

Hematological profile of children with severe acute malnutrition at the Tertiary care hospital in Multan

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ABSTRACT

Objective: To analyze the hematological profile of children with severe acute malnutrition.

Study Design: Descriptive cross sectional study

Place and Duration: Six months from 1st January 2018 to 1st July 2018 at Nutrition Stabilization Centre of The Children's Hospital and Institute of Child Health Multan

Methodology: The hematological profile was of children with severe acute malnutrition (SAM) was done by using EDTA anti coagulated samples on a five parts differential hematology analyzer Abacs-5 (Diatron) that works on the principle of Electrical Impedance. Focus was to analyze the values of RBC, HB, WBC and Platelets, Bicytopenia and Pancytopenia.

Results: Data of 100 children was analyzed. There were 58% male and 42% were female. About 34% children were under 6 month of age. Altered hematological profile of children with severe acute malnutrition was observed. Red blood cells count, WBCs and platelets count in blood of majority were significantly low than normal, 56%, 50% and 66% respectively. About 28% children had two cell lines depressed (Bicytopenia) and 48 % children showed three hematological cell line suppressed (pancytopenia). Children with SAM had lower mean hemoglobin, hematocrit and red cell indices. The mean \pm (S.D) of hemoglobin was $8.703 \pm (1.9271)$. There were 88% children with severe acute malnutrition that are suffering from anemia from which 27% children had mild anemia, 46% children had moderate anemia and 15% children had severe anemia and 12% children had no anemia.

Conclusion: Altered blood profile was found in children with Severe Acute Malnutrition. There was also a high prevalence of anemia in malnourished children as compared to general population. Majority of SAM children has markedly less Red Blood cell count, White blood cell count and platelet count presented with bicytopenia and pancytopenia.

Keywords: Severe Acute Malnutrition (SAM), Hematological profile, Anemia, Hemoglobin, Ethylene-di-aminine tetra acetic acid (EDTA)

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INTRODUCTION

Malnutrition is less supply of energy and nutrients from daily intake of food that is necessary for body performance and daily activities¹. Malnutrition has become a major challenge for world health organization (WHO)². In Pakistan malnutrition is the major problem of public health, two out five children are malnourished under 5 year of age³. Malnutrition and hematological abnormalities are directly associated with each other¹. Severe Acute Malnutrition results in widespread alterations in organ and functions of hematological system, which affect all the blood cells⁴.

According to Pakistan National nutritional survey, 17% children were wasted, 24% children were stunted, 31% children were underweight and 33% children had iron deficiency. 18% mothers were underweight, 51 % pregnant mothers were hemoglobin deficit and 26% pregnant women had iron deficiency. The anemia in pregnant mothers is directly linked with malnutrition in children and iron deficiency in children⁵. The deficiency of iron due to low food intake, diluted milk consumption, poor infant and young child feeding practices (IYCF) and worm infestation has been considered as being the

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primary reason of anemia in malnutrition⁶. However in reality many other factors also contributes to anemia such as lower intake and absorption of proteins, deficit in erythropoietin, and lower reduced red cell production due to lower lean body mass ratios all contribute to anemia⁷⁻⁹. SAM children may be presented with normochromic, normocytic, microcytic hypochromic or macrocytic anemia, Erythropoietin deficiency, deficiency of micronutrients such as folic acid, cobalamin (B₁₂), copper and zinc are also contributing factor for anemia in children with severe acute malnutrition^{10,11}. But due to varying data these are only partially beneficial in the preemptive care of these children¹². Severe acute malnutrition is also associated with both leucopenia and leukocytosis. Leucopenia is mostly due to alteration in cycle cell and decreases cellular immune response. Decreases in platelets is also observed in SAM due to decrease activity of mega karyocytes. However the literature describing cellular immune response in SAM is inconclusive. Bone marrow hypoplasia is another hematological abnormality often analyzed in children with severe acute malnutrition¹³.

This current study was designed to observe the hematological profile of children with severe acute malnutrition (SAM) and to determine different micronutrient deficiencies. In Pakistan, there is lack of data on hematological profile of severely malnourished children. So, this research was carried out in order to guide the appropriate management of blood profile abnormalities of the SAM children admitted at our nutritional rehabilitation center to improve their prognosis. The findings of this study can also be used for further detailed analysis into causes of these deficiencies and to figure out ways to overcome these. So this study was conducted with an objective to analyze the hematological profile of children with severe acute malnutrition.

METHODOLOGY

This descriptive cross sectional study was conducted in Stabilization Center of Children Hospital and Institute of Child Health Multan. The study was conducted for six months only from 1st January 2018 to 1st July 2018 due to limitation of resources and funds. The children admitted in Stabilization Center of Children Hospital and Institute of Child Health Multan with severe acute malnutrition (SAM) was included in this study. Severe acute malnutrition is defined by a very low weight for height (below -3z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional edema².

Simple random sampling technique was used to enroll maximum children for the study. The children came from Multan as well as other areas of Punjab and Baluchistan.

Children with severe acute malnutrition aged between 1 month to 5 years admitted at Stabilization Centre of The Children's Hospital and Institute of Child Health Multan during the duration of study were included whose parents were willing to give consent and participate. The patients who were not willing for admission, not fulfilling the criteria of SAM, were below 1 month of age or above 5 years and whose parents' did not gave consent were excluded from this study.

A total of 110 children were admitted during the six months of

study period. Out of 110 only 100 gave consent and were thus enrolled for the study. A written and informed consent was obtained from the parents. A detailed and thorough history along with complete anthropometry and physical examination was done. All of the children were screened for severe acute malnutrition (SAM) by using height, weight, MUAC and presence of edema. Weight/Height ratio was taken and analyzed the nutritional status by using Z-score method.

A questionnaire was designed for the study and the trained nurses of Stabilization Centre recorded the data on the questionnaires. The hematological parameters i.e hemoglobin, WBCs, RBCs, platelet count etc were analyzed and assessed by clinical laboratory of Children Hospital and the results were recorded on the questionnaire. The blood profile analyses of children with severe acute malnutrition (SAM) was done by using EDTA anti coagulated samples on a five parts differential hematology analyzer Abacs-5 (Diatron) that works on the principle of Electrical Impedance. The hematological parameters were defined by using WHO standards.

Operational Definitions:

Severe Acute Malnutrition: Severe acute malnutrition is defined by a low weight for height (below -3z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional edema².

Anemia: According to World Health Organization (WHO) criteria anemia labeled with hemoglobin less than 9 gm/dl. Mild Anemia was categorized at 9-11gm/dl, Moderate Anemia at 7-9gm/dl, Severe Anemia at <7gm/dl⁹.

Socioeconomic status: low socioeconomic status was defined as household with income ≤500\$US annum and middle class was categorized as household with income 500-1000 \$US annum¹⁴.

Bicytopenia: A deficiency in two out of the three cell lines in the blood, namely RBCs, WBCs, and platelets¹⁵.

Pancytopenia: Deficiency of all three cellular components of the blood (RBCs, WBCs, and platelets)¹⁵.

Data Analysis: Data was analyzed by using SPSS version 21. Mean, median, percentages and SD was evaluated for analysis.

RESULTS

Total 100 children were analyzed that are admitted in stabilization center of The Children's Hospital and Institute of Child Health Multan.

Table-I: Gender distribution, age distribution and socio economics status distribution in children with severe acute malnutrition (N=100)

Characteristics	N=100	Percentage (%)
Gender		
Male	58	58
Female	42	42
Age		
Less than 6 month	34	34
Greater than 6 month	66	66

Hematological profile of children with severe acute malnutrition altered. Red blood cells level and platelets count in blood were significantly less than normal, 56% and 66% respectively.

There were 58 (58%) male and 42 (42%) were female. Mostly children 34(34%) had under 6 month of age. Total 100% children were severely malnourished. The socioeconomic status of 92(92%) children was very poor (household income ≤ 500 \$US annum) and 8 (8%) belonged to middle class (household income 500-1000 \$US annum) which is directly linked with the higher prevalence anemia of children's that were admitted in stabilization center of The children's Hospital and Institute of Child Health Multan. The socio economic status and classes were defined by all using the markers by poverty line for Pakistan (Table-I).

Table-II: Complete Blood Count profile of Children with Severe Acute Malnutrition (N=100)

Complete Blood Count	N=100	%
White Blood Cells		
Normal	44	44%
Less than normal	50	50%
Greater than normal	6	6%
Red Blood Cells		
Normal	30	30%
Less than normal	56	56%
Greater than normal	14	14%
Platelet count		
Normal	12	12%
Less than normal	66	66%
Greater than normal	22	22%
Hemoglobin level		
Normal	12	12%
Mild Anemia	27	27%
Moderate Anemia	46	46%
Severe Anemia	15	15%
Children with Normal Hemotological Count	24	24%
Children with Bicytopenia	28	28%
Children with Pancytopenia	48	48%

Table-III: Hematological parameters and mean and standard deviation of children with severe acute malnutrition. (N=100)

Hematological parameters	Mean \pm SD
Hemoglobin (gm/dl)	8.703 \pm 1.9271
Hematocrit (%)	20.17 \pm 6.13
Mean corpuscular volume (g/dl)	72.70 \pm 13.90
Mean corpuscular hemoglobin (pg/cell)	24 \pm 5.25
Mean corpuscular hemoglobin concentration (pg/cell)	32.34 \pm 2.9
RBC count($\times 10^{12}$ /L)	3.9288 \pm 1.7768
WBC count($\times 10^9$ /L)	11.9075 \pm 4.3876
platelets count($\times 10^9$ /L)	324.250 \pm 207.1927

DISCUSSION

In current study majority of children with severe acute malnutrition had moderate anemia (46%), 27% children with

severe acute malnutrition had mild anemia and 15% had severe anemia. This study shows increased burden of anemia in children with severe acute malnutrition as compared to other studies that showed 40% children had moderate anemia, 26% had mild anemia and 3% children had severe anemia¹⁶. Although only 100 samples were included in this study as a total of only 110 patients were enrolled during the duration of study. If the duration of the study was longer, more patients could be enrolled in the study.

Microcytic and hypochromic anemia was significant finding with low MCV or MCH in severe acute malnutrition. 36% children has low red blood cells level (microcytic anemia and 5 % children was hypochromic. Microcytic hypochromic red blood cells morphology signifies iron deficiency anemia. Our results were comparable from two different studies conducted in India¹⁷. In one study there was an almost equal distribution of microcytic (34%), macrocytic (32.9%) and normocytic (31.8 %) anemia, however in the normal children most common anemia found was microcytic anemia (46.8%)¹⁸.

Iron deficiency is very common in general population. Severe Acute Malnutrition leads to reducing RBC's level and WBC's level. Due to deficiency of vitamins and minerals biosynthesis of essential components of blood cannot take place which leads to the deficiency of hemoglobin (iron deficiency). According to the previous studies Hemoglobin level, RBC's level was significantly decreased in malnourished children¹⁹.

It is due to decrease in bone marrow activities which indirectly effect megakaryocytic function, in our study 48% of the SAM children had pancytopenia and 28% had bicytopenia. Bicytopenia and pancytopenia further reduces immunity in SAM children making them more prone to further infections and complications²⁰. This findings is contradictory to the studies done previously on SAM children, as most of SAM children have higher counts of WBCs and platelets due to infections²¹. In another study conducted by Bshir et al, 10% patients show high platelets count in severe acute malnutrition whereas in our study out of 100 patients 66% children had low platelets count¹³.

Thrombocytopenia was also present in 66% children, low lymphocytes count was present in 22% and absolute neutrophil count was low in 25% children which is comparable with previous studies²². In another study conducted in India, the mean value of neutrophil was significantly higher in SAM children which contradicts our findings but the mean lymphocyte value was also lower which supports our findings¹⁸. Several other studies also suggested presence of leucopenia as well as neutropenia in severe acute malnutrition²³.

Children with SAM had lower mean hemoglobin, hematocrit and red cell indices and higher mean value of total leukocyte and platelet counts, similar findings were also reported by another study conducted on hematological profile of SAM children²¹.

There is a dire need to further study the hematological profile of SAM children and to compare it with Mild/Moderate acute malnutrition, chronic malnutrition and normal children for in-depth analysis.

CONCLUSION

Altered blood profile was found in children with Severe Acute Malnutrition. There was also a high prevalence of anemia in malnourished children as compared to general population. Majority of SAM children has markedly less Red Blood cell count, White blood cell count and platelet count presented with bicytopenia and pancytopenia.

AUTHOR'S CONTRIBUTION

Khan S: Conceived idea, Designed research methodology, Manuscript writing

Rubab Z: Data collection, Statistical analysis, Data interpretation

Hussain S: Literature review, Bibliography

Abbas A: Data collection, Data interpretation

Arshad R: Manuscript writing

Tareen MBK: Final review, Data collection

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