ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

Impact of Anemic Status on Leucocyte and Platelet Counts: A Study in Young Females

Dr Avijeet Swain, Dr Chandan Kumar Gantayat, Dr.BibhujitPadhy, Dr.Sangram Kishore Sabat

Assistant Professor, Department Of Anaesthesiology
SCB Medical College & Hospital, Cuttack, Odisha
Assistant Professor, Department of General Medicine,
MKCG Medical College & Hospital, Berhampur, Odisha
Assistant Professor, Department of Emergency medicine,
MKCG Medical college & Hospital, Berhampur, Odisha.
Assistant Professor, Department of Orthopedics,
MKCG Medical College & Hospital, Berhampur, Odisha

ABSTRACT

Background:

Anemia, characterized by a decrease in red blood cells or hemoglobin, results in insufficient tissue oxygenation. Nutritional anemia, a prevalent issue in countries like India, particularly affects adolescents and women of reproductive age. Adolescence, crucial for adult development, imposes heightened nutritional demands. Iron deficiency, a common cause of anemia in young females, is associated with compromised leucocyte bactericidal activity. This study explores the impact of anemia on leucocyte and platelet counts.

Methodology:

The study involved 40 females (18-24 years) with Hb>12gm% in the control group and anemic females (Hb<6gm%) from SLN Hospital. Informed consent was obtained, and subjects were selected based on history and examination. Hemoglobin, leucocyte count, differential count, platelet count, and the L ratio were measured using an electronic cell counter. Statistical analysis employed descriptive statistics and SPSS, with a significance level of $p<0.05$.

Results:

In anaemic females, the mean hemoglobin was 5.81±1.71, significantly lower than the control group (13.61±1.09). Total leucocyte count was higher in anaemia, with a significant rise in neutrophils and a decrease in monocytes and eosinophils. Platelet count significantly decreased, and the N/L ratio was higher in anaemia ($p<0.01$).

Discussion:

Nutritional anemia remains prevalent, impacting physical and mental well-being, especially in children and reproductive-age women. Iron's role in blood cell maturation is vital, and its deficiency compromises immune cell activity. The study aligns with prior research on increased neutrophils in anemia. Lower oxidative stress prolongs neutrophil lifespan, compensating for reduced phagocytic activity.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

Conclusion:

Iron deficiency anemia is associated with reversible arachidonic acid-induced platelet dysfunction, emphasizing the importance of iron replenishment. The study concludes that anemia induces hypoxia, contributing to inflammation, ischemic damage, increased myocardial workload, thrombocytopenia, altered leucocyte counts, and an elevated N/L ratio.

Keywords: Anemia, Leucocyte Count, Platelet Count, Iron Deficiency, Nutritional Anemia, Inflammation, Hypoxia, Ischemic Heart Disease.

Introduction

Anemia, characterized by a decrease in the number of red blood cells or hemoglobin in circulation, leads to insufficient oxygen supply to tissues. In countries like India, nutritional anemia persists as a prevalent nutritional deficiency, particularly affecting adolescents and women in the reproductive age group. Adolescence, a critical period for achieving adult weight and height, imposes heightened nutritional demands for optimal growth and development. Various factors, including poor dietary intake, low socio-economic status, and menstrual blood loss, contribute to iron deficiency, a common cause of anemia in young females. Iron, an essential micronutrient, plays a vital role in lymphoid tissue development, and its deficiency adversely affects blood cell formation. Iron deficiency, often accompanied by deficiencies in other micronutrients like zinc, selenium, and copper, is known to compromise the bactericidal activity of leucocytes. (1-6)

As anemia leads to low red blood cell counts, it reduces the blood's oxygen-carrying capacity, inducing hypoxia. Hypoxia associated with anemia contributes to increased morbidity and mortality. Furthermore, variations in white blood cell (WBC) counts are recognized as risk factors for numerous vascular diseases. This study aims to investigate the impact of anemic status on leucocyte and platelet counts.

Materials and Methods

The study was conducted at SLN Medical College and Hospital, Koraput, involving 40 females aged 18-24 years with Hb>12gm% in the control group (first phase MBBS students). The study group comprised females in the same age range with Hb<6gm%, drawn from SLN Hospital. Informed consent was obtained after explaining the procedures, and subjects were selected based on history and clinical examination. Hemoglobin estimation, total leucocyte count, differential count, and platelet count were performed using an electronic cell counter, and the L ratio was calculated.

Statistical Methods

Descriptive statistics, including mean and standard deviation, were employed for data representation. The analysis was conducted using SPSS, considering a p-value less than 0.05 as significant.

Results

Upon statistical analysis, the mean age group of the study participants was determined to be 17 ± 2.24. In anaemic females, the mean hemoglobin levels were 5.81 ± 1.71, compared to 13.61 ± 1.09 in the control group. This decrease in hemoglobin levels among anaemic individuals was found to be statistically highly significant. While the total leucocyte count

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

was higher in the anaemic group, the difference was not statistically significant. However, differential leucocyte counts revealed a highly significant rise in neutrophils ($p < 0.01$) and a significant decrease in monocytes and eosinophil counts ($p < 0.01$) in anaemia. Platelet count was significantly decreased in anaemic subjects, and the N/L ratio was significantly higher in the anaemic group ($p < 0.01$).

Table 1: Comparison of basic parameters in anaemia and control.

Parameters	Anaemia	Control	Significance
Age(yrs)	21.2 ± 4.1	22.5 ± 3.7	Notsignificant
Hb(gm%)	5.81 ± 1.71	13.61 ± 1.09	Highlysignificant
TLC(cummofblood)	7629 ± 3303	6877 ± 1771	Notsignificant
Plateletcount(lakhs/cumm of blood)	1.56 ± 0.5	3.26 ± 1.45	Significance

Table 2: Comparison of differential leucocyte count percentage of anaemia and control.

Parameters	Anaemia	Control	Significance
Neutrophils	68.78 ± 91	56.77 ± 5.53	Significant
Lymhocytes	33.60 ± 11.24	31.14 ± 3.77	Notsignificant
Eosinophils	2.61 ± 0.9	5.31 ± 3.04	Highlysignificant
Basophils	2.9 ± 0.9	1.7 ± 0.7	Highlysignificant
Monocytes	2.53 ± 1.77	7.15 ± 3.32	Highlysignificant
N/Lratio	1.93 ± 0.06	1.72 ± 0.02	Highlysignificant

Data presented as mean ± standard deviation; <0.05 not significant, <0.001 significant.

Discussion:

Nutritional anaemia remains a prevalent issue, constituting a leading cause of preventable nutritional deficiencies in developing nations, impacting both physical and mental well-being. Vulnerability to this iron-deficient state is particularly pronounced in children and women of reproductive age, a demographic responsible for achieving more than half of adult parameters during this crucial period. Experimental and clinical studies extensively document the vital role of iron in the growth and maturation of blood cells. Iron deficiency adversely affects blood cell formation and is linked to a reduction in the bactericidal activity of key immune cells such as macrophages, neutrophils, and monocytes (6).

This study, conducted on a small sample of young anaemic females, aimed to explore the impact of anaemia on leucocyte and platelet counts. The findings revealed a significant increase in leucocyte counts in anaemic individuals, primarily attributed to elevated

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

neutrophil levels. This aligns with previous research by Hrycek et al. (7), which reported increased neutrophil and basophil counts in anaemia.

Additional studies, such as the one by Paino et al. (8), highlighted that lower oxidative stress contributes to the extended lifespan of neutrophils. Similarly, Banerjee et al. (9) demonstrated a reduction in the phagocytic activity of neutrophils in anaemia. The heightened leucocyte counts observed in anaemia elevate the risk of vascular abnormalities and thrombotic events. Anaemia induces hypoxia, acting as a stressor that intensifies the reactivity of blood vessels to catecholamines. Increased leucocyte count serves as a common indicator of inflammation, with adhering leucocytes releasing cytotoxic materials and hydrolytic enzymes, causing damage to vessel walls (10).

The aggregated neutrophils, in conjunction with platelets, can damage the endothelium, leading to reperfusion injury and exacerbating existing ischemic conditions. Anaemia's involvement in the pathogenesis of chronic angina, heart failure, and myocardial ischemia has been suggested (11). The N/L ratio, an emerging inflammatory index, was significantly higher in the anaemic group compared to the control group in this study. This ratio, known for its utility in conditions such as ischemic heart disease (IHD) and myocardial infarction (MI), underscores the inflammatory response associated with anaemia (12,13).

A study by Akoy et al. (14) evaluated the effect of iron therapy on platelet function in women, revealing that iron deficiency anaemia in women contributes to arachidonic acid-induced platelet dysfunction, potentially leading to increased menstrual blood loss. This dysfunction can be mitigated through the replenishment of iron stores. Kiem et al. (15) and Karpatkin et al. (16) supported the notion that iron plays a functional role in controlling platelet production. The two-compartment model explaining the role of iron in maintaining platelet counts, where initial depletion from the essential compartment results in low platelet counts, aligns with the findings of the present study.

Conclusion:

Iron deficiency anemia was found to be linked with arachidonic acid-induced platelet dysfunction, reversible upon iron store replenishment. Iron's functional role in controlling platelet production was supported by studies, explaining the observed decrease in platelet counts in the present study. The study concludes that anemia induces hypoxia, leading to vessel wall inflammation, ischemic damage, increased myocardial workload, thrombocytopenia, altered leucocyte counts, and an elevated N/L ratio. Individuals with anemia are at a heightened risk of ischemic heart diseases and bleeding tendencies.

References

1. UNICEF/UNO/WHO/MI. Preventing iron deficiency in women and children. Technical consensus on key issues. International Nutrition Foundation, Boston, MA;199 p.1-60. -

2. Butensky E, Harmatz P, Lubin B. Nutritional anaemias. Nutrition in pediatrics. 2008 (4th).

3. Hercberg S, Galan P. Biochemical effects of iron depletion. ActaPediatrics SCAND 1989;361(Suppl);63-70.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 01, 2024

4. Beard JL. Iron biology in immune function, muscle metabolism, and neuronal functioning. J Nutr 2001;131(Suppl 2);568-80.

5. Ekiz C, Agaoglu L, Karakas Z, Gurel N, Yalchin I. The effect of iron deficiency anaemia on the function of the immune system. Hematol J 2005;5:579-83.

6. Hercberg S, Galan P. Biochemical effects of iron depletion. ActaPediatricScand 1989;361(Suppl):63-70.

7. Hrycek A, Kalina Z, Badowski R, Wartalska G. Spontaneous migration and adherence of leucocytes and NBT test of [peripheral blood neutrophils in patients with iron deficiency anaemia. ActaHaematol. Pol, 1991;22-

8. Paino I M, Miranda JC, Marzocchi-Machado CM. Cesarino EJ, de Castro FA, de Souza AM. Phagocytosis, oxidative burst, and produced reactive species are affected by iron deficiency anaemia and anaemia of chronic diseases in the elderly. Biol Trace Elem. Res., 2009;129(1-3):116-125.

9. Hrycek A, Kalina Z, Badowski R, Wartalska G. Spontaneous migration and adherence of leucocytes and NBT test of [peripheral blood neutrophils in patients with iron deficiency anaemia. ActaHaematol. Pol, 1991;22-(2):261-266.

10. Ernst E, Bagge U. Leucocyte and risk of ischemic disease. JAMA 1987; 257:2318-2324.

11. Chavan V, Patil N. Study of leucocytic hydrolytic enzyme in patients with the acute stage of coronary heart disease. Ind. J Med Sci. 2007;61:73-76.

12. Kuku I, Kaya E, Yologlu S, Gokdeniz R, Baydin A. Platelet counts in adults and iron deficiency anaemia. Platelets. 2009 Sep;20(6);401-5.

13. Akay OM, Akin E, Mutlu FS, Gulbas Z. Effect of iron therapy on platelet function among iron-deficient women with unexplained menorrhagia. PathophysiolHaemostThromb. 2008;36(2);80-3.

14. Kiem J, Borbrrg H, Iyengar GV, Kasperek K, Siegers M, Feinendegen LE, Gross R. Elemental composition of platelets Part II. Water content of normal human platelets and measurements of their concentrations of Cu, F, K, and Zn by neutron activation analysis. Clin Chem. 1979;25:705-10.

15. Freedman ML, Karpatkin S. Requirement of iron for platelet protein synthesis. BiochemBiophys Res Commun. 1973;54:475-81.

16. Gupta M, Joseph G. Severe thrombocytopenia associated with iron deficiency. Hospital Physician. 2001;37;49-54.