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Original Research Article

Prevalence and clinical manifestations of vitamin K deficiency in complicated severe acute malnutrition

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ABSTRACT

Background: In Severe Acute Malnutrition (SAM) clinical and biochemical abnormalities are commonly observed. In this institute author observed that many children of complicated SAM had bleeding manifestations but there is no defined prevalence of vitamin K deficiency in SAM that's why author have planned this study.
Methods: This was the hospital based prospective study conducted in 150 complicated SAM children. All children were treated according to WHO protocol for SAM management. Prothrombin Time (PT), International Normalized Ratio (INR), activated Partial Thromboplastin Time (aPTT) along with routine investigations were done on admission. All the collected data was managed and analyzed with standard software Biostatics (SPSS Version 20).
Results: Total 150 complicated SAM children were studied for prevalence and clinical manifestations of vitamin K deficiency. Mean age of children was 17.03±11.0 months, 52.0% were male and 48.0% were female children. Average weight was 5.92±1.57 kg. Average height/length was 70.66±8.38 cm and mean MUAC was 10.47±1.31 cm. Out of 150, 42(28%) children had abnormal INR and 28(18.7%) had abnormal aPTT with abnormal INR. The mean INR was 2.11±1.1 and mean aPTT was 45.30±9.59 in children those had abnormal INR. Twelve out of 42(28.6%) had various bleeding manifestations and majority (66.6%) had gastrointestinal bleeding.
Conclusions: More than one fourth children (28%) of complicated SAM children are having vitamin K deficiency and majority of children present with gastrointestinal bleeding.

Keywords: Activated partial thromboplastin time, International normalized ratio, Prothrombin time, Severe acute malnutrition, Vitamin K

INTRODUCTION

Malnutrition is the most common nutritional disorder affecting children in developing countries and the third most common disease of childhood.[1,2]

In Severe Acute Malnutrition (SAM) clinical and biochemical abnormalities like malabsorption, inadequate intake or impaired metabolism of fat-soluble vitamins and impaired protein synthesis are some of the factors potentially involved. Significant malabsorption of fat due to decreased pancreatic lipase, bacterial overgrowth in the small intestine resulting in increased bile salts deconjugation and poor absorption of vitamin K may inhibit synthesis of proteins and clotting factors and may have been responsible for the abnormal prothrombin times.[3-5]

In this institute author observed that many children of complicated SAM had bleeding manifestations but there is no defined prevalence of vitamin K deficiency in SAM that's why author have planned this study.

METHODS

It was a hospital based prospective study conducted in 150 complicated SAM children with aged 6 months to 5 years. They were admitted at Malnutrition Treatment Center (MTC), Bal Chikitsalya, RNT Medical College, Udaipur (Rajasthan) India from January 2018 to December 2018. Ethical clearance from the ethical committee of the institute was taken. Only complicated SAM were getting admission in this MTC. Uncomplicated SAM were treated on outpatient basis.

Criteria to define SAM with complications were taken as bilateral pitting edema and/or MUAC <115 mm and /or WFH <-3 SD and one of the following: anorexia, not alert, medical complications e.g.-lower respiratory tract infection, high grade fever, anaemia, hypoglycemia, severe dehydration. Those children were excluded who had any disease causing change in coagulation profile like liver disease, kidney disease/ hemodialysis, Cholestatic disease, Cystic fibrosis, multiple abdominal surgeries, long-term parenteral nutrition, viral hepatitis, massive blood transfusion and on drug therapy like Antibiotics, cholestyramine, warfarin, salicylates, anticonvulsants, and certain sulfa drugs or received vitamin K one week prior to admission.

All children were treated according to WHO protocol for SAM management including diet. Prothrombin Time (PT), International Normalized Ratio (INR), Activated Partial Thromboplastin Time (aPTT) along with routine investigations like complete blood count, urea, creatinine, electrolytes, urine complete, and chest x-ray were done on admission. Prolongation of the Prothrombin Time (PT) was defined as a five second increase outside the upper limit of the normal range (abnormal PT ≥18 seconds, control was 12 seconds and abnormal INR ≥1.5).[6] Vitamin K deficiency was considered in children who had INR equal or more than 1.5 on admission. All the collected data was managed and analyzed with standard software Biostatics (SPSS Version 20).

RESULTS

Total 150 complicated SAM children were studied for prevalence and clinical manifestations of vitamin K deficiency. Mean age of children was 17.03±11.0 months, 52.0% were male and 48.0% were female children. Average weight was 5.92±1.57 kg. Average height/length was 70.66±8.38 cm and mean MUAC was 10.47±1.31 cm. In INR assessment it was observed that 28% (42/150) of complicated SAM children had INR more than 1.5 and 72% (108/150) had INR less than 1.5 on admission. In aPTT assessment 18.7% (28/150) had more than 40 seconds and 81.3% (122/150) had less than 40 seconds aPTT on admission (Table 1).

It was also observed that children with abnormal INR, 61.9% (26/42) were male and 38.1% (16/42) were female. Out of 42, 27(64.3%, 16 males, 11 female) were 6 to 12 months age, 10(23.8%, 6 males,4 female) were 12 to 24 months age and 5(11.9%, 4 males, 1 female) were 24 to 60 months age group. Male children are more affected than female in all age group (Table 2).

Table 1: Various parameters in complicated SAM children on admission.

Parameters	Results
Total complicated SAM children	150
Male	78(52%)
Female	72(48%)
Mean age (in months)	17.03±11.0
Mean weight (in Kg)	5.92±1.57
Mean height/length (in cm)	70.66±8.38
Mean MUAC (in cm)	10.47±1.31
INR less than 1.5	108(72%)
INR more than 1.5	42(28%)
aPTT less than 40 seconds	122(81.3%)
aPTT more than 40 seconds	28(18.7%)

Table 2: Distribution of children with abnormal INR according age and sex.

Age	SAM children with abnormal INR			
	M	F	Total	%
6 ≤12	16	11	27	64.3%
12 ≤24	6	4	10	23.8%
24 ≤60	4	1	5	11.9%
Total	26 (61.9%)	16(38.1%)	42	100%

P=0.06

Out of 42, 27(64.3%) had INR between 1.5 to 2.0, 9(21.4%) had INR between 2.0 to 2.5 and 6(14.3%) had INR more than 2.5. Twelve out of 42 had bleeding manifestations and INR more than 1.5. Out of these 12 children with bleeding, 3(25%) had INR between 1.5 to 2.0, 5(41.7%) had INR between 2.0 to 2.5 and 4(33.3%) had INR more than 2.5. It shows that three fourth children with bleeding had INR more than 2.0 (Table 3).

Table 3: Bleeding manifestations and INR on admission.

INR	No. of children	Bleeding manifestation
1.5 to 2.0	27(64.3%)	3(25.0%)
2.0 to 2.5	9(21.4%)	5(41.7%)
More than 2.5	6(14.3%)	4(33.3%)
Total	42(100%)	12(100%)

P=0.052

Out of 42, 14(33.3%) had aPTT less than 40, 24(57.2%) had aPTT between 40 to 60 seconds and 4(9.5%) had more than 60 seconds. Twelve out of 42 had bleeding manifestation of which 1(8.3%) had aPTT less than 40 seconds, 9(75%) had aPTT between 40 to 60 seconds and 2(16.7%) had aPTT more than 60 seconds 90% had aPTT

more than 40 seconds on admission. It shows more than 90% children with bleeding had aPTT more than 40 seconds (Table 4).

Table 4: Bleeding manifestation and aPTT on admission.

aPTT (in Seconds)	No. of children	Bleeding manifestation
Less than 40	14(33.3%)	1(8.3%)
40 to 60	24(57.2%)	9(75.0%)
More than 60	4(9.5%)	2(16.7%)
Total	42(100%)	12(100%)

In children with abnormal INR, mean SD Z score was -3.81±1.29 and -3.87±1.31 in male and female respectively. The mean INR was 2.11±1.1 and mean aPTT was 45.30±9.59 in children those had abnormal INR on admission. Out of 42 children with abnormal INR, 47.6% (20/42) had diarrhoea, 23.8% (10/42) had pneumonia, 7.1% (3/42) had tuberculosis, 4.7% (2/42) had septicaemia, 7.1% (3/42) had celiac disease and other like malaria, heart disease, developmental delay etc. author observed that 28.6% (12/42) children had various bleeding manifestations like gastrointestinal, malena, ecchymosis, petechiae, purpura and mucosal bleeding but majority (66.6%) had gastrointestinal bleeding.

DISCUSSION

Malnutrition is a nutritional problem that results from varying proportion of protein and calories deficiency in infant and young children and is a complicating factor for other illnesses in developing countries.[7]

In the present study 150 children of complicated SAM were enrolled for assessment of prevalence and clinical manifestations of vitamin K deficiency.

Author observed that 28% of complicated SAM children had Vitamin K deficiency , based on abnormal PT-INR on admission. It appears that Vitamin K dependent coagulation factors were decreased in these malnourished children leading to abnormal PT-INR. Similar findings were reported by Akinyinka et al, in 40 consecutive cases of kwashiorkor, Eleven (27.5%) of the 40 patients died.[8] Eight out of the 11 patients who died had a prolonged prothrombin time compared to only 4 out of the 29 who survived (p=0.005).These results may indicate a predictive mortality value of prothrombin time in kwashiorkor.

Author observed that out of 42, about 88% children were 6 to 24 months age and more than 60% were male had abnormal INR on admission. This is contradictory to our study population in which 52% were male. The possible explanation is that they might suffered with recurrent infections in past which leads to a vicious cycle of malnutrition and infection.[9] Similar study in past from this centre denoted as more male are suffering from malnutrition. Various study shows that males are more sufferer of infection because of single X chromosome while double X in female is protective. This is well highlighted in the study by Davidson et al, in 2013.[10]

Out of 42 children who had abnormal INR of which 28 also had aPTT of more than 40 seconds and 14 had aPTT less than 40 seconds. Children who had abnormal aPTT also had abnormal INR. That shows INR is more affected than aPTT in vitamin K deficiency. This is well known fact that PT-INR was more sensitive than aPTT. It was similar to findings carried out by Bhat R.V et al, in 66 children with malnutrition on prolonged antibiotic therapy.[11] A total of 22(33.33%) children out of 66 developed hypoprothrombinemia. All children with prolonged PT had prolonged aPTT also. All children with severe coagulation abnormalities also had higher grades of malnutrition. Therefore malnutrition may be a contributing factor in the development of hypoprothrombinemia.

Twelve (28.6%) children had bleeding manifestations and all had abnormal INR and aPTT except one who had aPTT less than 40 seconds. Majority of children had gastrointestinal bleeding like coffee brown gastric content and malena. It was similar to findings carried out by Pineo et al, in 27 patients who developed vitamin K deficiency unexpectedly in the postoperative period or during hospitalization for a variety of medical conditions.[12] Nineteen were on no oral intake during part of their hospital stay, and the remainder had a poor food intake. Fifty percent developed vitamin K deficiency within seven days. Fifteen out of 27 had bleeding and most common site was gastrointestinal tract.

This study had limitation that author included only complicated SAM so author do not know that how many of uncomplicated SAM children are having vitamin K deficiency.

CONCLUSION

To conclude this study that in complicated SAM more than one fourth (28%) children had vitamin K deficiency and majority of children had Gastro-intestinal bleeding manifestation.

So author recommend that the complicated SAM children should be diagnosed and treated early for vitamin K deficiency.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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