A study of effect of moderate anemia on white blood cell count in adolescent females

Patel LC, Patel RK

ABSTRACT

Background: Adolescent population is more prone to suffer from nutritional anemia. As evident from many epidemiological studies anemia associated hypoxia and ischemia alter the white cell count and thus N/L ratio which has emerged as a significant biomarker for various ischemic diseases.
Aim: To see the impact of moderate anemia on total leukocyte count and differential leukocyte count in adolescents.
Methods: A case-control study in which blood samples from 30 moderately anemic adolescent female volunteers were taken and compared with same number of healthy controls. Proper approval from Institutional Ethics committee was sought and informed and written consent was obtained from the participants. Total leukocyte count, differential count and platelet count were determined. Statistical analysis was done using unpaired t test considering p value <0.05 as significant.
Results: The difference of Hb concentration in moderately anemic was 9.8 ± 0.63gm% compared to 12.75 ± 0.95gm% of the non anemic which was highly significant (p<0.01). The effect of moderate anemia on total count, differential count and platelet count was insignificant (p>0.05). There was no significant difference in the N/L ratio between both groups.
Conclusion: Mild to moderate degree of anemia does not alter the blood cell count as seen with the severe anemia

Key Words: adolescent, CHD, MI, moderate anemia, total leukocyte count

INTRODUCTION

Adolescents accounts for more than one-fifth of the world's population while in India, this group form 21.4 percent of the total population.[1] During this period, 50% of adult weight, 20% of adult height and 50% adult skeletal mass are acquired. Besides genetic factors, nutritional intake determines the extent of growth and maturation at this stage. Poor nutrition is often cited as a major reason for the delay in the onset of puberty in Indian adolescents. The additional requirements for iron, calcium and zinc for increments in skeletal mass, body size and bone density make 'nutrition' a critical factor in growth and development of adolescents. The gravity and enormity of the problem of micronutrient is evident from the fact that 52% of adolescent girls suffer from Iron Deficiency Anemia.[2]

Anemia is a significant public health challenge. It has devastating effects on health, physical and mental productivity affecting quality of life. Anemia is associated with increased susceptibility to infections, reduction in work capacity and poor concentration. Amongst all the types, anemia due to nutritional deficiency is most common. Nutritional anemia can be due to deficiency of vitamin A, members of the vitamin B group [pyridoxine (B6), riboflavin (B2), folate (B9), and cyanocobalamin (B12)], vitamin C, and vitamin E. Among minerals, iron, zinc and copper deficiency can lead to anemia. The nutritional deficiency affects the cell development and function. Iron deficiency in particular is said to impair lymphocyte mitogen response and decrease leukocyte killing.[3] Anemia also affects the polymorphonuclear leukocytes.

This study was done to with an aim estimate the effect of moderate anemia on the total leukocyte count, differential count and platelet count and the newly emerged inflammatory biomarker neutrophil to lymphocyte ratio (N/L ratio).

MATERIAL AND METHODS

The present study was carried out after seeking Institutional Ethical Committee approval. Informed consent was sought from the volunteers.

Thirty adolescent female volunteers in Baroda Medical College, having nutritional anemia for at least 3 months of duration with hemoglobin level between 8-10.9 gm% (by using WHO definition) were the participants. These moderate anemic volunteers were compared with 30 healthy adolescent female volunteers. (Hb level more than 12 gm %). Their detailed history and clinical examination of the participants were done in order to either include or exclude from the study.

Healthy adolescent female volunteers without any known communicable or non-communicable disease except anemia having no history of drug, blood transfusion or any condition that affect blood cell count were included in this study. Those volunteers with any known general or systemic disease and having any history of drug or medication that affects the blood cell count as well as female menstruating while sample drawing and data recording were excluded from the study.

Hemoglobin, total leukocyte count, differential count was estimated by cell counter and then

N/L ratio was estimated in the Pathology laboratory of the Baroda Medical College by automated cell counter. The mean value and standard deviations were estimated by appropriate statistical tests.

RESULT

Mean Hb concentration in anemic volunteer was 9.8 ± 0.63 gm% compared to control volunteers having Hb concentration of 12.75 ± 0.95 gm% which is highly significant ($p<0.001$). The total leukocyte count was insignificantly more in anemic volunteers as compared to the controls. Upon differential leukocyte count there was no significant difference in neutrophil, eosinophil, basophil, monocyte, and lymphocyte count. Therefore there was no significant change in the N/L ratio in both anemic and control volunteers. Here was no significant difference in the platelet count in both the groups.

Table.1. Comparison of basic parameters in anemic and control groups

Parameter	Anemic	Control
Age (yrs)	17.7±0.42	17.5±0.51
Height (mtr)	1.57±0.06	1.57±0.04
Hb gm%	9.8 ± 0.63	12.75 ± 0.95*

P<0.001*

Table.2. Comparison of TLC, DLC and Platelet count in anemic and control group

Parameters	Anemic	Control
TLC (per cu mm of blood)	7311.11±2129.03	7422.22±1731.22
DLC (%)		
Neutrophil	63.38±5.8	63.72±5.1
Eosinophil	1.22±0.42	1.16±0.38
Basophil	1.0±0.4	1.0±0.2
Monocyte	1±0.14	1±0.08
lymphocyte	34.44±5.60	34.77±5.60
Platelet count (lakhs/cu mm)	3.81±1.07	3.27±5.04
N/L ratio	1.92±0.55	1.91±0.53

DISCUSSION

Anemia is the most common nutritional disorder and adolescent population is most vulnerable to it. Iron deficiency is the major cause of anemia. Deficiency of Iron adversely effects formation of blood elements, especially thrombocytes and leukocytes and may have a direct effect on the development of lymphoid tissue as well.[4,5] Anemia leads to hypoxia, which in turn leads to increase in leuckocyte count which is the most common indicator of inflammation.[6] Inflammation is implicated in all stages of atherosclerosis.[7] Due to inflammation of the vessel wall the leukocytes adhere to the vessel wall releasing proinflamatory cytokines and chemotactic substances which lead to further adhering of the leukocytes. Studies suggest that polymorphonuclear granulocytes (PMNs) play a role in the pathogenesis of acute and chronic myocardial ischemia and extension of myocardial injury. Aggregated neutrophils along with platelets directly injure the endothelium and also cause reperfusion injury, thus aggravating myocardial ischemia.[8-11] In this context N/L ratio has emerged as the important index for CHD, MI, Diabetes mellitus, obesity and asthma.[12,13] N/L ratio has outnumbered the customary indicator of inflammation, total leukocyte count.

Though difference in the Hb level was significant (p<0.001), no significant difference was seen in the total leukocyte count, platelet count and differential leukocyte count. Also the N/L ratio was insignificant in moderately anemic volunteers. Multiple studies have shown that N/L ratio is inversely proportional to the hemoglobin level which is vivid in severe anemia (Hb<8gm %). Severe anemia had visible impact on granulocytes, viz. neutrophil, eosinophil and basophil.[14] The decrement in platelet count was also significant in severe anemia as compared to moderate degree of anemia.[6,15]

CONCLUSION

The effect on different hematological parameters depends on the degree of anemia. Mild to moderate degree of anemia has minimal or no effect on these parameters. Very low levels of hemoglobin have various adverse outcomes. The negligible effect of moderate anemia suggests that moderate decrease in Hb levels induces lesser amount of hypoxia and decreasing the amount of hematological stress that would lead to increase in the leukocyte count. Such outcomes can be prevented by treating moderate anemia in time and thus preventing its progression to severe anemia.

AUTHOR NOTE

Patel L C, P.G Student**, (Corresponding Author); Email:** lajja24@yahoo.co.in
Patel R K, Professor
Department of Physiology, Baroda Medical College, Baroda 390001

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