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FREQUENCY OF HYPOGLYCEMIA AND IN-HOSPITAL MORTALITY IN CHILDREN PRESENTING WITH SEVERE ACUTE MALNUTRITION IN NUTRITION STABILIZATION CENTRE AT TERTIARY CARE HOSPITAL, LARKANA

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Abstract

OBJECTIVE

To determine the frequency of hypoglycemia and in-hospital mortality in children presenting with severe acute malnutrition at the Nutrition Stabilization Center of a tertiary care hospital in Larkana.

METHODOLOGY

A descriptive cross-sectional study was undertaken at the Department of Paediatrics, Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU), Larkana, enrolling 117 children, aged 6 months to 5 years, either gender, who were present with severe acute malnutrition for at least two weeks to assess hypoglycemia and in-hospital mortality. Data was analyzed by SPSS version 26.

RESULTS

The mean ± standard deviation of the age was noted as 24.68 ± 13.75 months. Out of 117 children presented severe acute malnutrition, 54.7% were males and 45.3% were females. Hypoglycemia was noted in 19.65% patients and in-hospital mortality was noted in 60.9% of children.

CONCLUSION

This study highlights the strong association between hypoglycemia and in-hospital mortality in children with severe acute malnutrition (SAM). Risk was greater in younger and lower BMI children, suggesting the importance for early recognition and intervention. Providing routine blood glucose monitoring, appropriate treatment and total nutritional rehabilitation may lead to better survival rates. Mortality can be further decreased by strengthening hospital-based stabilization programs and training of hypoglycemia management of healthcare providers.

INTRODUCTION

Severe acute malnutrition (SAM) continues to be one of the biggest global public health problems and many million children are affected worldwide. Particularly in the developing world, poor nutritional status is intimately linked with higher levels of morbidity and mortality. Hypoglycemia, or abnormally low blood glucose levels, is one of the most important complications of children with SAM [1]. Previous studies have shown that a large number of children with severe acute malnutrition (SAM) have hypoglycemia. For instance, Ashebir et al. natural article: Hypoglycemia among pediatric ward patients facing treatment challenges in public hospitals in East Gojjam Zone, Ethiopia [2]. Hypoglycemia is a key comorbidity of severe acute malnutrition (SAM), associated with increased mortality [3]. At very low blood glucose levels, the physiological response to treatment is blunted, and mortality is increased [4]. Therefore, hypoglycemia prevention and management are key to augmenting survival in children with SAM.

A cohort study by Girum et al. emphasized the importance of early detection and timely correction of hypoglycemia in nutrition stabilization centers. Their findings revealed considerable differences in treatment outcomes based on the effectiveness of glucose monitoring and intervention strategies [5]. Centers that promptly identified and managed hypoglycemia demonstrated better survival rates compared to those that lacked consistent monitoring protocols. This highlights the necessity of systematic glucose monitoring and early intervention for children with SAM. Furthermore, Kebede et al. identified multiple predictors of mortality in malnourished children, including hypoglycemia, reinforcing its role as a critical factor in patient outcomes [6].

Additional evidence from Wen et al. underscores the value of daily clinical assessments, including blood glucose testing, in predicting mortality risk among hospitalized children with SAM [7]. Their findings advocate for an integrated treatment approach, where routine glucose monitoring complements standard nutritional and medical management. Similarly, research conducted by Bandsma et al. examined the role of nutritional strategies in stabilizing children with SAM, suggesting that appropriate dietary interventions may mitigate the risks associated with hypoglycemia [8].

Managing children with SAM remains a complex clinical challenge due to the multifaceted nature of malnutrition and its associated complications [9]. Continued research by scholars such as Choudhury et al. and Abiyu et al. may contribute to refining life-saving interventions and improving clinical guidelines [10,11]. Additionally, enhancing healthcare provider training in recognizing and treating hypoglycemia could play a crucial role in reducing in-hospital mortality among these high-risk patients [12].

A well-established relationship exists between hypoglycemia and mortality in children with severe acute malnutrition [13,14]. Therefore, the implementation of rigorous monitoring protocols and evidence-based interventions is essential to improving treatment outcomes and survival rates in nutrition stabilization centers. Addressing these challenges remains a priority in the fight against childhood malnutrition and mortality. Ultimately, integrating the latest research findings into clinical policies and protocols can lead to better health outcomes for children suffering from SAM.

METHODOLOGY

This was a descriptive cross-sectional study conducted at the Department of Paediatrics, Chandka Medical College, SMBBMU Larkana. Participants aged between 6 months to 5 years sex with a history of severe acute malnutrition (SAM) for a minimum of 15 days. Participants were recruited by consecutive convenience sampling technique. Children were excluded if they had a history of asthma, meningitis, sepsis, tuberculosis, dengue, malaria, typhoid fever or urinary tract infection in the last month, major congenital malformations of the cardiovascular, central nervous or respiratory systems or dysmorphic features, chronic liver or kidney disease, HIV/AIDS or were on immunosuppressive therapy. Mid-upper arm circumference (MUAC) was used for diagnosing severe malnutrition measured at midpoint of the left arm with Shakir tape, MUAC of ≤ 11.5 cm being classed as severe malnutrition the red zone on the tape indicating severe malnutrition. Blood glucose level of ≤3·0 mmol/L (54 mg/dL) with glucometer was used for diagnosis of hypoglycemia, attempts were made to perform blood glucose level testing at least 2 hours after eating. In mildly conscious children with hypoglycemia, 50 ml of 10% sucrose solution or 10% glucose was given orally or via nasogastric tube. In lethargic, unconscious, or convulsing children, a 5 ml/kg intravenous (IV) bolus of sterile 10% glucose was given, followed by 50 ml of 10% glucose or sucrose via a nasogastric tube, with a second bolus administered if necessary. Children were monitored for in-hospital mortality, defined as death occurring within 14 days of admission. Data were entered and analyzed using SPSS version 26. Descriptive statistics were computed, with mean ± standard deviation (SD) reported for continuous variables (age, height, weight, MUAC, and duration of SAM), while categorical variables (gender, residential status, presence of hypoglycemia, and in-hospital mortality) were presented as frequencies and percentages. The Chi-square test was applied to assess the statistical difference at 5% level of significance, and a 95% confidence interval (CI) was used to ensure the reliability of the analysis.

RESULTS

A total of 117 patients were included in the study. The mean age of participants was 24.68 ± 13.75 months, 63 (53.8%) between 6–24 months, and 54 (46.2%) older than 24 months. The mean body mass index (BMI) was 22.85±6.74 kg/m²; 72 (61.5%) participants had a BMI of 12-24 kg/m² and 45 (38.5%) above 24 kg/m². Regarding gender, the participants included 64 (54.7%) men and 53 (45.3%) women. Most participants, 72 (61.5%), resided in urban areas, while 45 (38.5%) were from rural areas. With respect to maternal education, 41(35.0%) of the mothers were uneducated, 27(23.1%) had primary education, 24(20.5%) secondary educated and 25(21.4%) higher educated. As per family income, there were 91 (77.8%) of low-income families and 26 (22.2%) of middle-income families. (TABLE 1)

Compared with >24 months of age, participants aged 6–24 months were more likely to have hypoglycemia (78.3% vs. 47.9%, OR 3.92 95% CI: 1.34–11.43 P=0.009) There was a higher proportion of hypoglycemia among females (60.9%) as compared to males (39.1%) although it did not reach statistical significance (OR = 0.456, 95% CI: 0.17–1.15, P = 0.094).

Concerning BMI, hypoglycemia was more prevalent in those participants with BMI 12–24 kg/m2 (82.6% vs. 56.4% ; OR = 3.675 ; 95% KCI: 1.16–11.63,P = 0.016) than in those with BMI >24 kg/m2. We found no effect of residential status on hypoglycemia frequency, urban residents 69.6% vs. rural residents 30.4% (OR = 1.551, 95% CI: 0.58–4.12, P = 0.377).

On the other hand, family income did not show any significance either (81.6% versus 17.4% low-income versus middle income OR = 1.451, 95%CI: 0.44–4.72, P = 0.378). While comparing the mothers' educational status with hypoglycemia frequency, it was found that there was no statistically significant relationship between the two (P = 0.499). Still, the highest proportion of hypoglycemia was observed in mothers with no education (34.8%). (TABLE 2)

Of the 23 hypoglycemic patients, 14(60.9%) died, while the mortality rate of the non–hypoglycemic patients was 0% (P < 0.010). This is statistically highly significant (P = 0.000) In survivors, on the other hand, 9 (39.1%) were hypoglycemic, and 94 (100.0%) were non-hypoglycemic. (TABLE 3)

DISCUSSION

Hypoglycemia in children with severe acute malnutrition (SAM) is a common metabolic complication and an established risk factor for higher in-hospital mortality [15-19]. In this study, hypoglycemia was found in 19.65% of children and overall, 60.9% of all children with SAM admitted died during their hospital stay. Hypoglycemia was significantly associated with mortality (P = 0.000), which emphasizes the need for timely identification and intervention for glucose derangement in hungry children.

Our findings align with a previous study by Rai et al., which reported a hypoglycemia prevalence of 12.5% and an in-hospital mortality rate of 69.6% [22]. Similarly, research by Ali et al. found that 6.3% of children with SAM succumbed to complications, highlighting the significant burden of mortality in this population [21]. Another study by Rizwana et al. documented hypoglycemia in 42.19% of children with SAM, with an associated mortality rate of

64.85% [20]. The lower prevalence of hypoglycemia in our study (19.65%) compared to Rizwana et al. may be due to differences in study populations, nutritional rehabilitation protocols, and diagnostic methods. Altaf T, et al in his study found mortality in 20% cases [23].

The age-associated risk of hypoglycemia was also apparent from our study. Hypoglycemia was more frequent in infants and toddlers aged 6–24 months (78.3%) compared to those aged >24 months (21.8%) (P = 0.009). This may be in agreement with the results of Maduzia et al. that indicated young children are at the highest risk due to smaller glycogen stores and poor metabolic flexibility [1]. There were also gender differences observed, with hypoglycemia relatively more frequent in the female population (60.9%) than in the male population (39.1%) (p=0.094), but not significant. Choudhury et al. reported a similar lack of statistical significance in gender differences in hypoglycemia (i.e. not clinically significant) [11].

Body Mass Index (BMI) was another important factor in hypoglycemia risk. Our study showed that children with lower BMI (12–24 kg/m^2) were at significantly higher risk of hypoglycemia (82.6%) compared to those with BMI >24 kg/m^2 (17.4%) (P=0.016). This finding is in agreement with the work of Girum et al., who noted that severely wasted children had impaired metabolic responses, predisposing them to hypoglycemia [5].

The strong association between hypoglycemia and mortality (P = 0.000) in our study reinforces the findings of Kebede et al., who also reported a significant increase in mortality risk among hypoglycemic children [6]. This is likely due to the inability of severely malnourished children to maintain glucose homeostasis, leading to fatal complications such as seizures, lethargy, and coma. Infections, electrolyte disturbances, and multi-organ dysfunction further exacerbate the poor prognosis in hypoglycemic children with SAM [8].

Importantly, our study underscores the need for routine blood glucose monitoring in children with SAM. A study by Wen et al. demonstrated that daily blood glucose assessments significantly improved survival rates by allowing early intervention in hypoglycemic children [7]. Similarly, Bandsma et al. emphasized that nutritional strategies, such as modified therapeutic feeds, could mitigate the risk of hypoglycemia in SAM patients [8]. Despite these interventions, our study revealed that hypoglycemic children had persistently high mortality rates, suggesting that a multifaceted approach—beyond glucose correction—is necessary to improve survival.

While our findings contribute to the growing body of evidence on hypoglycemia and mortality in SAM, some limitations must be acknowledged. This was a single-center study, which may limit the generalizability of the results. Additionally, confounding factors such as infections, micronutrient deficiencies, and pre-existing metabolic disorders were not controlled for, potentially influencing outcomes. Future multi-center studies with larger sample sizes are needed to provide a more comprehensive understanding of hypoglycemia as a predictor of mortality in SAM.

CONCLUSION

This study highlights the strong association between hypoglycemia and in-hospital mortality in children with severe acute malnutrition (SAM). Risk was greater in younger and lower BMI children, suggesting the importance for early recognition and intervention. Providing routine blood glucose monitoring, appropriate treatment and total nutritional rehabilitation may lead to better survival rates. Mortality can be further decreased by strengthening hospital-based stabilization programs and training of hypoglycemia management of healthcare providers.

Table 1: Baseline Characteristics of Study Participants	
Variable	**Frequency (%)**
Age, Mean ± SD= 24.68 ± 13.75 Months	
6-24 Months	63 (53.8)
>24 Months	54 (46.2)
Body Mass Index, Mean ± SD= 22.85 ± 6.74 kg/m^2	
12-24 kg/m^2	72 (61.5)
>24 kg/m^2	45 (38.5)
Gender	
Male	64 (54.7)
Female	53 (45.3)
Residential Status	
Urban	72 (61.5)
Rural	45 (38.5)
Mother's Education	
No Education	41 (35.0)
Primary	27 (23.1)
Secondary	24 (20.5)
Higher	25 (21.4)
Family Income	
Low	91 (77.8)
Middle	26 (22.2)

Table 2: Frequency of Hypoglycemia among Patients					
Characteristics		**Hypoglycemia**		**OR 95% (C.I.)**	**P-Value**
		Yes (n=23)	**No** (n=94)		
Age (months)	**6 - 24** (n=63)	18 (78.3)	45 (47.9)	3.920 (1.34--11.43)	0.009
	>24 (n=54)	5 (21.7)	49 (52.1)		
Gender	**Male** (n=64)	9 (39.1)	55 (58.5)	0.456 (0.17--1.15)	0.094
	Female (n=53)	14 (60.9)	39 (41.5)		
BMI (kg/m^2)	**12 - 24** (n=72)	19 (82.6)	53 (56.4)	3.675 (1.16--11.63)	0.016
	>24 (n=45)	4 (17.4)	41 (43.6)		
Residential Status	**Urban** (n=72)	16 (69.6)	56 (59.6)	1.551 (0.58--4.12)	0.377
	Rural (n=45)	7 (30.4)	38 (40.4)		
Family Income	**Low** (n=91)	19 (82.6)	72 (76.6)	1.451 (0.44--4.72)	0.378
	Middle (n=26)	4 (17.4)	22 (23.4)		
Educational Status	**No Education** (n=41)	8 (34.8)	33 (35.1)	0.834 (0.56--1.23)	0.499
	Primary (n=27)	3 (13.0)	24 (25.5)		
	Secondary (n=24)	5 (21.7)	19 (20.2)		
	Higher (n=25)	7 (30.4)	18 (19.1)		

Table 3: Frequency of In-Hospital Mortality among Hypoglycemic patients			
Mortality	**Hypoglycemia**		**P-Value**
	Yes (n=23)	**No** (n=94)	
Yes (n=14)	14 (60.9)	0 (0.0)	0.000
No (n=103)	9 (39.1)	94 (100.0)	

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