CASE REPORTS

Effect of Rehabilitation Nutrition Care Process on Physical Function in Lung Cancer Cachexia: A Case Report

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ABSTRACT. Objectives: Patients with cancer cachexia have poor adherence to treatment, which affects their prognosis. Currently, there are many studies on the effects of rehabilitation on cancer cachexia, but there is a lack of evidence on the effects of nutrition therapy alone or in combination with rehabilitation and nutrition therapy. This article describes a case in which rehabilitation nutrition care process was effective in a patient with lung cancer who developed cancer cachexia. Methods: A 68-year-old woman was hospitalized for treatment of lung adenocarcinoma. The patient had moderate malnutrition, sarcopenia, and cachexia at the time of admission, so the authors intervened according to rehabilitation nutrition care process. The physiotherapist mainly prescribed resistance training and aerobic exercise, 40-60 minutes a day, 5-6 days a week. And the dietitian provided oral nutritional supplements (100 kcal, branched-chain amino acid: 3.0 g) in addition to hospital food and adjusted the patient’s energy intake to 26.96-33.05 kcal/kg/day and protein intake to 1.07-1.14 g/kg/day. Outcomes: Comparing the initial evaluation with the discharge, nutritional status, such as body mass index and skeletal muscle mass, and physical functions, such as maximum grip strength, gait speed, and functional independence measure (motor items), were improved. Conclusions: Rehabilitation nutrition care process-based interventions may improve nutritional status and physical functions more than exercise therapy alone in patients with lung cancer cachexia.

Key words: Case report, Exercise, Lung neoplasms, Malnutrition, Nutrition therapy

Cancer cachexia pathophysiology is characterized by progressive skeletal muscle loss that is difficult to recover adequately with conventional nutritional support, and 83% of hospitalized lung cancer patients have cachexia. Patients with cancer cachexia have decreased physical function and quality of life (QOL), and shorter survival.

A systematic review that examined the effects of intervention with nutrition therapy alone in patients with advanced cancer found that it may lead to improved quality of life and reduced postoperative complication rates, but no consistent efficacy has been demonstrated. Two systematic reviews of the effects of exercise therapy have reported that aerobic exercise and resistance training alone or combined contribute to improvements in physical function and skeletal muscle mass in cancer patients undergoing medical treatment. There is a concept of rehabilitation nutrition to provide high-quality care for cancer patients, who frequently develop nutritional disorders and physical dysfunction. The rehabilitation nutrition care process is a systematic problem-solving method, which consists of five steps: 1) rehabilitation nutrition assessment and diagnostic reasoning, 2) rehabilitation nutrition diagnosis, 3) rehabilitation nutrition goal setting, 4) rehabilitation nutrition intervention, and 5) rehabilitation nutrition monitoring. For patients with cancer cachexia, multidisciplinary intervention with rehabilitation and nutrition therapy is expected to improve physical function and nutritional status. However, there is insufficient evidence, and to the author’s knowledge, no cases of cancer cachexia treated by rehabilitation nutrition care process have been reported. In this article, the authors report a case of lung cancer cachexia that showed improved nutritional status and physical functions using rehabilitation nutrition care process.
A 68-year-old woman was admitted to the hospital for a thorough examination because of decreased food intake and increased fatigue. The patient was diagnosed with adenocarcinoma of the left upper lobe of the lung and started treatment. The following was found at the time of cancer diagnosis: performance status 0; distant metastasis malignant pericardial effusion.

**Case**

Rehabilitation Nutrition Assessment, Diagnostic Reasoning, and Diagnosis (Fig. 1, Table 1)

The patient was of normal weight (Body Mass Index: 21.8 kg/m²) at admission, but had a weight loss of -6% on day 10 of admission, and had moderate malnutrition according to the Global Leadership Initiative on Malnutrition (GLIM) criteria. In addition, the motor items of the Functional Independence Measure (FIM) were 61 points 8 days after admission. A physical function assessment was performed on day 10 of admission. Bioelectrical impedance analysis (Inbody 770, Inbody Co., Seoul, Korea) was used to evaluate the patient’s skeletal muscle mass index, which was 4.3 kg/m². In addition, the patient’s grip strength was...
11.4 kg, and walking speed was 0.83 m/s. Applying the Asian Working Group for Sarcopenia 2019 criteria\(^\text{13}\), the patient was diagnosed with severe sarcopenia due to low muscle mass, low muscle strength, and low physical function (normal walking speed less than 1.0 m/s). The patient was also diagnosed with cancer cachexia\(^\text{11}\) because they had sarcopenia and weight loss of more than 2%.

**Rehabilitation Nutrition Goal Setting, Intervention, and Monitoring (Table 2)**

Physical therapy was started on the 8th day of admission, and its primary goal was to improve sarcopenia and cachexia. Exercise therapy consisted of aerobic exercise and resistance training, 40-60 minutes a day, 5-6 days a week. Aerobic exercise was performed on an ergometric bicycle for 10 to 15 minutes with a target heart rate (60% intensity load) calculated using a formula developed by Karvonen\(^\text{41}\). Resistance training was performed targeting the upper and lower limbs, and the load was gradually increased to a target of 10 repetitions maximum. The subjective strength during exercise was assessed using the modified Borg Scale. To ensure that effective exercise could be continued, the exercise therapy program was adjusted as necessary to ensure that general fatigue and muscle fatigue during and after exercise were less than modified Borg Scale 4 (low intensity load)\(^\text{38,40}\). At the time of admission, the patient’s goal was to maintain the weight, but anorexia persisted, and daily energy and protein intake were low. Therefore, after the tenth day of hospitalization, when rehabilitation started, the goal was gaining about 1 kg of body weight and improving SMI during 1 month. Dietitians increased the daily energy intake to 26.96-33.05 kcal/kg/day and protein intake to 1.07-1.14 g/kg/day during hospitalization. In addition, an oral nutritional supplement (100 kcal, Branched Chain Amino Acid: 3.0 g) was provided within 30 minutes after exercise therapy and on patient request to promote muscle protein synthesis.

### Table 2. Timeline of patient’s clinical course

| Hospitalization days | Day 1 | Day 10 | Day 28 |
|----------------------|-------|--------|--------|
| Chemotherapy         |       |        | Osimertinib 80mg (day 15-) |
| Exercise therapy     |       |        |        |
| Aerobic exercise     | 10 to 15 minutes | 25-70kg, 2 sets of 10 times | |
| Resistance training, lower limbs | 2 sets of 10 times | |
| Resistance training, upper limbs | 2 sets of 10 times | |
| Nutritional therapy  |       |        |        |
| BEE (kcal/day)       | 981   | 953    | 966    |
| TEE (kcal/day)       | 1280  | 1185   | 1230   |
| Energy intake (kcal/day) | 600    | 1065   | 1355   |
| Body weight ratio of energy intake (kcal/kg/day) | 14.07 | 26.96 | 33.05 |
| Body weight ratio of protein intake (g/kg/day) | 0.58 | 1.07 | 1.14 |

BEE, basal energy expenditure; TEE, total energy expenditure.

### Outcomes

During hospitalization, there were no side effects of osimertinib. Comparing the initial evaluation (on day 10) with the discharge (on day 32), BMI had improved from 20.2 kg/m\(^2\) to 20.9 kg/m\(^2\), SMI had increased from 4.3 kg/m\(^2\) to 4.9 kg/m\(^2\), maximum grip strength had improved from 11.4 kg to 13.9 kg, gait speed had improved from 0.87 m/s to 1.00 m/s, and FIM (motor items) from 61 to 83 points (Table 1).

### Discussion

In this study, it was suggested that interventions following rehabilitation nutrition care process improved the nutritional status and physical functions more than exercise therapy alone in patients with lung cancer cachexia. This case was a lung cancer patient with complications of cancer cachexia. It has been reported that 83% of hospitalized lung cancer patients have cachexia\(^\text{12}\), and many inflammatory and metabolic changes are primary factors in cancer cachexia, including systemic inflammation, acute phase response, protein and lipolysis, lipid mobilization, increased resting energy, decreased protein and fat synthesis, and decreased appetite\(^\text{47}\). This case showed anorexia before admission and significant weight loss 10 days after admission, suggesting that primary factors from cancer cells caused cancer cachexia. It has been reported that patients with lung cancer have a poor prognosis if they present with sarcopenia, in which cachexia is one of the factors.\(^\text{48}\) Therefore, it is important for patients with lung cancer cachexia to improve nutritional status and physical functions.

Interventions following rehabilitation nutrition care process improved the nutritional status and physical functions more than exercise therapy alone in patients with lung cancer cachexia. A review of the effects of exercise therapy alone in cancer patients found that the combination of aerobic exercise and resistance training\(^\text{6,7}\) affected physical...
function and skeletal muscle mass. Still, the improvement in grip strength was slight (improvement rate 4%)\(^9\), and the improvement in skeletal muscle mass was less consistent, ranging from 0.4 to 3.1%\(^{31,32}\). Also, consistent efficacy of nutrition therapy as a single intervention in cancer patients\(^3\) has not been demonstrated. The effects of combined exercise and nutritional therapy for advanced cancer has been discussed, but the evidence is currently lacking\(^{40}\). In this case, the authors thought it necessary to improve nutritional status and physical functions to continue anticancer therapy and improve prognosis. They intervened according to the rehabilitation nutrition care process. The effect was to improve the nutritional status of the patient, such as BMI and SMI, and their physical functions during hospitalization. In particular, the improvement rate of SMI and grip strength exceeded the results of previous studies\(^{19,21}\), which was considered the effect of multidisciplinary treatment by the rehabilitation nutrition care process.

**Conclusion**

The case showed that the rehabilitation nutrition care process might improve the nutritional status and physical functions more than exercise therapy alone in patients with lung cancer cachexia. It is important to use the rehabilitation nutrition care process to develop multidisciplinary treatment according to the stage of cachexia to maintain and improve the physical function of patients with lung cancer cachexia.

This case report was performed following the 1964 Declaration of Helsinki’s ethical standards and later amendments. The patient provided informed consent for the publication of this case report.

**Conflict of Interest:** The authors have no financial relationships to disclose.

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