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Clinical Value of Preoperative CT-Based Body Composition Analysis in Radical Resection of Esophageal Cancer

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Abstract

Objective: To calculate visceral fat area, skeletal muscle area and density at L3 level via preoperative CT images and analyze the correlation between body composition changes and postoperative complications of esophageal cancer radical resection. **Methods:** Data of patients who had esophageal cancer radical resection in the Department of Cardiothoracic Surgery of Jingzhou Central Hospital from January 2020 to December 2023 were retrospectively analyzed. Baseline, body composition, surgical data and postoperative complications were observed. Binary logistic regression was used to explore factors related to postoperative pulmonary infection. **Results:** 122 patients were included, with 113 males and 9 females, with a mean age of 61.3 years. Incidences of preoperative visceral obesity, sarcopenia and myosteatosis were 32.7% (40/122), 69.7% (85/122) and 66.4% (81/122), respectively. Incidences of postoperative complications like pleural effusion and pulmonary infection were 37.7% (46/122) and 30.3% (37/122). The risk of pleural effusion was lower in visceral obesity group (7.4% vs. 30.3%, P = 0.016). There was no significant difference in the distribution of postoperative complications of esophageal cancer between the sarcopenia group and the non-sarcopenia group. When comparing the myosteatosis group with the non-myosteatosis group, the operation time was shorter [(354 ± 71) min vs. (380 ± 61) min, P = 0.038], but the risk of developing pulmonary infection was higher (27.0% vs. 3.3%). Binary logistic regression analysis showed that the preoperative diagnosis of myosteatosis was an independent influencing factor for the occurrence of pulmonary infection after radical resection of esophageal cancer [odds ratio (OR) = 0.135, 95% confidence interval (CI): (0.041, 0.442), P = 0.001]. In addition, a history of alcohol consumption (OR = 3.124, 95% CI: 1.270 - 7.685, P = 0.013) and hemoglobin level (OR = 1.043, 95% CI: 1.011 - 1.076, P = 0.009) were also independent influencing factors for pulmonary in-

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fection. The prediction model established based on these independent influencing factors had an area under the curve (AUC) of 0.774, indicating a certain predictive ability. **Conclusion:** Preoperative CT can accurately reflect the patient's body composition status to evaluate their nutritional status, and the changes in preoperative body composition are related to the occurrence of postoperative complications of esophageal cancer.

Keywords

Esophageal Cancer, Postoperative Complications, Visceral Obesity, Sarcopenia, Myosteatosis

1. Introduction

Esophageal cancer is one of the common malignant tumors of the digestive system. Its diagnosis rate ranks eighth and the mortality rate ranks sixth among malignant tumors [1]. With the continuous optimization of comprehensive treatment regimens and the improvement of surgical techniques, the 5-year survival rate of patients with esophageal cancer has gradually increased [2]. Among many diagnosis and treatment options, radical surgical resection is still the most important treatment method for early-stage esophageal cancer [3]. Guided by the concepts of enhanced recovery after surgery (ERAS) and precise surgery, the incidence of postoperative complications of esophageal cancer shows a downward trend [4], but it still requires the key attention of clinicians. Some studies have shown that the body mass index (BMI) is related to the occurrence of postoperative complications of esophageal cancer [5]. In addition, the nutritional and physical status of patients is also closely related to the prognosis of the disease. Some studies have pointed out that patients with digestive tract tumors accompanied by sarcopenia [6] and myosteatosis [7] before surgery are prone to surgical-related complications after surgery, and it can affect the long-term prognosis of patients. Due to the acceleration of the body's energy consumption by the tumor and the influence on food intake when the tumor causes obstruction, the incidence of preoperative malnutrition in patients with esophageal cancer is high (65% - 85%) [8]. As an important part of the evaluation of nutritional status, skeletal muscle measurement may show changes such as a decrease in skeletal muscle content, myosteatosis, and a decline in muscle function when malnutrition occurs.

Currently, there are various methods for clinically assessing the risk of postoperative complications and nutritional status of patients with esophageal cancer. Traditional assessment indicators, such as the body mass index (BMI), are simple and easy to measure, but they only reflect the relationship between weight and height and cannot accurately reflect the distribution and quality of body fat and muscle [5]. Some biochemical indicators, such as albumin and pre-albumin, can reflect the nutritional status of patients to a certain extent, but it is difficult to comprehensively present the overall changes in body composition. Compared with these conventional methods, the assessment of body composition based on CT analysis has unique advantages. CT can intuitively and accurately measure the fat area, skeletal muscle area and density of different parts of the body, thus providing more detailed and accurate body composition information for clinical practice. This helps doctors to have a more comprehensive understanding of the patient's nutritional reserves, metabolic status, muscle function and other conditions and provides a strong basis for formulating personalized treatment plans and assessing the risk of postoperative complications.

Therefore, this study retrospectively analyzed the data of patients who underwent radical resection of esophageal cancer in the Department of Cardiothoracic Surgery of Jingzhou Central Hospital in recent years. The changes in the body composition of patients were analyzed through CT images to evaluate their value in predicting postoperative complications of esophageal cancer.

2. Data and Methods

2.1. General Data

This study retrospectively analyzed the clinical and imaging data of 122 patients with esophageal cancer admitted to the Department of Cardiothoracic Surgery of Jingzhou Central Hospital from January 2020 to December 2023. There were 113 males and 9 females in the study cohort, with an average age of 61.3 years, and the age range was from 44 to 82 years. All patients underwent radical resection of esophageal cancer. This study has been approved by the Ethics Committee of Jingzhou Central Hospital (Approval No.: 2024-227-01).

2.2. Inclusion and Exclusion Criteria

Inclusion criteria:

1) The patient underwent an abdominal CT scan within one month before surgery, and the imaging data were complete.

2) The patient had no obvious obstacles in the preoperative examinations related to cardiopulmonary function.

3) The patient received radical resection of esophageal cancer.

4) The postoperative pathological diagnosis was esophageal cancer.

Exclusion criteria:

1) Patients who underwent combined resection of multiple organs.

2) Patients with incomplete clinical and imaging data.

3) Patients with a history of major thoracoabdominal surgeries.

2.3. Observation Indicators

2.3.1. Clinical Indicators

1) General information: Age, gender, body mass index (BMI), smoking history, drinking history, history of hypertension, history of diabetes mellitus, hemoglobin concentration, albumin concentration, pathological type, pathological stage, and the location of the lesion in the esophagus.

2) Surgical and postoperative complication data: Operation time, intraoperative blood loss, postoperative anastomotic fistula, pulmonary infection, pleural effusion, postoperative bleeding, poor wound healing, and the occurrence of Clavien-Dindo grade III or above complications.

3) Body composition indicators: Visceral fat area at the L3 level, skeletal muscle area, and skeletal muscle density. The L3 level is selected for measurement because it can better represent the distribution of skeletal muscle and fat throughout the body. It has good repeatability and comparability and has been widely used in body composition analysis research [9]-[11]. The visceral fat area reflects the distribution of body fat. Excessive visceral fat is associated with multiple metabolic diseases, affecting surgical tolerance and postoperative recovery. The skeletal muscle area and density can evaluate muscle mass and quality. A decrease in muscle mass and a decline in quality are related to poor nutritional status and reduced immunity in patients, which in turn affects the risk of postoperative complications.

2.3.2. Body Composition Analysis

CT scanning and data acquisition: The abdominal CT data of patients were downloaded through the PACS system of the Imaging Department of Jingzhou Central Hospital. The model of the CT scanning instrument is SIEMENS Scope, and the scanning protocol is a routine thoracoabdominal CT scan. The patient is placed in a supine position with both hands raised. Scanning is performed after deep inspiration and breath-holding. The scanning range extends from the sternoclavicular joint to the upper one-third of the thigh, and the scanning slice thicknesses include 1.0, 1.25, and 1.5 mm. Scanning parameters: Tube voltage is 130 KV, tube current is automatic mAs, spiral speed is 0.5 s, pitch is 1.375 mm, matrix is 512 mm × 512 mm.

Image analysis and index measurement: The CT image data were imported into a computer equipped with 3D Slicer software for processing. On the plane of the third lumbar vertebra, image segmentation, area measurement, density measurement, and other processing and optimization were carried out on muscles, fat, etc. to obtain the corresponding observation indicators. The specific steps are as follows: Import the images into 3D Slicer (Version 5.6.1), add a segmentation template, and segment the region of interest (ROI) according to the corresponding tissue thresholds. For example, the threshold is adjusted to −29 to 150 HU to calculate the area of skeletal muscle, and the threshold is adjusted to −150 to −50 HU to calculate the area of visceral fat (**Figure 1**). The automatically generated area needs to be identified by researchers, and the data of redundant layers are removed to obtain the final data, so as to calculate the area of each component required. The marking function in the software is used to measure the average density of skeletal muscle at the level of the third lumbar vertebra (L3).

2.4. Evaluation Criteria

1) Sarcopenia: Convert the skeletal muscle area at the L3 level into a skeletal muscle index (SMI) based on height (H). Specifically, SMI (cm^2/m^2) = skeletal muscle area at the L3 level/H^2. When SMI < 42.2 cm^2/m^2 for males and SMI <

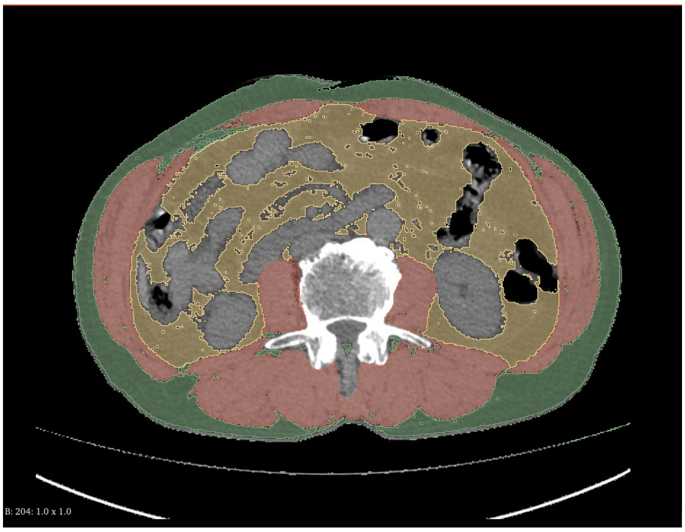

Figure 1. Measurement of the area of abdominal visceral fat and skeletal muscle at the L3 level (skeletal muscle, visceral fat, subcutaneous fat and other tissues).

33.9 cm^2/m^2 for females, sarcopenia is diagnosed [9].

2) Visceral obesity: The intra-abdominal fat area > 100 cm^2 (for both males and females) [10].

3) Myosteatosis: When BMI < 25 kg/m^2, a skeletal muscle density < 41 HU, or when BMI ≥ 25 kg/m^2, a skeletal muscle density < 33 HU can be diagnosed as myosteatosis [11].

2.5. Statistical Methods

Statistical analysis was performed using statistical software (SPSS, Version 26.0.0). For continuous data, a normal distribution test was first carried out. For measurement data conforming to a normal distribution, an independent t-test was used for comparison between groups, which was expressed as $\bar{x} \pm s$. For measurement data with a skewed distribution, the Mann-Whitney U test was used, which was expressed as M (Q1, Q3). Enumeration data were expressed as absolute values, and the Chi-square test or Fisher's exact probability method was used for comparison between groups. For patients who developed pulmonary infection after surgery, a logistic regression model was used to analyze the possible factors related to the occurrence of pulmonary infection after esophageal cancer surgery. A P-value < 0.05 was considered to indicate a statistically significant difference.

3. Results

3.1. General Situation

A total of 122 patients with esophageal cancer were included in this study, with an age of (61.3 ± 7.3) years. The results of preoperative CT analysis of fat area, muscle area and density showed that the incidences of preoperative visceral obesity, sarcopenia, and skeletal muscle esterification were 32.8% (40/122), 69.7% (85/122), and 66.4% (81/122) respectively. The operation time was (363 ± 68) minutes, and the intraoperative blood loss was 300 (200, 400) mL. Among the postoperative pathological results, there were 121 cases of squamous cell carcinoma and 1 case of adenocarcinoma. In terms of pathological stages, there were 20 cases in stage I, 39 cases in stage II, 57 cases in stage III and 6 cases in stage IV, among which 5 cases received preoperative neoadjuvant therapy. Among the postoperative complications, the incidence of pleural effusion was the highest, accounting for 37.7% (46/122), followed by pulmonary infection (30.3%, 37/122), respiratory failure 4.9% (6/122), anastomotic fistula 4.1% (5/122), poor wound healing 1.6% (2/122), chylothorax 1.6% (2/122), and postoperative bleeding 1.6% (2/122). The incidence of Clavien-Dindo grade III or above complications was 30.3% (37/122).

These data provide clinicians with intuitive information on the preoperative body composition status of esophageal cancer patients and the occurrence of postoperative complications. The high incidence of preoperative sarcopenia and myosteatosis prompts clinicians to pay special attention to the muscle quality and nutritional status of patients during preoperative assessment. They should develop intervention measures such as nutritional support in advance to improve patients' physical reserves and enhance their surgical tolerance.

3.2. The Relationship between Changes in Body Composition and Clinical Indicators, and Postoperative Complications

As can be concluded from **Table 1**, the hemoglobin level in the visceral obesity group was higher than that in the non-visceral obesity group ($P = 0.005$), and the BMI was significantly higher than that in the group without visceral obesity ($P = 0.001$). In addition, the incidence of postoperative pleural effusion in the non-visceral obesity group was significantly higher than that in the visceral obesity group ($P = 0.032$). Patients with sarcopenia were older than those without sarcopenia ($P = 0.014$), and their BMI and hemoglobin levels were lower ($P = 0.020$), but there was no significant difference in the complication incidence between the two groups. In the myosteatosis group, the age was higher than that in the non-myosteatosis group ($P = 0.001$), but the operation time was shorter ($P = 0.038$), and the incidences of pulmonary infection and overall complications were higher ($P = 0.001$).

From a clinical perspective, the associations between visceral obesity, hemoglobin levels, and BMI suggest that doctors can preliminarily assess patients' nutritional and hematopoietic function status by paying attention to their fat distribution. For patients who are not viscerally obese but have a high incidence of pleural effusion, clinicians should further explore the mechanism of pleural effusion. It may be necessary to monitor the thoracic cavity more closely and take preventive measures in advance if necessary, such as improving the patients' cardiopulmonary function. The relationship between sarcopenia, age, and nutritional indicators emphasizes the importance of assessing muscle mass in elderly esophageal cancer patients. Consider targeted nutritional supplementation and rehabilitation exercises to prevent further muscle loss. The phenomenon that the sarcopenic

Table 1. The relationship among the clinical indexes of 122 esophageal cancer patients, the occurrence of postoperative complications and the changes in body composition.

Variable	Visceral obesity				Sarcopenia				Myosteatosis			
	Yes (n = 40)	No (n = 82)	t/χ^2	P	Yes (n = 85)	No (n = 37)	t/χ^2	P	Yes (n = 81)	No (n = 41)	t/χ^2	P
Age (years)	64.5 ± 6.8	62.4 ± 7.5	0.303	0.114	64.2 ± 7.0	60.5 ± 7.6	0.246	0.014	64.8 ± 6.9	59.8 ± 7.1	0.762	0.001
Gender (Male/Female)	37/3	76/6		1.000[a]	78/7	35/1		0.449[a]	73/8	40/1		0.270[a]
Hemoglobin (g/L)	136 ± 15	127 ± 15	0.788	0.005	128 (118,139)	136 (128,144)	2.329	0.020	129.3 ± 16.5	130.5 ± 15.8	0.580	0.708
Albumin (g/L)	39.1 ± 3.2	38.9 ± 4.1	0.231	0.673	39.0 ± 3.9	39.0 ± 3.3	0.538	0.949	39.0 ± 4.1	38.9 ± 3.1	0.108	0.922
Surgical time (min)	375 ± 74	356 ± 65	0.690	0.177	360 ± 71	369 ± 64	0.622	0.493	354 ± 71	380 ± 61	0.336	0.038
Intraoperative blood loss (mL)	300 (200,400)	300 (200,400)	−0.014	0.989	300 (200,400)	200 (200,300)	0.832	0.406	300 (200,400)	200 (200,400)	−0.843	0.399
Pulmonary infection (n)	11	26	0.225	0.635	33	13	0.906	0.341	33	4	12.368	0.001
Pleural effusion (n)	9	37	5.858	0.016	32	14	0.149	0.699	33	13	0.946	0.331
Anastomotic leakage (n)	2	3		0.662[a]	2	3		0.163[a]	3	2		1.000[a]
Poor wound healing (n)	2	0		0.106[a]	1	1		0.516[a]	1	1		1.000[a]
Chylothorax (n)	0	2		1.000[a]	2	0		1.000[a]	2	0		0.550[a]
Respiratory failure (n)	3	3		0.392[a]	4	0		0.176[a]	6	0		0.096[a]
Postoperative bleeding (n)	1	1		0.550[a]	1	1		0.516[a]	1	1		1.000[a]
Complications of Clavien-Dindo grade III and above (n)	10	27	0.799	0.371	28	9	0. 906	0.341	29	8	3.419	0.064
Clinical stage (n)			−0.808	0.419			−0.447	0.655			−1.627	0.104
I	8	12			17	3			16	4		
II	14	25			25	14			26	13		
III	15	42			42	15			37	20		
IV A	3	3			3	3			2	4		
BMI (kg/m^2)	24.71 ± 2.25	20.66 ± 2.17	0.929	0.001	21.31 ± 2.63	23.54 ± 2.94	0.397	0.001	21.82 ± 2.58	22.32 ± 3.46	0.007	0.373

[a]Fisher's exact probability method was adopted.

obesity group has a short operation time but a high complication rate reminds doctors that when facing such patients, they should not relax their vigilance just because of the short operation time. Instead, they need to pay more attention to preventing complications such as postoperative infections, for example, by strengthening anti-infection treatment and nutritional support.

3.3. The Analysis of Risk Factors Affecting Postoperative Complications of Esophageal Cancer and a Prediction Model for Pulmonary Infection

In Table 2, univariate and multivariate logistic regression analyses were conducted on the factors related to the occurrence of pulmonary infection after esophageal cancer surgery. The results of the univariate analysis showed that preoperative age (P = 0.016), history of alcohol consumption (P = 0.028), hemoglobin (P = 0.021), skeletal muscle esterification (P = 0.001), and skeletal muscle density

Table 2. The analysis of risk factors affecting the occurrence of pulmonary infection after esophageal cancer surgery.

Variable	Postoperative pulmonary infection		t-value	P-value	OR	95% CI	P	OR’
	Yes (n = 37)	No (n = 85)						
Age (years)	65.2 ± 5.7	62.2 ± 7.8	0.066	0.016	1.074	(1.001, 1.152)	0.046	
Gender (male/female)	64/5	49/4		0.721[a]				
Hypertension (Yes/No)	14/23	18/67	3.698	0.054				
Diabetes mellitus (Yes/No)	1/36	4/81		1.000[a]				
History of smoking (Yes/No)	16/21	46/39	1.220	0.269				
History of alcohol consumption (Yes/No)	17/20	57/28	4.815	0.028	3.253	(1.267, 8.352)	0.014	3.124 (1.270, 7.685)
Hemoglobin (g/L)	134 ± 12	128 ± 16	0.081	0.021	1.059	(1.020, 1.099)	0.003	1.043 (1.011, 1.076)
Albumin (g/L)	39.1 (37.1, 41.4)	38.9 (36.7, 41.5)	0.555	0.579				
Surgical time (min)	370 ± 69	359 ± 69	−0.766	0.446				
BMI (kg/m ^{2})	21.81 ± 2.88	22.07 ± 2.93	0.607	0.656				
Visceral obesity (Yes/No)	11/26	29/56	0.225	0.635				
Sarcopenia (Yes/No)	9/28	28/57	0.906	0.341				
Myosteatosis (Yes/No)	4/33	37/48	12.368	0.001	0.108	(0.024, 0.486)	0.004	0.135 (0.41, 0.442)
Visceral fat area (cm^2)	49.6 (15.3, 99.6)	75.1 (34.9, 128.1)	−0.912	0.362				
Skeletal muscle index (cm^2/m^2)	37.0 ± 7.7	37.8 ± 7.9	0.934	0.579				
Skeletal muscle density (HU)	35.5 ± 3.9	38.3 ± 7.3	0.001	0.034	1.048	(0.953, 1.151)	0.333	

[a]Fisher’s exact probability method was adopted; OR’ represents the adjusted value.

(P = 0.034) were correlated with the occurrence of postoperative pulmonary infection. Further results of the binary multivariate logistic regression analysis showed that skeletal muscle density and age were not independent factors. After adjusting and including the influencing factors, the results showed that the history of alcohol consumption [OR = 3.124, 95% CI: (1.270, 7.685), P = 0.013], hemoglobin [OR = 1.043, 95% CI: (1.011, 1.076), P = 0.009], and skeletal muscle esterification [OR = 0.135, 95% CI: (0.041, 0.442), P = 0.001] were independent influencing factors.

A model was established based on these factors to predict the occurrence of pulmonary infection in the included cases. If the predicted probability was greater than 0.5, the patient was considered to have developed pulmonary infection; otherwise, the patient was considered not to have developed pulmonary infection (Table 3). Finally, the sensitivity of the model was 35.1, the specificity was 88.2, the positive predictive value was 56.5, and the negative predictive value was 75.8. An ROC curve was obtained by establishing a prediction model using the independent influencing factors, with an AUC of 0.774 (Figure 2), indicating that the model had a certain predictive ability.

Table 3. Contingency table for prediction of pulmonary infection.

		Predict pulmonary infection	
		Yes	No
Actual pulmonary infection	Yes	13	24
	No	10	75

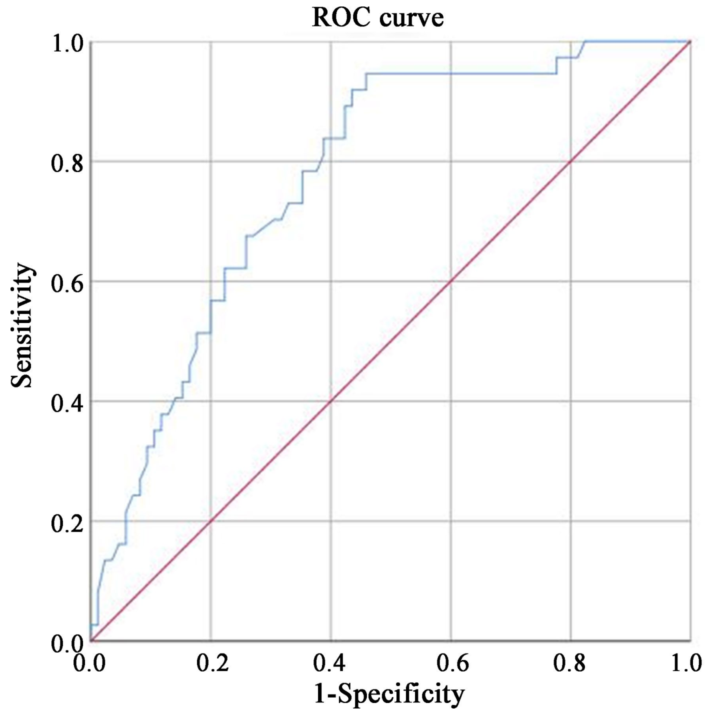

Figure 2. Prediction model for pulmonary infection—ROC Curve.

Identifying a history of alcohol consumption, hemoglobin levels, and myosteatosis as independent influencing factors for pulmonary infection helps doctors more accurately assess the risk of pulmonary infection in patients before surgery. For patients with a history of alcohol consumption, doctors should strengthen respiratory tract management during the perioperative period, such as guiding patients to perform respiratory training and quit smoking, to reduce the risk of pulmonary infection. For patients with abnormal hemoglobin levels, correction before surgery can be considered to improve the patients' oxygen supply and immune function. For patients with myosteatosis, in addition to nutritional support, appropriate muscle function exercises can also be considered to enhance the body's immunity.

4. Discussion

As a common malignant tumor of the digestive system, esophageal cancer has a relatively high incidence and mortality rate, which seriously threatens the life and health of patients. In this study, through a relatively superficial retrospective analysis of the data of patients who underwent radical resection of esophageal cancer in the Department of Cardiothoracic Surgery of Jingzhou Central Hospital, the value of changes in body composition in predicting postoperative complications of esophageal cancer was briefly explored. The research results provide a relatively meaningful reference basis for the clinical diagnosis and treatment of esophageal cancer.

4.1. The Relationship between Changes in Body Composition and Clinical Indicators

This study found that changes in body composition are associated with a variety of clinical indicators. The hemoglobin level and BMI in the visceral obesity group were higher than those in the non-visceral obesity group. This may be because the accumulation of visceral fat affects the metabolic state of the body, thereby influencing the hematopoietic function and nutritional indicators [12]. Patients with sarcopenia were older, and their BMI and hemoglobin levels were lower, suggesting that the decrease in muscle mass may be closely related to the nutritional status of the body and the aging process [13]. The age of the myosteatosis group was higher, which may reflect the physiological change that muscle tissue is gradually infiltrated by fat with age. At the same time, the operation time in the myosteatosis group was shorter. This may be because the muscle quality of the patients in this group is relatively poor, making the surgical exposure relatively easier. However, this may also be related to other factors and requires further study.

4.2. The Relationship between Changes in Body Composition and Postoperative Complications

The study results show that there is a certain relationship between changes in body composition and postoperative complications. The incidence of postoperative pleural effusion in the non-visceral obesity group was significantly higher than that in the visceral obesity group. The reason may be that visceral fat has a certain protective effect, or there are other factors affecting the occurrence of pleural effusion in non-visceral obese patients. The incidences of pulmonary infection and overall complications in the myosteatosis group were higher. This may be because myosteatosis leads to a decline in muscle function and a decrease in the body's immunity, thus increasing the risk of complications such as infection [14].

4.3. Risk Factors for Pulmonary Infection after Esophageal Cancer Surgery

Univariate and multivariate logistic regression analyses showed that the history of alcohol consumption, hemoglobin level, and skeletal muscle esterification are independent influencing factors for pulmonary infection after esophageal cancer surgery. Patients with a history of alcohol consumption may have a decreased defensive function of the respiratory mucosa due to long-term alcohol consumption, increasing the chance of pulmonary infection [15]. The hemoglobin level is closely related to the body's oxygen supply and immune function, and changes in its level may affect tissue repair and anti-infection ability. Skeletal muscle esterification reflects the changes in muscle quality and function [16]. As mentioned above, it will affect the body's immunity and, in turn, the occurrence of pulmonary infection.

4.4. The Significance of the Prediction Model

The prediction model established based on independent influencing factors has a certain predictive ability, with an area under the ROC curve of 0.774. This provides a powerful tool for clinicians to predict the occurrence of pulmonary infection after esophageal cancer surgery, helping to take targeted preventive measures in advance. For example, for patients with a history of alcohol consumption, abnormal hemoglobin levels, and skeletal muscle esterification, strengthen perioperative management, including respiratory tract care, nutritional support, etc., to reduce the incidence of complications such as pulmonary infection and improve the prognosis of patients.

4.5. The Limitations of the Study

Although this study has achieved some meaningful results, it still has certain limitations.

- Relatively small sample size: This may affect the accuracy and generality of the results. Only 122 patients were included in this study, and the sample size is relatively limited. It is difficult to comprehensively cover various characteristics and conditions of esophageal cancer patients.
- Insufficient variable analysis: The study only analyzed some body composition indicators and clinical factors. There may be other unincluded factors that affect the occurrence of postoperative complications in esophageal cancer patients. Preoperative chemotherapy or radiotherapy is an important potential confound-

ing factor. Preoperative chemotherapy or radiotherapy may change the patient's body composition, affecting muscle quality, fat distribution, and nutritional status.

- Defects in the research design: As a retrospective study, the data rely on medical records, and there are problems of incomplete and inaccurate information. It is prone to selection bias. Moreover, it is impossible to perform random grouping and intervention, making it difficult to determine causal relationships and affecting the reliability of the conclusions and their application value.
- Measurement method errors: The body composition analysis used the 3D Slicer software. Factors such as differences among operators and the quality of CT images can lead to measurement errors, affecting the judgment of patients' body composition and the analysis of the relationship with complications.

Future research needs to include a larger sample size and comprehensively consider multiple factors, including preoperative chemoradiotherapy, to further verify and improve these conclusions, providing a more reliable basis for the clinical treatment of esophageal cancer patients.

5. Conclusion

Body composition changes play a crucial role in predicting postoperative complications in esophageal cancer patients. These findings can help clinicians better understand the risk factors for postoperative complications, enabling more targeted perioperative management. This, in turn, has the potential to improve patient outcomes and quality of life after esophageal cancer surgery. However, due to the study's limitations such as a relatively small sample size, future research with larger cohorts is needed to further validate and expand these results, ultimately enhancing the clinical management of esophageal cancer.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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