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Paediatrics

HAEMATOLOGICAL PARAMETERS AND THYROID PROFILE IN SEVERELY MALNOURISHED CHILDREN: A CROSS SECTIONAL STUDY

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ABSTRACT

INTRODUCTION: India has the highest prevalence of severe acute malnutrition (SAM)). SAM and anaemia have an interplay association, the latter being the commonest comorbid medical problem. But now literature suggests that SAM is also associated with marked changes in secretion and metabolism of thyroid hormone as well as in the structure.

METHOD AND MATERIAL: A cross-sectional study was conducted in 60 children between the age group of 6 months to 5 years fulfilling the criteria of SAM over a period of 2 months admitted at NRC, ABVGMC and District Hospital Vidisha. Detailed history of the child was obtained; complications were noted and managed accordingly. Blood sample was collected and was subjected to complete blood count, peripheral smear examination and thyroid profile.

RESULTS: Out of 60 children of SAM, 11.67% had leukocytopenia and the same percent of children had leukocytosis. Thrombocytopenia was reported in 13.34% of the children and thrombocytosis was seen in 15%. TSH levels in children of age 6 month to 1 year of study population were in the normal range. Children of age 1 year to 5 years had values above normal in 7.31% and below normal in 2.43%.

CONCLUSION: Megaloblastic anemia and dimorphic anemia along with high TSH level are prevalent in children with SAM along with iron deficiency anemia but more specific studies are required to associate hypothyroidism with malnutrition and low serum protein.

KEYWORDS : Severe Acute Malnutrition, Anemia, Thyroid Profile

INTRODUCTION

According to the World Health Organization (WHO) malnutrition can be defined as "the cellular imbalance between the supply of nutrients and specific functions" [1]. This affects the child at the most crucial period of time of development, which can lead to permanent impairment in later life[2]. Severe acute malnutrition is defined as very low Weight for Height/Length (Z-score below -3SD of median WHO child growth standards), a mid-upper arm circumference of <11.5 cm, or by the presence of nutritional bipedal edema[3]. It is estimated that malnutrition is responsible for approximately 50% of death in infancy and childhood each year in developing countries. According to NFHS 4 about 42% of children under 5 years of age are stunted, 25.8% under 5 years of age are wasted[4].

The deficiency of iron due to low food intake, diluted milk consumption, poor infant and young child feeding practices and worm infestation has been considered as being the primary reason of anemia in malnutrition[5]. Many other factors also contribute to anemia such as lower lean body mass ratios [6-8]. Erythropoietin deficiency, deficiency of micronutrients such as folic acid, cobalamin (B_{12}), copper and zinc are also contributing factors for anemia in children with severe acute malnutrition [9,10].

SAM is also associated with both leukopenia and leukocytosis. Leukopenia is mostly due to alteration in cell cycle and decreased cellular immune response. Bone marrow hypoplasia is another hematological abnormality often analysed in children with SAM[11]. It also results in decreased thyroid activity and decreases T3 and T4. Absence of thyroid hormones causes mental and physical slowing, mental retardation and dwarfism[12]. In India there is paucity of data on haematological and thyroid profile of severely malnourished children. So, this research was carried out in order to study haematological parameters and thyroid profile in children with Severe Acute Malnutrition.

AIM AND OBJECTIVES
• To study the haematological profile of severely malnourished children.

• To evaluate thyroid status amongst severely malnourished children.

MATERIAL AND METHODS
1. **Setting:** This study was conducted as a facility based Cross-sectional study in Nutritional Rehabilitation Centre at tertiary healthcare centre, Vidisha.
2. **Sampling Technique and Sample size:** 60 children between the age group of 6 months to 5 years fulfilling the criteria of SAM over a period of 2 month were selected using purposive sampling. A written and informed consent was obtained from parents of children. A detailed and thorough history along with complete anthropometry and physical examination was done. All the children were screened for SAM by using WHO criteria.
3. **Exclusion Criteria:**
• SAM children presenting with pediatric emergency and requiring immediate intervention.
• SAM children presenting with neurological deficits were excluded from this study.
4. **Data Collection Procedure:** Data was collected using a predesigned semi-structured questionnaire. Venous blood samples were obtained under all aseptic precautions with written informed consent of the parents of children from the study population. It was subjected to haematological examination as well as thyroid function assessment. Haematological examination included complete blood count using autoanalyzer and peripheral blood smear. Grading of anemia has been done using age specific WHO criteria[25].

Grading Of Anemia –
• Mild anemia; 9-11 gm/dl
• Moderate anemia; 7-8.9 gm/dl
• Severe anemia; <7 gm/dl

5. **Data Analysis-** Data was compiled using MS Excel and analysed using SPSS20 version software. Grouped data was expressed as frequency and percentage whereas numerical data is expressed as mean±SD.

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6. **Ethics consideration** -Ethical clearance was obtained from Institute's ethical committee.

OBSERVATION AND RESULTS
Total 60 children were analysed that were admitted to NRC and pediatric ward of tertiary healthcare centre, Vidisha.

Table 1. Gender and age distribution in children with severe acute malnutrition

GENDER	N=60	Percentage
Male	34	56.66%
Female	26	43.33%
AGE		
6 months to 1 year	19	31.67%
1 year to 5 years	41	68.34%

Table 2. Clinical features in children with severe acute Malnutrition. (N=60)

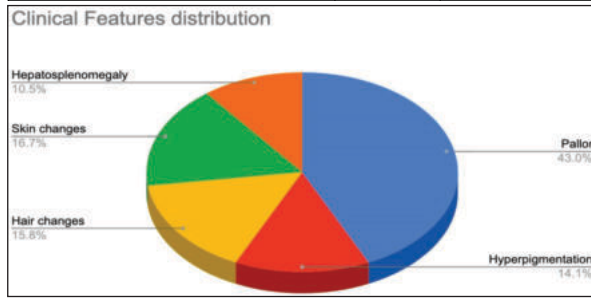| Clinical features	N=60	Percentage
Pallor	49	81.66%
Hyperpigmentation	16	26.70%
Hair changes	18	30%
Skin changes	19	31.67%
Hepatosplenomegaly	12	20.00%

Figure 1. Pie Chart depicting clinical features distribution of various types of anemia

Pallor is most frequent finding in children of SAM, found in 81.66% of the children, other features are hyperpigmentation, hair changes, skin changes, and hepatosplenomegaly seen in 26.70%, 30%, 31.67% and 20% respectively. (Table 2)

Table 3. Complete Blood count profile and TSH profile of children with severe acute malnutrition (N=60)

White Blood Cell	N = 60	percentage
4000-11000	46	76.67%
<4000	7	11.67%
>11000	7	11.67%
Platelet count		
1.5 lacs- 4.5 lacs	43	71.67%
<1.5lacs	8	13.34%
>4.5 lacs	9	15%
Hemoglobin level		
>11gm/dl	18	30%
9-11 gm/dl	20	33.34%
7-8.9 gm/dl	10	16.67%
<7 gm/dl	12	20%
TSH level (6 months to 1 years)		
0.5-10 mIU/L	18	94.73%
<0.5 mIU/L	1	5.26%
>10mIU/L	0	0
TSH level (1year to 5 years)		
0.5-5 mIU/L	37	90.24%
<0.5mIU/L	1	2.43%
>5mIU/L	3	7.31%

Out of 60 children with severe acute malnutrition, 11.67% of the children had leukocytopenia and the same percent of children had leukocytosis. Thrombocytopenia was reported in 13.34% of the children and thrombocytosis seen in 15%. (Table-3) TSH levels in children of age 6 month to 1 year of study population were in normal range, only 5.26% has value below normal. Children of age 1 year to 5 years show value above normal in 7.31% and below normal in 2.43%.

70% 0f the Children had anemia, out of which, 20(33.34%) had mild Anemia, 10 (16.67%) cases had moderate anemia and 12 (20%) cases had severe anemia.
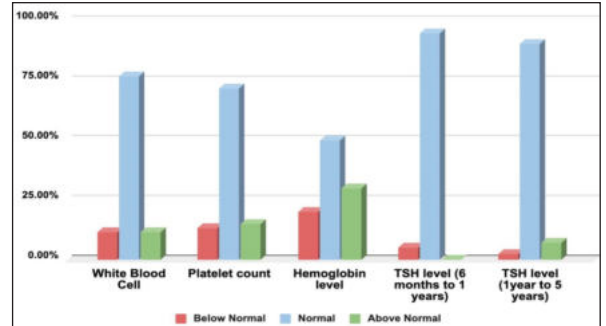

Figure 2. Bar Graphical representation of hematological parameters found in children with SAM

Table 4. Mean and Standard Deviation of hematological parameters and TSH of Children with severe acute malnutrition. (N=60)

Hematological parameter	Mean ±SD
Hemoglobin (in gm/dl)	9.355±2.452
Mean corpuscular volume (fl)	73.12±13.915
Mean corpuscular hemoglobin (pg/cell)	23.117±5.948
Mean corpuscular hemoglobin concentration (gm/dl)	31.40±3.419
Red cell distribution width (%)	20.76±6.8
WBC count ($\times10^9$/L)	11.7164±4.870
NEUTROPHIL (%)	35.76±15.55
LYMPHOCYTE (%)	54.143±16.10
Platelet count ($\times10^9$/L)	351.858±202.961
TSH (μIU/ml)	2.06±0.73

The mean Hb of the study population is 9.355±2.452 gm/dl. Red cell indices are Mean corpuscular volume (fl) 73.12±13.915.Mean WBC count of study population in ($\times10^9$/L) is 11.7164±4.870. The mean Differential counts are NEUTROPHIL (%) is 35.76±15.55 and LYMPHOCYTE (%) is 54.143±16.10. The mean Platelet count ($\times10^9$/L) is 351.858±202.961 and Mean TSH (μIU/ml) level is 2.06±0.73

Table 5. Peripheral smear examination findings in children with severe acute malnutrition. (N=60)

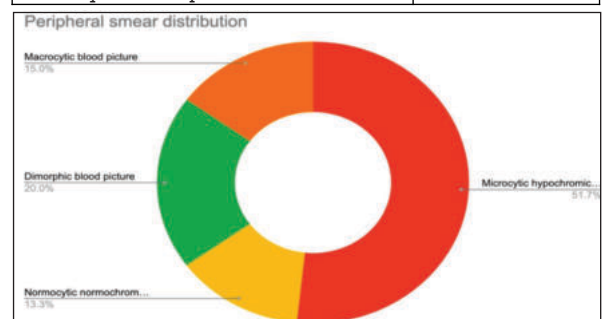| Peripheral smear comments	Percentage
Microcytic hypochromic blood picture	51.67%
Normocytic normochromic blood picture	13.34%
Dimorphic blood picture	20%
Macrocytic blood picture	15%

Figure 3. Pie Chart depicting various types of morphological anemia in peripheral smear

DISCUSSION

- There is enough evidence that children with severe acute malnutrition have altered hematological parameters and thyroid profile. A case control study conducted in Kanpur shows that patients with SAM suffered from moderate to severe anemia[13].In complete blood picture, mild anemia was seen in most patients (20) which is 33.3% which is contrary to the study done by **Thakur N et al**[14] where 131 children with SAM were evaluated and 67% had severe anemia i.e., Hb <7gm/dl.

- Another study in northern India concluded that the most common type of anemia was microcytic (38.6%) followed by megaloblastic (30.5%)[15]. A Study in Mumbai also shows 33.76% had microcytic RBC morphology and 25.97% had hypochromic. Microcytic hypochromic anemia[16]. A study in Bhopal shows that there was significant increase in the mean level of TSH with increasing severity of malnutrition[17]. In short term and mild forms of PEM, the observed changes are limited to the thyroid hormone transport system, and appropriate feedback mechanisms allow the maintenance of euthyroid state.

- A study in Uganda shows that pigmentary changes which include both hyper and hypopigmentation of the skin were seen in 58% of children[19]. Another study in India showed cutaneous features seen include xeroderma (58%), lusterless hair (53%), pigmentary changes (36%), loss of subcutaneous fat (31%), flag sign (29%), angular cheilitis (20%), etc[20]

- A study by **Gohain et al** in Gauhati shows that statistically significant lower mean values for RBC indices like RBC count, MCH and MCHC in children with PEM, also shows a significant leukocytosis among children with PEM compared to controls. Leukocytosis in these children may be a result of infection which is seen commonly in PEM. The cases had Higher mean value of Neutrophil and lower mean value of lymphocyte compared with controls although the Differences were not significant[21]. However, several other studies have shown leucopenia as well as neutropenia as a common finding in malnutrition[22,23,24]

- The haematological and thyroid status in children with SAM has not been evaluated before in these peripheral rural areas of M.P. In our study children with Severe Acute Malnutrition admitted in NRC or tertiary care centres were evaluated which is similar to the study done by **Monica et al**[25], where 80 malnourished children admitted in NRC were evaluated for the same. It is also similar to the study done by **Seema et AL**[26], **Arun et al** and **Deepak et al**[27] but in these studies only hematological parameters were evaluated.

- Results show that the maximum number of children belonged to 1-5 years of age (68.4%) which is similar to study done by **Monica et al**[25].

- Clinical features were recorded which is similar to a study done by **Jangid RK et al**[28], where prevalence and types of nutritional anemia was assessed in 260 children admitted with SAM .81% had pallor followed by skin and hair changes. 26% patients also had hyperpigmentation and splenomegaly which can be attributed to vitamin B12 and folate deficiency.

- WBC count was in the normal range in our study and the mean also turned out to be 11.7 (10^9/L) which is similar to the study done by **Arun et al**[13] and contrary to the study done by **K. O. IsZuo et al**[29] where WBC counts were found to be raised with mean 14.11 (10^9/L).

- The presence of thrombocytopenia can be due to vitamin B12 deficiency, bone marrow suppression or infections. It is similar to the study done by **Chabra et al**[30] where children from 6 months to 14 years were studied and thrombocytopenia as a common finding.

- In our study Peripheral smear was suggestive of Microcytic hypochromic anemia in most of the patients (51.7%) followed by dimorphic anemia (20%) and macrocytic (15%) depicted in Table -5. It is similar to the findings of **Seema et al**[26], **Neha et al**[14] and **Deepak et al**[27] where also

microcytic hypochromic anemia was predominant due to mainly iron deficiency/ nutritional anemia.

- Due to institutional deficits we could only assess serum. TSH levels which is different from the study done by **Monica et al**[25], where a complete thyroid profile including T3 and T4 was done. Similarly in another study by **Valinjkar et al**[31], T3 and T4 were also assessed along with serum proteins and their values were found to be on the lower side which again suggests low conversion of T3 to T4.

CONCLUSION

- Studies related to micronutrient deficiencies are inadequate and there are so many areas to be explored.
- B12 supplementation should also be the part of management but further studies are required to confirm the findings.
- More specific studies are required to associate hypothyroidism with malnutrition and low serum protein.

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