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Evaluation of Early Surgical Outcomes in NSCLC Patients Who Underwent VATS Complex Segmentectomy

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Abstract

Non-small cell lung cancer (NSCLC) is the most common form of lung cancer, and early-stage tumors are increasingly detected thanks to advanced imaging and screening programs. While lobectomy has long been the standard surgical approach, recent studies have shown that segmentectomy may offer comparable oncologic outcomes in selected patients with small, peripheral tumors. Complex segmentectomy, a more technically demanding procedure, has become more feasible with the development of video-assisted thoracoscopic surgery (VATS). However, its safety and short-term outcomes remain under debate. This study aims to evaluate the early surgical results of complex segmentectomy performed via VATS in patients with early-stage NSCLC. Conclusion: VATS complex segmentectomy appears to be a safe and feasible surgical option for selected patients with early-stage NSCLC. Low complication and mortality rates support its use in experienced centers, especially for tumors smaller than 2 cm.

Keywords: NSCLC, VATS, complex segmentectomy, early-stage lung cancer, minimally invasive surgery, surgical outcomes, sublobar resection.

Introduction

Surgical resection of early-stage NSCLC, particularly clinical stages T1A and T1B, has traditionally been performed through lobectomy, which is considered the gold standard in terms of therapeutic efficacy (1,2). However, the emergence of minimally invasive techniques, particularly Video-Assisted Thoracoscopic Surgery (VATS), has revolutionized the surgical approach to NSCLC and introduced alternatives such as complex segmentectomy (3,4). Following the publication of the JCOG 0802 study in 2021, which significantly illuminated the outcomes of segmentectomy versus lobectomy for small-sized peripheral NSCLC, the number of performed segmentectomies has markedly increased (1,2). This pivotal study suggested that segmentectomy may offer survival outcomes comparable to lobectomy in certain patient groups, particularly those with small (≤2 cm), peripheral tumors, thereby significantly contributing to the ongoing debate on the optimal surgical approach for early-stage NSCLC (5, 6, 10).
However, complex segmentectomies remain a controversial issue due to unclear anatomical parenchymal boundaries and surgical technical challenges (3,4). There is no consensus in the literature regarding whether complex segmentectomies and simple segmentectomies are equivalent in terms of early and late postoperative outcomes (3-8). For these reasons, our study aimed to evaluate the early outcomes of patients

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with non-small cell lung cancer (NSCLC) who underwent complex segmentectomy using VATS.

Methods

A retrospective analysis was conducted on 129 NSCLC patients who underwent VATS surgery for clinical stages T1A and T1B between 2020 and 2023. Patients who underwent lobectomy and simple segmentectomy were excluded from the study. The surgical team consisted of a single team. Tumors beyond clinical stage IA and those with benign pathology or requiring conversion to thoracotomy were also excluded. A total of 36 patients who underwent complex segmentectomy for T1A-T1B NSCLC were included in the study. Complex segmentectomy was defined as all surgical procedures excluding S6 segmentectomy, lingulectomy (S4-5), and trisegmentectomy (S1-3). Patient data were obtained from medical records without any additional testing or imaging. Demographic data, early and late postoperative data, and survival data were recorded. The data were analyzed using SPSS 27.00 software. Ratios, means, standard deviations, minimum, and maximum values were analyzed. The primary outcomes of our study were early surgical results, complications within the first 30 days, and mortality within the same period.

Results

Among the patients, 28 were male (77.8%) and 8 were female (22.2%). The mean age was 60.8±9.0 years (range 44–74), and 33.3% were over the age of 65. Of the patients, 47.2% underwent right-sided surgery and 52.8% left-sided. According to the Charlson Comorbidity Index, 72.2% of the patients had a score of 4 or higher. Final pathology revealed adenocarcinoma in 72.2%, squamous cell carcinoma in 22.2%, and other pathologies in 5.6%. The mean postoperative hospital stay was 5.5 days (range 3–13). Postoperative complications were observed in 4 patients: prolonged air leak and subcutaneous emphysema in 1 patient, prolonged air leak and wound infection in 1 patient, prolonged air leak in 1 patient, and pneumonia in 1 patient. An air leak lasting 5 days or longer was considered a prolonged air leak.

Patients diagnosed with prolonged air leak underwent hemopleurodesis, and none required revision surgery. In patients with prolonged air leak, the duration was 9 days in one case and 10 days in the other. In the patient with wound site infection, daily dressing changes and antibiotic therapy were administered.

The patient who developed pneumonia was managed with antibiotic therapy and inhalation treatment.

Table-1: Comparison of Patients' Demographic Characteristics

Variables		Segmentectomy (n=36)	
		n	(%)
Gender	Male	28	77,8
	Female	8	22,2
Age (Year)	(mean±Std)	60,8±9.0	
Age (Year)	<65	24	66,7
	>65	12	33,3
Side	Right	17	47,2
	Left	19	52,8
Charlson Comorbidity Index	2-3	10	27,8
	>4	26	72,2
Histopathology	Adenocarcinoma	26	72,2
	Squamous cell carcinoma	8	22,2
	Other	2	5,6
Postoperative Hospital Stay (IQR)	3-13 min-max		5,5 (3-13)
Complication	Total	4	1,08
	PAL- pneumoderm	1	0,27
	PAL-WSI	1	0,27
	PAL	1	0,27
	Pneumonia	1	0,27

PAL: Prolonged Air Leak,WSI:Wound Site infection

None of the patients with complications required additional surgical intervention. All patients with complications had a Charlson Comorbidity Index score of 4 or higher. There was no 30-day mortality, while 90-day mortality was observed in 1 patient.

Discussion

In our study, the early surgical outcomes of complex segmentectomy performed using the VATS method in stage I non-small cell lung cancer (NSCLC) patients were evaluated. Although complex segmentectomy is anatomically

Table-2: Segmentectomy Distributions

	n	%
S1	8	%22
S1+S2	10	%28
S1+S2+S6	1	%3
S1+S3	2	%5
S2	9	%25
S3	2	%5
S7+S8	2	%5
S7+S8+S9	1	%3
S9+S10	1	%3

more challenging and requires technical expertise, the results indicate that it can be performed with low complication rates (3,4,9). The fact that all patients with postoperative complications had high Charlson Comorbidity Index scores suggests that complications are more related to the patient's underlying pulmonary reserve than to the type of resection performed.

The absence of 30-day mortality in our study indicates that complex segmentectomy is a safe surgical method. Additionally, the low incidence of postoperative complications such as prolonged air leak and wound infection in the complex segmentectomy group supports the feasibility of this surgical approach.Given that complex segmentectomies often require fissure and parenchymal dissection, concerns have been raised regarding the risk of prolonged air leaks.. However, the low incidence of this complication in our study is important and contributes to the literature.

There is growing evidence in the literature that segmentectomy is oncologically equivalent to lobectomy and better preserves functional lung reserve in peripheral NSCLC tumors smaller than 2 cm (1-4). The mean tumor size of 1.5 cm in our study supports the applicability of this surgical strategy in selected patients. The limitations of this study include its retrospective nature, the relatively small number of patients, and the lack of long-term oncologic outcomes. Nevertheless, our findings indicate that complex segmentectomy can be a safe alternative in experienced centers based on early surgical safety and complication profile data. We have demonstrated that complex segmentectomy is feasible and safe in the early postoperative period for patients undergoing surgical resection for NSCLC smaller than 2 cm.

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Conflict Of Interest : The authors declare that there are no conflicts of interest.

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