Nutritional parameters and risk of mortality in critically ill children

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Purpose: Undernutrition is prevalent in critically ill children admitted to Pediatric Intensive Care Unit (PICU) and is associated with poor clinical outcomes, such as increased risk of mortality. The aim of this study was to determine the association of nutritional variables on admission and the risk of 60-days-mortality in critically ill children.

Methods: In a single-center prospective cohort study, we enrolled children aged 1 month to 15 years who were admitted for at least 48 hours to a tertiary PICU in a teaching hospital in the south of Brazil, The Pediatric Index of Mortality-2 (PIM-2) illness severity score, nutritional status, including serum albumin, and nutritional therapy (NT) variables were recorded. NT variables included time to initiate NT, route of delivery and enteral nutrition (EN) or parenteral nutrition (PN) prior PICU admission. Anthropometric parameters, weight, height, mid-upper arm circumference (MUAC) and triceps skinfold thickness (TSF) were measured within 72 hours of admission and their z-scores were calculated. The primary outcome was 60-days-mortality. Multivariate logistic regression was used to determine variables predictive of mortality. The results are expressed as median (interquartile range, IQR), odds ratio (OR) and 95% confidence interval (95% CI).

Results: A total of 199 critically ill children were enrolled, 63% male median age 23.1 months, with a 60-day mortality of 13.57%. Based on BMI z-score, 18% were undernourished at PICU admission. In the univariate analysis PIM2, BMI-for-age < -2 z-score, early NT (enteral or parental intake within 24 hrs of admission) and have received EN or PN before PICU admission were associated with 60-day mortality. In the multivariate model, BMI-for-age z-score, early nutrition therapy and PIM2 were associated with mortality (Table 1). Among the anthropometric parameters, weight-for-age, TSF-for-age and MUAC-for-age below -2 z-score were associated with an increase of the risk of 60-day mortality. Hypoalbuminemia was not associated with higher mortality (Table 2).

Conclusion: Undernutrition on admission, assessed by BMI, weight-for-age, MUAC and TSF were predictors of 60-day mortality in critically ill children in this study. In addition, early NT and PIM2 were associated with mortality in this population. Our results may guide the

development nutrition screening tools that predict outcomes in critically ill children. Anthropometrical parameters and NT variables are important variables for such a tool. Early nutrient delivery must be prioritized in this cohort.

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Table 1 – Logistic Regression of variables on admission associated with 60-days-mortality in critically ill children. (N=199)

	No. of death/N (%)	**Univariate analysis OR (95% CI)**	**P**	**Multivariate analysis OR (95% CI)**	**P**
Age			0.16		-
≥ 24 months	10/99 (10.1%)	Reference		-	
< 24 months	17/100 (17.0%)	1.82 (0.79, 4.21)		-	
PIM2 category			0.024		0.023
< 2%	6/76 (7.9%)	Reference		Reference	
2%-10%	7/62 (11.3%)	1.79 (0.54, 5.95)		1.53 (0.42, 5.53)	
≥ 10%	14/60 (23.3%)	4.20 (1.41, 12.46)		4.26 (1.38, 12.14)	
BMI-for-age			0.009		0.006
≥ -2 z-score	16/156 (10.3%)	Reference		Reference	
< -2 z-score	9/33 (27.3%)	3.40 (1.34, 8.60)		4.07 (1.51, 10.97)	
NT within 24 h	14/142 (9.9%)	0.39 (0.17, 0.90)		0.39 (0.16, 0.98)	0.044
Route of NT			0.42		-
Fasting	3/15 (20.0%)	Reference		-	
EN or EN+PN	18/155 (11.6%)	0.53 (0.14, 2.04)		-	
PN	5/26 (19.2%)	0.95 (0.19, 4.71)		-	
NT prior PICU admission	19/104 (18.3%)	2.43 (1.01, 5.85)	0.048		-
Hospital-acquired infection	18/144 (12.5%)	1.58 (0.66, 3.78)	0.31		-

CI: 95% confidence interval; BMI: body mass index ; PIM2: prognostic index of mortality; NT: nutrition therapy (Enteral or Parenteral Nutrition) ; EN: enteral nutrition; PN: parenteral nutrition; PICU: pediatric intensive care unit

Table 2 - Nutritional status on admission and risk of 60-days-mortality in critically ill children

	n/N (%)	Multivariate analysis OR (95% CI)	P
BMI-for-age			0.006
≥ -2 z-score	16/156 (10.3%)	Reference	
< -2 z-score	9/33 (27.3%)	4.07 (1.51, 10.97)	
Weight-for-age			0.007
≥ -2 z-score	11/119 (9.2%)	Reference	
< -2 z-score	11/40 (27.5%)	3.89 (1.45, 10.47)	
MUAC-for-age			<0.001
≥ -2 z-score	9/131 (6.9%)	Reference	
< -2 z-score	7/19 (36.8%)	10.59 (2.75, 40.75)	
TSF-for-age			0.003
≥ -2 z-score	9/106 (8.5%)	Reference	
< -2 z-score	4/14 (28.6%)	5.36 (1.18, 24.32)	
Albumin, g/dL			0.17
≥ 3.0 g/dL	10/101 (9.9%)	Reference	
< 3.0 g/dL	17/87 (19.5%)	1.88 (0.76, 4.66)	

CI: 95% confidence interval; BMI: body mass index; MUAC: mid-upper arm circumference; TSF: triceps skinfold thickness.

[a] Adjusted for variables: PIM2 (prognostic index of mortality) and nutrition therapy within 24 hours.