Original Article

Nutrition problems of hospitalised children in a developing country: Thailand

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Nutritional assessment reveals the nutritional status of a patient. It thereby helps identify each patient's need for specific nutritional care and facilitates early intervention. Generally, the common nutrition and nutrition-related problems in hospitalised paediatric patients are: protein energy malnutrition in various degrees; vitamin deficiencies such as A, B_1, B_2, niacin, folic acid, K and E; mineral deficiencies such as Zn, Fe, Ca, Mg, P, K and Na; essential fatty acid deficiencies; carbohydrate intolerance; maldigestion and malabsorption; and overweight and obesity. However, there is limited information about nutritional status of hospitalised patients in some countries, especially in developing countries. In Thailand, it was found that the prevalence of hospital malnutrition in children aged 1–15 years in the paediatric ward was similar (50–60%) to that of a study conducted 10 years earlier. In another study of micronutrients in 45 paediatric AIDS patients (aged 3–46 months), high prevalences of malnutrition, anaemia and mineral deficiencies were found. For convenience in clinical practice, body mass index (BMI) values for use as an indicator in the assessment of undernutrition in children whose heights are less than 145 cm have been published. These BMI values have been tested and retested using normal children and patients with various degrees of undernutrition and were found to be reliable and valid. Therefore, nutritional status must be assessed in all hospitalised patients. At the very least, weight and height (length) should be obtained.

Key words: body mass index, children, developing country, hospital, nutrition problem, Thailand.

Introduction

Nutrition screening is vital for the early recognition of patients at risk of malnutrition. At the very least, weight and height should be recorded for all hospitalised patients so that body mass indices (BMI) can then be calculated. In children, BMI according to age and sex can be plotted on percentile charts to determine nutritional status. A screening process facilitates early intervention for cases of malnutrition while more comprehensive assessment is conducted. Nutritional assessment reveals nutritional status and helps identify, for each patient, specific objectives of nutritional care, such as maintenance of body weight or repletion of lean body mass. The assessment of protein energy malnutrition (PEM) has been based on objective measurements, including weight, serum concentration of proteins produced by the liver, anthropometric measurements, grip strength, anergy, immunological functions, BMI and the nutritional-risk index. No single measurement is both sensitive and specific enough in identifying malnutrition.[1] For example, although serum albumin values are used to predict nutritional risk[2] and a low serum albumin concentration at the time of hospital admission can predict death and length of stay,[3] hypoalbuminaemia is not specific to poor nutritional status. Protein malnutrition is the most common type of malnutrition encountered in the hospital setting, although vitamin and mineral deficiency syndromes also occur. A patient may exhibit kwashiorkor, marasmus or a marasmic-kwashiorkor. Determining the specific type of malnutrition identifies the deficient nutrients, provides a guide to medical nutritional therapy and helps establish nutritional needs. Protein malnutrition develops rapidly, often in association with catabolic stress, such as infection, trauma, neoplasms, or when 5% dextrose in water is the only source of nutrition.[4] Conversely, PEM is a chronic condition characterised by generalised loss of body fat and muscle. The combined form of PEM frequently occurs when a marasmic patient experiences the catabolic stress of illness or trauma. Generally, the common nutrition and nutrition-related problems in hospitalised paediatric patients are as follows:

1. Protein energy malnutrition in various degrees
2. Vitamin deficiencies, including A, B_1, B_2, niacin, folic acid, K and E

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3. Mineral deficiencies, including zinc, iron, calcium, magnesium, phosphorous, potassium and sodium
4. Essential fatty acid deficiencies
5. Carbohydrate intolerance, for example, lactose
6. Maldigestion and malabsorption
7. Overweight and obesity

Protein depletion and nitrogen death

In the body, every protein molecule probably serves at least one function. Hence, loss of protein is equal to loss of function. The majority of infants and children can tolerate brief periods of starvation. However, in severely malnourished children or when a major complication occurs (e.g., gastrointestinal fistula), the catabolic phase gets prolonged. There is autocannibalisation of body proteins and, if not aggressively supported with nutrition by some means, death occurs from inanition and sepsis. When the weight loss is over 30%, recovery is improbable.[5] Various studies have shown that malnutrition results in poor wound healing, increased susceptibility to infection, muscle weakness and inability to tolerate stress (Fig. 1). Malnutrition will therefore lead to prolonged suffering for the patient as well as increased expenditure for the hospital and community.[5]

Prevalence of malnutrition in hospitalised patients

The influence of nutrition on disease and that of poor nutrition on morbidity and mortality has not been well recognised by physicians. Malnutrition is associated with poor outcomes, such as an increased incidence of wound infection, fluid and electrolyte imbalance, depressed ventilatory response, decreased response to certain kinds of chemotherapy and other treatment regimens, depressed immune mechanisms and reduced functional status. Malnutrition also interferes with wound healing and increases the risk of septicaemia and postoperative complications. These undesirable outcomes translate into reduced patient well-being, increased incidence of malnutrition-related complications, prolonged hospital stays and increased medical care costs.[6,7] The prevalence of clinically significant PEM is high in some patient populations and the incidence increases among patients who remain in hospital for more than 2 or 3 weeks. It has been shown that about 30% of patients in surgical wards are malnourished at admission.[8] However, there is limited information about the nutritional status of hospitalised patients in some countries, especially in developing countries. Table 1 shows the prevalence of hospital malnutrition in different societies.[9–24] In one study, Tanphaichitr and colleagues found that more than half of the adult patients at Ramathibodi Hospital in Bangkok, Thailand were malnourished.[20] Another study in Thailand also found that the prevalence of hospital malnutrition in children in the paediatric ward, aged 1–15 years, had a similar incidence of malnutrition (50–60%) as in a study conducted 10 years earlier.[23,24] Table 2 shows the prevalence of biochemical values below cut-off values in hospitalised children in 1985, and 10 years later in 1995. In a study by Tienboon of micronutrients in 45 paediatric AIDS patients (aged 3–46 months), high prevalences of malnutrition, anaemia and mineral deficiencies were found, as shown in Table 3.[25–27]

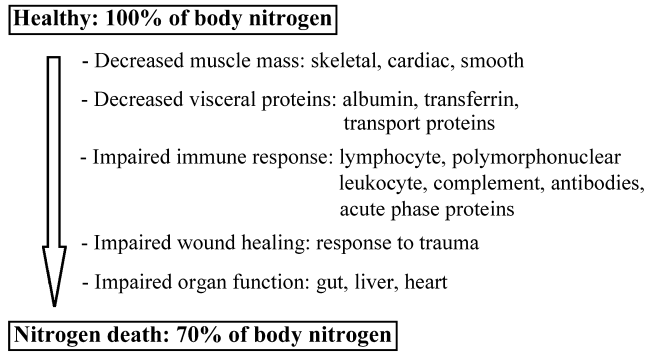

Figure 1. Consequences of various degrees of protein depletion.

BMI as an indicator for undernutrition in children

Weight-for-height (W/H) index is often used in the clinical assessment of both obesity and undernutrition in children and adolescents. BMI has been used in adults but not in children for the assessment of undernutrition, although percentile charts are available (http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/clinical_charts.htm). In fact, BMI is very helpful, especially when reference growth charts and tables are not available. BMI values for use as an indicator in the assessment of undernutrition in children whose heights are less than 145 cm are also available, having been published by Tienboon in 1995.[28] These BMI values have been tested and retested, using normal children and patients with various degrees of undernutrition, and were found to be reliable and valid. According to Waterlow's classification for undernutrition, the cut-off values are 80–90% for mild degree, 70–80% for moderate degree and <70% for severe degree. The corresponding BMI values are shown in Table 4.

Factors affecting nutrition support in hospitalised patients

In all patients, health care professionals should try to recognise early PEM, micronutrient deficiencies and other nutrition-related problems, and also to provide nutritional support for them in parallel with treatment of the primary disease. Therefore, nutrition screening must be performed in all hospitalised patients. Nutritional support in developing countries, unlike in well-developed countries, faces several problems and factors that cause difficulties and sometimes result in the unsuccessful nutritional management of patients. These factors or problems include:

1. Unawareness of malnutrition by physicians
2. Inadequate equipment for evaluating nutritional status
3. Current sophisticated nutritional support techniques
4. Lack of feeding equipment, for example, enteral pump, feeding tube
5. High cost of nutrition support and hospitalisation
6. Poverty of admitted patient

Table 1. Prevalence of malnutrition in hospitalised patients

Country	Reference	Year	Patients	Malnutrition prevalence (%)
UK	Hill *et al.*[9]	1977	Surgery	61 (At least 1 variable)
				86 (1 week later, after postop)
USA	Weinsier *et al.*[10]	1979	Medicine	48
				69 (2 weeks later, after hospitalised)
	Bistrian *et al.*[11]	1976	Adult	48 (Biochem)
	Merritt and Suskind[12]	1979	Children	2–37 (Anthro + biochem)
	Parsons *et al.*[13]	1980		
	Pollack *et al.*[14]	1982		
	Kamath *et al.*[15]	1986	33 Hospitals	50 (At least 1 variable)
			(Chicago)	40 (W/H)
Sweden	Albini *et al.*[16]	1982	Adult	21
Italy	Agradi *et al.*[17]	1984	Adult	79
South Africa	O'Keefe *et al.*[18]	1986	Medical and surgical	20
Netherlands	Naber *et al.*[19]	1997	Adult	45 (SGA)
Indonesia	Barus *et al.*[20]	1990	Children (<5 years)	12 (Not stated)
Thailand	Tanphaichitr *et al.*[21]	1973	Medical	60 (W/H)
				84 (SF)
				53 (Muscle cir)
				55 (Albumin)
				65 (Haemoglobin)
	Watanasap and Posri[22]	1989	Medical	98
			Surgical	94
			Pediatric	60
	Tienboon[23]	1985	1 month–1 year	96 (W/A)
			1–15 years	57 (W/H)†
	Tienboon[24]	1995	1–15 years	55 (W/H)‡
				50 (BMI < P5)
				40 (Transferrin)
				27 (Albumin)
				46 (Haemoglobin)
				18 (Iron deficiency)

†37 Stunting, 11 wasting and 9 both stunting and wasting. ‡9 Severe. Anthro + biochem, anthropometry and biochemistry; BMI, body mass index; Muscle cir, muscle circumference; P5, 5th percentile; Postop, post-operation; SF, skinfold thickness; SGA, subjective global assessment; W/A, weight for age; W/H, weight-for-height index.

Table 2. Prevalence of biochemical values below the cut-off value in hospitalised children†

Parameter	Below cut-off (%)	
	1985 (n = 2528)	1995 (n = 2538)
Haemoglobin	60	46.1
Haematocrit	NA	–
Total white blood cell count	NA	7.7
% Lymphocyte	NA	–
Albumin	40 (boys), 33 (girls)	27.0
Serum iron	NA	22.4
Total iron binding capacity	NA	25.0
% Transferrin saturation	NA	18.4
Transferrin	NA	40.3
Total cholesterol	NA	14.7
High density lipoprotein cholesterol	NA	47.8

†Cut-off value by age for children. NA, not assessed.

Table 3. Micronutrient status in paediatric AIDS patients aged 3–46 months

Micronutrient	Mean	SD	Cut-off value	% Lower†
Haemoglobin (g/dL)	9.1	1.79	10	65
Haematocrit (volume %)	28.0	5.13	–	–
SI (mg/dL)	69.0	30.20	–	29
TIBC (mg/dL)	313.6	59.80	–	–
Trans (mg/dL)	207.9	47.90	218	63
TSAT (%)	23.8	13.30	16	31
Zinc (ug/dL)	123.6	55.70	92	25
Copper (ug/dL)	178.6	62.80	–	–
Alkaline phosphatase (U/L)	135.1	51.60	–	–
Calcium (mg/dL)	8.5	1.17	7	13
Phosphorous (mg/dL)	4.5	1.08	2.5	8
Magnesium (mg/dL)	1.9	0.42	1.5	25

†Percentage lower than the cut-off value. SI, serum iron; TIBC, total iron-binding capacity; Trans, transferrin; TSAT, transferring saturation.

Table 4. Body mass index as an indicator of malnutrition in children

Body mass index (kg/m2)	Degree of undernutrition
14.5–13.0	Mild
<13.0–11.5	Moderate
<11.5	Severe

Children surveyed were <145 cm in height.

7. Lack of nutrition support team
8. The need to develop inexpensive enteral and parenteral nutrition formulas
9. Different disease states of hospitalised patients
10. Inadequate skills and knowledge of nutrition therapy
11. Inadequate management strategies
12. Complications associated with enteral and parenteral nutrition
13. Lack of research activities

Conclusion

Nutritional status must be assessed in all hospitalised patients. At the least, weight and height (length) should be recorded. Several studies have shown that approximately half of all hospitalised patients are malnourished in various degrees. Health care professionals should try to recognise early PEM, micronutrient deficiencies and other nutrition-related problems in all patients and when found, treat them in parallel with treatment for the primary disease. Nutritional support can be given via either oral, enteral or parenteral routes.

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