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Co-morbidities of Microcytic Anemia in Severe Acute Malnutrition Infants: A Tertiary Care Hospital Experience in Central India

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Abstract

When microcytosis occur with severe acute malnutrition it is characterized by body's tissues thus organs do not get enough oxygen as the red blood cells becomes smaller in size and carries less oxygen which causes sudden major weight loss requiring a quick nutritional and medical intervention. SAM was diagnosed by WHO – MUAC method. Complete blood count and red cell indices were measured by automated 5-part hematoanalyzer and microcytosis was determined by peripheral smear method.Among all SAM infants with microcytic anemia; WBC was elevated and comparative mean value of RBC, MCV and MCH were statistically significant. Xeropthalmic stage and eyes puffiness was associated clinical symptoms of SAM infants with microcytosis. The result of the study emphasizes the importance of identifying the co-morbidities of microcytic anemia in SAM infants.

Keywords: malnutrition, microcytosis, anemia, sam.

1. Introduction

Malnutrition is a common problem in developing countries and often associated with co-morbidities (Thapa et al., 2015). Globally, more than one- third of under-five deaths are attributed to under nutrition and of these, 10 % are severely malnourished (UNICEF-WHO, 2013; Collins et al., 2006). Severe acute malnutrition, among children below five years of age remains a major embarrassment and impediment to optimal human capital development in India (Vaid et al., 2018). Anemia is usually classified based on the size of RBCs, as measured by the mean corpuscular volume (MCV). Anemia can be microcytic (MCV typically less than 80 fL), normocytic (80 to 100 fL), or macrocytic (greater than 100 fL). The RBC distribution width is a measure of the size variance of RBCs. A low RBC distribution width suggests uniform cell size, whereas an elevated width (greater than 14 percent) indicates RBCs of multiple sizes. Anemia impairs normal development, decreases physical exercise tolerance & intellectual performance in children which may lead to a slowdown of growth in children. It constitutes a major public health problem in young children in the developing world with wide social & economic implications (Quaderi et al., 2016). Causes of anemia in the newborn are blood loss, decreased RBC production, and increased RBC turnover. Blood loss during delivery can result from a ruptured umbilical cord, placenta previa, and abruptio placentae. Maternal-fetal transfusion occurs in 50 % of all pregnancies, but usually does not cause significant loss of blood volume. The patient's history eliminates most of these causes. Anemia is commonly associated with nutritional deficiencies such as iron deficiency, the main factor responsible for microcytic anemia, while folate or vitamin B12 deficiencies are

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responsible for macrocytic anemia (Dallman et al., 1980; Fleming et al., 1982). It results in the various pathophysiological changes in the body systems including significant changes in hematological parameters. Low red cell counts resulting in anemia has always been a constant feature of protein energy malnutrition and may be normochromic normocytic, microcytic hypochromic or macrocytic anemia (Lukens et al., 1995; Warrier et al., 1990). Anemia associated with severe malnutrition is the consequence of multiple factors and represents an interaction between adaptation to inadequate food intake and the impact of other stresses associated with infection or dietary imbalance (Kraemer et al., 2007). There is none of the reported literature available with details of co-morbidities with microcytic anemia associated with severe acute malnourished children. Thus the aim of this study was to determine the pathophysiological co-morbidities of microcytosis in SAM infants.

2. Materials and methods

Study subjects were severe acute malnutrition children; admitted in SAM unit, Department of Paediatrics, Gandhi memorial hospital Rewa, Madhya Pradesh. Study was approved by the institutional ethical committee. Malnourished children were screened as per WHO Mid-upper arm circumference (MUAC) under nutrition guidelines. About 2 ml venus blood was collected after taking signed consent from children parents. Complete blood count and red cell indices were measured by automated 5-part hematoanalyzer (SYSMEX XS-800i, Kobe Japan) using Transasia diagnostic kit. Leishman stain was used in peripheral smear for determination of red cell size in binocular microscope (Olympus CX21ILED). Unpaired *t*-test was used to compare the mean calculated of two groups on GraphPad (version 3.06) software. The *P* value < 0.05 was considered statistically significant.

3. Results

This cross-sectional study was conducted in Multidisciplinary Research Unit, Shyam Shah Medical College, Rewa, Madhya Pradesh over a period of one year from January 2018 to December 2018. A total 74 clinically symptomatic severe acute malnourished infants blood samples were collected and categorised in two groups. First group had 42 SAM infants with microcytosis (22 male and 20 female with mean age 13.23 ± 7.02 months) while second group had 32 SAM infants without microcytosis included 26 normocytic and 6 macrocytic anaemia (15 male and 17 female with mean age 15.62 ± 9.68 months). Haematological profile of SAM microcytic infants group as well as SAM without microcytosis was recorded. All the parameters were statistically significant except WBC and HGB. RBC, MCV and MCH were extremely significant. Details of the comparative value are given in Table 1**.** Various clinical features associated with severe acute malnutrition were documented for both groups. Hair pigmentation (100 %) was the main similar clinical finding in both groups while oedema (50 %) was presented by SAM infants without microcytosis. Xeropthalmic stage (14.2 %) and puffiness over eyes were predominated in SAM infants with microcytosis. Skin pigmentation was similar in both groups while lymphadenopathy (12.5 %) was high in SAM without microcytosis group. Detail clinical profile are depicted in Figure 1.

Table 1. Hematological profile of SAM infants

Haematological Profile	SAM with Microcytosis (N=42) Mean±SD	SAM without Microcytosis (N=32)	*P* value
WBC(ths/µl)	12.44±6.33	10.19±5.19	0.106
RBC (millions/ µl)	4.16± 0.867	2.89±1.21	< 0.001
HGB(g/dl)	8.33± 1.810	74±2.33	0.224
MCV(fl)	67.37±8.158	93.73± 11.25	< 0.001
MCH(pg)	20.33± 3.88	29.01± 7.85	< 0.001
MCHC(g/dl)	28.57± 3.713	30.79±5.46	0.076
PLT(ths/µl)	2.88±1.55	2.25± 1.68	0.099

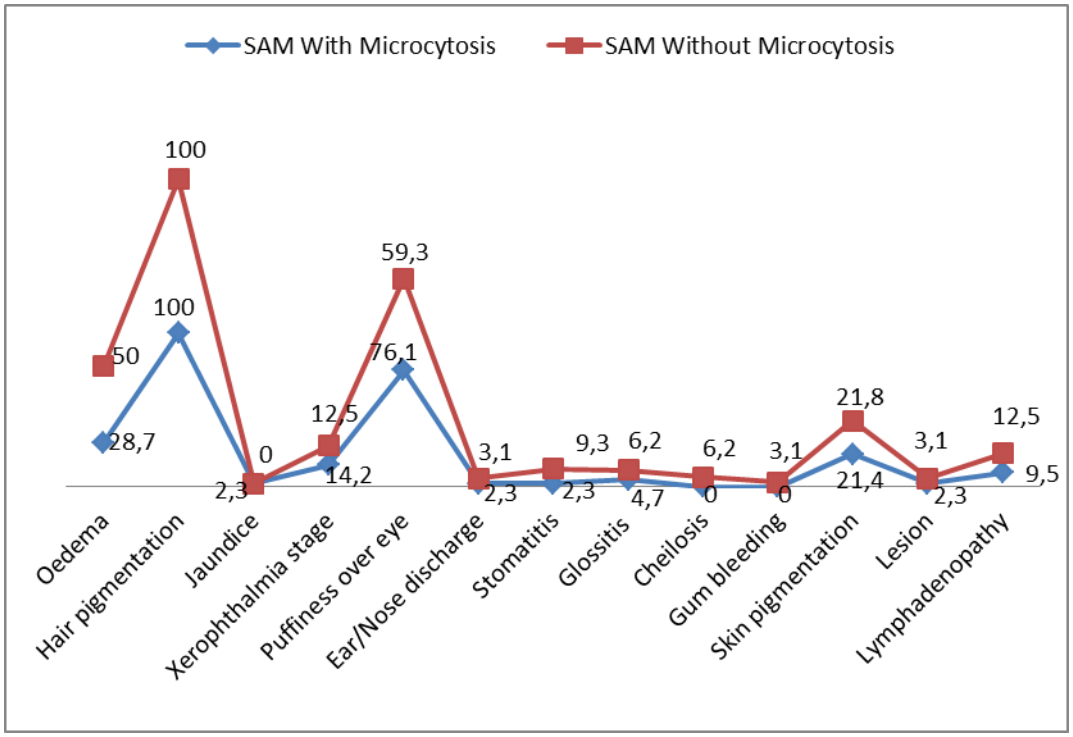

Fig. 1. Comparative clinical frequency (%) of SAM with microcytosis and without microcytosis

4. Discussion

Child malnutrition is a major global health problem contributing to childhood morbidity, mortality, impaired intellectual development, suboptimal adult work capacity and increased risk of diseases in adulthood. The mortality rate of children with complicated severe acute malnutrition in hospitalized set-up also remains high (Collins et al., 2006). Also high mortality has been attributed to co-morbidities like infections and associated complications. The most common type of anemia was microcytic followed by megaloblastic anemia reported in a study of Kangra district Himanchal Pradesh (Vaid et al., 2018). Anemia being very common in childhood; more seen in aged 6 months to 24 months old. When discussed about its prevalence in SAARC in Bangladesh 68 % of children aged 6-59 months are anemic also in third world countries, 39 % children below 5 years and 48 % children between 5–14 years are suffering from anemia. Children with anemia may present in hospital with anemia related nonspecific or specific symptoms or with other associated diseases (Ghosh et al., 2015). We report the elevation of WBC in SAM with microcytosis; however it was not statistically significant (*P* value 0.106) which showed the patients are prone to infection. Mean value of RBC (*P* value < 0.001), MCV(*P* value < 0.001) and MCH (*P* value < 0.001) were showed extremely significant in compared groups. Mean value of MCHC (*P* value 0.076) and Platelet (*P* value 0.099) was significant in compared groups. Similar finding was reported in previous studies (Saka et al., 2012; Laditan et al., 1983; El-Nawawy et al., 2002).It is reported that, in Asia, the prevalence of anemia in children below two years of age will possibly surpass 90 % of children if not addressed as important health issues (Janus et al., 2010). The prevalence of anemia in India was reported 74.35 % for 6-35 months age group & neighbor country Nepal has 78 % anemic cases for 6-59 months age group. Going towards east Kazakhstain reported 73.7 % anemic cases for 0-23 months age group. The prevalence of anemia in preschool children (0-4 yr) of Africa, southeast Asia and eastern Mediterranean were 67.6 %, 65.5 % and 46.7 % cases were reported respectively. The prevalence of anemia in developed countries i.e. in America 29.3 % and Europe 21.7 % cases were reported (Benoist et al., 2008). In our study; cases of SAM with microcytic anemia was highly associated with xeropthalmic stage and eyes puffiness while oedema and lymphadenopathy was significantly high in SAM without microcytosis. A study reported microcytosis in control group 40.6 % and macrocytosis 33 % in SAM children (Dwivedi et al., 2017). Other studies reported acute gastroenteritis being the most common co-morbid condition on followed by respiratory tract infections in their cohort of SAM (Talbert et al., 2012; Kumar et al.,

2014; Sunguya et al., 2006; Irena et al., 2011). With detailed discussion it appears that malnutrition is still a common problem in developing countries.

5. Conclusion

Hospitalized SAM infants were found associated with co-morbidities of microcytic anemia. Among all SAM infants with microcytic anemia; WBC was elevated and comparative mean value of RBC, MCV and MCH were statistically significant. Xeropthalmic stage and eyes puffiness is associated clinical symptom of SAM infants with microcytosis. These results emphasize the importance of identifying the co-morbidities of microcytic anemia in SAM infants.

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