

## Assessment of Nutritional Status in Pediatric Patients Readmitted To an Pediatric Intensive Care Unit

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### Abstract:

**Background:** Malnutrition is common at hospital readmission and tends to worsen during hospitalization. As critical illness has a major impact on nutritional status of children it is imperative to be aware of the nutritional status of the children at readmission in order to direct the health care strategies towards the overall improvement of these little lives.

**Materials and Methods:** This is hospital based cross sectional study in cases readmitted to PICU. The study was carried out in 100 pediatrics readmitted subjects. Inclusion criteria for study participant's included age group between 1month to 12 years. Exclusion criteria for study included Less than 1month of age group. The first admission to PICU. Patients primarily admitted to ward and being shifted to PICU for acute deterioration

**Results:** Evaluation of the nutritional status of the subjects using W/A, W/H and H/A criteria revealed that a total of 38 % of the children were underweight, 30% were wasted and 32% were stunted.

**Conclusion:** The observation of this study reveals that there is a co-existence of undernutrition in greater percentages among readmitted critically ill children, posing a serious challenge to their care and clinical prognosis. Our study provides need for quality nutrition support administration to readmitted critically ill pediatrics population and thereby improve the overall clinical outcome.

**Key Word:** Pediatric Intensive Care Unit, Readmission

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### I. Introduction

"Pediatrics is concerned with the health of infants, children and adolescents, their growth and development and their opportunity to achieve full potential as adults". In general, little is known about the nutritional status of critically ill children during hospitalization and after discharge from ICUs. Studies conducted more than 20 years ago had already demonstrated that 15-20% of children readmitted to pediatric intensive care units were acutely or chronically malnourished. Hospital malnutrition constitutes an important risk factor for increases in morbidity, lethality, length of hospital stay and medical costs. Critical illness has a major impact on the nutritional status of both children and adults. The nutritional requirement of children becomes very high when they are confronted with any illness resulting in deterioration of their 26 nutritional status leading to severe malnutrition. The situation frequently confronted in the critically ill is not simply that nutrient supply is less than nutrient demand as in starvation. Critically ill patients have a state of hypermetabolism initiated by a variety of causes such as shock, sepsis, thermal injury and trauma. This hypermetabolism is secondary to a number of events initiated in large part by the same mediators seen in the Systemic Inflammatory Response Syndrome (SIRS). The profound and stereotypic metabolic response to critical illness and failure to provide optimal nutrition support therapy during the intensive care unit (ICU) stay are the principal factors contributing to malnutrition in this cohort. The metabolic response to stress, injury, surgery, or inflammation cannot be accurately predicted and the metabolic alterations may change during the course of illness. Although nutrition support therapy cannot reverse or prevent this response, failure to provide optimal nutrients during this stage will result in exaggeration of existing nutrient deficiencies and in

malnutrition, which may affect clinical outcomes. For the prevention and treatment of malnutrition among children, screening for malnutrition should be an integral part of pediatrics care universally. Nutritional assessment should be one of the main aspects of the pediatric intensive care patient and the most important tool to avoid hospital undernutrition. The objective of nutritional assessment should be to identify those patients at risk for complications and create treatment options aimed at decreasing morbidity and mortality. \_\_\_Appropriate nutritional status “ and \_\_\_malnutrition“ are difficult to define and assess because of inappropriate assessment tools and the challenges of separating the impact of malnutrition and the disease state on markers of malnutrition and on outcome. While various nutritional assessment techniques exist, there are still not many gold standards offering high sensitivity and specificity for nutritional assessment in the pediatrics intensive care unit. In fact, the ideal nutritional assessment tool has not been defined, possibly due to complexity and variability in body composition associated with the individual response to illness and stress. Nutrition assessment of children during the course of critical illness is desirable. There is correlation between energy deficits and deterioration in anthropometric parameters such as mid-arm circumference and weight in a mixed population of critically ill children. These anthropometric abnormalities accrued during the PICU readmission returned to normal by six. Using reproducible anthropometric measures, 65% prevalence of malnutrition on readmission with increased mortality in this group. On follow up, a significant portion of these children had further deterioration in nutrition status. Routine monitoring of weight is a valuable index of nutrition status in critically ill children. However, weight changes and other anthropometric measurements during the PICU readmission should be interpreted in the context of fluid therapy, other causes of volume overload and diuresis. Nutrition assessment can also be achieved by measuring the nitrogen balance and resting energy expenditure (REE).

## **II. Material And Methods**

This was a hospital based cross sectional study conducted in a tertiary care referral center involving pediatric patients aged 1 month to 12 years readmitted to PICU after being stabilized & discharged home from the PICU. The protocol of this study was approved by the Institutional Ethical committee of the medical college. Written informed consent was taken from guardian/parents of all study subjects before collection of data, and they were informed about complete right to withdraw from the study at any time without disadvantage. In case any parent who was not literate verbal consent was obtained after reading out the consent form to him and his verbal agreement was recorded by the interviewer in front of a witness.

**Study Design:** cross sectional observational study.

**Study Location:** This was a tertiary care teaching hospital based study done in Department of Pediatrics, at B. J. Govt. Medical College & Sassoon General Hospital, Pune.

**Study Duration:** December 2019 to June 2021

**Sample size:** 100 patients.

**Sample size calculation:** The sample size was estimated on the basis of a simple random sampling. Considering readmission rate of 9.8, with 90% confidence interval, sample size came out to be 96 but for convenience of calculations, we have decided to round up the figure to 100.

**Subjects & selection method:** The study was conducted on nutritional assessment of pediatrics patients who was getting repeatedly readmitted to pediatrics intensive care unit to B. J. Govt. Medical College & Sassoon General Hospital with complex chronic condition, acute on chronic infection, cerebral palsy patients studied from December 2019 to June 2021.

### **Inclusion criteria:**

1. Children between 1month to 12years of age getting readmitted directly to the PICU after stabilized and discharged from the hospital in previous admission, as per level 3 and level 2 guidelines mentioned below
2. All previous admissions of the child should be in the same PICU of the study site.  
(Multiple ICU readmission to same hospital were included in this analysis)
- 3) Subjects with PICU length of stay 72 hours or longer
- 4) Subjects who are on Oral nutrition support and Oro/nasoenteric feeding

**Exclusion criteria:** Children who were

- 1) Less than 1month of age group
- 2) The first admission to PICU. (Index PICU admission)
- 3) Patients primarily admitted to ward and being shifted to PICU for acute deterioration

4) Had a planned readmission.

**Procedure methodology**

Nutritional assessment is important in children because undernutrition is the single most important cause of growth retardation. Severe malnutrition during critical illness can result in suboptimal organ growth or function. All the children should receive nutrition assessment within one to five days of pediatrics intensive care readmission. Nutrition screening, unlike assessment, identifies children who at risk for malnutrition or already malnourished. Nutritional assessment of the subjects was done using the universally accepted ABCD method i.e. Anthropometric measurements, Biochemical data, Clinical Evaluation and Dietary information upon admission to the pediatrics intensive care unit. Anthropometric measurement deals with the measurement of size, shape, weight and proportions of human body. In our study, anthropometric measurements such as height, body weight and weight for Height Waterloos Classification

**Body Weight:** It is the most frequently used and important anthropometric measurement. Body weight recording is essential for assessing the growth of the child and his/her nutritional status, important for planning the diet, for follow up of the child especially while recuperating from an illness or during nutritional rehabilitation

Table 3.2 (a): IAP Classification

IAP Classification	Weight for age%
Normal	>80
First degree PEM	71-80
Second degree PEM	61-70
Third degree PEM	51-60
Fourth degree PEM	<50

**WATERLOW CLASSIFICATION FOR WEIGHT/HIGHT**

Normal	>90
First degree PEM	80-90
Second degree PEM	70-80
Third degree PEM	>70

**Mid**

Waterloos Classification	Height for age (% of expected)
Normal	>95
Mild stunting	90-95
Moderate stunting	85-90
Severe stunting	<85

**Arm**

**Circumference (MAC):** It is a simple, cheap and easy method of detecting somatic protein and fat stores and to identify —at risk children. Mid arm circumference is constant between 1-5 years of age

Table 3.5: Mid Arm Circumference Interpretation

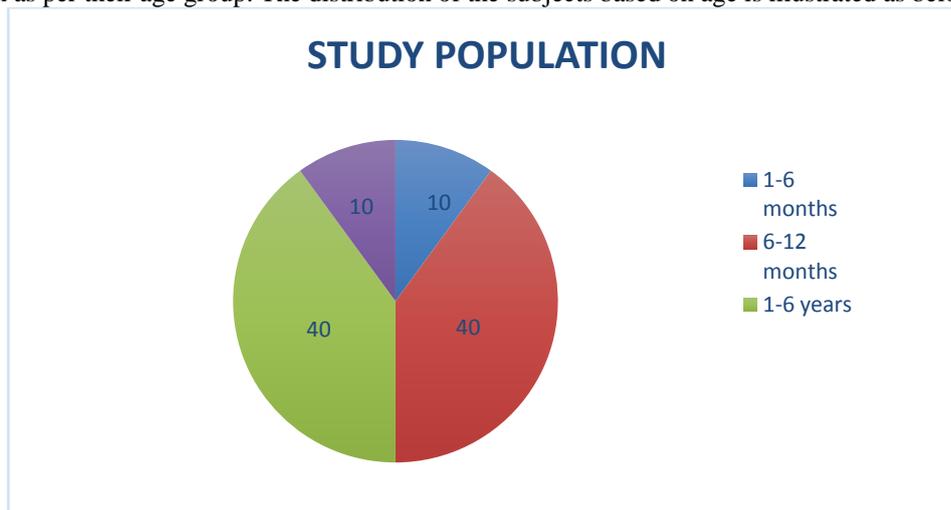
**STATISTICAL ANALYSIS:**

statistical analysis was done on IBM SPSS STATISTICS VERSION 20. Categorical variables were taken in form of frequencies and proportion and cross tabulation were done for chosen parameter and column proportion were compared with chi square test. Distribution was represented by pie charts or bar graphs.

**III. Result**

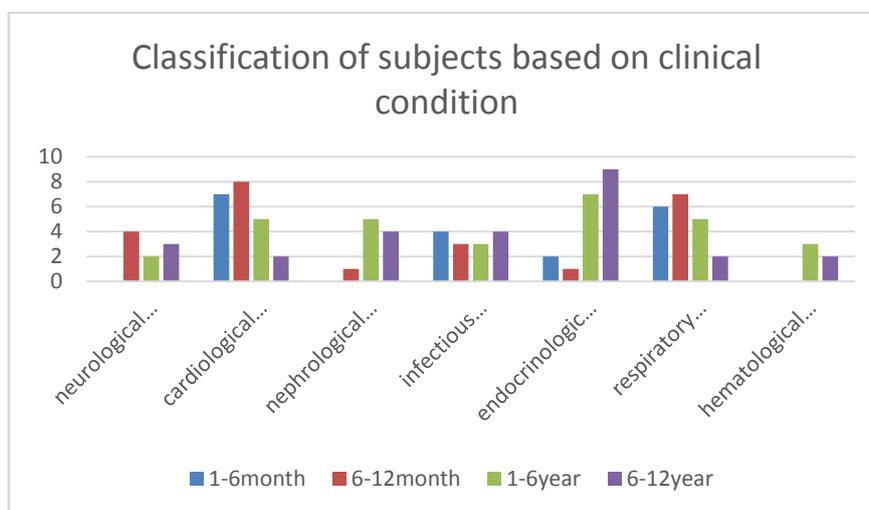
A total of 100 subjects aged one month to 12 years who were readmitted to the Pediatrics Intensive Care Unit (PICU) of Sassoon tertiary care hospital, Pune were initially enrolled in the study. Nutritional

assessment was performed in the patient enrolled in study. Pediatrics comprises of different age groups and each age group has distinct requirements. Hence majority of the analysis in this study have been done and interpreted for children as per their age group. The distribution of the subjects based on age is illustrated as below :



#### CLASSIFICATION OF SUBJECTS BASED ON CLINICAL CONDITION

pediatrics Intensive care unit of any hospital is an area, where patients with different diagnosis are admitted and treated on a routine basis. pediatrics critical care services support children admitted with life-threatening medical conditions. The subjects under this study also were found to be admitted with various complications.



#### NUTRITIONAL STATUS

Malnutrition is a major problem in pediatric intensive care units therefore nutritional assessment has become an essential component of the 100 hospitalized patients, to understand the pre-existing and prognostic nutritional status of critically ill children. Nutrition assessment is a detailed evaluation and interpretation of multiple parameters and seeks to define the risk of developing nutrition-related medical complications

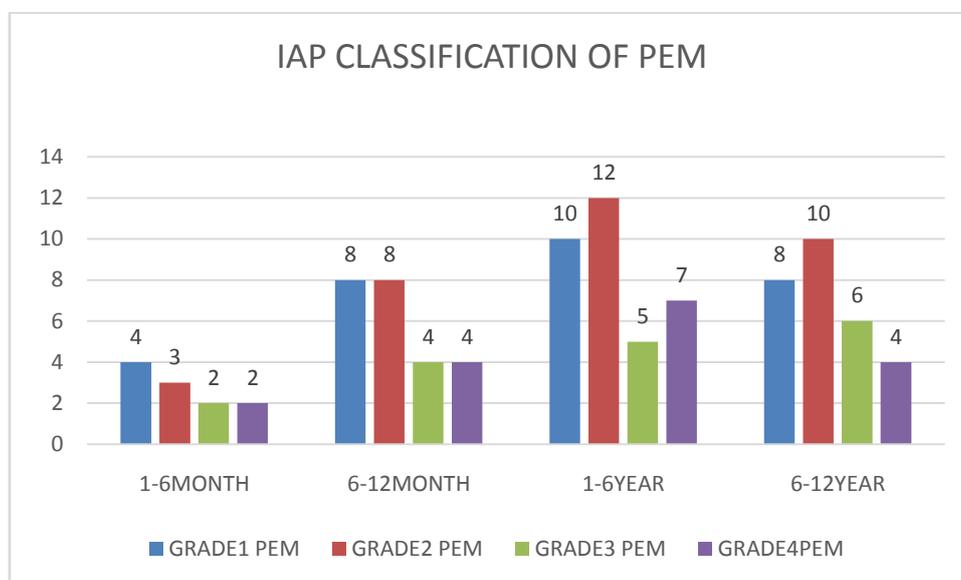
In our study, nutritional status of subjects was evaluated upon admission to the pediatric intensive care unit using various anthropometric parameters such as height, body weight, Mid Arm Circumference.

The assessed body weight was compared with the expected weight using reference standards and was interpreted in comparison with IAP Classification for weight for age and Waterloo's classification for weight for height to understand the extent of malnutrition or adequacy of nutritional status. Similarly, the assessed height was compared with the expected height using reference standards and was interpreted with Waterloo's classification for height for age.

#### IAP CLASSIFICATION

It was proposed by Indian Academy of pediatrics in 1972. It is an accepted classification and it is being widely used for clinical studies. It has four grades of PEM. The scientific reason why PEM is further classified into grade III and IV is not clearly explained, it may to highlight that severe PEM exists.

In this study, among subjects in all three age groups, around 40-60 percent, of subjects in each age group were in any one of the three stages of undernutrition. Most of them had either Grade I or Grade II PEM. However, in 100 children 30 percent, were underweight and only 35 percent, were undernourished of which Grade I PEM was predominant. Acute malnutrition prevalent in our study population is worth attention.



OVERALL NUTRITIONAL STATUS ACCORDING TO „z“ SCORES OF W/A, W/H, H/A

Overall evaluation of the nutritional status of the subjects using *z* scores of W/A, W/H and H/A criteria was done to determine the prevalence of acute and chronic malnutrition.

Nutritional Status	W/A (n-100) n (%)	W/H (n-100) n (%)	H/A (n-100) n (%)
<-3SD (Severe)	20	18	16
<-2SD to >-3SD (Moderate)	14	8	11
- 2SD to + 2SD (Normal)	4	4	5

Overall, evaluation of W/H values revealed a nutritional disturbance (wasting) in 30 (30%) cases, of which severe wasting was observed in 18 percent of the subjects. W/A (according to IAP) analysis showed changes in nutritional status (underweight) in 38(38%) cases, of which 20 percent of the subjects were severely underweight. The calculation of H/A analysis showed lower height (stunting) in 32 (32%) cases of which over 16% of them were severely stunted. Current studies have shown that when a chronically malnourished child with any illness is readmitted to a PICU, its nutritional status may further deteriorate if adequate nutritional support is not provided and this in turn is associated with increased mortality and morbidity, including a higher risk of infections due to poor immune defense, wound healing problems, reduced gut function, longer dependency on mechanical ventilation and longer hospital stay. The remarkable findings on the high prevalence of undernutrition in our study, emphasis that nutritional assessment measurement should be performed as early as in the acute phase of critical illness so that appropriate and optimal nutrition support can be provided to this subset of population.

**IV. Conclusion**

In conclusion, the results of the current study provide multiple evidences for importance of nutrition assessment to readmitted child in pediatrics ICU which support administration nutrition to the critically ill pediatric population across the healthcare system. Based on the observations of the study, an institution specific nutrition assessment protocol was developed, including published guidelines considered as the best practices that would help in early initiation, progression and transition of nutrition support and thereby improve the overall clinical outcome of the critically ill pediatric children.

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