Application of Subjective Global Assessment as a Screening Tool for Malnutrition in Pediatric Surgical Patients

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Objectives : *To determine the incidence of malnutrition in the pediatric surgical ward and to evaluate the value of SGA as a nutrition assessment tool in this patient group.*

Patients and Method : *Consecutive pediatric patients aged 2 months -16 years who were admitted for an operation in the pediatric surgical ward, Songklanagarind Hospital from February to September 2001 were included. Nutritional assessment was performed for each case, using a translated version of the SGA questionnaire. Anthropometric measurements and laboratory tests were performed as a routine pre-operative evaluation. The result of the SGA ratings were tested against the other parameters and Gomez's weight for age (W/A) criteria for protein energy malnutrition. SGA and the other parameters were tested for association with post-operative infectious complications. Each SGA question was analyzed by multivariate logistic regression analysis, to determine an independent correlation between the question item and final SGA rating.*

Results : *The study included 78 patients. At least one item of SGA history was positive in 28 cases (35.9%). The SGA rating was class A in 50 cases (64.1%), class B in 17 cases and class C in 11 cases. According to the Gomez classification, 42 cases (53.8%) were considered normal or overweight, whereas 23 cases (29.5%) were in the first degree underweight, 9 cases were in the second degree and 4 cases were in the third degree. Malnutrition by SGA rating correlated significantly with Gomez's second and third degree malnutrition, lower z-score, lower BMI and hypoalbuminemia. Malnutrition by SGA rating and hypoalbuminemia were associated with increased risk of an infectious complication, whereas a significant relation between a complication and anthropometric malnutrition could not be demonstrated. Moreover, SGA malnutrition was significantly associated with a longer post-operative stay.*

Among 5 items of SGA questions, history of weight change in the recent 2 weeks and increased energy need considered by an underlying disease were found to be independently associated with a final SGA rating of malnutrition. History of weight loss and gastrointestinal symptoms were the 2 most sensitive questions.

Conclusions : *SGA is a sensitive and specific nutrition assessment tool useful in a pre-operative pediatric setting. Application of the protocol as a complement of standard anthropometric tool should be considered.*

Keywords : *Malnutrition, Subjective Global Assessment, Pediatric surgery, Nutritional assessment*

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Protein energy malnutrition has been clearly proven as a major determinant of poor operative outcomes in surgical patients[1,2]. Identification and correction of nutritional deficiencies in a severely malnourished patient helps reduce this risk [3-5].

The incidence of malnutrition in pediatric surgical patients varies with screening criteria. In Thailand, the figure in hospitalized pediatric patients is around 55-60%[6-8]. To the best of our knowledge, nutritional status among pediatric surgical patients in Thailand has never been studied.

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Subjective global assessment (SGA) is a comprehensive screening tool for malnutrition in hospitalized patients[9]. The tool emphasizes the use of simple clinical data to identify a patient as nutritional-at-risk for further detailed evaluation and proper therapy. Despite its subjectivity, various studies have demonstrated a predictive validity and reproducibility of this simple method in adult patients[10,11]. The main objectives of this study were to evaluate the nutritional status of a group of pediatric surgical patients and determine the validity of SGA as a screening tool for malnutrition in these patients.

Patients and Method

The study included consecutive pediatric patients aged 2 months to 16 years who were admitted to the pediatric surgical ward, Songklanagarind Hospital from February to September 2001.Cases without an operation were excluded from the study. Nutrition related history according to SGA protocol was taken for each patient. (From a translated-into-Thai version of the SGA questionnaire). (Fig. 1) History taking was conducted by a senior medical student or an intern doctor who was practicing in the ward during the study period. Data from the SGA history was summarized into one of three class groups; A-well nourished, B-moderately (or suspected of being) malnourished and C-severely malnourished[9]. The rating for each case was appraised by the first two authors.

Anthropometric data, including weight and height at the first hospitalization date, were collected. Body mass index (BMI) was calculated from weight and height by standard formula of [weight/(height)^2] kg/m^2. Hemoglobin level, total lymphocyte count and serum albumin level were measured as part of a routine pre-operative evaluation. Stool examination was electively performed in some cases.

Protein energy malnutrition was defined as weight for age (W/A) under expected value, as described in the Gomez classification [12]. Standard values of weight and height used in this study were those of the Thai normograph[13]. Z-score (standard normal value) of W/A was calculated using this same standard curve.

Data regarding disease, operation and operative morbidity were also collected. Operative morbidity was defined as a complication that occurred within the 60th post-operative day and potentially related to the foregoing procedure. Infectious complications included bacterial infection of a surgical wound, an organ or a body cavity or an implanting device. Verification of each specific infection used the definitions of nosocomial infection, according to the American Center of Disease Control[14].

For analysis, malnutrition by SGA rating in this study means SGA class B or C. SGA malnutrition result were analyzed against various clinical parameters. SGA malnutrition result and the other parameters were then analyzed against infectious complications. Student T test or Pearson Chi-square test were used where appropriate. Statistical significance was set at p-value less than 0.05.

Univariate exploration for crude association with final SGA rating was done for each individual SGA question using Pearson Chi-squared test. Variables having a p-value < 0.05 were then included in multivariate logistic regression models, which were refined by stepwise exclusion guided by the change in log-likelihood of consecutive models. The p-value for significance in the likelihood ratio test was set at 0.05. Data processing was aided by Stata program version 7.0 (Stata corporation, Texas, USA).

Results

Demographic data

Data from 78 cases were analyzed. Age of the patients ranged from 2 months to 16 years, with a median age at 4.5 years. The majority of operations involved corrective procedures for congenital or chronic gastrointestinal disorders as shown in Table 1. Length of hospital stay ranged from 3 to 68 days with a median of 7 days. Median post-operative stay was 4.5 days (1-59 days). Thirteen of 70 cases whose data could be traced had a birth weight of less than 2,500 grams. Parents of the patients worked in the private sector (34.7%), agriculture (30.6%), governmental service (20.4%) and as merchants (10.2%), with an average income of 7,343 Thai-baht a month. Surgical complications occurred in 14 cases (17.9%), with 8 of them considered to have infectious complications. Infectious complications were 2 cases of urinary tract infection, 2 cases of wound infection, 2 cases of implanting device infection and each one of pneumonia and ascending cholangitis. All infectious episodes were managed successfully, either by antibiotics or device removal.

Anthropometric parameters

Mean weight of the patients was 16.1 $\pm$ 11.3 kilograms and mean height (length) was 96.2 $\pm$ 30.2 centimeters. Considering anthropometric percentiles

(P), 23 cases (29.5%) were under the 10th P of W/A and 21 cases (27.0%) were under the 10th P of H/A. Mean BMI was 15.7 kg/m^2 (range 10-34.5 kg/m^2). Mean Z score was -0.51 (range -9.6-15). Physical signs of malnutrition were detected in 8 cases, which were pale conjunctiva (3 cases), easy pluckability of hair (2 cases), loss of muscle mass (1 case) and white band on the nails (2 cases). All those patients with positive physical signs also had one or more positive SGA history items. According to the Gomez classification, 42 cases (53.8%) were considered normal or overweight, 23 cases (29.5%) were in the first degree , 9 cases were in the second and 4 cases were in the third degree underweight.

Laboratory parameters

Mean hemoglobin level was 11.6 mg%. Excluding cases with hematologic diseases, 12.8% of the patients had a hemoglobin level less than 10 mg%. Mean absolute lymphocyte count was 4,163 cells/ml. (ranged 115-14,755 cells/ml.). Mean serum albumin was 3.97 g% (ranged 2.6-4.7 g%), (measured in 57 cases). Stool examination was done in 34 cases and positive for parasites in 9 cases. The most common parasites found in the stool were *Ascaris lumbricoides* and hookworm.

SGA rating

At least one item of the SGA history was positive in 28 cases (35.9%) (Table 2). SGA rating was class A in 50 cases (64.1%), class B in 17 cases and class C in 11 cases. Thirteen of 17 cases who were rated in SGA class B and 6 of 11 cases of class C had their W/A above the 80 percent of mean value, thus were in normal or mild wasting by Gomez's classification. Among cases who were positive for SGA malnutrition but negative for W/A criteria, there was a positive history of weight loss in 52.6 %, eating reduction in 31.5%, abnormal gastrointestinal symptoms in 42.1%, functional capacity reduction in 10.58%, and increased energy need in 21.05%. Among six cases that met the criteria for second degree malnutrition by Gomez classification but were negative for SGA malnutrition, 2 cases were born prematurely and 3 had a congenital syndrome that explained the stunted growth.

Table 1. Diagnostic groups of 78 patients and incidences of malnutrition by SGA and Gomez's classification

Diagnosis	No. (cases)	SGA class B,C (cases)	Gomez grade2 or 3	Median length of postoperative stay (days)
Abdominal surgery for chronic and congenital diseases of gastrointestinal tract	34	14 (41.2%)	8 (23.5%)	7.8 (1-45)
Abdominal surgery for acute gastrointestinal diseases of gastrointestinal tract	14	6 (42.8%)	2 (14.3%)	4.9 (2-18)
Surgery of inguino-scrotal region	12	0	1 (8.3%)	4.8 (1-14)
Major oncologic surgery	5	5 (100%)	2 (40.0%)	21.0 (7-59)*
Miscellaneous procedures	13	3 (23.0%)	0	4.7 (2-13)

* significantly longer than the other groups ($p < 0.01$)

Table 2. Positive results of each SGA questionaire and its association to the final SGA rating

History question	Positive history (%)	Positive history in SGA malnutrition (%)	p-value**
1. History of weight loss in previous six months	13.5*	32.0	0.001
2. History of weight loss in previous two weeks	16.7	42.8	< 0.001
3. Reduction of oral food intake	11.5	32.1	< 0.001
4. Gastrointestinal symptoms	28.2	50.0	0.001
5. Reduction of functional capacity	2.6	7.1	0.056
6. Increased energy demand	14.1	28.6	0.006

* excluding infants aged less than 6 months

** Chi-square or Fisher's exact test for association of positive history and SGA malnutrition (SGA class B or C)

Analysis

SGA malnutrition was associated with moderate and severe protein energy malnutrition as defined by second and third degree malnutrition (p 0.006). Analyzing against other objective parameters, SGA malnutrition correlated significantly with serum albumin level, z score and BMI (Table 3). Data from this analysis also suggested the cut-off level of serum albumin, BMI and z-score between SGA well-nourished and SGA malnourished cases by their 95% confidence intervals.

Univariate analysis revealed statistically significant association between an infectious complication and SGA malnutrition (Table 4). Correlation of a serum albumin level with an infectious complication was also confirmed. Moreover, cases with SGA malnutrition had significantly longer post-operative hospitalization (12.0 days) than those cases with SGA class A (4.5 days), $p < 0.01$). Multivariate analysis demonstrated that the association between SGA malnutrition and longer stay was independent of diagnostic group ($p < 0.01$).

History of weight loss in 2 weeks prior to admission (odds ratio 34.0, p-value 0.001) and increase energy demand considered by a concurrent disease in each patient (odds ratio 5.41, p-value 0.038) were two history items that were found by the final regression model to be independently associated with SGA malnutrition (Log likelihood ratio = -37.579).

Discussion

Incidence of malnutrition by anthropometry in the presented patients seemed to be less than the other series of hospitalized pediatric patients in Thailand[6-8]. Which might be partly explained by differences in diagnostic groups and study period. However, since there has been no report of a survey in a pediatric surgical ward before, the presented figure of 46% malnutrition by the Gomez classification or 36% by SGA did find a high incidence of this problem which should not be overlooked.

The purpose of nutritional assessment in pediatric surgical patients differs from that in a well-child clinic. An assessment in this group of patients aimed to identify a patients-at-risk of developing a malnutrition-related complication and a case for whom nutritional support may give benefit[9]. Most pediatric clinical nutrition assessment tools are based mainly on anthropometry[6,8,12,15,16]. However, malnutrition related complications in surgical patients are usually

Table 3. Analysis of SGA malnutrition against various nutrition parameters

Nutritional parameters*	SGA class		p-value
	A	B or C	
Total lymphocyte count (cells/mm^3)	4274.5 (3400.4–5148.6)	3972.0 (2946.0–4998.0)	0.66
Serum albumin (mg/dl)	4.15 (4.07–4.24)	3.72 (3.90–3.95)	< 0.001**
Z score of weight for age	0.19 (-0.71–1.09)	-1.76 (-2.5– -1.05)	0.004**
Body mass index (kg/m^2)	16.72 (15.59–17.85)	13.73 (12.96–14.50)	< 0.001**

* Values are expressed in mean and 95% confidence interval
** Considered significantly different by Student's T test

Table 4. Analysis of nutrition parameters against incidence of infectious complications

Nutritional parameters	Number of cases	Infectious complications (cases)	Odds ratio	p-value
SGA malnutriton	28	8 (28.6%)	-	< 0.001*
Z score < -1.0	41	5 (12.2%)	1.574	0.55
Malnutrition by Gomez criteria**	13	2 (15.4%)	1.788	0.50
Weight for age $\leq 10^{th}$ percentile	23	3 (13.0%)	1.500	0.61
Serum albumin < 3.95 g%	23	6 (26.1 %)	-	0.002*
BMI < 13 kg/m^2	12	2 (16.7%)	2.28	0.39

* Considered significantly different by Chi-square test or Fisher exact test
** Including only the second and third degree malnutrition

Name _____

*HN _____ Ward _____

Date of birth _____ Sex ☐ male ☐ female

Admission date _____Discharge date _____

* Hospital Number

History items

1. History of weight change

   a. History of weight loss in last 6 months

      ☐ No ☐ Yes _____ (grams/kilograms) [___% of previous weight]

   b. History of weight change in the past 2 weeks

      ☐ No change ☐ Increase ☐ Decrease

2. History of dietary change

   Usual diet

      ☐ Breast milk ☐ Formula/Instant milk (specify name and quantity) _____

      ☐ Supplementary diet ___ meals /day; specify type _____

      ☐ Regular diet ___ meals/day; specify type _____

   History of change in type and/or quantity of diet

      ☐ No ☐ Yes; details: _____

3. History of gastrointestinal symptoms

      ☐ No ☐ Nausea ☐ Vomiting ☐ Anorexia ☐ Diarrhea

4. History of change in functional capacity or activity

      ☐ No dysfunction or reduction in activity

      ☐ Reduction in normal activity, duration _____

5. Disease and its relationship to nutritional requirements

   Primary diagnosis _____

   Change in energy demand ☐ No change ☐ Increase

Physical examination items

6. Basic antropometry

   Weight _____ grams/kilograms Height (length) _____ cms

   Head circumference _____ cms. Body mass index _____ kg/m^2

7. Signs of malnutrition

   ☐ pale ☐ easy pluckability of hair ☐ muscle wasting ☐ ascites ☐ white bands at nails

   ☐ angular stomatitis ☐ glossitis ☐ pellagrous dermatitis ☐ other; specify _____

Fig. 1 Nutritional-screening checklist based on SGA questionnaire (translated from the Thai version used in this study)

associated with a change in functional status rather than body composition or physical growth[9,17]. The presented demographic data showed that the majority of patients had their disease in the gastrointestinal system, derangement in gastrointestinal functions from the disease itself has the potential to cause inadequate food intake and/or absorption. Also, abdominal operations may lead to a period of paralytic ileus, and worsen the nutritional status in those with already depleted energy storage, resulting in increased susceptibility to infection, poor wound healing and delayed recovery[15,16]. In certain instances, such functional reduction of the gastrointestinal tract does occur, but not severely enough or not long enough to put a patient out of the growth curve.

Subjective global assessment (SGA) is a nutritional assessment method that emphasizes the use of clinical data simply derived from careful history taking and the physical examination. The SGA protocol has been proven by various authors to correlate with objective measurement and reproducible[10,11]. Using the history of appetite, weight change, and change in functional capacity, a perspective picture of energy balance can be drawn. Of our patients with positive SGA malnutrition but negative W/A malnutrition criteria (Gomez's classification grades 2 or more), about half had a positive history of weight loss and 40% had abnormal gastrointestinal symptoms. This indicates that standard anthropometry was less sensitive in these cases, and SGA could fill the gap. On the other hand, there may be cases who are out of the normal curve but may indeed be in a positive nitrogen balance, such as a premature baby who is catching up his weight or a child who is stunted because of genetic determination. These situations are areas in which cross-sectional anthropometry is not specific, and nutritional assessment should not be based on a single measurement.

The presented data demonstrated a correlation between SGA and other key objective measurements. The BMI cut-off value for malnutrition at 13 agreed with that reported by Tienboon[18]. Significant association between SGA malnutrition and the occurrence of an infectious complication were also demonstrated. The data also confirmed an inverse correlation between serum albumin levels and incidence of complications, as also reported by recent series[19,20]. Although post-operative stay was also associated with oncologic diagnosis (Table 1), SGA malnutrition was found to be an independent factor determining longer stay.

Multivariate analysis demonstrated an independent correlation between two SGA questions and the final rating, the history of weight loss in the past two weeks and the increased energy need of disease status. Significance of a gastrointestinal symptom as an independent parameter could not be demonstrated and this item is perhaps not specific in a case with an acute gastrointestinal disease. However, sensitivity of the symptoms should play a role as a complement to other questions. Reduction of functional capacity was a question that the authors hardly explored because the patient group had a variety of normal activities. Increased energy need is rather a subjective consideration of a health care provider than a medical history item. The energy need was considered positive in all cases of oncologic surgery and about half of the cases undergoing surgery for acute gastrointestinal tract problems, compared to only 3.2 % in the group with chronic or congenital gastrointestinal tract problems and none in the other groups (data not shown). Physical examinations were specific to certain nutrient deprivations but did not seem to be sensitive in protein energy malnutrition. Putting it all together, the authors summarized that three items that should be emphasized in history taking of the patient are history of weight loss, gastrointestinal symptoms and specific diagnosis of the disease. Above all is the awareness of using those data together with physical examinations and anthropometric data to identify a patient-at-risk. A patient who is rated as SGA class B or C should be evaluated in more detail regarding an anatomy of malnutrition by means of serum biochemistry assessment and/or a body composition study. In Songklanagarind Hospital, pediatric nutritionist consultation during a weekly nutrition round was mandated in all cases with obvious malnutrition. Whether to postpone an operation and give pre-operative nutritional support or not was considered, case by case, based on the risks and benefits.

A practical problem which the authors encountered was the fact that patient history in the pediatric age group is usually secondary data, especially in small infants. Without parents with a patient, the quality of the data may not be reliable, and the authors believe this is a limitation of SGA in pediatric patients.

Conclusion

The authors assessed the nutritional status of patients in the pediatric surgical ward by various

tools and found that the SGA protocol can be adapted for use in this group of patients. Malnutrition as identified by SGA significantly predicted infectious complications and longer post-operative hospital stay.

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การประยุกต์ใช้การประเมินภาวะโภชนาการแบบ Subjective Global Assessment สำหรับผู้ป่วยกุมารศัลยศาสตร์

เฉลิมพร โรจน์รัตน์ศิริกุล, สุรศักดิ์ สังขทัต ณ อยุธยา, ศักดา ภัทรภิญโญกุล

ได้ศึกษาอุบัติการณ์ของภาวะทุพโภชนาการในผู้ป่วยเด็กอายุ 2 เดือนถึง 16 ปี ที่รับไว้ใน หอผู้ป่วยกุมารศัลยศาสตร์ โรงพยาบาลสงขลานครินทร์ในระหว่างเดือนกุมภาพันธ์ถึงกันยายน 2544 โดยใช้แนวทางการคัดกรองภาวะทุพโภชนาการแบบ subjective global assessment (SGA) เทียบกับปัจจัยประเมินภาวะโภชนาการทางคลินิกอย่างอื่นได้แก่การจัดระดับภาวะทุพโภชนาการโดยใช้เกณฑ์น้ำหนักเทียบตามอายุ การใช้ดัชนีมวลกาย การใช้ระดับ albumin ในเลือด

ผู้ป่วยเด็กจำนวน 78 ราย พบว่ามีความผิดปกติทางโภชนาการเมื่อใช้แนวทาง SGA 28 ราย (35.9%) ทุพโภชนาการในระดับสองขึ้นไปตามเกณฑ์ของ Gomez 13 ราย (16.7%) ภาวะทุพโภชนาการตามแนวทาง SGA มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติกับการประเมินตามเกณฑ์ของ Gomez ค่า z-score ของดัชนีมวลกายและระดับ serum albumin นอกจากนี้ภาวะทุพโภชนาการตามแนวทางของ SGA และระดับ serum albumin เป็นปัจจัยพยากรณ์ที่มีนัยสำคัญของการเกิดภาวะแทรกซ้อนทางการติดเชื้อหลังผ่าตัด และผู้ป่วยที่มีภาวะทุพโภชนาการยังมีระยะการพักฟื้นในโรงพยาบาลหลังผ่าตัดนานกว่าปกติอย่างมีนัยสำคัญ

เมื่อวิเคราะห์แบบพหุปัจจัย พบว่าใน 5 คำถามของแนวทางประเมินแบบ SGA ซึ่งเป็นคำถามเกี่ยวกับการเปลี่ยนแปลงน้ำหนักในช่วง 2 สัปดาห์และการที่โรคที่นำผู้ป่วยเข้ารับการรักษามีผลให้ร่างกายต้องการพลังงานสูงขึ้นเป็นหัวข้อที่สัมพันธ์ต่อการประเมินภาวะโภชนาการขั้นสุดท้ายอย่างเป็นอิสระ ในขณะที่การเปลี่ยนแปลงน้ำหนักและอาการผิดปกติในระบบทางเดินอาหารเป็นสองปัจจัยประเมินที่มีความไวมากที่สุด จึงสรุปได้ว่าการประเมินตามแนวทาง SGA สามารถประยุกต์ใช้อย่างมีความหมายในผู้ป่วยกุมารศัลยศาสตร์