Analysis of Influencing Factors of Moderate to Severe Malnutrition in Elderly Patients with Lung Cancer during Chemotherapy

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Abstract: *Objective:* This study aims to identify the factors influencing moderate to severe malnutrition in elderly lung cancer patients undergoing chemotherapy and to provide a basis for developing clinical prevention and intervention strategies. *Methods:* The clinical data of 150 elderly lung cancer patients who received chemotherapy were retrospectively analyzed. Demographic data, clinical characteristics, laboratory indicators, treatment plans, and other relevant information were collected. Independent risk factors for moderate to severe malnutrition during chemotherapy were identified. *Results:* During chemotherapy, 50 patients (33.33%) developed moderate to severe malnutrition. The BMI of patients with moderate to severe malnutrition was significantly lower than that of patients with no or mild malnutrition (21.20 ± 1.60 vs. 26.14 ± 2.31, $P < 0.001$), and the proportion of patients with stage IV tumors was significantly higher (60.00% vs. 27.00%, $P < 0.001$). Serum pre-albumin (pre-ALB) and hemoglobin (Hb) levels in patients with moderate to severe malnutrition were significantly lower than those in patients with no or mild malnutrition (152.67 ± 30.41 g/L vs. 252.47 ± 51.24 g/L and 102.44 ± 10.09 g/L vs. 154.21 ± 15.18 g/L, respectively, $P < 0.001$ for all). *Conclusion:* Low BMI, decreased serum pre-ALB levels, and decreased serum Hb levels before chemotherapy are independent risk factors for moderate to severe malnutrition in elderly lung cancer patients during chemotherapy. Close clinical attention should be given to these patients, with early intervention measures such as nutritional support to reduce the incidence of malnutrition and improve patients' quality of life and prognosis.

Keywords: Lung cancer; Chemotherapy; Moderate to severe malnutrition; Influencing factors

1. Introduction

Lung cancer is one of the most prevalent malignant tumors globally, with the highest morbidity and mortality rates, posing a severe threat to human life and health. Each year, approximately 2.2 million new cases and 1.8 million deaths from lung cancer are reported worldwide, with elderly patients making up a significant proportion of these numbers [1,2]. As the global population continues to age, the number of elderly lung cancer

patients is steadily increasing. Chemotherapy, a critical treatment for advanced lung cancer, plays a vital role in inhibiting tumor cell proliferation and spread, thereby prolonging patient survival. Chemotherapy drugs achieve this by inhibiting DNA replication, interfering with cell division, and other mechanisms to control tumor growth and metastasis. However, while targeting tumor cells, chemotherapy drugs inevitably damage normal cells, leading to a range of toxic side effects, including bone marrow suppression, nausea and vomiting, hair loss, and decreased immune function, with malnutrition being one of the most common complications [3].

Elderly lung cancer patients are particularly susceptible to malnutrition due to factors such as physiological degeneration, multiple comorbidities, decreased appetite, and the gastrointestinal toxicity of chemotherapy drugs [4]. The aging digestive system reduces the capacity for nutrient digestion and absorption, making elderly patients more prone to nutrient deficiencies. Additionally, these patients often suffer from other chronic conditions, such as hypertension, diabetes, and coronary heart disease, which, along with their respective treatments, can further negatively impact their nutritional status. Research has shown that moderate to severe malnutrition not only diminishes the quality of life in elderly lung cancer patients but also exacerbates the toxic side effects of chemotherapy, reduces chemotherapy tolerance, and diminishes its efficacy, ultimately affecting patient survival and prognosis [5]. Malnutrition can weaken the immune system, increasing susceptibility to infections and other complications, thereby hindering the smooth administration of chemotherapy. Furthermore, malnutrition can affect the metabolism and excretion of chemotherapy drugs, intensifying toxic side effects and further reducing chemotherapy tolerance.

Therefore, early identification of risk factors for moderate to severe malnutrition in elderly lung cancer patients during chemotherapy and the implementation of targeted interventions are crucial for improving nutritional status, enhancing chemotherapy efficacy, and extending patient survival. This study retrospectively analyzed the clinical data of 150 elderly lung cancer patients to identify the factors influencing moderate to severe malnutrition during chemotherapy and to provide a reference for early clinical intervention and improved patient prognosis.

2. Materials and methods

2.1. General information

A total of 150 elderly lung cancer patients who received chemotherapy at our hospital from October 2022 to October 2023 were selected for this study. All patients had been diagnosed with lung cancer through pathology or cytology and had undergone at least three cycles of chemotherapy. The inclusion criteria were as follows: (1) Patients aged ≥ 65 years; (2) Patients diagnosed with lung cancer via pathology or cytology [6]; (3) Patients who had completed at least three cycles of chemotherapy; (4) Patients with complete clinical data. The exclusion criteria were: (1) Patients with other malignant tumors; (2) Patients with severe liver or kidney dysfunction; (3) Patients with mental disorders or impaired consciousness who were unable to cooperate with the study.

2.2. Methods

The following patient data were collected:
  (1) General information: age, gender, BMI, smoking history (yes or no), comorbidities (hypertension, diabetes, coronary heart disease, etc.);
  (2) Clinical characteristics: tumor stage (TNM staging, classified as stages I–IV), pathological type (adenocarcinoma, squamous cell carcinoma, small cell carcinoma, etc.), chemotherapy regimen (chemotherapy drug type, dosage, number of cycles, etc.);

(3) Laboratory indicators: blood routine, including hemoglobin (Hb) level, white blood cell count, platelet count, etc.;

(4) Biochemical indicators: serum albumin (ALB) level, serum prealbumin (pre-ALB) level, alanine aminotransferase, aspartate aminotransferase, total bilirubin, creatinine, etc.;

(5) Nutritional status assessment: Nutritional status before chemotherapy was assessed using the NRS2002 score [7], and patients were divided into three groups based on the scoring results: no malnutrition (NRS2002 score ≤ 2 points), mild malnutrition (NRS2002 score = 3 points), and moderate to severe malnutrition (NRS2002 score ≥ 4 points). The NRS 2002 nutritional risk screening scale was used to assess the nutritional risk of patients, categorizing them into no/mild malnutrition (0–2 points) and moderate to severe malnutrition (≥ 3 points).

2.3. Observation indicators

(1) The incidence of moderate to severe malnutrition in elderly lung cancer patients during chemotherapy. The diagnostic criteria for moderate to severe malnutrition were based on a comprehensive assessment of the patient's weight change, BMI index, and laboratory indicators. Moderate to severe malnutrition was diagnosed if any of the following criteria were met: (i) Weight loss ≥ 5%; (ii) BMI < 18.5 kg/m^2; (iii) Serum albumin < 30 g/L; (iv) Hemoglobin < 100 g/L.

(2) Factors influencing the occurrence of moderate to severe malnutrition in elderly lung cancer patients during chemotherapy.

2.4. Statistical analysis

SPSS 27.0 software was used for statistical analysis of the research data. Measurement data were described as mean ± standard deviation (SD), and group comparisons were made using the independent sample t-test. Enumeration data were expressed as the number of cases and percentage (%), with group comparisons made using the χ^2 test. A P-value < 0.05 was considered statistically significant.

3. Results

3.1. Incidence of moderate to severe malnutrition in elderly lung cancer patients during chemotherapy

A total of 150 elderly lung cancer patients were included in this study, comprising 80 males and 70 females aged 65–85 years, with an average age of 70.72 ± 4.21 years. During chemotherapy, 50 patients developed moderate to severe malnutrition, resulting in an incidence rate of 33.33%.

3.2. Factors affecting moderate to severe malnutrition in elderly lung cancer patients during chemotherapy

Significant differences were observed in BMI, tumor stage, serum pre-ALB, and serum Hb levels between patients with moderate to severe malnutrition and those with no/mild malnutrition. Specifically, the BMI of patients with moderate to severe malnutrition was significantly lower than that of patients with no/mild malnutrition (21.20 ± 1.60 vs. 26.14 ± 2.31, P < 0.001), and the proportion of patients with stage IV tumors was significantly higher (60.00% vs. 27.00%, P < 0.001). Additionally, serum pre-ALB and serum Hb levels in patients with moderate to severe malnutrition were significantly lower than in those with no/mild malnutrition (152.67 ± 30.41 g/L vs. 252.47 ± 51.24 g/L and 102.44 ± 10.09 g/L vs. 154.21 ± 15.18 g/L, respectively, P <

0.001 for all). In contrast, there were no significant differences in age, gender, or smoking history between the two groups. See **Table 1** for details.

Table 1. Factors affecting moderate to severe malnutrition in elderly patients with lung cancer during chemotherapy

Factor	Moderate to severe malnutrition ($n = 50$)	No/mild malnutrition ($n = 100$)	t / χ^2	P
Age (years)	70.12 ± 4.22	71.02 ± 4.20	1.235	0.219
Gender [n (%)]				
Male	24	55	0.121	0.728
Female	26	45		
BMI (kg/m^2)	21.20 ± 1.60	26.14 ± 2.31	13.571	< 0.001
Smoking history [n (%)]				
Yes	15 (30.00%)	20 (20.00%)	1.893	0.172
No	35 (70.00%)	80 (80.00%)		
Tumor stage [n (%)]				
Stage II–III	20 (40.00%)	73 (73.00%)	15.408	< 0.001
Stage IV	30 (60.00%)	27 (27.00%)		
Serum pre-ALB (g/L)	152.67 ± 30.41	252.47 ± 51.24	12.688	< 0.001
Serum Hb (g/L)	102.44 ± 10.09	154.21 ± 15.18	21.808	< 0.001

Abbreviations: BMI, Body mass index; Hb, Hemoglobin; Pre-ALB, Serum albumin before chemotherapy.

4. Discussion

Nutrition plays an indispensable role in maintaining normal bodily functions, especially in elderly patients with lung cancer, where its importance is even more pronounced. Maintaining good nutritional status is crucial for enhancing a patient's immunity and improving their tolerance to chemotherapy, which in turn can effectively prolong survival and improve overall prognosis [8,9]. This study indicates that patients with moderate to severe malnutrition have significantly lower BMI compared to those with better nutritional status. Additionally, stage IV lung cancer is more prevalent among patients with moderate to severe malnutrition. Key indicators such as serum pre-ALB and Hb levels are also significantly lower in these patients. However, no significant differences were found between the two groups regarding age, gender, or smoking history. The data analysis suggests that low BMI before chemotherapy, decreased serum pre-ALB levels, and decreased serum Hb levels are independent risk factors for moderate to severe malnutrition in elderly lung cancer patients undergoing chemotherapy.

Generally, patients with lower BMI may face issues such as insufficient fat reserves, weak physical constitution, and low immune function, resulting in poor tolerance to chemotherapy drugs. This makes them more susceptible to the toxic side effects of chemotherapy, such as loss of appetite and difficulty eating, significantly increasing the risk of malnutrition [10,11]. In terms of tumor staging, stage IV patients are often in a state of high metabolism and energy consumption, commonly associated with severe cancer pain. This condition can lead to changes in dietary habits, with many chemotherapy patients resorting to liquid foods, which often results in inadequate nutrition and a heightened risk of malnutrition [12,13].

Serum pre-ALB levels are considered a sensitive indicator of nutritional status, and a decrease in this

marker suggests insufficient protein intake or increased protein consumption. A negative nitrogen balance can occur when serum pre-ALB levels decline, leading to an inadequate nutrient supply for the body. During chemotherapy, the body's nutritional demands significantly increase, and the risk of malnutrition rises when the balance between nutritional intake and consumption is disrupted [14,15]. Additionally, a decrease in serum hemoglobin (Hb) levels can lead to hypoxia and malnutrition. If uncorrected for an extended period, this can cause anemia and impair the function of the hematopoietic system, exacerbating the toxicity of chemotherapy drugs and increasing the risk of moderate to severe malnutrition during chemotherapy [16].

While this study provides important insights, it is retrospective in nature, which may introduce selection bias, and the sample size is relatively small. Future research should involve large-scale, multicenter prospective studies to further verify and expand upon these conclusions. In clinical practice, healthcare providers should closely monitor patients' BMI, serum pre-ALB, and Hb levels, identify high-risk groups for malnutrition as early as possible, and implement individualized nutritional interventions for these patients.

In summary, low BMI, decreased serum pre-ALB levels, and decreased serum Hb levels are independent risk factors for moderate to severe malnutrition in elderly lung cancer patients undergoing chemotherapy. Therefore, clinicians should pay special attention to these patients and promptly implement intervention measures such as nutritional support to reduce the incidence of malnutrition, thereby improving patients' quality of life and prognosis.

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Disclosure statement

The authors declare no conflict of interest.

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