related study, Carlo Zaninetti[10] found that, in addition to age, potential clinical risk factors independently associated with anemia included solid tumors, chronic renal failure, chronic liver disease, hematological malignancies, anemia of chronic inflammation (52.9%), and multifactorial anemia (35.2%). Heart conditions made up the majority of comorbidities (approximately 65%). Medical treatment was offered based on the anemia's severity. The majority of the time, a combination of treatments was used to treat severe to moderate anemia, including blood transfusions, erythropoietin, Zincovit, Zincofer, MVI, folic acid, V.B12, and Ferrisome. Multiple therapies were administered to 30% of the study's subjects. Instances of anemia brought on by CKD were given injections of erythropoietin in particular. Any one or a combination of Zincovit, Zincofer, MVI, V.B12, Folic acid, and Ferrisome was prescribed for mild anemia. 24 percent of individuals with moderate-to-severe anemia had no medical treatment for the condition. As per 2019-Global-Market- Study-Analysed-by-Type-of-Anemia-Type-of-Drug-and-Geography [19], Iron deficiency anemia, thalassemia, aplastic anemia, hemolytic anemia, sickle cell anemia, and pernicious anemia are the anemia types that are treated with medication. Mild to moderate iron-deficiency anemia is treated by oral iron supplementation with ferrous sulphate, ferrous fumarate, or ferrous gluconate. Daily iron supplements have been shown to be effective in reducing anemia in women of childbearing age. [20] In the anemia of chronic kidney disease, recombinant erythropoietin or epoetin alfa is recommended to stimulate RBC production, andif iron deficiency and inflammation are also present, concurrent parenteral iron is also recommended. [21] Blood transfusions in those without symptoms are not recommended until the haemoglobin is below 60 to 80 g/L (6 to 8 g/dL). [71] For those with coronary artery disease who are not actively bleeding, transfusions are only recommended when the haemoglobin is below 70 to 80 g/L (7 to 8 g/dL).[22] In many cases, vitamin B_{12} is usedby intramuscular injection in severe cases or cases of malabsorption of dietary B12. Pernicious anemia caused by a loss of intrinsic factor cannot be prevented. If there are other, reversible causes of low vitamin B_{12} levels, the cause must be treated. Treatment of exceptional blood loss (anemia) is recognized as an indication for hyperbaric oxygen (HBO)by the Undersea and Hyperbaric Medical Society.[23] The use of HBO is indicated when oxygen delivery to tissue is not sufficient in patients who cannot be given blood transfusions for medical or religious reasons. HBO may be used for medical reasons when thethreat of blood product incompatibility or concern for transmissible disease are factors. [24] Thebeliefs of some religions (ex., Jehovah's Witnesses) may require them to use the HBO method. [24] A 2005 review of the use of HBO in severe anemia found all publications reported positive results.

VI. Conclusion

Morphological patterns of anemia reflect the underlying etiology, the study of which would ensure benefits in early detection and appropriate treatment.

The study revealed normocytic normochromic anemia being the most prevalent morphological pattern of anemia, comorbidities, and advanced age as primary causes of anemia, which assist in proper investigation and

treatment of underlying morbidities and proper dietary care in the elderly population. Iron deficiency anemia is a nutritional anemia that can be prevented by improving nutritional status, creating awareness, and educating people.

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