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The Development of a Computerized Nutrition Support Program for Inpatients

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Purpose: The importance of detecting malnourished patients or those at risk of becoming malnourished has been emphasized recently. However, it is difficult with limited resources to rapidly identify patients requiring nutrition management. Therefore, the Nutrition Support Team (NST) at our hospital wanted to use the adult nursing admission questionnaire, which is documented by a nurse at admission, for nutrition screening with various parameters of the SGA. The aim of this study was to develop a computerized program that includes nutrition screening using the adult nursing admission questionnaire, a nutrition assessment, a care plan, monitoring and reevaluation for more effective and earlier nutrition management with limited staff.

Methods: The task force team within the NST is composed of a physician, nurse, pharmacist and diettian, whose aim is to develop a practical and fast screening program. The reports express a score that is dependent on the impact of the symptoms and the nutritional status of the patient derived from the adult nursing admission questionnaire. The scores are added to give a total. A score of 0∼5 is deemed adequate nutrition, 6∼10 denotes moderate or suspected malnutrition; 11 or more indicates severe malnutrition. The score uses the ordered diet, percent IBW, albumin and TLC according to the objective index. Malnutrition was defined as two items out of four being abnormal.

Results: This program consists of whole procedures in the following order: nutrition screening, malnutrition, assessment and monitoring. The computerized system is as follows: nutrition screening, consultation, assessment and care plan, reply, monitoring, reevaluation and the end.

Conclusion: It is expected that this program will facilitate nutrition screening using the adult nursing admission questionnaire, and provide early nutrition management through cooperation with various occupations. However, further study will be needed to assess the validity of identifying malnourished patients using the adult nursing admission questionnaire.

Key Words: Nutrition screening, SGA, Nutrition support program

INTRODUCTION

The Joint Commission for Accreditation of Healthcare Organization (JACHO) recommends that nutrition screening should be completed within 24 h of admission. Nutrition screening is the process of identifying parameters known to be associated with nutritional problems. The purpose of nutrition screening is to identify individuals who are malnourished or at risk of becoming malnourished and who may benefit from nutrition support. The screen is conducted by a diettian, nurse or health worker. The nutrition screening parameters should be cost-effective and easy to administer. We need to select the most appropriate nutritional parameters from the data available to our hospital.

In recent years, several screening tools have been developed. Kruizenga et al. have developed the Short Nutritional Assessment Questionnaire (SNAQ) which is the nutrition screening tool to use items of nutrition assessment from other tools such as the Subjective Global Assessment (SGA) and Mini Nutrition Assessment (MNA). In particular, the SGA methodology has...
been used as a "gold standard" for the development of some nutrition screening tools. The SGA is a validated method for nutritional assessment based on the features of a medical history and physical examination. However, the final results of SGA always require subjective judgments. If the screening tool for all inpatient requires corresponding staff's judgment the NST activity will be jammed.

In the Guidelines for Hospital Evaluation that has the items of the faith of nursing process, the hospital understand the patient's problems through the systematic observation of his/her nursing needs and a nursing care plan is established and implemented according to those needs. The adult nursing admission questionnaire is the first, most basic step in the nursing process; it records the patient's identification information, vital signs, lifestyle considerations, physical condition, development, and information about the patient's society, culture, property, patient and family history. Our hospital had nutrition screening program; however it was of limited because it failed to account for involuntary weight loss and percent ideal body weight (%IBW). It was also hard to rapidly identify patients who needed nutrition management through personal interviews or medical records as we had limited staff. Thus the nutrition support team (NST) used selected items from the existing adult nursing admission questionnaire as a nutrition screening tool, because the nursing assessment satisfied the SGA and the European Society of Clinical Nutrition and Metabolism (ESPEN) guidelines. This was cost effective, given the computerized intake process and limited number of workers. The aim of this study was to develop a program which includes nutrition screening using the adult nursing admission questionnaire, assessment, a care plan, monitoring and reevaluation for more effective and earlier nutrition management.

**MATERIAL AND METHODS**

The task force team (TFT) within the NST was composed...
of a physician, nurse, pharmacist and dietitian, and they were designated to develop. The TFT developed one which included nutrition screening, assessment and monitoring within the Ordering Communication System (OCS), which referred to various literature and material related to another hospital’s program. We had made the final plan in April 2006, and asked it the Department of Medical Information. The program was instituted in July 2007.

1. Nutrition screening and assessment

1) Nutrition screening

(1) Nutrition screening based on the adult nursing admission questionnaire: The adult nursing admission questionnaire has used a partially modified version of the standardized documentation that was developed by Park et al.11 (Fig. 1). The nutrition screening questions were developed from various parameters (weight change, dietary intake change, gastrointestinal symptoms, functional capacity, physical assessment, age) of the modified SGA and Patient-Generated Subjective Global Assessment (PG-SGA) based on the SGA and ESPEN guidelines.3,12,13 The reports express a score depending on the impact of the symptoms and nutritional status in the nursing assessment tool, and then a total score is summed. A score of 0~5 denotes adequate nutrition; 6~10 is moderate or suspected malnutrition; and 11 or more is severe malnutrition (Table 1).

(2) Nutrition screening based on objective parameters: We used the objective parameters such as the ordered diet, percent ideal body weight (%IBW), albumin and total lymphocyte count (TLC) for nutrition screening.14 Malnutrition was as having two or more abnormal items out of four items (Table 2). Urinary urea nitrogen (UUN) and prealbumin are used as a reference.

Patients with a nutrition score of ≥6 or the more than two abnormal items out of four are classified as nutritionally at risk or high risk.

2) The nutrition assessment and nutrient requirement

(1) The nutrition assessment: This used a modified metabolic nutrition profile,14 and fat reserves (triceps skinfold thickness), somatic proteins (%IBW, percent weight loss [%wt], mid-upper arm muscle circumference), visceral proteins (albumin, prealbumin) and immune competence (TLC) as indicators assessing nutritional status.

(2) The nutrient requirements: For caloric requirement, “the rule-of-thumb” was used, which is done by multiplying

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**Table 1. Nutrition scoresheet based on the adult nursing questionnaire**

| Variable                        | Score  |
|---------------------------------|--------|
| Route of hospital admission     | Exotic (0)  | Emergency (1)  | Etc (0)     |
| How to hospitalize              | Afoot (0)   | Wheelchair (1) | Stretcher cart (1) | Etc (1) |
| Patient history                 | None (0)    | Hypertension (1) | Diabetes (1) |
| - Tuberculosis (1)              | Hepatitis (1) | Tumor (1)   |
| - Hepatitis (1)                 | Genetic disease (1) |
| Appetite                        | Good(0)     | Normal (0)    |
| Weight change                   | No (0)      | Yes (2)       |
| Defecation disorder             | None (0)    | Diarrhea (2)  |
| - Tuberculosis (1)              | Constipation (1) |
| - Hematemesis (1)               | Melena (1)  |
| Functional Capacity             | Full capacity (0)  | Dysfunction (2) |
| - Nausea(1)                     | Vomiting (3) |
| Bowel dysfunction               | None (0)    | Dysphagia (2) |
| - Hematemesis (1)               | Abdominal distention (1) |
| - Mucous stool (1)              | Abdominal pain (3) |
| Edema                           | No (0)      | Yes (1)       |
| Age                             | <60 (0)     | ≥60 (1)       |
| Total score*                    |           |

*Score of 0~5 = adequate; 6~10 = moderate or suspected malnutrition; 11 or more = severe malnutrition.

**Table 2. Nutrition screening based on the objective parameter**

| Variables          | At risk of malnutrition | At high risk of malnutrition |
|--------------------|-------------------------|-----------------------------|
| Diet (day)         | NPO, tube feeding, liquid diet >5day %IBW | 75 ~ 90 | <75 |
| Serum Albumin (g/dl) | 2.8 ~ 3.5 | 2.8 |
| TLC (/mm³)         | 1,200 ~ 1,500 | <1,200 |

*Malnutrition was defined as two items out of four being abnormal.*
a patient’s ideal body weight in kilograms by 20 ~ 35 kcal/kg. Computation of caloric requirement for obese patients (%IBW ≥ 120%) was based on their adjusted body weight.

For the protein requirement nitrogen balance (NB) was used. If we had no NB, we used protein requirements per unit of body weight. Protein requirements per unit of body weight is computed by multiplying ideal body weight in kilograms by a factor that depends on the disease state (0.8 to 1.5 g/kg of ideal body weight).

2. The development of the computerized program

The program should be operated automatically within the already installed OCS of Chonbuk University Hospital. The algorithm for the development of the program was as follows:

1) Plan

The system conducts the nutrition management for inpatients. It used the OCS database for general information, diagnosis, the adult nursing admission questionnaire, biochemical data, ordering records and ordered diet. We asked to add some new
input fields to the adult nursing admission assessment since height and weight weren’t computerized.

2) Analysis

The analysis of work is done on the computerized range. We analyze the work with enough time to minimize the error. The workflow is as follows:

(1) Hospitalization: The adult nursing admission questionnaire is conducted by the nurse on the day of admission to the hospital.

(2) Nutrition screening: The NST identifies the malnourished patient through the adult nursing admission questionnaire and informs the physician rapidly through the ordering program.

(3) The consultation: The attending physician can check the results of the screening using the ordering program and he asks for a consultation about nutrition support by his decision.

(4) The reply: The NST checks whether the physician asks for the consultation through the nutrition support program and then he confirms the answer through the ordering program.

(5) Monitoring: The NST monitors the nutritional condition of the patient for two weeks.

(6) The end: They draw up the work flowchart and a functional specification.

3) Design

The program design was created on the basis of the work analysis to make the data inquiry associated with OCS convenient; inputs and outputs were designed according to the data process; the interface design focused on connecting well to the OCS. Fig. 2 shows the data flow diagram of this program. The sever environment of the program used the UNIX system and operates under a distributed system environment using middleware (Tuxedo). The database designed using Oracle, the program language using Power Builder. The client computers operating system is based on Windows XP.

4) Practice

This program is operated in combination with the OCS and restricts the use of the program through the rights of the user.
RESULTS

The nutrition support program consists of nutrition support, ordering input and the adult nursing admission questionnaire. Nutrition support is used by the NST and ordering input can be used by the doctor.

1. The nutrition support

This program consists of these procedures in the following order: nutrition screening, assessment, malnutrition and monitoring. In each step we can find the information when we click the patient.

1) The nutrition screening

Fig. 3 shows the nutrition screening display. It shows patient identification number, name, room number, name of attending physician, diet, %IBW, albumin and TLC; The diet means days of ordered diet-NPO, tube feeding and liquid diet for 14 days from the present. %IBW is computed by the weight and height in the adult nursing admission questionnaire. Albumin, TLC, UUN and prealbumin fields display the most recent value.

2) The malnutrition display

The malnutrition display shows all patients classified by results of screening. We can see here whether the physician has asked for a consultation, To ask for the consultation is decided by the doctor.

3) The nutrition assessment

Fig. 4 shows the nutrition assessment display. It can find both the patients identified for intervention via screening and also those identified by the attending physician. When you click assessment of details, you can see the patient’s assessment screen (Fig. 5). It displays weight, height, biochemical data, diet and any order.

4) The monitoring

All patients who’ve had consultation can be found and monitored for 14 days from the request. The patient’s information is deleted automatically in case of monitoring end or discharging within the monitoring period. The patient’s information is shown when you click the details.
2. The ordering input

The results of the screening are shown through pop-ups on the ordering input screen of patients classified as malnourished and the ordering code is entered automatically with the attending physician choosing “OK”. UUN and prealbumin, however, are entered automatically with ordering code in the case of high risk patients. A doctor can ask directly for a consultation. The nutrition support process is shown below the diagnosis section on the ordering input screen (Fig. 6A). When the physician clicks “Reply”, he can check the result of the consultation (Fig. 6B).

DISCUSSION

The importance of early detection of malnutrition or being at risk of becoming malnourished has been identified recently. The JACHO recommends that nutrition screening be completed within 24h of admission. The hospital quality assessment of 2007 recommends that a nutrition screening be executed within 48h of admission to receive nutritional treatment for patients with malnutrition or at risk of malnutrition.

Several screening tools, such as the Nutrition Risk Score (NRS-2002), Malnutrition Screening Tool (MST), SNAQ, the BAPEN 4 screening tool and more have been developed in recent years. The NST of our hospital uses the adult nursing admission questionnaire which is a complex information unit, as nutrition screening tool for nursing of high quality and accessing generally the health being the basis step to solve the nursing problem performing the nursing process. It is easy to identify items related to nutrition and sum each item because the form uses check boxes. The score given to items of the screening tool refers to the modified SGA and PG-SGA which is based
on the SGA and ESPEN guidelines. The criteria of malnutrition defines that score of 0~5 is adequate, 6~10 is moderate or suspected malnutrition and 11 or more is severe malnutrition by modified SGA. The nutrition screening using of the adult nursing admission questionnaire is developed basing on the SGA. In their recent guidelines, the ASPEN board of directors stated that no screening system has been validated with respect to clinical outcome. They also suggested that, in the absence...
of an outcome validated approach, a combination of clinical and biochemical parameters should be used to assess the presence of malnutrition. They recommend the use of the SGA.18

The adult nursing admission questionnaire has limitations; which are available as such initial nutrition screening because it was written once admission date; which are omitted among malnourished patients because the adult nursing admission questionnaire was written late in case of admitting in emergency. The plan to get more reliable information is also needed, not to use it in actuality and it becomes just formally. The previously documented adult nursing admission questionnaire is sometimes used when patients are re-admitted.

Although the adult nursing admission questionnaire has limitations, it has some advantages in executing nutrition screening. It makes all admitted patients screening object because it is contained in Guidelines for Hospital Evaluation and Medical Record and not only improves efficiency but also decreases patient’s rejection because of avoiding duplicate questions. It is just thought to need a study assessing validity about how to identify malnourished patients using adult nursing assessment tool.

The nutrition screening parameters have an objective index (anthropometric data [% IBW or BMI], weight change, albumin, TLC, age) and subjective index (dietary intake, problem related diet).12 We use an objective index (% IBW, TLC, ordered diet) with subjective index because subjective index may give inaccurate information to be written on a subjective judgment. The objective index has the advantage of getting objective and correct results but immediately reflects that the nutritional status of the patient is influenced by several factors beyond nutritional status such as drug-nutrient interaction and change of metabolic stress by stress or disease.19 Also the objective index reflect nutritional status during hospitalization.

The height and weight are, however, written directly by the admitting nurse on vital sign sheet during hospitalization and at admission. The adult nursing assessment questionnaire adds the height and weight and the vital sheet including them is printed to avoid duplication. The program, which can use weight computerized during hospitalization, is needed after discussion with nursing department not to know a change of their weight because it was written once for admission. Various studies report that they should be evaluated adequacy with applying it in actual, because the validity is changed by patients and hospital’s condition though they apply nutrition screening tool which proves it in various studies.5 The validity and reliability that have not clearly proven but been used in this program, should be solved.

A study of the itemized nutrition screening tool is also needed for patients who are at high risk for malnutrition - the children, elderly, surgical patients and critically ill patients.

The doctors are notified of the results of nutrition screening through a pop-up message. We lead doctor’s consultation and their interest of nutritional status. But 40% of malnourished patients request a doctor’s consultation. This is caused by doctor’s apathy of nutrition and it will be solved by their education of nutrition support and a positive publicity campaign.

It is expected that this program will execute nutrition screening rapidly using the adult nursing admission questionnaire providing early nutrition management through cooperation with various occupations. It can be used as a basis for various studies, which become effective nutrition treatments through positive nutrition management, adding statistics beyond steps of nutrition management including screening, assessment and monitoring. Some problems of the program still appear so that constant correction and supplementation are necessary.

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