

**EARLY POSTOPERATIVE RESULTS OF PATIENTS UNDERGOING UNIPORTAL VIDEO-ASSISTED THORACOSCOPIC LOBECTOMY AND THEIR ASSESSMENT WITH THE SYSTEMIC INFLAMMATION SCORING SYSTEM**

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**ABSTRACT**

**Background & Aim:** Uniportal video-assisted thoracoscopic surgery (u-VATS) is a minimally invasive approach that allows thoracic operations to be performed through a single small incision of approximately 4 cm. The Systemic Inflammation Score (SIS) is a scoring system that can be measured easily and inexpensively in routine clinical practice and consists of three laboratory parameters, which are serum albumin level, lymphocyte count, and monocyte count. Scoring systems can provide low-cost and easily attainable objective information that can assist surgeons in evaluating patients. The aim of this study was to examine the early postoperative results of patients who underwent u-VATS lobectomy and to evaluate the relationship of these results with the systemic inflammation scoring system. **Methods:** Age, gender, smoking habits, preoperative lymphocyte and monocyte counts, preoperative albumin values, comorbidities, operative times, length of hospital stay, chest tube removal time, duration of air leak, amount of drainage, and postoperative complications of patients who underwent u-VATS lobectomy operation in our clinic between March 2018 and March 2020 were retrospectively analyzed. Patients were classified by the SIS based on preoperative serum albumin (ALB) level and lymphocyte-to-monocyte ratio (LMR) as follows: SIS=0, ALB  $\geq$ 4.0 g/dL and LMR  $\geq$ 3.4; SIS=1, ALB  $<$ 4.0 g/dL or LMR  $<$ 3.4; and SIS=2, ALB  $<$ 4.0 g/dL and LMR  $<$ 3.4. **Results:** The number of patients who underwent u-VATS lobectomy was 42. There were 12 patients in the SIS 0 group, 19 patients in the SIS 1 group, and 11 patients in the SIS 2 group. The amount of postoperative drainage ( $p=0.000$ ), chest tube removal time ( $p=0.006$ ), and length of hospital stay ( $p=0.000$ ) were correlated with systemic inflammatory scores of patients. The rate of developing postoperative complications was found to increase to almost a statistically significant level as the systemic inflammatory scores of patients increased ( $p=0.084$ ). There was no significant difference between the SIS groups in terms of other parameters. **Conclusion:** Patients who underwent u-VATS lobectomy and had a high preoperative systemic inflammation score had higher amounts of postoperative drainage, longer duration of chest tube and length of hospital stay. The SIS scoring system is a simple, effective risk stratification method that can be routinely used for patients undergoing u-VATS lobectomy.

**Keywords:** Uniportal Video-Assisted Thoracoscopy, Lobectomy, Systemic Inflammation Scoring System, Thoracic Surgery

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## INTRODUCTION

Over the past two decades, video-assisted thoracic surgery (VATS) has revolutionized the way thoracic surgeons diagnose and treat lung diseases. The greatest progress in VATS procedures is performing large pulmonary resections with this technique [1]. The final stage in the evolution of this technique is the uniportal approach. The first uniportal VATS lobectomy was performed by Gonzalez-Rivas at Coruña University Hospital in 2010 [2]. Uniportal VATS (u-VATS) is a minimally invasive approach that allows thoracic surgery operations with large incisions to be performed through a single small incision of approximately 4 cm. It has been increasingly adopted with the increasing number of publications showing successful results of this technique. The advantages include less surgical trauma, reduced postoperative pain, faster recovery, and patient satisfaction because of being less invasive than conventional VATS [3]. Despite advances in surgical techniques, the overall morbidity rate after VATS lobectomy still remains as high as 26.2%-36.3%. Therefore, a better understanding of possible predisposing factors and risks is extremely important to help thoracic surgeons in preventing morbidity [4].

It is known that changes in hematological indicators and blood protein levels of patients are indicators of the systemic inflammatory response. The Systemic Inflammation Score (SIS), which is a postoperative prognostic predictive score, can be easily and inexpensively measured in routine clinical practice based on three laboratory tests, namely serum albumin level, lymphocyte count, and monocyte count. Such biomarkers provide low-cost and easily attainable objective information that can be used to assist physicians in patient assessment [5]. The aim of this study was to examine the early postoperative results of patients who underwent lobectomy with the u-VATS technique and to evaluate the relationship of these results with the systemic inflammation scoring system.

## MATERIALS AND METHODS

The study included patients who underwent u-VATS lobectomy operation between March 2018 and March 2020 in Hacettepe University Department of Thoracic Surgery. All of our patients were routinely managed with standard clinic care, including pulmonary physiotherapy, antibiotic prophylaxis, breathing training, and surgical pain control. Age, gender, smoking habits, preoperative lymphocyte and monocyte counts, preoperative albumin values,

comorbidities, operative times, length of hospital stay, chest tube removal time, duration of air leak, amount of drainage, and postoperative complications of patients were retrospectively analyzed.

Patients who underwent u-VATS lobectomy were divided into three groups based on their systemic inflammation scores. Patients were classified by the SIS based on preoperative serum ALB level and LMR as follows: SIS=0, ALB  $\geq 4.0$  g/dL and LMR  $\geq 3.4$ ; SIS=1, ALB  $< 4.0$  g/dL or LMR  $< 3.4$ ; and SIS=2, ALB  $< 4.0$  g/dL and LMR  $< 3.4$ .

Statistical Package for the Social Sciences (SPSS) version 26 software was used to analyze the data. Changes in systemic inflammation scores of patients by smoking habits, postoperative air leak, and postoperative complications were analyzed using the chi-square test. The mean values of age, total postoperative drainage amount, chest tube removal time, length of hospital stay of the three groups were compared with the non-parametric Kruskal-Wallis test since the sample size per group was less than 30. Results with a significance level of less than 0.05 were considered significant in all analyses.

## RESULTS

The number of patients who underwent u-VATS lobectomy operation was 42. The histopathological examinations of the specimens of our patients who underwent u-VATS lobectomy revealed that 23 patients had adenocarcinoma of the lung, 9 patients had squamous cell carcinoma of the lung, 2 patients had large cell carcinoma of the lung, two patients had typical carcinoid tumor, two patients had pulmonary metastasis of colorectal cancer, two patients had pulmonary metastasis of breast cancer, one patient had mucoepidermoid carcinoma of lung, one patient had pulmonary metastases of alveolar soft part sarcoma. All of our patients had surgery for malignant diseases. None of the patients had specific clinical features suggestive of infection, such as fever. The patients had no history of infection in the last month. The mean age of patients was 61.6 years. Of the patients, 20 were male and 22 were female. As a result of the grouping of patients by the SIS, there were 12 patients in the SIS 0 group, 19 patients in the SIS 1 group, and 11 patients in the SIS 2 group. The mean ages of patients in the SIS 0, SIS 1, and SIS 2 groups were 58.50, 60.32, and 67.45 years, respectively. There was no statistically significant correlation between the groups created by the SIS scoring system and the age of patients ( $p=0.284$ ) (**Table I**).

**Table I: Correlation of SIS with the age of patients**

Systemic Inflammation Score	Number of Patients	Mean	Median	Standard deviation	p value
SIS-0	12	58.50	65.50	16.09	0.284
SIS-1	19	60.32	61.00	16.34	
SIS-2	11	67.45	69.00	6.64	

There was no statistically significant difference between smokers and non-smokers in terms of distribution ratios of patients to systemic inflammatory scores ( $p>0.05$ ). Similarly, there was

no statistically significant difference between the groups in terms of the presence of postoperative air leak ( $p>0.05$ ) (**Table II**).

**Table II: Correlation of SIS with smoking and postoperative air leak**

		Systemic Inflammation Score			p value
		SIS-0	SIS-1	SIS-2	
		n (%)	n (%)	n (%)	
Smoking	-	7 (%50)	4 (%28.57)	3 (%21.43)	0.094
	+	5 (%17.86)	15 (%53.57)	8 (%28.57)	
Postoperative Air Leak	-	10 (%37.04)	11 (%40.74)	6 (%22.22)	0.233
	+	2 (%13.33)	8 (%53.33)	5 (%33.33)	

The analysis of the postoperative drainage amounts of patients showed a statistically significant difference between the three SIS groups ( $p=0.000$ ). The pairwise comparisons showed that the mean drainage amount of the SIS 0 group (172.92) was statistically significantly lower than those of the SIS 1 (232.89) and SIS 2 (329.55) groups. Based on these results, it can be stated that the systemic inflammatory scores and drainage amounts of patients decrease and increase simultaneously. There was a statistically significant difference between the SIS groups in terms of mean chest tube removal time ( $p=0.006$ ). According to the pairwise comparisons, the mean chest tube removal time was 4.25 days in the SIS 0 group, while it was 6 days in the SIS 2 group. Based on these results, it can be stated that the systemic inflammatory scores and

chest tube removal time of patients decrease and increase simultaneously. There was a statistically significant difference between the groups in terms of mean length of hospital stay ( $p=0.000$ ). The paired comparisons revealed that the patients in the SIS 2 group had a longer length of hospital stay than the SIS 0 and SIS 1 groups. The mean length of hospital stay was 4.25 days in the SIS 0 group, while it was 5.16 days in the SIS 1 group and 7 days in the SIS 2 group. The systemic inflammatory scores and length of hospital stay of patients were correlated. There was no statistically significant difference between patients' SIS groups and the length of intensive care unit (ICU) stay ( $p>0.05$ ) (**Table III**).

**Table III: Correlation of SIS with continuous variables**

	Systemic Inflammation Score	n	Mean	Median	Standard Deviation	p value	Post Hoc
Total Drainage Amount (ml)	SIS-0	12	172.92	162.50	39.11	0.000*	0-1
	SIS-1	19	232.89	250.00	57.77		0-2
	SIS-2	11	329.55	275.00	121.36		
Chest Tube Removal Time (day)	SIS-0	12	4.25	4.00	0.75	0.006*	0-2
	SIS-1	19	4.95	5.00	0.85		
	SIS-2	11	6.00	5.00	2.19		
Length of Hospital Stay (days)	SIS-0	12	4.25	4.00	0.75	0.000*	0-2
	SIS-1	19	5.16	5.00	0.76		1-2
	SIS-2	11	7.00	6.00	2.53		
Length of Stay in Intensive Care (days)	SIS-0	12	1.00	1.00	0.00	0.244	
	SIS-1	19	1.00	1.00	0.00		
	SIS-2	11	1.18	1.00	0.60		

The analysis of the SIS groups showed almost a statistically significant difference between patients with and without postoperative complications (p=0.081) (Table IV).

**Table IV: Correlation of SIS with postoperative complications of patients**

		Systemic Inflammation Score			p value
		SIS-0 n (%)	SIS-1 n (%)	SIS-2 n (%)	
Post- operative Complications	-	11 (%33.33)	16 (%48.48)	6 (%18.18)	0.081
	+	1 (%11.11)	3 (%33.33)	5 (%55.56)	

**DISCUSSION**

Over the past 30 years, video-assisted thoracoscopic techniques have been used for simple procedures and have become the preferred technique for performing more complex operations such as lobectomy and esophagectomy. In 2004, Rocco reported the first uniportal thoracoscopic wedge resection worldwide [6]. In this way, patients benefit from an operation that includes less traumatic manipulation [7]. Afterward, Gonzalez-Rivas et al. reported the world's first uniportal lobectomy experience of uniportal major lung resection. Since then, they have published serial studies on uniportal segmentectomy, pneumonectomy, and sleeve lobectomy [8]. SIS is an inflammation score calculated from serum ALB level and LMR that can be easily obtained by routine blood testing. The mechanisms underlying the prognostic value of SIS depend on the biological function of lymphocytes, monocytes, and albumin [9]. This scoring system uses both serum ALB and LMR to reflect the balance between the patient's inflammatory and nutritional conditions [10]. Since its introduction, this scoring system has been used by surgeons for prognostic prediction and has been validated as a new risk stratification model [11]. A study by Shuangjiang et al. retrospectively examined the results of patients who underwent VATS lobectomy. The study found a statistically significant difference between the ages of patients

and their SIS. As SIS increased, the age of patients increased [4]. In our study, the mean ages of patients in the SIS 0, SIS 1, and SIS 2 groups were 58.50, 60.32, and 67.45 years, respectively. There was no significant correlation between the groups and the age of patients (p=0.284). Our study demonstrated that the mean age of patients increased as their SIS increased, but it was not statistically significant. We believe that this is due to the limited number of patients included in our study. Similarly, a study by Ma et al. including 496 patients showed an association between higher SIS scores and advanced age [12]. Smoking causes numerous pulmonary and systemic immunological alterations. Smoking increases the number of macrophages, neutrophils, eosinophils, and mast cells in the lung, decreases the number of airway dendritic cells, and alters macrophage and neutrophil functions [13]. Systemically, smoking leads to elevated white blood cell count, particularly neutrophils [14]. Moreover, nicotine has been shown to be an immunosuppressant [15]. A 2019 study by Zhou et al. on non-small cell lung cancer patients reported no correlation between systemic inflammation markers and the smoking status of patients [16]. Our study showed no statistically significant difference between smokers and non-smokers in terms of distribution ratios of patients to systemic inflammatory scores. (p>0.05).

A study showed a significant correlation between the preoperative SIS and postoperative air leak, chest tube removal time, and amount of drainage in patients who underwent lobectomy [4]. Our study, however, demonstrated no statistically significant difference between patients with and without postoperative air leak by the SIS groups ( $p>0.05$ ). Given the postoperative drainage amounts of patients, there was a statistically significant difference between the three SIS groups ( $p=0.000$ ). In addition, there was a significant difference between the SIS groups in terms of mean chest tube removal time ( $p=0.006$ ).

Our study showed a statistically significant correlation between the SIS and the length of hospital stay ( $p=0.000$ ). Prolonged length of hospital stay increases the risk of nosocomial infections and the overall cost [17]. For this reason, we predict that providing preoperative nutritional support in cases of high systemic inflammatory scores may shorten the length of hospital stay, thus reducing both infection rates and costs.

A study on patients who underwent surgical treatment for colorectal cancer showed a significant correlation between the systemic inflammation score and postoperative complications [18]. A study by Li et al. found no significant difference in the rates of postoperative complications when patients undergoing thoracoscopic lobectomy were classified by the SIS [19]. In our study, the analysis of the SIS groups revealed a statistically significant difference between patients with and without postoperative complications ( $p=0.081$ ). We are of the opinion that this scoring system can be used to predict postoperative complications.

Our results show that patients who underwent u-VATS lobectomy and had a high preoperative systemic inflammation score had higher amounts of postoperative drainage, longer duration of chest tube and length of hospital stay. In patients with a higher preoperative systemic inflammation score, methods such as early enteral nutrition and nutritional support, which are reported to increase serum albumin levels and lymphocyte counts, may improve the postoperative outcomes of the patients. Some clinical studies have shown that preoperative enteral nutrition for surgical patients with gastrointestinal cancer and malnutrition improves postoperative outcomes through significant elevations in serum albumin and lymphocyte counts [10].

## CONCLUSION

In conclusion, the SIS is a simple, effective, and routine risk stratification method for patients undergoing u-VATS lobectomy. Due to the limited

number of patients in our retrospective study, larger-scale and prospective confirmatory analyses are required to confirm our results.

## Ethics Committee Approval:

The study was approved by the Ethics Committee of Hacettepe University (Project No: GO 20/508, Decision No: 2020/11-34) and was conducted in accordance with the principles of the Declaration of Helsinki.

## Conflict of Interest:

The authors have no conflict of interest to declare.

## Financial Disclosure:

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