



Review Article

## Feeding of hospitalised children, how important is it?

Vinod H. Ratageri<sup>1</sup>, Shilpa C<sup>1</sup>

<sup>1</sup>Department of Pediatrics, Karnataka Institute of Medical Sciences, Hubli, Karnataka, India.

**\*Corresponding author:**

Vinod H. Ratageri,  
Department of Pediatrics,  
Karnataka Institute of Medical  
Sciences, Hubli, Karnataka,  
India.

ratageri@rediffmail.com

Received: 24 September 2022

Accepted: 09 June 2023

Published: 17 August 2023

**DOI**

10.25259/KPJ\_22\_2022

**Quick Response Code:**



### ABSTRACT

Malnutrition among hospitalised children, although an under-recognised entity has a vital impact on patient outcomes. In Paediatric Intensive Care Units, malnutrition is often not recognised and not treated properly, which may lead to bad outcomes. A detailed history and clinical examination alone is inadequate for accurate evaluation of malnutrition and an accurate anthropometric assessment is essential. A combination of poor food intake and the severity of disease are good predictors of poor nutrition status in children and fundamental corrective steps with this regard will aid in early recovery. Hence, feeding of hospitalised children should be considered a priority as a part of critical care. Two types of nutritional support are practiced (i) enteral nutrition (EN) and (ii) parenteral nutrition. Early EN is preferred because of many advantages such as earlier gut function, lesser infections, low cost, and short duration of hospital stay. This article aims to provide an outline for assessing nutrition and providing nutritional support in hospitalised children.

**Keywords:** Malnutrition, Enteral feeding, Parenteral, Critically ill child, Hospitalised children

### INTRODUCTION

Malnutrition among hospitalised children and its impact on patient outcomes, although reported for many years, are still under-recognised entities. Its prevalence is reported to range from 20% to 50%.<sup>[1-5]</sup> This is associated with increased morbidity, mortality and increased length of hospital stay thus making this an important health and economic issue.<sup>[1,6-9]</sup>

Many factors contribute to the development of malnutrition such as increased requirements, nutrient malabsorption, metabolic dysregulation, and decreased energy intake,<sup>[10]</sup> decreased food intake being the major contributor to malnutrition among hospitalised children.<sup>[6,7]</sup> In this article will discuss (i) various tools for assessing nutrition, (ii) risk factors for weight loss, (iii) types of nutritional support, particularly in detail about enteral feeding, and (iv) briefly on the impact of breastfeeding in hospitalised children.

### TOOLS FOR ASSESSING NUTRITION

Anthropometric parameters have been a set standard in the diagnosis of malnutrition<sup>[11,12]</sup> In several countries, nutritional risk screening tools have been described and validated.<sup>[13,14]</sup> The American Society for Parenteral and Enteral Nutrition and the European Society of Pediatric Gastroenterology, Hepatology, and Nutrition have recommended screening for undernutrition in hospitalised children<sup>[11]</sup> However, this is not a routine practice in many hospitals.

A tool that can reliably and quickly triage children based on their nutritional status and help identify the high risk group that will need a more detailed assessment is considered as an ideal

screening instrument. Further demonstration of such intervention in the improvement of clinical outcomes and well-being in the patient would lead to the acceptability of such a tool.

The risk of malnutrition in hospitalised children is assessed by different tools. Among these, two are widely accepted, these are (i) Screening Tool for Risk ON Nutritional Status and Growth (STRONG kids) proposed by Hulst *et al.*,<sup>[15]</sup> and (ii) Screening Tool for the Assessment of Malnutrition in Pediatrics (STAMP) developed by McCarthy *et al.*<sup>[16]</sup> However, there is no consensus on the best screening method or the scales to detect/or establish malnutrition in children.

The STAMP showed high sensitivity and reasonable specificity whereas STRONG kids, showed high sensitivity, low specificity, good inter and intra-observer agreement, and also user friendly.<sup>[18]</sup>

## RISK FACTORS FOR WEIGHT LOSS DURING HOSPITAL STAY

Sermet-Gaudelus *et al.*, in their correlational analysis of a large paediatric population, discovered that a combination of poor food intake, pain, and severity of disease are good predictors of poor nutrition status in hospitalised children.<sup>[6]</sup> Other risks include ongoing illness, pre-existing undernutrition, catabolic stress, metabolic dysregulation, increased nutrient requirements, and malabsorption.

## TYPES OF NUTRITIONAL SUPPORT

Nutritional support can be supplemented either by enteral or parenteral route. In enteral nutrition, EN, feeding is supplemented through the oro-gastric route. This includes either normal oral feed or through a tube. In parenteral nutrition (PN), food is delivered through an intravenous route. It has been found in many studies that EN is preferred over PN because it leads to earlier gut function, fewer infections, lower cost, and shorter hospital stay. In addition, EN avoids abnormal physiological changes in the gut that occurs due to the intravenous (PN) route. PN is indicated when there is a gastrointestinal dysfunction which in turn prevents adequate nutrition absorption.<sup>[17]</sup> [Table 1] shows indications for EN.

## METHODS OF ENTERAL FEEDING

Recent advances in feeding techniques have enhanced survival chances and decreased morbidity and mortality of children, especially in those children with intestinal pathology. The advantages of trophic feeding are well known. EN helps in maintaining traditional gut flora and immunity. However, the widespread use of formula feeding has

**Table 1:** Indications for enteral nutrition.

1. Reduced oral intake for example, chronic infections, malabsorption, anorexia, malignancy or increased needs for example, congenital heart disease, bronchopulmonary dysplasia, chronic kidney disease, etc.
2. Oral motor disorders for example, prematurity/neurologic/or neuromuscular disease
3. Gastrointestinal tract anomalies for example, oesophageal stenosis/intestinal pseudo-obstruction
4. Injury/critical illness for example, burns/trauma
5. Sepsis/surgery/critical illness

EN: Enteral nutrition

**Table 2:** Complications of enteral nutrition.

- Gastrointestinal
  - i. Nausea/vomiting
  - ii. Aspiration
  - iii. Constipation
  - iv. Fullness/distention
- Metabolic
  - i. Dehydration/Overhydration
  - ii. Hypokalaemia/Hypophosphatemia
  - iii. Hyperkalaemia
  - iv. Acidosis
  - v. Renal insufficiency
- Pressure effects
  - i. Mechanical Pyloric stenosis
  - ii. Improper anchoring of tube/pressure
  - iii. Tube blockage
  - iv. Perforation
  - v. Dislodgement of tube or button
- Skin Erythema/Irritation
- Infection/Dental caries

disturbed and substituted many liquid infant and children's feedings completely.<sup>[18]</sup>

When oral feeding is not attainable or is insufficient, tube feeding (TF) is the method of choice because of its additional benefit. The main indication for TF is the non-functioning gastrointestinal tract, for example, GI obstruction or severe enteral ischemia. Conditions like for example, enteral fistulae once considered as a contraindication for TF are now no longer contraindicated.<sup>[19]</sup>

## CHOICE OF ENTERAL ACCESS FOR TF

Once the choice to initiate enteral feeding is made, the next important step is to decide the type of enteral feed. The choice of enteral feed depends on the following various factors;

- i. The child's anatomy and physiology of the gastrointestinal tract (GIT)

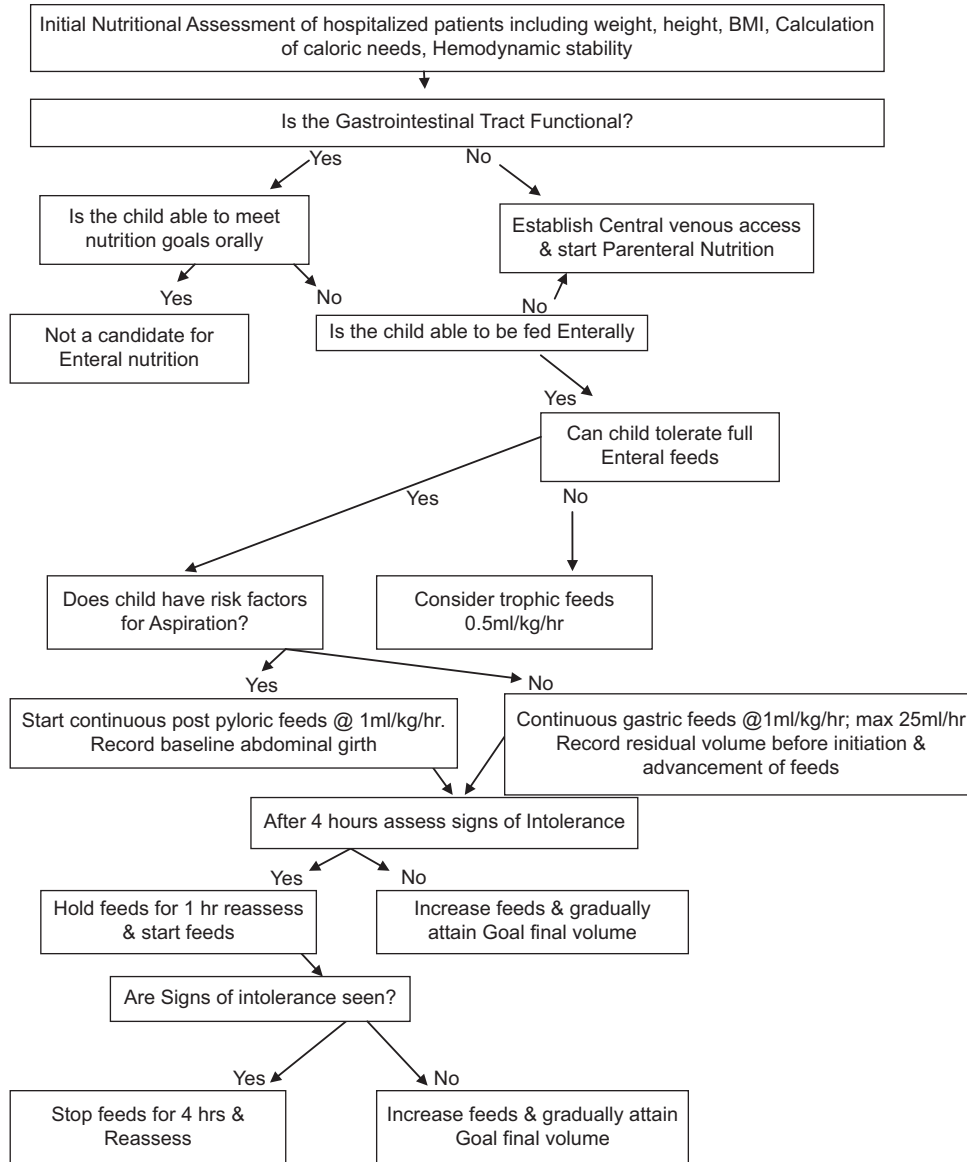


Figure 1: Flow chart for enteral nutrition in critically ill children.

- ii. Indication for feeding
- iii. Duration of feeding
- iv. Risk of aspiration.

Orogastric (OG) feeding: This is a preferred method in pre-term infants as these pre-term infants are obligate nose breathers (as it avoids nose obstruction). This is the method of choice in babies with normal gut function, low risk for aspiration, and who need short-term nutrition support. Gastrostomy (G-tubes) tubes are used in children who require prolonged intragastric feeding beyond 3 months. G-tubes are placed either surgically or by endoscopy. There are many devices for feeding through gastrostomies. Among them, the most accepted is a low-profile gastrostomy replacement device. A plan should be made to replace the device after

6 weeks as complete healing of the gastrostomy tract takes approximately 6 weeks.

### SITE OF ENTERAL FEEDING: PRE-PYLORIC VERSUS POST-PYLORIC FEEDING

A comparison of the pre-pyloric and post-pyloric feeding techniques reveals that pre-pyloric feeding is more physiologic as this method allows a more normal digestive process. This will be well tolerated provided the stomach is anatomically and physiologically normal. Post-pyloric is defined if feeding is beyond pylorus (Duodenum or Jejunum). The different ways of post-pyloric feeding include nasoduodenal, gastrojejunal, or surgical jejunostomy. Following are the indications for post-pyloric feeding:

(i) Intolerance to gastric feeding, (ii) recurrent emesis, (iii) severe gastroesophageal reflux disease, and (iv) in those with risk for aspiration.<sup>[20,21]</sup>

## TYPES OF ENTERAL FEEDING: CONTINUOUS FEEDING VERSUS BOLUS

TF can be given as continuous feeds or intermittent boluses. Usually, a combination of continuous feeds at night and bolus during the day works better in ambulatory patients. While bolus feeds simulate GIT physiologically, continuous feedings reduce the incidence of emesis.<sup>[22]</sup>

## MONITORING

It is well known that strict monitoring is essential while administering PN, likewise, long-term EN also requires stringent follow-up and monitoring which includes

- i. Clinical examination including assessment of hydration
- ii. Anthropometry,
- iii. Total intake and output chart and
- iv. Laboratory investigations to rule out electrolyte, metabolic derangements, and nutrient deficiencies.

## COMPLICATIONS OF ENTERAL FEEDING

Only a few minor complications were observed in EN [Table 2].

## FEEDING IN CRITICALLY ILL CHILD

Studies reveal a positive correlation between nutritional support during critical illness and patient outcomes. There will be increased metabolic demand and altered nutritional requirements in children with serious illnesses due to increased stress. Nutrition can be delivered to critically ill children through the parenteral route (patients with diminished gastrointestinal function) or enteral route.<sup>[23]</sup>

Enteral feed is the preferred method. The advantages of the enteral route are Cost-effectiveness, lower complication rates, and improved outcomes. Immunonutrition and immunomodulation are upcoming areas in paediatric enteral nutrition. They have some role in protecting gastrointestinal mucosal structure and function. This in turn helps in improved circulating pro-inflammatory markers and decreased bacterial translocation.<sup>[24]</sup> [Figure 1] shows the practical approach to nutritional support in paediatric intensive care unit.

## IMPACT OF BREASTFEEDING IN HOSPITALISED CHILDREN

Many prospective studies have revealed a statistically significant association between breastfeeding and lesser

hospitalisation. An association between breastfeeding and mortality in hospitalised children for diarrhoea revealed a decreased mortality, fewer hospitalisations for neonatal fever, fewer investigations, and less invasive therapy and its complications. Studies have revealed that exclusive and prolonged breastfeeding protects against severe morbidity and would result in lower rates of hospitalisations due to respiratory and diarrhoeal diseases. Breastfeeding is the safest way to feed a baby during an emergency and provides the nutrients the babies need. Breast milk contains antibodies and other immunological factors that can help protect infants from illness. It will ensure adequate hydration as well. Increasing awareness of mothers about breastfeeding benefits children, mothers, and society at large.<sup>[25-30]</sup>

## CONCLUSION

- Although malnutrition among hospitalised children is an under-recognised entity, it has a vital impact on the final clinical outcome
- Malnutrition cannot be assessed solely on clinical parameters and anthropometry is always crucial
- Malnutrition is often missed in critically ill children which may lead to adverse outcomes
- The most important factors for nutritional depletion in at-risk patients are a combination severity of the disease, poor food intake, and associated pain
- Two types of nutritional support are known as enteral and parenteral. EN is always preferred over other methods of nutrition because it results in lesser infection rates, less cost, short duration of hospital stay, and earlier gut function
- TF is the preferred choice in cases where there is difficulty in oral feeding or feeding is inadequate. Either OG or nasogastric feeding can be used. OG feeding is used most commonly in preterm infants
- In comparison with post-pyloric feeding pre-pyloric feeding is considered more physiologic
- A combination of bolus and continuous feeding is preferred
- No major complications were noted by following the right approach to enteral feeding in hospitalised children
- Not only patients on PN but patients receiving long-term EN also require follow-up and monitoring
- The importance of exclusive breastfeeding and continued breastfeeding in hemodynamically stable hospitalised children has to be reemphasised time and again.

## Declaration of patient consent

Patient's consent not required as there are no patients in this study.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

Dr. Vinod Ratageri is the Managing Editor of the journal.

**REFERENCES**

- Secker DJ, Jeejeebhoy KN. Subjective Global Nutritional Assessment for children. *Am J Clin Nutr* 2007;85:1083-9.
- Marginean O, Pitea AM, Voidazn S, Marginean C. Prevalence and assessment of malnutrition risk among hospitalized children in Romania. *J Health Popul Nutr* 2014;32:97-102.
- Joosten KF, Zwart H, Hop WC, Hulst JM. National malnutrition screening days in hospitalised children in the Netherlands. *Arch Dis Child* 2010;95:141-5.
- Pawellek I, Dokoupil K, Koletzko B. Prevalence of malnutrition in paediatric hospital patients. *Clin Nutr* 2008;27:72-6.
- Rocha GA, Rocha EJ, Martins CV. The effects of hospitalization on the nutritional status of children. *J Pediatr (Rio J)* 2006;82:70-4.
- Sermet-Gaudelus I, Poisson-Salomon AS, Colomb V, Brusset MC, Mosser F, Berrier F, *et al.* Simple pediatric nutritional risk score to identify children at risk of malnutrition. *Am J Clin Nutr* 2000;72:64-70.
- Campanozzi A, Russo M, Catucci A, Rutigliano I, Canestrino G, Giardino I, *et al.* Hospital-acquired malnutrition in children with mild clinical conditions. *Nutrition* 2009;25:540-7.
- Mezoff A, Gamm L, Konek S, Beal K, Hitch D. Validation of a nutritional screen in children with respiratory syncytial virus admitted to an intensive care complex. *Pediatrics* 1996;97:543-6.
- Einloft PR, Garcia PC, Piva JB, Bruno F, Kipper DJ, Fiori RM. A sixteen-year epidemiological profile of a pediatric intensive care unit, Brazil. *Rev Saude Publica* 2002;36:728-33.
- Mehta NM, Skillman HE, Irving SY, Coss-Bu JA, Vermilyea S, Farrington EA, *et al.* Guidelines for the provision and assessment of nutrition support therapy in the pediatric critically ill patient: Society of Critical Care Medicine and American Society for Parenteral and Enteral Nutrition. *JPEN J Parenter Enteral Nutr* 2017;41:706-42.
- Mehta NM, Corkins MR, Lyman B, Malone A, Goday PS, Carney L, *et al.* Defining pediatric malnutrition. *J Parenter Enteral Nutr* 2013;37:460-81.
- Waterlow JC. Classification and definition of protein-calorie malnutrition. *BMJ* 1972;3:566-9.
- De Longueville C, Robert M, Debande M, Podlubnai S, Defourny S, Namane SA, *et al.* Evaluation of nutritional care of hospitalized children in a tertiary pediatric hospital. *Clin Nutr ESPEN* 2018;25:157-62.
- Teixeira AF, Viana KD. Nutritional screening in hospitalized pediatric patients: A systematic review. *J Pediatr (Rio J)* 2016;92:343-52.
- Hulst JM, Zwart H, Hop WC, Joosten KF. Dutch national survey to test the STRONGkids nutritional risk screening tool in hospitalized children. *Clin Nutr* 2010;29:106-11.
- McCarthy H, Dixon M, Crabtree I, Eaton-Evans M, McNulty H. The development and evaluation of the Screening Tool for the Assessment of Malnutrition in Paediatrics (STAMP©) for use by healthcare staff. *J Hum Nutr Diet* 2012;25:311-8.
- Carter LE, Klatchuk N, Sherman K, Thomsen P, Mazurak VC, Brunetwood MK. Barriers to oral food intake for children admitted to hospital. *Can J Diet Pract Res* 2019;80:195-9.
- Serrano MS, Mannick EE. Consultation with the specialist: Enteral nutrition. *Pediatr Rev* 2003;24:417-23.
- Singhal S, Baker SS, Bojczuk GA, Baker RD. Tube feeding in children. *Pediatr Rev* 2017;38:23-34.
- Metheny NA, Stewart BJ, McClave SA. Relationship between feeding tube site and respiratory outcomes. *J Parenter Enteral Nutr* 2011;35:346-55.
- Lewis SJ, Egger M, Sylvester PA, Thomas S. Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: Systematic review and meta-analysis of controlled trials. *BMJ* 2001;323:773-6.
- Joe A, Anton N, Lequier L, Vandermeer B, Tjosvold L, Larsen B, *et al.* Nutritional support for critically ill children. *Cochrane Database Syst Rev* 2016;2016:CD005144.
- Gómez IJ, González CB, Palacio PA, Santis ET, Bayona JD, Hernández JP, *et al.* Nutritional support of the critically ill pediatric patient: Foundations and controversies. *Clin Med Insights Trauma Intensive Med* 2017;8:1179560317701108.
- Brown AM, Carpenter D, Keller G, Morgan S, Irving SY. Enteral nutrition in the PICU: Current status and ongoing challenges. *J Pediatr Intensive Care* 2015;4:111-20.
- Sachdev HP, Kumar S, Singh KK, Puri RK. Does breastfeeding influence mortality in children hospitalized with diarrhoea? *J Trop Pediatr* 1991;37:275-9.
- Asl MG, Sogheh RF, Ghavi A, Shear bafi MA. Related factors to continued breastfeeding in infants. *J Holist Nurs Midwifery* 2014;24:1-8.
- Netzer-Tomkins H, Rubin L, Ephros M. Breastfeeding is associated with decreased hospitalization for neonatal fever. *Breastfeed Med* 2016;11:218-21.
- Talayero JM, Lizán-García M, Puime A, Muncharaz MJ, Soto BB, Sánchez-Palomares M, *et al.* Full breastfeeding and hospitalization as a result of infections in the first year of life. *Pediatrics* 2006;118:e92-9.
- Tiewsoh K, Lodha R, Pandey RM, Broor S, Kalaivani M, Kabra SK. Factors determining the outcome of children hospitalized with severe pneumonia. *BMC Pediatr* 2009;9:15.
- Quigley MA, Kelly YJ, Sacker A. Breastfeeding and hospitalization for diarrheal and respiratory infection in the United Kingdom Millennium Cohort Study. *Pediatrics* 2007;119:e837-42.

**How to cite this article:** Ratageri VH, Shilpa C. Feeding of hospitalised children, how important is it? *Karnataka Paediatr J* 2023;38:42-6.