

Risk Factors and Clinical Outcomes of Postoperative Hypoproteinemia in Patients with Non-Small Cell Lung Cancer

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Abstract:

Objective: To analyze the risk factors for hypoalbuminemia (HA) in non-small cell lung cancer (NSCLC) patients after surgery and to compare the effect of postoperative human serum albumin (HSA) infusion on clinical outcomes, providing evidence for prevention and treatment strategies. **Methods:** Retrospective data collection was performed on 206 NSCLC patients who underwent video-assisted thoracoscopic surgery (VATS) at the First Affiliated Hospital of Chongqing Medical University from September to November 2021, including clinical characteristics and laboratory examination results. Univariate and logistic regression analyses were conducted to identify the risk factors for postoperative HA. Patients with postoperative albumin levels of no less than 30g/L were divided into an observation group and a control group based on whether they received exogenous infusion of Human Serum Albumin (HSA). Propensity score matching (PSM) was used to match patients in the two groups, and clinical outcomes were compared. **Results:** HA occurred on the first day after surgery in 44% of patients. Univariate analysis showed that age, preoperative serum albumin level, comorbid diabetes, intraoperative colloid volume replacement, surgical duration, and intraoperative blood loss were associated with postoperative HA. Multivariate analysis indicated that intraoperative colloid volume replacement, intraoperative blood loss, and lymph node dissection were independent risk factors for postoperative HA. After PSM matching, there were 28 patients in each group. The observation group had a longer postoperative hospital stay and drainage tube placement time compared to the control group ($P < 0.05$). The observation group also had higher drug costs and total postoperative drainage volume compared to the control group ($P < 0.05$). There was no significant difference in total complications and pulmonary complications between the two groups ($P > 0.05$). **Conclusion:** Postoperative HA is common in NSCLC patients. Active measures should be taken to reduce the occurrence of postoperative HA in patients with high-risk factors. Routine exogenous HSA infusion is not recommended for NSCLC patients with albumin levels not lower than 30g/L.

Keywords:

Video-Assisted Thoracoscopic Surgery, Lung Cancer, Hypoalbuminemia, Human Serum Albumin, Propensity Score Matching Method

1. Introduction

Since the introduction of video-assisted thoracoscopic surgery (VATS), it has rapidly become the main method for the surgical treatment of operable non-small cell lung cancer (NSCLC). Although surgical techniques and perioperative management have rapidly developed, postoperative complications remain an important factor that both patients and doctors have to deal with. According to reports, the incidence of postoperative complications after lung cancer surgery is about 8%-35%. [1] Postoperative complications may prolong the length of hospital stay, increase hospital costs, and affect the recovery of patients' functional status. [2] It has been shown in clinical practice that there is a high risk of developing low albumin levels early after lung cancer surgery, even in patients with normal serum albumin levels before surgery. As an indicator of nutritional status and inflammation, perioperative low albumin levels have been shown to be an independent predictor of postoperative complications and mortality. [3] There is also growing evidence that low albumin levels after abdominal surgery are associated with patient outcomes. [4,5,6,7] It has also been shown that low serum albumin levels after thoracic surgery for lung cancer are closely related to the occurrence of pulmonary complications.[8] Ryan et al. found that early postoperative low albumin levels are associated with complications after esophagectomy.[9] Therefore, it is necessary to explore the risk factors that influence postoperative HA in patients, predict high-risk patient groups, and actively prevent and treat postoperative HA. In clinical practice, patients with lung cancer who develop HA after surgery are commonly given HSA infusion to correct the deficiency, but its effectiveness in improving clinical outcomes remains controversial, and no unanimous conclusion has been reached. The infusion of albumin in patients with low albumin levels after surgery has been shown to improve clinical outcomes in some studies, [10,11] while in others it has been shown to be beneficial for correcting low albumin levels or improving clinical outcomes early after gastrointestinal surgery. [12,13] There are also studies that show correcting low serum albumin levels after pulmonary segmentectomy does not improve outcome indicators. [14] HSA is a blood product that is prepared by using cold ethanol protein separation method from plasma obtained from healthy human blood. It is widely used to increase blood volume and maintain plasma colloid osmotic pressure and nutritional supply. Additionally, HSA is expensive and resource-intensive. Clinicians should use it judiciously to ensure safe treatment and avoid resource waste. For patients with lung cancer who have an albumin level of less than 30g/L after surgery, clinicians usually infuse HSA to correct HA. However, for postoperative patients with $ALB \geq 30g/L$, there is a significant controversy regarding whether HSA supplementation is necessary. This study compares the effect of exogenous HSA infusion on clinical outcomes in patients with lung cancer whose serum albumin levels do not lower than 30g/L after surgery using the propensity score matching method (PSM) to provide a reference for clinical medication.

2. Methods

2.1. Patients

This is a retrospective cohort study from a single center. The study collected patients who underwent lung cancer surgery in the thoracic surgery department of the First Affiliated Hospital of Chongqing Medical University between September and November 2021 as the research subjects. Patients' inclusion criteria: a. Lung cancer

patients who had not undergone any prior anti-tumor treatments; b. Patients who underwent video-assisted thoracoscopic surgery and had confirmed histopathological diagnosis of non-small cell carcinoma; c. Patients without severe heart, brain, liver, or kidney diseases. Exclusion criteria: a. Patients with preoperative serum albumin levels less than 35g/L; b. Patients who received preoperative albumin infusion; c. Patients with incomplete clinical data. Finally, a total of 206 patients were enrolled in the study.

2.2. Data collection

Data including: Demographic information: gender, age, height, weight, body mass index (BMI), smoking history, alcohol consumption history, pulmonary function (forced expiratory volume in 1 second, FEV1), presence of hypertension, diabetes, and emphysema. tumor size, postoperative pathological type, and TNM staging. Laboratory examination results during the perioperative period: liver and kidney function tests, complete blood count, and C-reactive protein levels. Surgical details: surgical approach, extent of resection, lymph node dissection, intraoperative blood loss, surgical duration, and intraoperative fluid replacement. Postoperative information: postoperative drainage output, duration of drainage tube placement, duration of antibiotic use, length of hospital stay, hospitalization costs, medication costs, and occurrence of postoperative complications.

2.3. Perioperative management

All patients underwent lung wedge/segment or lobe resection using VATS. Postoperatively, prophylactic antibiotics were administered to prevent infections. For patients with cessation of lung air leakage for more than 24 hours and a daily fluid drainage volume ≤ 200 ml, the chest drainage tube was removed. All patients received standard postoperative care management. Postoperative complications of lung cancer include pneumonia, atelectasis, air leak in the lungs, acute respiratory distress syndrome (ARDS), pulmonary embolism, arrhythmias, incision dehiscence, and the criteria used to define them are according to the Association of Thoracic Surgeons and the European Association of Thoracic Surgeons definitions. [16]

2.4. Statistical analysis

The patients included in this study were divided into an observation group and a control group based on whether they received exogenous human serum albumin (HSA) infusion after surgery. Thirteen patients with severe postoperative hypoalbuminemia (ALB < 30g/L) were excluded. In total, 193 patients were included, with 41 patients in the HSA infusion group and 152 patients in the non-HSA infusion group. Propensity score matching (PSM) was performed using SPSS 25.0 software with a tolerance setting of 0.03 to achieve a 1:1 matching between the observation and control groups, balancing the baseline characteristics differences caused by confounding factors. The balanced variables included age, gender, BMI, preoperative creatinine level, bilirubin level, smoking history, presence of hypertension, diabetes, extent of resection ($\geq$ lobe), lymph node dissection, and occurrence of persistent air leakage postoperatively. After balancing the confounding factors, the differences in short-term outcome measures were compared between the two groups to evaluate the impact of HSA supplementation in patients with mild hypoalbuminemia after surgery for non-small cell lung cancer on clinical outcomes.

SPSS 25.0 software was used for statistical analysis. Normally distributed continuous variables were expressed as mean $\pm$ standard deviation, while skewed

continuous variables were presented as median and interquartile range. Categorical variables were expressed as frequency and percentage. In univariate analysis, t-tests or non-parametric tests were used for continuous variables depending on their normality, and chi-square tests were used for categorical variables. Variables that showed statistical significance in univariate analysis were further analyzed by multivariate logistic regression analysis. $P < 0.05$ was considered statistically significant.

3. Results

3.1. Study population and baseline characteristics

According to the relevant inclusion and exclusion criteria, among the 206 patients included in the study, 92 patients experienced hypoalbuminemia on the first postoperative day. The criterion for hypoalbuminemia after lung cancer surgery was a serum albumin level less than 35g/L, with an incidence rate of 44.6%. General information of the 206 patients is shown in Table 1.

Table 1. Characteristics of two group patients divided by ALB.

Characteristic	HA		² /t/ Z	P
	Yes(n=92)	No(n=114)		
Age (years, $\bar{x} \pm s$)	58.42 $\pm$ 11.25	53.98 $\pm$ 10.43	2.932	0.004
Gender[male,n(%)]	32(34.78)	40(35.08)	0.002	0.964
BMI(kg/m ² , $\bar{x} \pm s$)	22.98 $\pm$ 3.02	22.92 $\pm$ 2.96	0.147	0.883
smokers[n(%)]	24(26.08)	21(18.42)	1.752	0.186
Smoking index $\geq$ 400[n(%)]	20(21.73)	15(13.16)	2.658	0.103
Concomitant Diseases[n(%)]	21(22.82)	20(17.54)	0.891	0.345
Hypertension	22(23.91)	24(21.05)	0.240	0.624
Diabetes	12(13.04)	4(3.51)	6.461	0.011
emphysema	14(15.21)	11 (9.65)	1.480	0.224
Tumor size[cm,M(P ₂₅ ,P ₇₅)]	1.50(1.00,2.57)	1.40(0.90,2.02)	-1.601	0.109
Tumor size $\geq$ 3cm[n(%)]	17(18.47)	11(9.65)	3.379	0.066
Pathology[n(%)]			2.497	0.144
Adenocarcinoma	84(91.30)	110(96.49)		
SCC	8(8.70)	4(3.51)		
FEV1(L, $\bar{x} \pm s$)	2.35 $\pm$ 0.49	2.49 $\pm$ 0.58	-1.784	0.076
TNM stage,[n(%)]			1.093	0.628
I	84(91.3)	108(94.7)		
II	9(9.8)	4(3.5)		
III	5(5.3)	2(1.8)		
ALB(g/L,M(P ₂₅ ,P ₇₅))	45.00(43.00,47.00)	47.00(45.00,48.00)	-3.522	<
TBIL(umol/L,M(P ₂₅ ,P ₇₅))	10.40(7.50,14.10)	11.10(8.30,14.25)	-0.757	0.449
SCR(umol/L,M(P ₂₅ ,P ₇₅))	69.00(62.00,76.00)	64.50(57.00,78.75)	-1.879	0.060
Intraoperative fluid replacement				
Crystalloid fluids	6.00(6.00,11.00)	11.00(6.00,11.00)	-1.158	0.247
Colloid fluids	5.00(0,5.00)	0(0,5.00)	-3.697	<
Total fluid	11.00(11.00,12.75)	11.00(11.00,11.00)	-2.459	0.014
Intraoperative blood	100(50,100)	50(50,100)	-3.821	<
Operation	110.00(80.00,150.00)	90.00(74.25,126.25)	-2.615	0.009
Extent of resection[n(%)]			0.614	0.433

≥Lobectomy	38(41.30)	41(35.96)		
Segmentectomy/Wedge	54(58.70)	73(64.04)		
lymph node	42(45.65)	34(29.82)	5.478	0.019
POD1				
CRP(g/L,M(P ₂₅ ,P ₇₅))	23.90(12.00,42.70)	13.30(6.93,27.10)	-3.503	<
WBC(x10 ⁹ /L,M(P ₂₅ ,P ₇₅))	11.08(9.27,12.20)	11.78(10.08,14.67)	-3.053	0.002
NEUT%(M(P ₂₅ ,P ₇₅))	86.10(81.15,90.75)	89.45(84.67,92.75)	-2.870	0.004
HB(g/L,M(P ₂₅ ,P ₇₅))	119.00(111.50,125.50)	128.00(120.00,136.25)	-4.958	<

3.2. Univariate and multivariate analyses

The univariate analysis results showed that there were statistically significant differences between the two groups of patients in terms of age, comorbid diabetes, preoperative serum album levels, intraoperative colloid fluid supplementation, total intraoperative fluid supplementation, whether lymph nodes were cleared, blood loss, and surgical duration ($P < 0.05$). There were no statistically significant differences between the two groups of patients in postoperative C-reactive protein (CRP), white blood cell count (WBC), and neutrophil ratio ($P < 0.05$).

The results of multivariate regression analysis showed that intraoperative colloid fluid supplementation, intraoperative blood loss, and lymph node dissection were independent risk factors for postoperative hypoproteinemia in patients with non-small cell lung cancer, while preoperative serum albumin level was a protective factor. The results can be found in Table 2.

Table 2. Multivariate analysis.

Variables	B	S.E.	Wald	P	OR(95%CI)
Age	0.18	0.016	1.241	0.265	1.018(0.986-1.051)
Alb	-0.132	0.060	4.834	0.028	0.876(0.779-0.986)
Colloid fluids	0.162	0.071	5.177	0.023	1.176(1.023-1.352)
Total fluid	-0.013	0.070	0.037	0.848	0.987(0.860-1.132)
Intraoperative blood loss	0.736	0.315	5.461	0.019	2.087(1.126-3.867)
Operation time	-0.059	0.265	0.050	0.823	0.943(0.561-1.584)
Concomitant diabetes	0.916	0.657	1.944	0.163	2.498(0.690-9.050)
Thoracotomy	0.282	0.981	0.083	0.774	1.326(0.194-9.062)
extent of resection(≥Lobectomy)	-0.939	0.517	3.299	0.069	0.391(0.142-1.077)
lymph node dissection	1.025	0.512	4.008	0.045	2.787(1.022-7.600)
constant	3.852	3.178	1.469	0.225	

BMI, body mass index; SCC: Squamous Cell Carcinoma; FEV1, forced expiratory volume in 1 second. POD: Postoperative day, TBIL: Total bilirubin, SCR: Serum creatinine.

3.3. Propensity score matching

The study included a total of 193 patients, with 41 patients receiving postoperative human serum albumin (HSA)

infusion and 152 patients not receiving HSA infusion. The comparison of clinical baseline characteristics between the two groups is shown in Table 3. PSM was used to balance the confounding factors, resulting in 28 patients in both the observation group and the control group. After matching, there were no statistically significant differences in clinical baseline characteristics between the two groups ($P > 0.05$), as shown in Table 3.

Table 3. Clinical baseline characteristics of the observation group and the control group before and after matching.

Factors	Before matchmaking			After matchmaking		
	Observation group (n=41)	Control group (n=152)	P	Observation group (n=28)	Control group (n=28)	P
Age (years, $\bar{x}\pm s$)	59.90 $\pm$ 10.25	54.36 $\pm$ 10.85	0.004	57.18 $\pm$ 9.83	58.68 $\pm$ 8.86	0.546
Gender[male,n(%)]	21(51.2)	45(29.6)	0.010	12(42.9)	11(39.3)	0.786
BMI(kg/m ² , $\bar{x}\pm s$)	22.84 $\pm$ 2.87	22.90 $\pm$ 2.84	0.891	22.61 $\pm$ 2.80	22.00 $\pm$ 2.86	0.418
Hypertension[n(%)]	9(22.0)	32(21.1)	0.901	4(14.3)	5(17.9)	1.000
Diabetes[n(%)]	6(14.6)	6(3.9)	0.012	2(7.1)	1(3.6)	1.000
emphysema[n(%)]	14(34.1)	28(18.4)	0.030	9(32.1)	9(32.1)	1.000
SCR(umol/L,M(P ₂₅ ,P ₇₅))	70.5(61.5,82.8)	66.0(58.0,77.0)	0.036	69.5(58.3,82.8)	69.0(62.0,83.5)	0.855
TBIL(umol/L,M(P ₂₅ ,P ₇₅))	11.4(7.4,14.6)	10.7(7.9,13.6)	0.568	11.35(8.8,15.8)	9.4(7.5,12.4)	0.475
POD1 ALB(g/L)	33.0(31.0,37.00)	36.0(34.0,38.0)	0.000	33.0(31.0,37.0)	33.0(32.0,34.0)	0.550
extent of resection($\geq$ Lobectomy)[n(%)]	28(68.3)	44(28.9)	0.000	16(57.1)	17(60.7)	0.786
lymph node dissection[n(%)]	25(61.0)	44(28.9)	0.000	15(53.6)	19(67.9)	0.274
Air leaked > 5d[n(%)]	15(36.6)	8(5.3)	0.000	4(14.3)	3(10.7)	1.000

POD1: Postoperative day 1

3.4. Comparison of clinical outcomes between the observation group and the control group after matching

The observation group had a longer length of hospital stay and duration of drainage tube placement compared to the control group ($P < 0.05$). The observation group also had higher medication costs and total postoperative drainage volume compared to the control group ($P < 0.05$). There was no significant difference in overall complications and pulmonary complications between the two groups ($P > 0.05$). Additionally, there was no significant difference in duration of antibiotic use, postoperative drainage volume on day 3, and total hospitalization costs between the two groups ($P > 0.05$).

Table 4. The clinical outcomes of the observation group and the control group were compared.

Classification	Total	Observation group (n=28)	Control group (n=28)	P
Total complications[n(%)]	13(23.2)	8(33.3)	5(14.3)	0.737
Pneumonia[n(%)]	4(7.1)	2(7.1)	2(7.1)	1.000
Atelectasis[n(%)]	3(5.4)	2(7.1)	1(3.6)	1.000
Pulmonary air leak[n(%)]	10(14.3)	7(17.9)	3(10.7)	0.295
Postoperative drainage in 3d[ml, $\bar{x}\pm s$]		442.0 $\pm$ 161.7	375.4 $\pm$ 190.0	0.265
Total drainage [ml, $\bar{x}\pm s$]		770.6 $\pm$ 427.3	438.3 $\pm$ 238.4	0.001

Drainage duration[d,M(P ₂₅ ,P ₇₅)]		4.5(4.0,6.0)	3.0(2.25,4.0)	0.001
antibiotic application[d,M(P ₂₅ ,P ₇₅)]		2.0(1.0,3.5)	2.0(1.0,3.0)	0.743
Antibiotic duration[d,M(P ₂₅ ,P ₇₅)]		5.0(4.0,6.75)	4.0(3.0,5.0)	0.008
medication costs(yuan, $\bar{x}\pm s$)		3478.8 $\pm$ 920.7	2914.0 $\pm$ 613.6	0.014
Hospitalization expenses(yuan, $\bar{x}\pm s$)		63618.8 $\pm$ 11451.6	60315.5 $\pm$ 10081.0	0.282

4. Discussion

Similar to many other types of cancer, postoperative HA is often observed in lung cancer patients. The mechanisms contributing to this phenomenon include: a. Increased permeability of systemic capillaries due to the release of a large number of inflammatory mediators under stress conditions, leading to the extravasation of albumin. [18] Previous studies have shown that early postoperative levels of C-reactive protein (CRP) can predict future HA to some extent. In our study, the CRP levels in the HA group were higher than in the control group ($P < 0.05$), indicating a close relationship between CRP and albumin. This may be related to the increased inflammatory cytokines during the perioperative period, which promote the breakdown and reduce the synthesis of serum albumin. [19] b. Reduced hepatic synthesis of albumin in the postoperative stress state and increased albumin degradation due to metabolic hyperactivity. [20] c. Decreased appetite and reduced intake due to anesthesia and postoperative conditions. d. Loss of albumin due to intraoperative blood loss and dilution caused by fluid administration. [21] Studies have shown that administration of low oncotic colloids can result in albumin loss from the vascular gap. [22] Similarly, our study found that intraoperative colloid fluid supplementation and intraoperative blood loss were independent risk factors for postoperative HA. e. Malignant tumors often coexist with malnutrition, and excessive nitrogen consumption by tumors and secretion of cytokines such as TNF- α , IL-6, and interferon into hepatocytes inhibit protein synthesis, resulting in HA. [23] Furthermore, surgical trauma is a major cause of postoperative HA. We found that HA was more likely to occur in patients undergoing lymph node dissection, which may be related to increased trauma. In recent years, robotic surgery using the da Vinci system has gained popularity for the treatment of lung cancer due to its minimally invasive advantages, wider operating range, less blood loss, and fewer postoperative complications. Whether it can reduce postoperative HA needs further investigation. [24]

Postoperative HA in lung cancer patients can lead to pulmonary and organ edema, compromised immune function, delayed lung tissue repair, further affecting ventilation and gas exchange function, prolonging hospital stays, and impacting the recovery of functional status. [25] Therefore, it is important to focus on preventing and treating postoperative HA. Studies have shown that maintaining serum albumin levels above 45g/L through preoperative nutritional supplementation can effectively reduce the occurrence of postoperative HA and complications, as well as shorten hospital stays. [26] Furthermore, implementing nutritional support therapy based on nutritional risk screening can enhance albumin levels within the first 7 days postoperatively. [27] Our study identified intraoperative colloid fluid supplementation, intraoperative blood loss, and lymph node dissection as independent risk factors for postoperative HA, while preoperative serum albumin levels served as a protective

factor, which can aid in predicting the occurrence of HA in lung cancer patients. For high-risk patients prone to postoperative HA, personalized nutritional support and protein supplementation should be initiated early to avoid or minimize the occurrence of HA, thus improving clinical outcomes.

However, there is extensive controversy regarding the supplementation of exogenous human serum albumin (HSA) for postoperative HA, as well as its impact on improving clinical outcomes for patients. [10,11,12,13,14] HSA has various functions, including maintaining plasma colloid osmotic pressure, increasing circulating blood volume, binding and transporting small molecules in the blood, as well as exhibiting anti-inflammatory and antioxidative properties. [28,29] It is widely used in clinical practice, such as in major surgeries, severe plasma volume deficiency due to any cause, fulminant or subfulminant liver failure, advanced liver cirrhosis, spontaneous bacterial peritonitis, and other conditions leading to HA or exacerbated by low albumin levels. [30] However, due to the limited availability of HSA resources, as production is susceptible to blood supply constraints, and its high cost, it is an important burden on healthcare costs and remains in short supply, highlighting the need for clinicians to adhere to appropriate and guideline-based application of HSA. [31] Although the HSA prescribing information includes HA as an indication, it does not provide specific concentration guidelines for the prevention and treatment of HA, and there is a lack of unified and guiding HSA-specific guidelines and standards. [32] Currently, there is a lack of evidence-based medicine to support the use of HSA supplementation for improving clinical outcomes in lung cancer patients following surgery. In clinical practice, exogenous HSA supplementation is commonly used to correct severe HA ($\text{ALB} < 30\text{g/L}$) in postoperative lung cancer patients, with the intention of improving clinical outcomes. In our study, all 13 patients with severe HA received exogenous HSA infusion. However, for postoperative patients with $\text{ALB} \geq 30\text{g/L}$, there is a significant controversy regarding whether HSA supplementation is necessary. Therefore, by selecting postoperative lung cancer patients with $\text{ALB} \geq 30\text{g/L}$ from our study, we conducted a retrospective cohort study to evaluate the effectiveness and rationality of postoperative HSA supplementation in lung cancer patients, aiming to assess the impact of HSA supplementation on clinical outcomes in this subgroup of patients.

Our study found that exogenous supplementation of human serum albumin (HSA) did not reduce perioperative complications or improve clinical outcomes in lung cancer patients with postoperative albumin levels $\geq 30\text{g/L}$, but rather increased medication costs. Exogenous HSA infusion can correct postoperative HA and maintain intravascular colloid osmotic pressure. However, some studies shown that even with the infusion of exogenous HSA to improve plasma colloid osmotic pressure, there may not be significant reabsorption of interstitial fluid. [33] We found no significant difference in postoperative drainage volume between the two groups on the third day, indicating that administering HSA to patients may not improve the drainage in the surgical site. It has been suggested patients undergoing surgery often have varying degrees of hypoalbuminemia, as the liver has the ability to synthesize albumin. Most patients can recover serum albumin levels within the first week after surgery. [34] Additionally, HSA has a long metabolic half-life of 5-11 days, even under stress conditions, and cannot be immediately broken down into amino acids for protein synthesis in the body. Moreover, albumin lacks essential amino acids such as tryptophan and isoleucine, and its high cost as a nutrient supplement does not provide good value for money. Therefore, we do not recommend routine exogenous

supplementation of HSA for lung cancer patients with postoperative albumin levels $\geq 30\text{g/L}$.

Our study has some limitations. First, we only assessed the short-term outcomes of patients after cancer surgery and exogenous HSA supplementation, without discussing long-term prognosis. Second, the timing and amount of HSA infusion in our study were not consistent, making it difficult to the impact of these differences on surgical outcomes. Third, our study was a single-center retrospective study with a small sample size, and further multicenter randomized prospective are needed to verify our findings. Fourth, whether exogenous supplementation of HSA is beneficial for patients with postoperative albumin levels $< 30\text{g/L}$ in lung cancer patients needs further experimental research.

5. Conclusions

Non-small cell lung cancer has a higher risk of postoperative hypoalbuminemia (HA). For patients with high-risk factors for postoperative HA, active measures can be taken to reduce the occurrence of HA in clinical practice. For lung cancer patients with postoperative albumin levels $\geq 30\text{g/L}$, routine exogenous supplementation of human serum albumin (HSA) is not recommended.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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