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Case Report

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Nutritional Intervention for a Patient with Acute Lymphoblastic Leukemia on Allogeneic Peripheral Blood Stem Cell Transplantation

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Conflict of Interest
The authors declare that they have no competing interests.

ABSTRACT

Hematopoietic stem cell transplantation (HSCT) causes many complications such as anorexia, nausea, vomiting, diarrhea, and mucositis. Most patients undergoing HSCT have risk for malnutrition in the process of transplantation so artificial nutrition support is required. The purpose of this case report is to share our experience of applying nutrition intervention during the transplantation period. According to HSCT process, the change of the patient's gastrointestinal symptoms, oral intake and nutritional status was recorded. By encouraging oral intake and providing parenteral nutrition, the patient had only 0.3%, losing weight during the transplantation period. In conclusion, it emphasized that the nutritional status changes during the HSCT period should be closely monitored and nutritional management through appropriate nutritional support and interventions in hospital and after discharge.

Keywords: Peripheral blood stem cell transplantation; Nutrition support; Acute lymphoblastic leukemia

INTRODUCTION

Leukemia is hematopoietic disorder which is featured the aggressive proliferation of immature hematopoietic progenitor cells. Acute lymphoblastic leukemia (ALL) is a cancer of the blood and bone marrow, and usually gets worse rapidly if it is not treated [1].

High-dose conditioning and peripheral blood stem cell transplantation (PBSCT) are an accepted method all over the world for the therapy of hematological malignancy. [2]. The therapy has advantages of increased dose-response effect but entail severe gastric toxicity and nutrition affect symptoms that are able to reduce food intake. Malnutrition before transplant has been showed as being a negative prognostic factor for survival following hematopoietic stem cell transplantation (HSCT). Some results reported that malnutrition increased as well as the hospitalization period and chance of early death for HSCT patients. Also, malnutrition presents an interrelation between poor prognosis and severe graft-versus-host disease (GVHD) [3,4]. Therefore, the importance and challenge of maintaining well-nourished status in patients undergoing HSCT has been widely demonstrated [5].

Furthermore, for the success of transplantation it is important to assess the nutritional status of patients before the transplant period [6]. It is necessary to analyze risk factors affecting nutritional status during and after HSCT [7]. The scored Patient-Generated-Subject Global Assessment (PG-SGA) is a valid nutrition assessment tool specifically designed to evaluate nutrition status of patient with cancer [8-10]. It is subjective global assessment which not only containing 3 global ratings of nutritional status (well-nourished, moderately or suspected of being malnourished and severely malnourished) but also includes a numerical score and additional nutrition impact symptoms.

Traditional hospital food meal with set meal times, limited food choices, and advance menu selection may fail to satisfy the dietary needs of the most of HSCT patients. Sufficient meal selection, a satellite kitchen, availability of foods and beverage are typically requested for a way of accurately assessing daily oral intake on HSCT [11].

The purpose of the current case study is to share our experience the process of nutritional support and intervention conducted on malnourished patient on HSCT at a hospital. After admission, the patient was identified as being at risk of malnutrition, according to an early nutritional assessment program and analyzed intervention-related changes.

CASE

A 63-year-old male patient electively admitted to Seoul National University of Bundang Hospital for high-dose conditioning and allogeneic PBSCT. The patient was diagnosed with colon cancer 12 years ago, for which the patient underwent a right hemicolectomy and received 6 cycles of adjuvant chemotherapy. Afterward, the patient has no evidence of disease state. However, B lymphoblastic leukemia, BCR/ABL+ had been diagnosed. After diagnosis, induction chemotherapy started and consolidation with high-dose conditioning and allogeneic stem cell transplantation was planned.

When the patient admitted to the oncology ward, it was reported to be in his usual health. No clinical signs of infection (like fever, coughing, sneezing, or dysuria) had happened in the weeks before admission. The clinical characteristics of the patient are shown in **Table 1**. Routine laboratory testing showed no noticeable problems except slightly lower hemoglobin level of 9.4 g/dL.

The registered dietitian assessed the nutritional status of the patient by using the scored PG-SGA at admission day and estimated the nutritional requirement. The patient had a good

Table 1. Characteristics of the patient at admission

Variables	Value
Age, yr	63
Sex	Male
Height, cm	161.5
Usual body weight, kg	65
BMI, kg/m^2	25.1
Serum albumin*, g/dL	3.6
Hemoglobin†	9.4
ANC‡	1,060

BMI, body mass index; ANC, absolute neutrophil count.
*Normal range: 3.3–5.2 g/dL; †Normal range: 13–17 g/dL; ‡Normal range: > 1,000/mL.

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appetite and did not have any gastrointestinal complication, so the patient was classified well-nourished (scored 2 points, SGA A). Approximately 1,700 kcal of energy (baseline weight 57.4 kg; based on calculation, 30 kcal/kg needed) and 70 g of protein (baseline weight 57.4 kg; based on calculation 1.2 g/kg) were set as the required nutritional requirement.

In addition, the registered dietitian explained the sterilization meal during the hospital stay. Seoul National University of Bundang Hospital provided 3 types of menus for sterilization meals; general menu, special menu, and order menu. The general menu was served with rice, soup and 4-dishes. Special menu was provided as single food items such as noodles and rice bowl. On the other hands, the order menu was consisted of 20 different kinds of foods including bread, porridge, canned fruits, and confectionery which served depending on the patient's choice. Also, from the all menus, the patient was able to select oral nutrition supplement on every meal.

Since the high-dose conditioning was started, there were gastrointestinal complications which changed oral intake and nutritional status. **Table 2** presents the results gained from analyzing the changes in nutritional intake during the HSCT period according to 3 stages: hospitalization (Admission), 1 week after admission (Post + 1 week), and after engraftment (Pre-discharge). Since the high-dose conditioning, the patient suffered from nausea and diarrhea, which made oral intake difficult. The patient was able to select preferred foods from the order menu which were sterilized and consumed 30% of the requirement. The patient became more sensitive to food smell, the order menus preferred to the general menu.

On the day of stem cell transfusion from human leukocyte antigen (HLA) identical sibling donor (HLA full matched), the patient developed severe diarrhea most probably caused by chemotherapy and antibiotics. The nutrition support team decided to supply artificial nutrition support. For appropriate nutritional support, total parenteral nutrition (TPN) was provided (Nutriflex lipid central; energy, 1,475 kcal; C:P:F ratio, 50:20:31; carbohydrate, 184 g; protein, 72 g; fat, 50 g) by the nutrition support team. It took 9 days for engraftment after the transplantation of the hematopoietic stem cells. The oral intake was still insufficient to 40% of the requirement after engraftment, the parenteral nutrition (PN) was maintained by the day before discharge. Therefore, the patient was supplied intravenous nutritional support for 12 days during the 23 days of hospital stay and experienced weight loss 0.3% during the hospitalization period.

Nutritional status was assessed using the scored PG-SGA not only at admission but also pre-discharge. The **Table 3** presents the results of the nutritional status during the HSCT period. Before discharge, the patient was classified moderate malnutrition (scored 7 points, SGA B) indicating the need for improved symptom and focused nutrition management.

Table 2. Changes of nutritional intake during the hematopoietic stem cell transplantation period

Variables	Admission	Post + 1 wk	Pre-discharge
Body weight, kg	65.35	65.8	65.15
Height, cm	161.5	161.5	161.5
Calorie intake by oral diet, kcal	1,900	518	670
Protein intake by oral diet, g	88	18	23
% calorie intake by oral diet	111	30	40
% protein intake by oral diet	125	25	32
% calorie intake by oral diet and TPN	111	30	117
% protein intake by oral diet and TPN	125	25	120

TPN, total parenteral nutrition.

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Table 3. Change of nutritional status during the hospital visit

Variables	Admission	Pre-discharge
PIBW, %*	113.9	113.5
Weight loss, %†	-	0.3
PG-SGA score	2	7
Nutrition assessment	Well-nourished	Moderate malnutrition

PIBW, predicted ideal body weight; PG-SGA, Patient-Generated-Subject Global Assessment.
*Percentage ideal body weight; †Percentage weight loss compare with admission weight.

After the engraftment, the patient had improved nausea, vomiting and diarrhea, but still complained of decreasing appetite. The registered dietitian educated the patient to maintain the neutropenic diet while using immunosuppressant to prevent infection.

DISCUSSION

Malnutrition and weight loss are frequent complications of high-dose conditioning and allogeneic PBSCT and malnutrition itself has been demonstrated to be an independent risk factor for poor outcome in HSCT [12,13]. Therefore, supportive enteral nutrition (EN) might be beneficial [14]. In the present case, the nutrition status of the patient with ALL on allogeneic PBSCT was assessed before and after transplantation. According to HSCT process, the patient experienced several gastrointestinal symptoms and changed oral intake and decreased nutritional status. The nutrition support team made efforts to conduct proper nutritional intervention in accordance with the HSCT process. Especially, in this case, the implementation of a personalized diet was effective for prevention of malnutrition.

Provision of TPN must be considered for malnourished patients due to transplantation and nutritional support team should focus on the regulation of the nutritional quantity [15]. TPN allows better modulation of fluid, electrolytes, and nutrient administration when gastrointestinal complications arise. Also, benefits of TPN are seen in patients through a decrease in the relapse rate, an increase in disease-free survival, and a high survival rate [16]. One study reported that TPN has been indicated 58% of allogeneic transplant recipients with irradiation and HLA-compatible donors, and 92% of allogeneic transplant recipients with irradiation and HLA-non-compatible donors with the application of severe malnutrition criteria [17]. In this case, the TPN was supported to meet the requirement and there was no significant weight loss despite the long-term lack of oral intake.

On the other hand, according to the guidelines on nutritional support in patients undergoing HSCT of the American Society for Parenteral and Enteral Nutrition and the European Society for Parenteral and Enteral Nutrition, EN should be the first option and preferred over PN due to the metabolic complications. PN was only recommended in cases of severe microsites or gastrointestinal failure [18,19]. In case of the TPN periods would prolong, gastrointestinal mucosal alteration with the atrophy of villi and their immune function appeared. Also, increase in bacterial translocation to create a new source of infection induced. Therefore, EN should be preserved whenever possible to help intestinal tropism [15]. In this case, the changes in the oral intake of the patient were carefully monitored, and the timing of tapering the PN was continuously discussed. When the registered dietitian performed the pre-discharge interview, the patient's oral intake was slightly higher than the previous interview, and the PN was stopped the day before discharge. Furthermore, in order to optimize EN, the registered dietitian continued to encourage oral intake and tried to adjust the patient's

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preference such as palatability and food texture. In this case, the patient was able to select meals among the 3 sterilization menus, it was encouraged to increase oral intake by providing an opportunity to choose according to preference. In addition, there was one study comparing survival of patients needing oral nutrition support to patients receiving EN. The authors reported poorer survival for patients receiving EN than patients receiving oral nutritional support [20]. Although the patient in this case had a poor tolerance about oral nutritional supplements, it would be helpful to use oral nutritional supplements for proper nutrition support.

Hung et al. [21] found that patients are not malnourished by 100 days' post-transplantation but may require nutritional support from a registered dietitian to address persisting nutrition impact symptoms because the adverse effects of HSCT on body composition were not completely reversed by 100 days after transplantation. In this case report, the nutrition assessment and intervention were not conducted after discharge. We suggested that appropriate methods for nutritional support after discharge from patients on HSCT should be created.

In conclusion, HSCT is an intense and prolonged medical therapy that presents a wide range of nutritional challenges. According the HSCT process at hospital, proper PN and EN support is required and routine nutrition assessment should be undertaken. Moreover, long-term nutritional management after discharge is necessary because GVHD may be present after transplantation and for increasing survival rate.

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