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RISK AND FREQUENCY OF HYPOGLYCEMIA IN SEVERE ACUTE MALNUTRITION AMONG LOCAL POPULATION OF PAKISTAN

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Abstract:

Introduction: *Both hypo and hyperglycemia occur frequently in sick children and have been associated with increased risk of deaths in pediatrics units.* ***Objectives of the study:*** *The main objective of the study was to analyse the risk and frequency of hypoglycemia in severe acute malnutrition among local population of Pakistan.* ***Material and methods:*** *This cross-sectional study was conducted in Jinnah Hospital, Lahore during August 2019 to December 2019. This study was done with the permission of ethical committee of hospital. The data was collected from Pediatrics department of the hospital. The data was collected from those patients who visited the OPD of the hospital. All children having age range from 1 month—15 years were eligible for the study.* ***Results:*** *The data was collected from 200 patients. The mean age was 32.12±2.50 months. Of 200 children, 62.2% were severely ill, and 49.1% had at least one IMCI danger sign. A total of 15 had hypoglycemia, 99 low glycemia, 65 euglycemia and 21 hyperglycemia. Overall 149 (42.5%, 95% CI: 37.3–47.9) children presented with abnormal blood glucose. The distribution of blood glucose was skewed: median glycemia 5.2 mmol/L.* ***Conclusion:*** *It is concluded that Hypoglycemia and abnormal blood glucose are associated with a high risk of mortality for children. These results should encourage advocacy for improvements of local health facilities, especially pre-hospital care and management, which could impact the CFR.*

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INTRODUCTION:

Both hypo and hyperglycemia occur frequently in sick children and have been associated with increased risk of deaths in pediatrics units. Neonates and young children are particularly susceptible to hypoglycemia leading to the well-recognized long term sequelae especially with prolonged fasting[1]. While this dangerous problem is greatly recognized in western countries, reports have only started to emerge about neonatal hypoglycemia in developing countries[2].

Young children have a limited tolerance for fasting. Hypoglycemia in non-neonate children is independently associated with poor outcomes in the tropics[3]. It is a well recognized feature and predictor of death in severe malaria and was often aggravated by quinine treatment[4]. The iatrogenic hyperinsulinemia after quinine treatment is expected to progressively disappear with the switch to artesunate combination therapy to treat diseases[4-5]. The management of hypoglycemia remains one of the leading priorities to decrease the child-malaria fatality rate[6].

Malnutrition includes both under nutrition and over nutrition. Undernutrition is preventable cause of morbidity and mortality among children aged below five years. Moreover severe malnutrition is one of the reasons of hospital admissions in economically poor[7]. Diarrhea is the second most common life threatening condition worldwide among all infectious diseases in children younger than 5 years[8]. Diarrhea and malnutrition are inter-related. Hypoglycemia is usually associated with severe malnutrition and persistent diarrhea. Decreased stores of glycogen, increased peripheral utilization of glucose, and intestinal malabsorption have all been associated with hypoglycemia[9]. In children, hypoglycemia resulting from impaired glucogenesis is associated with mortality from infectious diarrhoea regardless of their nutritional status[10].

Theoretical background

Hypoglycemia is a biochemical symptom, which refers to the presence of an underlying cause. As glucose is the fundamental energy currency of the cell, disorders that affect its availability or its use can cause hypoglycemia. Glucose is a source of energy storage in the form of glycogen, fat, and protein and hypoglycemia is the most common metabolic problem among pediatric patients in the critical care medicine[11]. The lower limit of the accepted normal value of blood glucose level in newborn infants with associated illness especially in presence of hypoxemia and ischemia that already impairs the cerebral metabolism has not been determined[12].

Objectives of the study

The main objective of the study was:

- To analyse the risk and frequency of hypoglycemia in severe acute malnutrition among local population of Pakistan.

MATERIAL AND METHODS:

This cross-sectional study was conducted in Jinnah Hospital, Lahore during August 2019 to December 2019. This study was done with the permission of ethical committee of hospital.

Data collection

The data was collected from Pediatrics department of the hospital. The data was collected from those patients who visited the OPD of the hospital. All children having age range from 1 month—15 years were eligible for the study. Children with known diabetes, hemophilia or history of neonatal hypoglycemia were excluded from the study. Children diagnosed with hypoglycemia were treated with intravenous bolus administration of 5 ml/kg of 10% dextrose, followed by dextrose infusion. The treatment for their baseline disease was started as early as possible. Children warranting hospitalization were sent to the pediatric ward for further treatment according to hospital guidelines. Children were weighed with 100g precision and measured (length below 2 years, height above) with 1mm precision. Nutritional Z-scores were calculated for children under the age of 5 years, using WHO software for anthropometrical Z scores. Malnutrition was defined as moderate or severe if one of the Z-scores was below -2 or -3 SD, respectively.

Blood glucose level

0.6 µL of blood was collected by investigators through a finger prick to measure the blood glucose concentration. After every twenty-fifth measurement, a quality control by Accu-Chek® was performed. Blood glucose concentrations were recorded in mmol/L (conversion to mg⁄dl by multiplying by a factor of 18).

Statistical analysis

The data was collected and analysed using SPSS version 19.0 and Microsoft Excel (2007). All the values were expressed in mean and standard deviation.

RESULTS:

The data was collected from 200 patients. The mean age was 32.12±2.50 months. Of 200 children, 62.2% were severely ill, and 49.1% had at least one IMCI danger sign. A total of 15 had hypoglycemia, 99 low glycemia, 65 euglycemia and 21 hyperglycemia. Overall 149 (42.5%, 95% CI: 37.3–47.9) children presented with abnormal blood glucose. The distribution of blood glucose was skewed: median glycemia 5.2 mmol/L.

Children with hypoglycemia and hyperglycemia were younger than those with euglycemia.

Hypoglycemia tended to be associated with being a female (p = 0.07) and belonging to the poorest families (p = 0.01) with the highest debts (p = 0.002). Hypoglycemia was associated with longer fasting (p = 0.001) and fewer immunizations (p = 0.05).

Table 01: Analysis of characteristics associated with death for children

	Mortality				
	n	**(%)**	**Crude OR**	**95%CI**	**p**
Euglycemia	3/200	1.4	1 (Ref.)		
Hypoglycemia	10/15	66.6	132	29.0–596.5	<0.001
Low glycemia	6/99	6.0	4.2	1.1–15.6	0.02
Hyperglycemia	2/35	5.7	4	0–21.9	0.1
Abnormal blood glucose	18/149	12.1	9.0	2.7–29.3	<0.001
Socio-characteristics					
Male	5/138	3.6	1 (Ref.)	1	
Female	16/112	7.5	2.1	0.8–5.8	0.1
Aged ≥12 Months	14/146	5.7	1 (Ref.)		
Aged <12 Months	7/104	6.7	1.1	0.4–2.9	0.8
Some immunization	13/110	4.2	1 (Ref.)		
Never immunized	8/40	20.0	5.7	2.2–14.1	0.001
Urban residential area	5/125	4.0	1 (Ref.)		
Rural residential area	16/225	7.1	1.8	0.6–4.9	0.3
Not poor	2/136	1.5	1 (Ref.)		
Poor	19/214	8.9	6.5	1.7–23.8	0.004
Disease Characteristics					
Direct admission	18 /327	5.5	1 (Ref.)		
Referral	3/23	13.0	2.5	0.7–9.0	0.14
Illness ≥2 days	1/33	3.0	1 (Ref.)		
Illness <2 days	20/317	6.3	2.1	0.06–3.4	0.4
Fasting < 5 hrs	51/329	15.5	1 (Ref.)		
Fasting ≥5 hrs	10/21	47.6	4.9	2.0–12.0	<0.001
Severe dehydration	5/12	41.6	15.4	4.5–53.0	<0.001
No malnutrition	15/304	4.9	1 (Ref.)		
Severe malnutrition[a]	6/46	13.0	2.8	0.8–8.4	<0.03
No pneumonia	16/289	5.5	1 (Ref.)		
Severe pneumonia	5/61	8.2	1.5	0.5–4.3	0.4
No vomiting	11/202	5.4	1 (Ref.)		
Vomiting	10/148	6.7	1.2	0.5–3.0	0.6

DISCUSSION:

According to our results there is a high frequency of malnutrition and hypoglycemia in our local population of Pakistan. Malnutrition is a condition responsible for majority of all child deaths under the age of 5 years[13]. Diarrhea may be fatal when superimposed upon malnutrition. Huq et al was under five years of age, infants in a 16 study by Chisti et al, 6-months to 12 years in the study by Talbert et al and less than 15 years in the study by Bennish et al. The male to female ratio was equal in current study while in a study by Talbert et al 52% were male[14-16]. The children were having severe malnutrition in that study. The population in a study by Chisti et al and by Talbert et al were severely malnourished while in a study by Huq et al the population was both normal as well as malnourished children[17]. The children were suffering from diarrhea of less than 14 days duration in current study while other studies[18].

CONCLUSION:

It is concluded that Hypoglycemia and abnormal blood glucose are associated with a high risk of mortality for children. These results should encourage advocacy for improvements of local health facilities, especially pre-hospital care and management, which could impact the CFR. Emergency care at the district level could be improved with rapid tests for hypoglycemia.

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