

A STUDY ON PREVALENT MORPHOLOGICAL PATTERNS OF ANEMIA IN A TERTIARY CARE CENTER FOR A PERIOD OF ONE YEAR

1. Dr. M. KOTESWARI, Associate Professor, Department of Pathology, G.M.C, [RIMS], Ongole, A.P
2. Dr. J. RAJENDRA PRASAD, Professor & HOD, Department of Pathology, G .M.C, [RIMS], Ongole, A.P
3. G.SUDHAKAR, Associate Professor, Department of Pathology, Guntur Medical College, Guntur, A.P

Corresponding Author: G.SUDHAKAR *, Associate Professor, Department of Pathology, Guntur Medical College, Guntur, A.P

Email-drgsudhakarjournals@gmail.com, Ph.No-9493506080

ABSTRACT:

Aim: Not just reporting the condition as the anemia is enough, but the pathologist needs to subtype the anemia, so as to guide the clinician in a proper direction towards the prevention and treatment.

Material and Methods: The study was done in central clinical laboratory, government general hospital, [RIMS], Ongole. The study participants were the patients admitted and investigated at RIMS hospital during one year period, from January 2019 to December 2019.

Results: A total of 1477 participants, 706 participants (47.8%) had a microcytic hypochromic pattern, followed by 356 participants (24%) with a normocytic normochromic pattern, 321 participants (21.7%) with a normocytic hypochromic pattern, 85 participants (5.8%) with a dimorphic pattern, 4 participants (0.3%) with a hemolytic pattern, one participant (0.07%) with a macrocytic normochromic pattern.

Discussion: The present study includes all age groups and both the sexes, proved that anemia is the among the most common health problems faced by the society. Microcytic hypochromic anemia is the most common type and females are more commonly affected than males. Majority of the patients (46.8%) had moderate degree of anemia with haemoglobin levels 6-9 gm/ dl was seen in 691 patients. Mild degree of anemia (42.7%) with haemoglobin more than 9 gm/dl, was seen in 631 patients. Severe degree of anemia (10.5%) with haemoglobin less than 6 was seen in 155 patients.

Conclusion: Anemia is not a standalone disease, but a clinical condition seen in general practice. Treating anemia in early stages reduces the morbidity and mortality rate and improves the quality of life.

KEYWORDS: Anemia, Complete Blood Count, Morphological Types, Prevalence, Red Cell Indices.

INTRODUCTION:

Anemia most often a sign of an acquired or genetic abnormality. It is one of the commonest manifestations of the underlying medical condition. Anemia functionally defined as an insufficient RBC mass to adequately deliver oxygen to peripheral tissues. Hemoglobin

concentration estimation is the ideal and convenient way of detecting Anemia. Other measurements, which are also helpful are haematocrit and the RBC count. It is not enough to just report that patient has anemia, but also morphological sub typing of anemia is required, so that the clinician can be properly guided in the proper management and follow up of the anemic patient^[1].

Anemia being the most common example of the health related problems faced by the Society, it is essential to diagnose anemia at the early stage. Education plays a very important role in the health of people. Females with high school education or more were found two times less anemic than those with lower education. Smoking and tobacco chewing persons had higher incidence than those with not. Even diet affects the severity of Anemia. Consumption of milk and green leafy vegetables in the women had shown, lesser severity of anemia than those without such nutrients^[2].

Anemia is a condition of reduction in the haemoglobin (Hb) concentration of the peripheral blood below the normal level or the reduction in hematocrit below the lower limit of the 95% reference interval in relation to age and sex. It is not a disease but an expression or sign of an underlying disease. The World Health Organization (WHO) criteria for anemia in men are <13 gm/dl and women is < 12 gm/ dl. However, it differs by age, sex and pregnancy status as shown in Table : 1^[3].

Hb concentration estimation is the ideal and convenient way of detecting Anemia. Anemia is a common condition in the older population. Generally in individuals over 65 years, 8.5 % have a hemoglobin concentration meeting the WHO definition of Anemia. Prevalence of Anemia rises steadily with age, increasing from about 10 % in persons of 65 years and older, to about 20% in persons over 85 years. Anemia is a significant predictor of morbidity, mortality and quality of life in the elderly, as a general risk factor or in the setting of other clinical conditions like heart failure. Iron deficiency Anemia is one of the silent killers in India and is one of the most important factors of maternal and fetal morbidity & mortality in India. There is also a strong association of males being involved in alcoholic consumption are more likely to develop anemia, which is macrocytic in nature^[3].

The main causes of anemia are a decrease in RBCs, insufficient Hb synthesis or increased RBC's destruction and the primary cause is an iron deficiency. Anemia is the most common health issue in the World^[1].

The most frequent etiologies of anemia are 1. Nutritional deficiencies, 2. Malaria, 3. Parasitic infections 4. Blood loss. 5. Bone marrow replacement or 6. Suppression and 7. Haemoglobinopathies.

The morphological classification of anemia is based on morphological criteria of red cells in ideal thin blood film, and also on red cell indices, mean corpuscular volume (MCV), mean cell haemoglobin (MCH) and MCH concentration (MCHC). Each of these morphological types has varied etiologies and can be known by correlating with patients clinical history, clinical examination and by further suitable investigations.

MATERIAL & METHODS

The study was done in central clinical laboratory, GGH [RIMS], Ongole. The study participants were the patients admitted and investigated at RIMS, Hospital during one year period, from January 2019 to December 2019. All necessary aseptic precautions were taken.

Detailed relevant history and clinical details were collected from patients. The blood collected in EDTA vacutainer was sent to central laboratory and reporting was done based on readings from automated cell counter,Horiba cell counter 3 part (TRIPOD) as well as by peripheral smear examination from the slide stained with Romanowsky stains. The morphological evaluation of anemia was done on the basis of RBC indices obtained from automated hematology analyzer and on peripheral blood smear examination. 1477 cases were studied during the period of one year.

Morphological patterns of anemia are considered essential for classification, diagnosis and management of patients. Laboratory tests were performed for complete blood count, blood smears were performed for morphology and vitamin B12, folate and iron levels were measured. Participants were classified as—microcytic hypochromic, normocytic normochromic, normocytic hypochromic ,dimorphic, hemolytic, microcytic normochromic,¯ocytic normochromic. Further classification based on haemoglobin levels was also performed. Morphological patterns appeared to predict types of vitamin and mineral deficiency and the degree of Anemia.

The most common etiology worldwide is iron deficiency anemia, followed by the anemia of chronic disease & inflammation ,and anemia of renal disease¹⁴ .Considerable information is contained in the initial laboratory tests, that led to the detection of anemia, complete blood count (CBC) with white blood cell (WBC) differential, mean corpuscular volume (MCV), and reticulocyte count.

The diagnosis of anemia needs to be carried out by various investigations.

A. Routine investigation : complete blood count with white blood count, platelet count and red blood count parameters (MCV/MCH/MCHC), and reticulocyte count.

B. Peripheral smear examination: simple method for diagnosis of anemia. Examination of the peripheral smear is an important part of the workup of patients with anemia.

C. Bone marrow examination:1.Reveal primary marrow disease (Ex- Aplastic Anemia &Myelodysplasticsyndrome). 2.Marrow involvement of non-marrow diseases (Ex: Lymphoma, infection). 3. Used to accurately gauge iron stores and nonmalignant marrow processes(Ex: Hemophagocytic syndromes, Gauchers diseases).

D. Special Investigations : Needed to make diagnosis and required for specific type of anemia.

1. Iron deficiency anemia---decreased serum iron, increased total iron binding capacity (TIBC),decreased bone marrow, and decreased serum ferritin.
2. Hemolytic Anemia---increased indirect bilirubin, decreased serum haptoglobin and increased lactate dehydrogenase [LDH] levels.
3. Macrocytic Anemia--- vitamin B12 (level of < 200 pg/ ml is diagnostic of megaloblasticanemia), folate (<2mg/ml is diagnostic of folate deficiency) and reticulocyte count.
4. Anemia of chronic disease--- (normal to increased serum iron, increased ferritin, decreased TIBC, and increased bone marrow iron.

According to World Health Organization (WHO) guidelines, Anemia in pregnancy is defined as a haemoglobin level < 11gm/dl for the first & third trimester and < 10.5 gm/ dl for the second trimester. Both red blood cell (RBC) mass and plasma volume expand in pregnancy, reaching the maximum level in the second trimester. However, the expansion of 35%--40% in plasma volume exceeds the 20%--25% increase in RBC mass, as a result there is a dilutional

drop in haemoglobin concentration, haematocrit & RBC count. Additionally there is a 2—3 fold increase in iron requirements and 10—20 fold increase in folate requirements^[5].

Anemia during pregnancy is one of the leading causes of maternal and foetal morbidity and mortality in almost all developing countries. Foetal growth restriction and low birth weight are increased, when haemoglobin drops. Also maternal anemia adversely affects cognitive, behavioral and physical development in infants. Anemia also depresses immune status and increases morbidity from infections in neonates.

RESULTS

Present study includes 1477 patients, age group 0 to >80 years. The study shows most commonly affected age group was 0-10 years, followed by 11-20 years, and then by 21-30 years [Table.2]. Females are more commonly affected than males. [Table.3].

Total no. of Females = 777, (52.6%). Total no. of Males = 700, (47.4%). Female : Male = 1.11:1.

The present study shows majority of the patients had moderate degree of anemia with haemoglobin levels 6—9 gm/dl [Table.4].

All 1477 participants peripheral smears studied and classified in to various morphological types of anemia. Among all cases 706 participants (47.8%) had a microcytic hypochromic pattern, followed by 356 participants (24%) with a normocytic normochromic pattern, 321 participants (21.7%) with a normocytic hypochromic pattern, 85 participants (5.8%) with a dimorphic pattern (0.3%), 4 participants (0.3%) with a hemolytic pattern, 4 participants with a microcytic normochromic pattern and one participant (0.07%) with a macrocytic normochromic pattern [Table.5].

DISCUSSION

The present study includes all age groups and both the sexes, proved that anemia is the most common health problem faced by the society. Females are more commonly affected than males.

The study participants were followed with evaluation of the history, clinical examination, and peripheral blood smear examination. After the morphological typing of anemia done, the participants were investigated with further biochemical investigations. Microcytic hypochromic type of anemia—patients were investigated for the levels of serum iron, serum ferritin, TIBC (total iron binding capacity). It was found that nearly 90% of microcytic hypochromic anemia patients had low levels of serum iron (normal 50—160 microgram/dl), serum ferritin (normal 12—300 microgram/L) and the TIBC (normal 250—400 microgram/dl) was found to be raised. In case of the patients with macrocytic anemia, serum vitamin B 12 (normal 160—950 pg/ml or 118 to 701 picomoles per liter) levels were done, which were found to be low in nearly half of such cases.

Nutritional deficiency has been the most common cause of anemia in our study participants. Patients with hemolytic anemia, were further investigated with serum bilirubin levels. Haemoglobin fractionation studies helped to diagnose the patients of thalasemias, sickle cell anemias and other haemoglobinopathies.

In the present study peripheral blood smear, majority of the patients (47.8%) showed microcytic hypochromic anemia followed by normocytic normochromic anemia seen in (24%) cases and then normocytic hypochromic (21.7%) picture. Microcytic hypochromic Anemia was the predominant type of anemia (46.5%) seen in study by Patel S et al.^[6].

Mukaya JE et al study had (54%) followed by normocytic normochromic (31%)^[7].

The present study shows, majority of the patients (46.8%) had moderate degree of anemia with haemoglobin levels 6—9 gm/dl, was seen in 691 patients. Mild degree of anemia (42.7%) with haemoglobin more than 9 gm/dl, was seen in 631 patients. Severe degree of anemia (10.5%) with haemoglobin less than 6 was seen in 155 patients. This is also comparable with the findings of Singla S et al, majority of the cases having haemoglobin in the range of 7—10 gm/dl^[8].

The result of data analysis obtained from the present study showed a predominance of females,(Female: Male= 1.1: 1). Similar sex distribution result was obtained in the study of Jadhav M V et al^[9],with female : male ratio of 1.25: 1 and Singhal S et al^[10], in which 65% females were affected with anemia. Sandhya V & Rashmi GS reported 51.4% females and 48.6% males with Anemia^[11].

The age of the patients in the present study ranged from <10 years, 10 years –80 years,and >80 years. Majority of patients 471 cases (31.9%), belonged to the age group of 0—10 years.

CONCLUSION

The first step in investigating anemia is to study the morphological type of anemia, which provides valuable information and aids the clinician/ haematologist to further investigate the patient in order to identify the cause of anemia, so that it can be appropriately treated. Anemia is a very common health problem. It is necessary to evaluate anemia for early diagnosis and treatment of the patients. For the evaluation of anemia , morphological patterns provide a clue to the underlying pathology.

The most frequent morphological pattern of anemia in this study was microcytic hypochromic, followed by normocytic hypochromic, normocytic normochromic, and dimorphic and hemolytic patterns.

Investigations like serum iron, serum ferritin and total iron binding capacity , serum vitamin B12 levels and others should be done at regular interval for the follow up. A detailed history and careful examination are the most common step to make the diagnosis. During investigations , one should try to interpret simple investigations (like complete blood count with general blood picture and other indices) before moving on to high-end investigation like bone marrow examination and special investigations.

REFERENCES

1. Saxena R, Chamoli S, Batra M. Clinical Evaluation of Different Types of Anemia. *World J Anemia* 2018;2(1):26-30.
2. Ishii K, Young NS. Anemia of Central Origin. *SeminHematol.* 2015 Oct;52(4):321-38. doi: 10.1053/j.seminhematol.2015.07.002. Epub 2015 Jul 9. PMID: 26404444; PMCID: PMC4826729.
3. Abusharib AB. Morphological patterns of anaemia among pregnant women from Sudan. *Afr J Lab Med.* 2019 Oct 14;8(1):743. doi: 10.4102/ajlm.v8i1.743. PMID: 31745454; PMCID: PMC6852600.
4. Patel S, Shah M, Patel J, Kumar N. Iron DeficiencyAnemia in Moderate to Severely Anaemia Patients. *GujMed J* 2009; 64(2): 15- 17.

5. Mukaya JE, Ddunger H, Ssali F, Shea T, crowther MA. Prevalence and morphological types of anemia and hookworm infestation in the medical Emergency ward. Mulago Hospital/ Uganda. S Afr Med J 2009; 99: 881—886.
6. Singla S, Bedi, Joshi K. Comparative study of anemia cases based on peripheral blood smears and cell counter generated red cell indices Int Med J 2017; 4 (1): 44—48.
7. Jadhav MV, Agarwal SA, Kadgi NV, Khedkur SS, Kulkarni KK, Kudrimoti JK. Utility of automated RBC parameters in evaluation of Anemia, Int J Healthcare Biomed Res 2015; 3 (3): 170—81.
8. Singal S, Verma N, Rathi M, Singh N, Singh P , Sharma SP,et al. Can peripheral blood smear examination be totally replaced by automated hematology analyser—with special reference to anemia? Int J Res Med Sci 2016; 4 (10): 4563—66.
9. Sandhya V, Rashmi GS. Correlation of peripheral smear with RBC indices and RBC histograms in the diagnosis of anemia. Indian Journal of pathology and Oncology 2017; 4 (2) : 242—6.
10. Kumar A, Kushwaha R, Gupta C, Singh US. An analytical study on peripheral blood smears in anemia and correlation with cell counter generated red cell parameters. J Appl Hematol 2013; 4(4):137-144 Reporting and grading of abnormal red blood cell morphology . International journal of Laboratory Hematology. B.T. constantino.c 2014 john wiley & Sons ltd, Int. Jnl. Lab. Hem. 2015, 37,1—7.
11. Adewoyin AS, Ogbenna AA (2016) Morphologic Evaluation of Anemia – I. Biol Med (Aligarh) 8: 322. doi:10.4172/0974-8369.1000322

Tables and Figures

Table1: World Health Organization criteria for anemia

	Venous blood (gm/dl)	MCHC
Adult males	13	34
Adult females, non-pregnant	12	34
Adult females, pregnant	11	34
Children (6 months---6 years)	11	34
Children (6 ---14 years)	12	34

Table 2:Age distribution of patients with Anemia.

S. NO	Age in years	No. of patients	Percentage (%)
1.	0—10	471	31.9
2.	11—20	287	19.4
3.	21—30	174	11.8
4.	31—40	161	10.9
5.	41—50	153	10.4
6.	51—60	116	7.9
7.	61—70	81	5.5
8.	71-80	23	1.6
9	>80	11	0.7

Table 3: Distribution, according to Sex

S.NO	ANEMIA TYPE	MALE	FEMALE
1.	Microcytic hypochromic	296	425
2.	Normocytic hypochromic	160	161
3.	Normocytic normochromic	211	137
4.	Dimorphic	32	46
5.	Hemolytic	0	4
6.	Micro/normochromic	0	4
7.	Macro/norm	1	0

Table 4: Shows the haemoglobin levels, in patients with Anemia

S.NO	Haemoglobin in gm/dl	No. of patients	Percentage (%)
1.	< 6 (less than 6)	155	10.5
2.	6-9	691	46.8
3.	>9 (more than 9)	631	42.7
4.	Total no. of cases	1477	100

Table 5: Showing distribution of patients as per the morphological types basing on peripheral blood smear.

S.No	Anemia type	Prevalence	
		No. of Cases	Percentage (%)
1	Microcytic hypochromic	706	47.8
2	Normocytic hypochromic	321	21.7
3	Normocytic normochromic	356	24
4	Dimorphic	85	5.8
5	Hemolytic	4	0.3
6	Microcytic normochromic	4	0.3
7	Macrocytic normochromic	1	0.07

Figure 1: Distribution of morphological patterns of Anemia

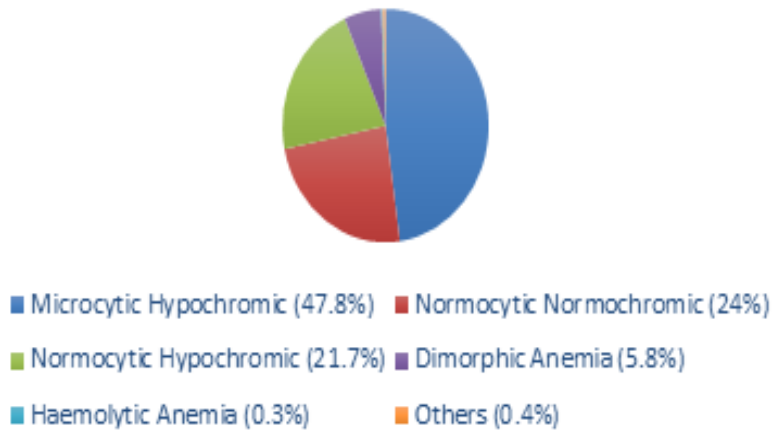


Figure 2: Peripheral smear - Microcytic hypochromic Anemia



Figure 3: Peripheral smear - Macrocytic Anemia

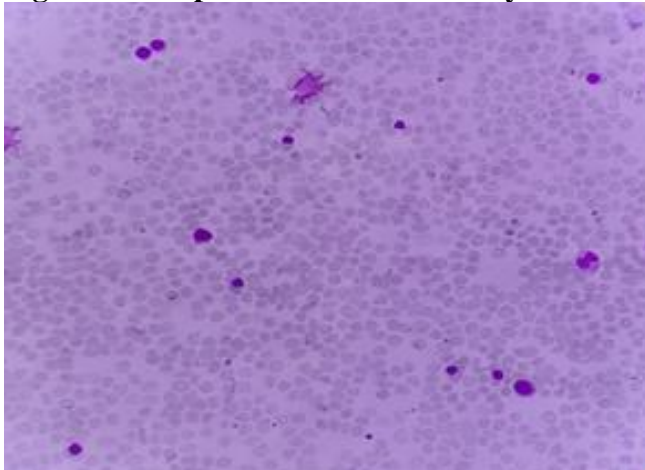


Figure 4: Peripheral smear—Hemolytic Anemia

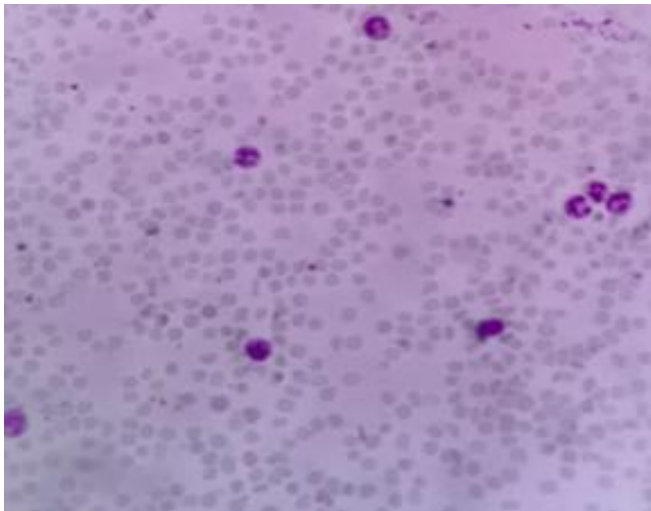


Figure 5: Peripheral smear—Sickle cell Anemia.

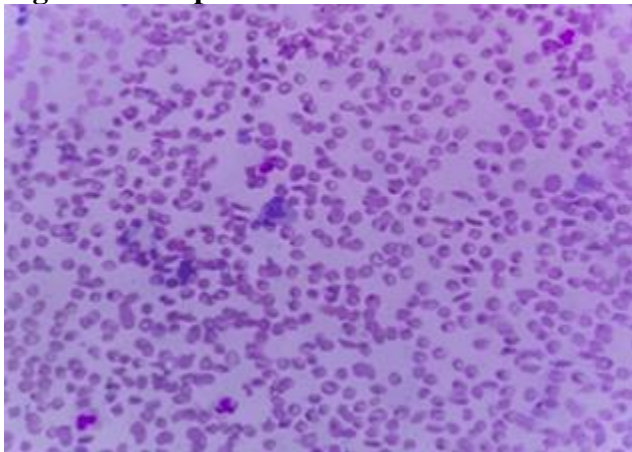


Figure 6: Peripheral smear - Sickle-Thalassemia

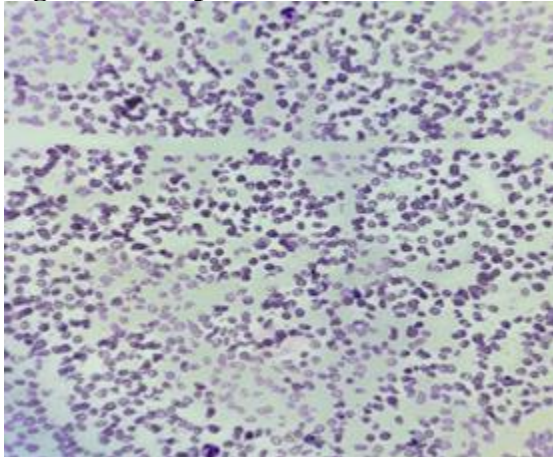


Figure 7: Peripheral smear— Pancytopenia

