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CASE REPORT

Enteral Nutrition Support in Management of a Pediatric Patient with Secondary Acute Malnutrition and SARS-CoV-2 Infection : A Case Report

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Abstract

Severe acute malnutrition (SAM) contributes to about one million deaths annually in children under the age of 5 years. Secondary acute malnutrition is common in children with underlying medical conditions. It may pose a great risk in developing severe illness during SARS-CoV-2 infection among children. Proper implementation of nutrition care process is critical in management of secondary acute malnutrition among children in clinical settings. Eight months old male admitted with meningoencephalitis; septic shock, anemia, rickets, osteomyelitis, severe malnutrition and severe SARS-CoV-2 pneumonia complications. On admission, body temperature was 37^0C, random blood sugars were 17.5mmol/L and with saturation of 98% on room air. He had a body weight of 5.5kg on admission with a z-score of -3sd. Nutrition focused physical examination revealed severe loss of muscle mass and adipose tissue. Nutrition prescription of high calorie high protein diet providing 846 calories and 22.3 g of protein per day was prescribed. The feed of choice was fortified blended flour (FBF) porridge which was administered via nasogastric feeding tube. After fourteen days of nutrition care in the unit, the patient had a weight gain of 100g. The average weight gain rate was 1.29g/kg/day. This case report documents challenges in nutrition management of secondary acute malnutrition with SARS-CoV-2 pneumonia in resource limited clinical settings. The review of existing guidelines and disease specific nutrition commodities in the management of secondary acute malnutrition in clinical settings is recommended.

Keywords: Enteral nutrition; Nutrition care process; Secondary acute malnutrition; SARS CoV2 infection; Covid19

Introduction

Severe acute malnutrition[1] (SAM) lead to about one million deaths annually in children under the age of 5 years[(1)]. While primary acute malnutrition is attributed to inadequate food intake at household level, secondary acute malnutrition is linked to abnormal loss of nutrients, hypermetabolism or decrease in food intake due to underlying medical conditions[(2)]. Unlike primary acute malnutrition, most cases of secondary acute malnutrition are managed in clinical settings.

In the wake of Covid-19 pandemic, about 47 million children under the age of five years had acute malnutrition[(3)]. Covid-19 disease clinical manifestation among children presents with pharyngitis, fever, cough, vomiting and diarrhea. About 30% of children with Covid-19 present with hypoxia and require intensive care support[(4,5)]. Existing evidence indicate that children with underlying medical conditions are likely to develop severe illness from SARS-CoV-2 infections due to compromised immune system[(6,7)].

To date, there are limited case reports in Africa on implementation of nutrition care process in nutrition support among pediatric population in clinical settings. The aim of this case report is to provide insights on the implementation of nutrition care process in management of secondary acute malnutrition and Covid-19 pediatric patient in a resource limited setting.

Case presentation

Eight months old male baby admitted at Kenyatta National Hospital through paediatric general wards was transferred to Covid-19 Critical Care Unit. On admission patient had meningoencephalitis; septic shock, anaemia, rickets, osteomyelitis, severe malnutrition, left leg swelling and Covid-19 pneumonia. The rest of data was collected using data capture sheet as dictated by nutrition care process format[(8)].

Client history

The patient was admitted into the CCU-Covid-19 unit on 27th October, 2021 due to history of fever, cough, difficulty in breathing and reduced level of consciousness. He had cold extremities up-to elbows and knees; capillary refill was 6 sec, weak pulses and persistent hypoglycaemia. Medical history revealed that patient was born as pre-term twin with birth weight of 2.8 kilograms. Shortly after birth he was admitted to a new-born unit with neonatal sepsis (NNS). He had history of persistent poor weight gain was previously enrolled in a nutrition program. He also had regressed millstones.

[1]Severe acute malnutrition refers to the presence of bilateral edema or severe wasting based on weight –for- height or length ratio of less than -3 standard deviation (SD); or mid-upper arm circumference of less than 11.5 cm.

Anthropometric assessment

On admission, he weighed 5.5kg, body length was 64cm with z-scores of -3sd (severe acute malnutrition). Prior to admission, patient's body weight was 5.5kg. The ideal body for eight months old is 8.9 kg.

Biochemical tests, medical tests and procedures

Baseline laboratory investigations were: Sodium-152 milimoles/L; potassium-1.95mmol/L; Urea 7.2 mmol/L; creatinine- 63.2 umol/l and Haemoglobin leve-7g/dl, random blood sugar-17.5mmol/L. Had nasogastric tube (size F-10) inserted for feeding. Triple serology test was negative. SARS-CoV-2 test was positive after six days of admission in pediatric unit. Computed Tomography (CT) head scan report suggested hypoxic ischemic or brain injury.

Nutrition-Focused Physical Examination

On physical examinations, baby had a hollowed look depression under the eyes and triceps had very little space between fingers on touch. He had obvious hollow depressed temple and prominent ribs. On further examination, the patient could not stand without assistance or was able to crawl. He was noted to have delayed milestones. In addition, he afebrile. Oxygen saturation was 98% on room air.

Food and Nutrition Related History

In general paediatric unit, the baby was unable to feed orally and a nasogastric tube feeding was fixed. Bolus of expressed breast milk (EBM) alongside F-75 formula of 100ml every three hours was given for seven days. This was transitioned with kitchen feed (enriched porridge made of sorghum, oil and sugar). The indication for this feed was occasioned by stock-outs of F-100 in the hospital and also lack of suitable commercial formula. This kitchen feed was nutritionally inadequate and it also required dilution into thin liquid to be administered into the narrow bore of paediatric nasogastric tube. Mother did not have adequate production of breast milk for the twin babies immediately after. This necessitated her to initiate complementary feeding at four months. Patient had longstanding history of poor feeding and faltering weight gain. On admission, mother reported depressed production of expressed breast milk.

Nutrition Diagnosis

Based on nutrition assessment data, working nutrition diagnosis formulated was: - Inadequate caloric and nutrients intake due to lack of appropriate feed as evidence by intake

of low caloric- nutrients dense kitchen feeds.

Nutrition Intervention

A high calorie-high protein diet with appropriate proportion of micronutrients was prescribed. Caloric and nutrients requirements were calculated based on ideal body weight of 8.9kg, with provisions of 95 kilocalories and 2.5g of protein per ideal body weight per day[9]. This translated to 846 calories and 22.3 g of protein per day.

There was no suitable paediatric formula that could adequately provide prescribed calories and nutrients. Enteral commercial feeds available in the hospital though they could meet caloric requirements, they exceed protein contents with more than 40% of daily protein needs.

The only enteral feed at disposal by material time which could deliver calories and protein in relatively appropriate amount was fortified blended flour (FBF). It had another advantage in that it had appropriate viscosity for paediatric size F-10 nasogastric tube. This therapeutic feed is commonly used in HIV/AIDS nutrition programs to support children with moderate malnutrition[10]. It is a pre-cooked flour made up of maize, sorghum, sugar, soybean oil and fortified with minerals and vitamins[11].

On the first day in the unit, prepared FBF feed from flour amount of 150g was given in bolus of 90mls in every three hours. The mother was requested to express breastmilk and feed the baby first before administration of this therapeutic feed. This provided about 630 calories and 30grams of protein per day[11]. An increment of 10ml of the feed was done every day to achieve 120mls per every three hours. In the third day the patient had episodes of loose stool. This necessitated provision of 50 ml bolus of fermented milk which contains live cultures to improve gut flora[12].

On the 5th day, it was noted that the patient appetite had improved greatly and was not satisfied with volume of feed that was provided. This prompted to an increment of 10ml of FBF per feed to provide a total volume of 150ml per every three hours per day. Total volume was 1200mls per day with 1,050 calories and 50g of protein and good range of micronutrients. The main challenge with this feed was that amount of protein almost tripled when trying to achieve high calories. On day 14th the patient was transferred to paediatric unit with body weight of 5.6 kg after repeat Covid test was done and it turned negative.

Discussion

Timely provision of appropriate nutrition support may prevent nutrition status deteroriation and improve clincial outcomes of the critically-ill pateints[8,13]. Application of nutrition care process is crucial in successful provision of quality nutrition support. Nutrition assessment as the first step of nutrition care process is critical in identifying nutrition diagnosis label for appropriate nutrition intervention. Poor nutrition assessment profile may lead to poor choice of nutrition intervention[14].

In clinical settings, commercial enteral feeds are prefered to traditional enteral feed for managing critically ill pateints as their are superior in their nutrients content and safe to administer[15]. However, it is often a challenge to get appropriate commercial enteral formula for pediatrics who are aged more than six months to 1 year in clinical settings in most of developing world countries. According to the standard protocol on treatment of acute malnutrition, during stabilization phase, F-75 formula is used as an intial feed in order to replenish depleted micronutrients first to prevent re-feeding syndrome[14]. Only when patient has good appetite and able to complete all the prescibed volume of F-75 feed and medical complications have resolved is transitioned into nutrition rehabiliation phase. In nutrition rehabiliation phase, an aggressive nutrition support is recommended for catch-up weight using F-100 feed or ready-to-use therepeutic feeds[14,15].

Despite the fact that the patient presented with malnutrition, this was not like classical acute malnutrition cases (primary acute malnutrition) which are straight forward to manage using existing protocols for intergrated management of acute malnutrition. In this case report, patient had existing underlying medical complications coupled with oppotunistic infections (Covid-19) and did not pick up well in terms of nutrition intervention as with classical acute malnutrition cases. After fourteen days of nutrition intervention, patient had the average weight gain rate of 1.298g/kg/day.

Even though there was a positive weight gain, this was below the recommended average weight gain rate for children with acute malnutrition in stabilization centers [2] and out-patient therapeutic feeding programs. However, it is not clear the recommended average gain of weight for pediatrics with secondary acute malnutrition in the context of underlying medical conditions in clinical settings. The SPHERE standards recommend an average weight gain rate of more than 5g/kg/day in children with primary acute malnutrition[16,17].

Poor weight gain may adversely affect patient's clinical outcomes and increase the length of stay[14,15]. The probable reason for low average weight gain rate in this case report would be due to increased caloric and nutrients requirement or altered nutrients absorption and metabolism because of existing underlying conditions. Also, FBF is formulated for patients with moderate acute malnutrition which may have fallen short in certain nutrients content required for patients with severe acute malnutrition and exiting underlying polymorbid medical conditions.

[2]Stabilization centre- A specialized unit for managing children with severe acute malnutrition with medical complications

Conclusion

This case report documents nutrition care process and challenges in nutrition intervention implementation in secondary acute malnutrition with SARS-CoV-2 pneumonia in resource limited clinical settings. The review of existing guidelines and disease specific nutrition commodities for management of secondary acute malnutrition in clinical settings is recommended.

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Statements of ethics

Written informed consent was obtained from the child's father. Anonymity of the study participant in the case report has been maintained. The case report was approved by Kenyatta National Hospital- University of Nairobi Research Ethics Committee on 30th August, 2021 under reference number: KNH-ERC/01/PUB/5.

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Authors' contributions

Alexander Mbogo developed the concept and did the manuscript writing. Siva Kiran (from IAPEN) provided mentorship in data collection within nutrition care process framework and identification of the journal for publication. Dr. Sophie Ngala provided guidance on manuscript development.

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