Original Article

Accuracy of Modified Simple Pediatric Nutritional Risk Score to Detect In-Hospital Malnutrition

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Abstract

Background In-hospital malnutrition is malnutrition that occurs during hospitalization. Approximately 70% patients with in-hospital malnutrition are not identified during hospitalization. Only few nutritional screening tools are widely used among children, one of those is the modified simple pediatric nutritional risk score.

Objective This study was objected to determine cutoff point and accuracy of risk scores using the modified simple pediatric nutritional risk score to detect in-hospital malnutrition.

Methods A diagnostic study on 1 month-12 year old children hospitalized at Sanglah Hospital Denpasar was conducted between September-December 2008. The subjects were collected using consecutive sampling method and were assessed using the modified simple pediatric nutritional risk score. In-hospital malnutrition was defined if there was a weight loss of $\geq$ 2% (length of stay $\leq$ 7 days), 5% (length of stay 8-30 days), or 10% (length of stay >30 days). The statistical analyses done were sensitivity, specificity, positive/negative predictive value (PPV/NPV), positive/negative likelihood ratio (PLR/NLR), and post-test probability.

Results This study recruited 310 children. Based on ROC curve, the cutoff point with combination of the highest sensitivity and spesificity was score 2. By using score value of 2, it was found that the sensitivity was 79%, spesificity was 71%, PPV was 47%, NPV was 92%, positive likelihood ratios was 2.71, negative likelihood ratio was 0.29, and post test probality was 47%.

Conclusion *The modified simple pediatric nutritional risk score* can be used as a screening tool to detect in-hospital malnutrition. **[Paediatr Indones. 2010;50:305-9].**

Keywords: *in-hospital malnutrition, modified simple pediatric nutritional risk score, screening tool, children*

World Health Organization (WHO) defines malnutrition as an imbalance between intake and nutritional requirement for maintenance of optimal growth and development.[1] In-hospital malnutrition is malnutrition that occurs during a hospitalization period. The prevalence of in-hospital malnutrition is estimated 20-40%.[2,3] A recent study in Denpasar Bali revealed the incidence of in-hospital malnutrition among children was 30.1%.[4] In-hospital malnutrition is often related to increase of mortality rate, delayed functional recovery, and increased health cost.[3]

The prevalence of in-hospital malnutrition based on previous studies was 30.1%.[4] Approximately 70% of in-hospital malnutrition cases are not diagnosed and treated until the patients discharged from hospital. Several tools and methods have been developed to asses the risk of malnutrition. However, most of those tools and methods are too complicated and not designed spesifically for children.[5] One of the method

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to determine the risk of malnutrition among children who hospitalized is the simple pediatric nutritional risk score. This tool consists of 3 clinical parameters such as food intake, pain, and pathology condition. Clinical evaluation is done during the first 48 hours of hospitalization period. The tool will give score value that be classified into 3 degrees of malnutrition risk; the mild, moderate, and severe risk. Decreased food intake below 50% per day, pain, and pathology condition are related to decreased of body weight more than 2%.[6] The objective of this study is to determine the cutoff point and accuracy of risk score using the modified simple pediatric nutritional risk score to detect in-hospital malnutrition.

Methods

This was a diagnostic study conducted between September and December 2008 in the Department of Child Health, Sanglah Hospital, Denpasar, Bali. This study was approved by the Ethics Study Committee of Medical School, Udayana University, Sanglah Hospital. Written informed consent was obtained from the parents. The inclusion criteria were children aged 1 month-12 years who were hospitalized in Sanglah Hospital for 48 hours or more and parents agreed to participate in the study. The subjects were excluded if they were hospitalized in ICU, suffered from permanent decrease of conciousness, suffered from severe renal failure, severe heart failure, and fulminant heart failure. The minimal amount of subjects required in this study was 203 children based on the confidence interval of 95% and the range of the standard deviation of the sensitivity and specificity rate of 10%.

The sampling technique used was consecutive sampling. The subjects were diagnosed as having in-hospital malnutrition if there were weight loss of ≥2% (length of stay ≤ 7 days), 5% (length of stay 8-30 days), or 10% (length of stay >30 days). The anthropometric measurements were done twice, first when the patient was admitted and the second was when the patient was discharged. All anthropometric measurements were done by independent trained medical staff.

The modified simple pediatric nutritional risk score was a tool to asses risk of in-hospital malnutrition. It consisted of 3 parameters such as pain, decreased of food intake, and disease pathology. The

assesment was performed during the first 48 hours of hospitalization period. It was a modification of the simple pediatric nutritional risk score that has been formulated by Sermet-Gaudelus, et al.[6] In the simple pediatric nutritional risk score, pain was assesed by using visual analogue scale (VAS) for children aged 5 years or more and score of abnormal crying, movements and other behaviours that showed pain for children aged less than 5 years. The modifications done in this study were the assesment of pain in children aged less than 5 years which used face, legs, activity, crying, and consolability.[7] The assessment of food intake and disease pathology in this study were not differed from the simple pediatric nutritional risk score. Food intake was assessed by recording food intake for the first 48 hours of hospitalization by independent nutritiologist. Pathology of disease was assesed by recording the admission diagnosis of the subjects, classified in to 3 degrees; the mild, moderate, and severe. Score 0 was given if there was no pain, food intake <50%, and mild pathology of disease, while score 1 if there was pain, food intake <50% and had moderate pathology of disease. Score 3 for disease pathology was given for the severe disease. The total score of the 3 parameters was recorded as the score of risk of in-hospital malnutrition which ranged from 0-5. The simple pediatric nutritional risk score was described on **Table 1.**

We used SPSS 13.0 for descriptive analysis and WinPEPI programme to found sensitivity spesificity with their confidence interval. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (PLR), negative likelihood ratio (NLR), prevalence and post-

Table 1. The simple pediatric nutritional risk score

Pathology of disease	Pain (1) Food intake <50% (1)	Score	Nutritional risk
Mild (0)	None	0	Mild
Mild (0)	One	1	Moderate
Mild (0)	Both	2	Moderate
Moderate (1)	None	1	Moderate
Moderate (1)	One	2	Moderate
Moderate (1)	Both	3	High
Severe (3)	None	3	High
Severe (3)	One	4	High
Severe (3)	Both	5	High

test probability of each score was calculated. Cutoff point of score to detect in-hospital malnutrition was determined by using receiver operating characteristic (ROC) curve.

Results

A total number of 331 children fulfilled the inclusion criteria but 21 children out of them were excluded because they moved to ICU (11 children), suffered from severe renal failure (2 children), severe heart failure (2 children), and permanent decreased level of conciousness (6 children). The prevalence of in-hospital malnutrition in this study was 24.8%. More than half subjects (55.9%) were males. Most of the children (48.9%) were suffered from mild malnourished at hospital admission. Acute diarrhea was the most frequent disease at this study. Table 2 showed baseline characteristics of the subjects.

Based on ROC curve, the cutoff point of combination of the highest sensitivity and spesificity was at score 2 (**Figure 1**). Area under curve of risk score using modified simple pediatric nutritional risk score was 0.81 (95% CI 0.75 to 0.87). The highest sensitivity was achieved by score 1 (90%) but it had

the lowest spesificity. The highest spesificity was achieved by score 4 (96%) but it had low sensitivity (35%). The sensitivity and spesificity results of each score were described in **Table 3.** Score 2 was the cutoff point of risk score to detect in hospital malnutrition. It had sensitivity 79% with spesificity was 71%. Post test probality of score value 2 was 47% (95%CI 42 to 53). **Table 4** described the sensitivity, spesificity, PPV, NPV, likelihood ratio, and post test probability of score 2.
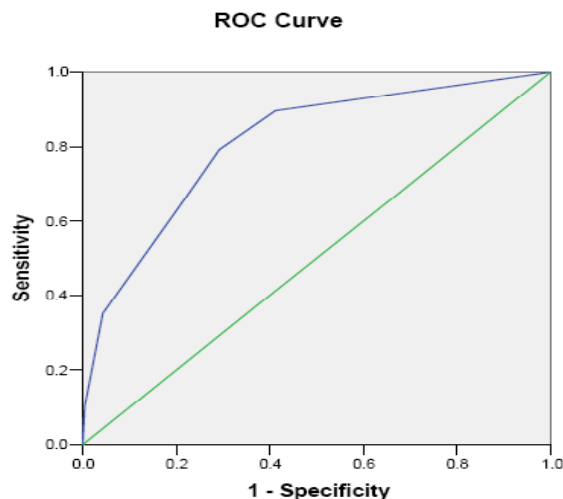

Figure 1. ROC curve of malnutrition risk score using Modified Simple Pediatric Nutritional Risk Score.

Table 2. The baseline characteristics of the study subjects (total 310 children)

Characteristics	N	%
Sex, male	174	55.9
Nutritional status		
Malnourished	152	48.9
Wellnourished	133	42.8
Obese	25	8.0
Malnutrition risk score		
0	145	46.8
1	36	11.6
2	35	11.3
3	57	18.4
4	28	9.0
5	9	2.9
Diagnosis at admission		
Acute diarrhea	52	16.8
Pneumonia	49	15.8
Bronchiolitis	30	9.7
Acute tonsilopharingitis	26	8.4
Dengue fever	16	5.2
Complex febrile seizure	14	4.5
Others	123	39.6
	Median	Range
Age (months)	20	1-144
Length of stay (days)	5	2-51

Table 4. Sensitivity, spesificity, PPV, NPV, PLR, NLR, prevalence, and post test probability by using score 2 from The Modified Simple Pediatric Nutritional Risk Score

Results	Value (%) (95% Confidence Interval)
Sensitivity	79 (70-88)
Spesificity	71 (65-71)
Positive predictive value	47 (37-57)
Negative predictive value	92 (85-96)
Positive Likelihood ratio	2.71 (1.97-3.76)
Negative Likelihood ratio	0.29 (0.20-0.44)
Prevalence	24.8 (17.1-34.2)
Post test probability	47(42-53)

Table 3. Sensitivity and spesificity of malnutrition risk score using the Modified Simple Pediatric Nutritional Risk Score

Score	Sensitivity (%) (95% Confidence Interval)	Spesificity (%) (95% Confidence Interval)
1	90 (83-97)	59 (53-65)
2	79 (70-88)	71 (65-77)
3	62 (51-73)	80 (75-85)
4	35 (24-46)	96 (93-99)
5	10 (3-17)	95 (92-98)

Discussion

Malnutrition that occurs during hospitalization period is widely studied. There are few factors related to in-hospital malnutrition. Those factors can be divided into two groups, the first is factors related to the disease and the other is factors not related to the disease. The diseases can affect nutritional status through decreased of food intake, disfunction of gastrointestinal system, and altered metabolism.[8-12] Other factors do not relate to the disease such as capability of medical staff and nutritional support during hospitalization.[8] In severe disease, few cytokines as interleukin, tumor necrosis factor, and interferon will alter metabolic changes, such as anorexia, pyrexia, released of amino acids from muscle tissues, increasing glucose transport, decreasing albumin synthesis, and increasing of vascular permeability.[10,13] Children who suffer from severe disease also will have decrease of intestine mucous barrier accompanied with increase permeability of intestine from microbial toxins that induce release of cytokines and promote degragation of the tissue.[13] Combination of those phenomenons will result in increasing enery requirement, alteration in metabolism, and decreased food intake which will end up with in-hospital malnutrition.

The prevalence of children who suffer from in-hospital malnutrition varies from 20-40%.[2] In this study, it was found the prevalence of in-hospital malnutrition was 24.8%. A recent study held in Sanglah hospital found the prevalence of in-hospital malnutrition was 30.1%. The difference may be caused by the difference in subjects of the study.[4] In the previous study, the subjects were children aged less than 6 years, meanwhile in this study the subjects were aged between 2 months-12 years.

A nutritional screening tool is a simple and rapid method to identify patients who at risk of sufferring from in-hospital malnutrition.[5] A screening tool used widely in adults is the Malnutrition Universal Screening Tools (MUST). This screening tool uses body mass index (BMI) measurement, percentage of weight loss during last 6 months and estimation of disease effects on food intake.[14,15] A nutritional screening tool in children is rarely developed. One of them is the simple pediatric nutritional risk score developed by Sermet-Gaudelus, *et al.*[6] This screening tool consists of 3 parameters such as pain, decreased food intake >50%, and pathology of disease. At present, there is no other study that investigate the accuracy of this screening tool.

In this study, we found that the cutoff point of score using modified simple pediatric nutritional risk score related to in-hospital malnutrition was 2. This score represented one of the parameters such as pain or decreased food intake > 50%, or pathology of disease. The area under curve of this study represented above 80% which showed that the power of modified simple pediatric nutritional risk score to detect in-hospital malnutrition was good.[16]

The limitation of this study was the using of difference methods to asses in-hospital malnutrition in age below and above 5 years. The range of age in this study was too wide. We also did not record the nutritional support for each patient.

In conclusion, the modified simple pediatric nutritional risk score can be used to detect in-hospital malnutrition with score value of 2 as the cutoff point.

Acknowledgements

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