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Determinants of mortality during severe acute malnutrition in children under 5 years old in Mahajanga Madagascar

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Abstract

Introduction: Severe acute malnutrition is responsible for one million deaths in children under five years old every year worldwide. The aim was to determine mortality risk factors in children hospitalized for severe acute malnutrition.

Methods: This was a case-control study over a 39-month period from January 1, 2019 to March 31, 2022 in the pediatrics department of the University Hospital Center Professeur Zafisaona Gabriel (CHU PZaGa) Mahajanga Madagascar. Cases were represented by severe acute malnourished patients who died, and controls by severe acute malnourished patients who were discharged alive.

Results: During the study period, 178 children were enrolled, representing a hospital prevalence of 5%. The mean age was 18.6 ± 13.9 months, with a sex ratio of 1.02. The case-fatality rate was 17.4% (n=31). The main complications encountered were anemia 34.3% (n=61), respiratory infections 24.2% (n= 43) and gastroenteritis 19.6% (n=35). The completion of 2 or more consultations prior to admission was associated with the occurrence of death (OR= 3.9 [1.5-9.9], p=0.002), as was the absence of vaccination (OR=2.6 [1.1-6.5], p=0.02). Convulsion (OR=8.04 [1.99-32.47], p=0.001), disturbed consciousness (OR= 5.2 [2.06-13.2], p=0.0003), respiratory distress (OR= 6.85 [2.63-17.83], p=0.0011) and hepatomegaly (OR= 8.04 [1.99-32.47], p=0.0011) were also associated with the occurrence of death.

Conclusion: Early and optimal management in a specialized setting is essential, especially for the most severe cases associated with a complication.

Keywords: Complications, risk factors, severe acute malnutrition, mortality, pediatrics

Introduction

Child malnutrition is still a public health problem. Child malnutrition is defined as a pathological state resulting from nutritional imbalance. It encompasses 2 main groups: undernutrition and overnutrition. Undernutrition is due to insufficient intake of energy and other nutrients, leading to a state of emaciation ^[1]. Severe acute malnutrition is the most severe form of undernutrition. It is defined by a weight/height ratio of less than -3Z score according to World Health Organization (WHO) growth standards and/or a brachial circumference of less than 115 mm, whether or not associated with nutritional oedema ^[2].

Acute malnutrition affects more than 52 million children under the age of 5, 17 million of whom suffer from severe acute malnutrition ^[3]. It is responsible for one million deaths every year, most of them in sub-Saharan Africa and South Asia ^[3]. In Madagascar, severe acute malnutrition affects 8.3% of children ^[4]. It is associated with at least 44% of deaths ^[4]. Knowledge of the factors predictive of mortality in these children suffering from severe acute malnutrition could improve management and preventive measures. The hypothesis of this study is that several factors worsen the prognosis of hospitalized severely malnourished children. The main objective of this study was to determine the risk factors for under-five mortality linked to severe acute malnutrition.

Methods

Study setting

The present study was conducted in the Pediatrics Department of the University Hospital Center Professeur Zafisaona Gabriel (CHU PZaGa) Androva Mahajanga Madagascar. This department has an Intensive Nutritionnal Recovery Center for children suffering from severe acute malnutrition with medical complications.

Type of study and study period

This was a retrospective analytic case-control study. It covered a 39-month period from January 1, 2019 to March 31, 2022.

Study population

All children aged between 1 and 59 months with severe acute malnutrition admitted to the department during the study period were included. Those discharged against medical advice were excluded.

Severe acute malnutrition was defined by a weight/height ratio < -3Z score according to WHO growth standards and/or a brachial circumference < 115 mm associated or not with nutritional edema [2].

For the analysis of risk factors for death, cases were represented by severe acute malnourished patients who died, and controls by severe acute malnourished patients who were discharged alive. Cases were included exhaustively. Controls were selected by matching with a case/control ratio of 1/2.

Studied variables

The variables studied were sociodemographic, clinical, paraclinical and therapeutic data, as well as changes during hospitalization.

Data analysis

These data were then analyzed using EPI-INFO 7® software. Patient outcome was the dependent variable. The Odds Ratio (OR) was used as the measure of association.

Chi-square and Fisher exact tests were used according to their conditions of application to test the hypothesis of an OR different from 1. An OR > 1 constituted an association of the independent variables with the occurrence of death. The significance level (p-value) was set at 0.05.

Ethical considerations

Authorization from the Director of the establishment and the Head of the Pediatrics Department was obtained for consultation of medical records and the hospitalization register. Patient anonymity was preserved at all times, thanks to a computerized encoding system.

Results

Description of the sample

During the study period, 178 children were severely acutely malnourished, representing a hospital prevalence of 5%. The sex ratio was 1.02. The mean age was 18.6±13.8 months. The majority of patients (82%) were under 24 months of age. Median hospital stay was 6 days [1-35 days]. Severe marasmus or emaciation was the most frequent form in 131 children (76.6%). The edematous or kwashiorkor form was found in 20 patients (11.7%) and the mixed form in 20 patients (11.7%). Table 1 describes the medical complications found. Of these severely acutely malnourished children, 31 died, representing a case-fatality rate of 17%.

Risk factors for death

After matching according to a case/control ratio of 1/2, we selected 31 cases for 62 controls. Table II shows the risk factors for death related to clinical status during severe acute malnutrition. The completion of 2 or more consultations prior to admission was associated with the occurrence of death (OR= 3.9 [1.5-9.9], p=0.002), as was the absence of vaccination (OR=2.6 [1.1-6.5], p=0.02) (Table 2). Intravenous infusion was also associated with a risk of death (OR=53.03 [14.28-196.95], p=0.0000) (Table 3).

Table 1: Distribution of patients according to complication

Complications	Effective (n=178)	Percentage (%)
Anemia	61	34,3
Pneumonia	43	24,2
Gastro-enteritis	35	19,6
Fluid and electrolyte disorders	15	8,4
Neuromeningeal infections	11	6,1
Tuberculosis	10	5,6
HIV infection	8	2,2
Urinary tract infection	4	4,5
COVID-19	2	1,1
Severe malaria	1	0,5

Table 2: Clinical risk factors for death in severe acute malnutrition

Variables	Deceased n=31 (%)	Alive n=62 (%)	OR [IC]	Valeur p
Number of pre-admission consultation				
≥2	18(58,1)	16 (25,8)	3,9[1,5-9,9]	0,002
<2	13 (41,9)	46 (74,2)		
Vaccination				
Incomplete or absent	20 (64,5)	25 (40,3)	2,6[1,1-6,5]	0,02
Complete	11 (35,5)	37 (77)		
Convulsion				

Yes	9 (29)	3 (4,8)	8,04[1,99-32,47]	0,002
No	22 (71)	59 (95,2)		
Confusion				
Yes	20(64,5)	16(25,8)	5,2 [2,06-13,24]	0,0003
No	11(35,5)	46(74,2)		
Respiratory distress				
Yes	20 (64,5)	13 (20,9)	6,85[2,63-17,83]	0,0011
No	11 (35,5)	49 (79,1)		
Dehydration				
Yes	15 (48,4)	23 (37,1)	1,58[0,66-3,80]	0,20
No	16 (51,6)	39 (62,9)		
Hepatomegaly				
Yes	9 (29,1)	3 (4,8)	8,04[1,99-32,47]	0,0011
No	22 (70,9)	59 (95,2)		
Edema				
Yes	7 (22,6)	6 (9,7)	2,72[0,82-8,95]	0,05
Non	24 (77,4)	56 (90,3)		
Signs of shock				
Yes	10 (41,7%)	7 (10,1%)	6,3[2,05-19,5]	0,001
No	14 (58,3%)	62 (89,9%)		

Table 3: Comorbidity-related risk factors for death in severe acute malnutrition

Variables	Deceased n (%)	Alive n (%)	OR [IC]	Valeur p
HIV infection				
Yes	5(16,1%)	3(4,8%)	3,7[0,8-17,01]	0,04
No	26(83,9%)	59(95,2%)		
Tuberculosis				
Yes	6(19,3%)	4(6,5%)	3,4[0,9-13,4]	0,03
No	25(80,7%)	58(93,5%)		

Table 4: Risk factors for treatment-related death in severe acute malnutrition

Variables	Décédés n (%)	Vivants n (%)	OR [IC]	Valeur p
Nasogastric tube				
Yes	11(35,5%)	11(17,7%)	2,5[0,9-6,9]	0,05
No	20(64,5%)	51(82,3%)		
Intravenous fluid				
Yes	27(79%)	7(21%)	53,03[14,28-196,95]	0,0000
No	4(7%)	55(93%)		

Discussion

This study highlighted the factors associated with the occurrence of death in children under 5 years of age hospitalized for severe acute malnutrition. The retrospective and monocentric nature of this study is a limitation. However, these results may serve as a reference for future studies.

Hospital prevalence was 5%. This result is in line with that of a study carried out in Sudan in 2016, which found a hospital prevalence of 6.5% [5]. On the other hand, it is lower than that of a study carried out in Conakry in 2019, which found a hospital prevalence of 17.6% [6]. Another study carried out in Mali in 2020 found an even higher prevalence of 50% [7]. This difference could be explained by low hospital attendance. It could be that there are cases of severe acute malnutrition that have not reached the hospital. Parents may have opted for treatment with traditional remedies due to a lack of financial resources or traditional beliefs and customs.

The majority of children were under 24 months of age (82%), with a mean age of 18.6±13.8 months. This finding is in line with previous studies of severe acute malnutrition in children under 5 years of age in Africa [8-10]. This age corresponds to the period of weaning from breastfeeding

and the gradual transition to the family meal. If food diversification and weaning from breastfeeding are not carried out under the right conditions, nutritional balance could be disrupted.

In the present series, the case-fatality rate was 17%. A lower case-fatality rate was found in Mali in 2020 (5%) and in Guinea in 2021 (10.9%) [6, 7]. According to the World Health Organization (WHO), a mortality rate of over 15% among children with SAM is alarming [11]. Improving the care of these children therefore deserves particular attention.

This study showed that 2 or more consultations prior to admission were associated with a higher risk of death (OR= 3.9 [1.5-9.9], p=0.002). In severe acute malnutrition, the presence of complications is a criterion for emergency hospitalization in an Intensive Nutritional Recovery Unit [11, 12]. Multiple consultations would delay treatment. These children would arrive late at hospital with multi-visceral failure, complicating management and increasing the risk of death. In addition, the presence of signs of shock was associated with a 6.3-fold increased risk of death (OR=6.3 [2.05-19.5], p=0.001). A study conducted in Conakry in 2017 also highlighted this association between signs of shock and death (OR=4.04 [2.53 - 6.43], p=0.000) [13]. Shock during severe acute malnutrition can be secondary to

several associated etiologies, including infection associated with hypovolemia and metabolic disorder. Management is therefore complex and a real challenge in paediatric intensive care. In addition, the administration of intravenous infusion fluid for filling should be done with caution due to the high risk of cardiac failure during severe acute malnutrition^[14]. It was also shown in this study that the use of an intravenous infusion was associated with a higher risk of death (OR=53.03[14.28-196.95], p=0.0000). A cohort study conducted in Ethiopia in 2021 on 610 children with severe acute malnutrition also found this association between intravenous infusion and death^[15]. All this underlines the need for emergency hospital treatment of cases of severe acute malnutrition with complications. Updating the knowledge of healthcare staff on the protocol for the management of these children is also essential. Health workers need to be made aware of the danger signs and urgently refer children presenting complications, to avoid delays in treatment and progression to multi-visceral failure.

In this series, disturbed consciousness and convulsion on admission were risk factors for death. A study carried out in Ethiopia in 2021 also found an association between disturbed consciousness and mortality^[16]. The presence of neurological signs may be related either to a metabolic disorder such as hypoglycemia or severe hyponatremia, or to a neuro-meningeal infection, thus worsening the prognosis.

The absence of vaccination (OR=2.6[1.1-6.5], p=0.02) also constituted a risk of death. Infections are the main cause of morbidity and mortality in severe acute malnutrition^[14]. During SAM, the immune system is weakened. These children are therefore more vulnerable to infectious diseases^[17]. However, the majority of infectious diseases are vaccine-preventable, including pneumonia, meningitis, gastroenteritis and tuberculosis. Any action to improve vaccination coverage should therefore be promoted.

Conclusion

Severe acute malnutrition is responsible for a non-negligible fatality rate of 17%. Several factors are associated with mortality in hospitalized severe acute malnourished patients. Early and optimal management in a specialized environment is essential to improve prognosis. Updating the knowledge of health workers at different levels on the management protocol is essential. This could prevent delays in treatment, as well as progression to an advanced stage with a poor prognosis. Improving vaccination coverage is also essential.

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Conflicts of interest

The authors declare no conflict of interest.

Authors' contributions

- Ranaivo NAR developed the research protocol and drafted the manuscript.
- Nandrasamampihoby HEF collected and analyzed the data and presented the results.
- Rahariniainaso A contributed to the drafting of the manuscript.

- Andrianarimanana KD checked and approved the final version of the manuscript.

References

1. Ge KY, Chang SY. Definition and measurement of child malnutrition. *BES*. 2001;14(4):283-91.
2. World Health Organization. Guideline: Updates on the Management of Severe Acute Malnutrition in Infants and Children. Geneva, Switzerland: World Health Organization; c2013. Available on <http://www.who.int> (accessed on October 27, 2023).
3. UNICEF. Child malnutrition; c2023. Available on <https://data.unicef.org/topic/nutrition/malnutrition/> (accessed on February 13, 2024).
4. INSTAT, Vice-primature Chargée de l'Industrie et de l'Économie, Secrétariat Général. Enquête nationale sur le suivi des objectifs du millénaire pour le développement à Madagascar; c2013. Available on: <http://madagascar.unfpa.org/fr/publications/enquete-nationale-sur-le-suivi-des-objectifs-du-millenaire-pour-le-developpement>. (accessed on February 12, 2024).
5. Kanan SOH, Swar MO. Prevalence and outcome of severe malnutrition in children less than five-year-old in Omdurman Paediatric Hospital, Sudan. *Sudanese Journal Of Paediatrics*. 2016;16:23-30.
6. Camara E, Diop MM, Barry IK, Conde I, Barry A, *et al*. Malnutrition Aigüe Sévère avec Complications chez les Enfants de 0 à 59 Mois: Aspects Épidémiologiques, Cliniques et Thérapeutiques au Service de Pédiatrie de Labé (Conakry). *Health Sci Dis*. 2021;22(7):6-10.
7. Traore F, Maïga B, Diall H, Sissoko S, Sacko K, *et al*. Prise en charge de la malnutrition aigüe chez l'enfant dans un hôpital Secondaire sahelien. *Mali Med*. 2020;35(2):32-7.
8. Maïga B, Diall H, Sacko K, Dembélé A, Traoré F, *et al*. Aspects Épidémiocliniques de la Malnutrition Aigüe Sévère chez les Enfants de Moins de Cinq Ans au CHU Gabriel Toure. *Health Sci Dis*. 2019;20(3):74-8.
9. Chiabi A, Malangue B, Nguefack S, Dongmo NF, Fru F, *et al*. The clinical spectrum of severe acute malnutrition in children in Cameroon: a hospital-based study in Yaounde, Cameroon. *Transl Pediatr*. 2017;6(1):32-9.
10. Camara E, Diop MM, Barry IK, Conde I, Barry A, *et al*. Malnutrition Aigüe Sévère avec Complications chez les Enfants de 0 à 59 Mois: Aspects Épidémiologiques, Cliniques et Thérapeutiques au Service de Pédiatrie de Labé (Conakry). *Health Sci Dis*. 2021;22(7):6-10.
11. Tickell KD, Denno DM. Inpatient management of children with severe acute malnutrition: a review of WHO guidelines. *Bull World Health Organ*. 2016;94:642-51. DOI:10.2471/BLT.15.162867.
12. Hossain M, Chisti MJ, Hossain MI, Mahfuz M, Islam MM, Ahmed T. Efficacy of World Health Organization guideline in facility-based reduction of mortality in severely malnourished children from low and middle-income countries: a systematic review and meta-analysis. *J Paediatr Child Health*. 2017;53:474-9. DOI:10.1111/jpc.13443.
13. Barry IK, Camara E, Kaba FD, Diallo ML, Conde I, *et al*. Évaluation du Risque de Choc chez l'Enfant Souffrant de Malnutrition Aigüe Sévère à l'Institut de Nutrition et de Santé de l'Enfant au CHU de Donka (Conakry) *Health Sci. Dis*. 2021;22(1):22-28.

14. Obonyo E, Maitland K. Fluid management of shock in severe malnutrition: What is the evidence for current guidelines and what lessons have been learned from clinical studies and trials in other pediatric populations? *Food Nutr Bull.* 2014;35(2):71-8. DOI:10.1177/15648265140352S111.
15. Bitew ZW, Ayele EG, Worku T, Alebel A, Alemu A, *et al.* Determinants of mortality among under-five children admitted with severe acute malnutrition in Addis Ababa, Ethiopia. *Nutrition Journal.* 2021;20(5):90-105. DOI:10.1186/s12937-021-00750-0.
16. Kassaw A, Amare D, Birhanu M, Tesfaw A, Zeleke S, *et al.* Survival and predictors of mortality among severe acute malnourished under-five children admitted at Felege-Hiwot comprehensive specialized hospital, northwest, Ethiopia: a retrospective cohort study. *BMC pediatrics.* 2021;21(2):176-86.
17. Bourke CD, Berkley JA, Prendergast AJ. Immune dysfunction as a cause and consequence of malnutrition. *Trends Immunol.* 2016;37:386-98. DOI:10.1016/j.it.2016.04.003.

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