

# FIRST EXPERIENCE WITH VATS BRONCHOPLASTIC LOBECTOMY

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## ABSTRACT

**Relevance:** Surgical treatment for lung cancer is the primary radical approach in antitumor therapy, utilized as a standalone method and as part of a combined strategy. Radical surgical intervention typically involves anatomical lung resection accompanied by lymph node dissection. Modern oncological surgery increasingly emphasizes organ- and function-preserving procedures that maintain oncological efficacy. Video-assisted thoracoscopic surgery (VATS) presents an alternative to traditional open methods, although it is technically more challenging and generally more expensive. Nonetheless, its advantages – such as reduced postoperative pain, shorter duration of pleural drainage, better preservation of lung function, decreased length of hospital stay, and quicker return to normal activities—continue to motivate the surgical community to adopt minimally invasive techniques. This report highlights the first observation of a VATS lobectomy with bronchoplasty.

**The study aimed to** demonstrate the feasibility of minimally invasive bronchoplastic lobectomy as an alternative to pneumonectomy and traditional thoracotomy lobectomy with bronchoplasty.

**Methods:** This paper details a case of video-assisted thoracoscopic surgery performed on a patient with non-small cell lung cancer (NSCLC), along with the technical specifics of the surgical procedure.

**Results:** The article presents short-term outcomes of the VATS bronchoplastic lobectomy, showcasing the effectiveness of this surgical approach.

**Conclusion:** For the first time in Kazakhstan, we successfully performed a thoracoscopic bronchoplastic lobectomy. Based on our experience and insights from international colleagues, we believe this intervention is safe and effective for patients with centrally located lung tumors.

**Keywords:** Video-assisted thoracoscopic surgery (VATS), bronchoplasty, non-small cell lung cancer (NSCLC), sleeve resection, lobectomy.

**Introduction:** Improvement of organ-preserving operations is currently one of the priorities of modern oncology. Cancer treatment relies on the functional and oncological adequacy of such operations. In the case of central lung tumors, reconstructive plastic surgery is the only life-saving alternative to pneumonectomy. Bronchoplasty was first performed in 1947 to remove a benign tumor [1, 2]. Later, in 1959, the first bronchoplastic surgery was performed to remove a bronchial carcinoma [1, 3]. In 2002, L. Santambrogio et al. performed the world's first thoracoscopic bronchoplastic lobectomy [4, 5].

With the development and implementation of minimally invasive techniques worldwide, the number of articles on thoracoscopic bronchoplastic surgeries was growing [6,7]. Experience in performing such operations, modern tools and equipment, and the development of anesthesia are the main reasons for expanding indications for the most complex procedures with VATS appliances [8, 1]. The possibility of using lobectomy with bronchoplasty and angioplasty as an alternative to pneumonectomy makes it admissible to perform these operations with acceptable immediate and long-term outcomes, non-inferior to those after pneumonectomy [9].

**The study aimed to** demonstrate the feasibility of minimally invasive bronchoplastic lobectomy as an alternative to pneumonectomy and traditional thoracotomy lobectomy with bronchoplasty.

**Methods:** This paper details a case of video-assisted thoracoscopic surgery performed on a patient with non-small cell lung cancer (NSCLC), along with the technical specifics of the surgical procedure.

**Patient information:** Patient S., 68 years old. On 07/30/2024, he applied to the Kazakh Research Institute of Oncology and Radiology (KaziOR), complaining of shortness of breath in slight physical activity, general weakness, and periodic heart pain. From the anamnesis: The patient's condition worsened in June 2024, so he visited a pulmonologist who prescribed CT (computed tomography). Due to moderately severe COPD of category B, the patient is subject to regular medical check-ups by a pulmonologist. The patient receives regular treatment. A cardiologist who consulted the patient diagnosed CHD (coronary heart disease), effort angina, FC 2, and arterial hypertension stage 1, risk level 4.

**Clinical findings:** The general condition of the patient was relatively satisfactory. ECOG scale was – 0-1 points. The Karnofsky scale was – 90-80 points. The CCI index was 5 points.

**Diagnostics:** Prior to referring to KaziOR, the patient was examined at the cancer care dispensary of the residence place.

**Computed tomography (CT) of the chest organs from 07/03/2024 Conclusion:** Formation of the upper lobe of the right lung with involvement of the upper left bronchus and development of lymphogenic carcinomatosis rightward? Pulmonary emphysema.

The district oncology dispensary oncologist consulted the patient on 07/10/2024 and recommended additional examination.

*Fiberoptic bronchoscopy as of 07/17/2024:* C-r of the upper lobe bronchus rightward.

*Biopsy. Histology report as of 07/29/2024:* Non-small cell lung carcinoma, G2. The contrast-enhanced CT scan of the chest organs as of 07/17/2024. Formation of the upper lobe of the right lung with involvement of the upper left bronchus and development of lymphogenic carcinomatosis rightward? Pulmonary emphysema. The contrast-enhanced CT scan of the abdominal organs as of 07/17/2024: Single liver cyst. Right kidney concretion.

*The contrast-enhanced CT scan of the brain as of 07/17/2024:* Microangiopathy. No formations have been detected. The ultrasound scan of the peripheral lymph nodes as of 07/17/2024: A single lymph node of the supraclavicular region rightward (reactive changes?). Age-related changes in the axillary lymph nodes. EGDS as of 07/17/2024: gastro-duodenitis, inactive. Spirography as of 07/26/2024: Moderate to severe obstruction.

The KazIOR interdisciplinary team prescribed neoadjuvant polychemotherapy according to the cisplatin 75 mg/m<sup>2</sup> + docetaxel 75 mg/m<sup>2</sup> scheme. The patient underwent follow-up control examinations after 2 courses of neoadjuvant polychemotherapy.

*The contrast-enhanced CT scan of the chest organs as of 09/16/2024. Conclusion:* CT image of the condition after PCT regarding the central Cr of the upper lobe of the right lung. Pulmonary emphysema (Figure 1). According to a video bronchoscopy from 10/01/2024: On examination, the segmental bronchi of the upper lobe of the right lung B1,2 were obturated by an exophytic formation, irregular shape, the surface was uneven and looked loose. The infiltrative component of the formation along the lateral wall was spread to the upper lobe bronchus with a wide transition to its mouth. The interlobular spur was without features. The middle lobe and lower lobe bronchi were intact. The content of the bronchi was mucous in small amounts (Figure 2). A comprehensive examination with an assessment of the tumor spread and functional operability did not reveal any contraindications. Physical status according to ASA II. Ryabov IIB anesthetic risk.

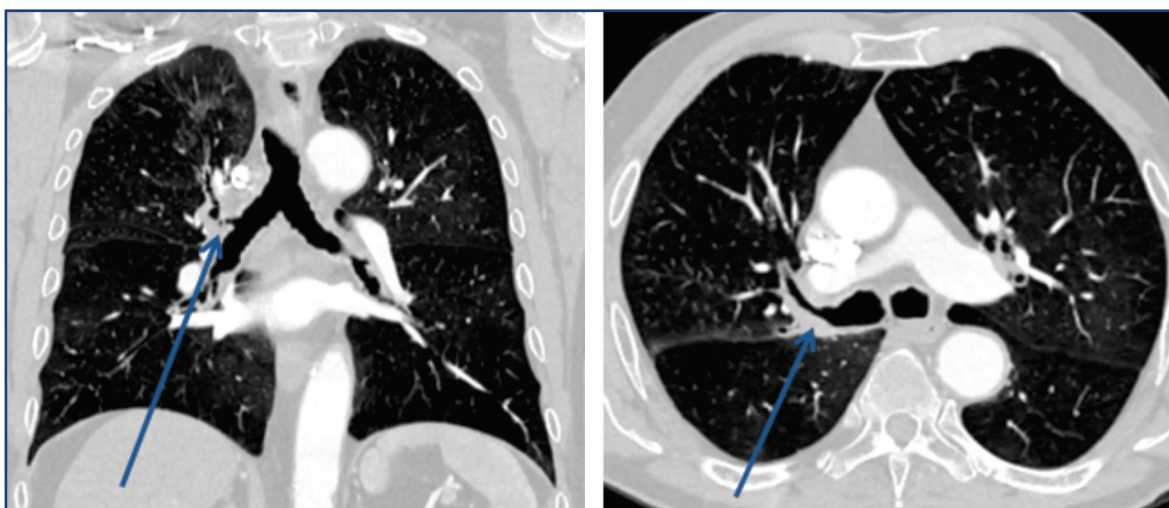


Figure 1 – Computed tomography of patient S., 68 years old. Formation of the root of the upper lobe of the right lung with infiltrative narrowing of the lumen. Signs of pulmonary emphysema

**Treatment:** The patient was admitted to the hospital for surgery on a scheduled basis. On 10/03/2024, the patient underwent surgery in the scope of VATS rightward, upper lobectomy of the lung with circular resection of the main and intermediate bronchi, bronchial anastomosis, and lymph node dissection. The surgical intervention was performed under combined anesthesia with separate intubation of the bronchi and single-lung ventilation. In the 5<sup>th</sup> intercostal space, a mini-access of 4-5 cm was made; in the 7<sup>th</sup> intercostal space along the posterior axillary line, a 10 mm thoracic portal for a video camera was installed. After revision and determination of the absence of signs of metastases, mobilization of bronchial and vascular structures was carried out with parallel systematic lymph node dissection, and interlobular fissures were dissociated. After suturing and crossing all vascular structures of the root

of the upper lobe of the right lung, the mobilized intermediate and right main bronchi were circularly crossed, and the upper lobectomy was performed (Figure 3). The macro preparation is indicated in the snapshot (Figure 4). Subsequently, the bronchial resection margin has been referred for further express histology examination. After confirmation of R0 resection, an anastomosis was performed between the right main and intermediate bronchi with a blanket suture of a 4/0 monofilament thread (Figure 5a, 5b). After completion of the bronchial anastomosis, a water test for sufficiency and a control bronchoscopy were performed (Figure 5c). The draining was carried out through the thoracic portal in the 7<sup>th</sup> intercostal space along the posterior axillary line to the pleural cavity cupula with one drain. The operation took 390 minutes; the intraoperative blood loss was about 30-40 ml.

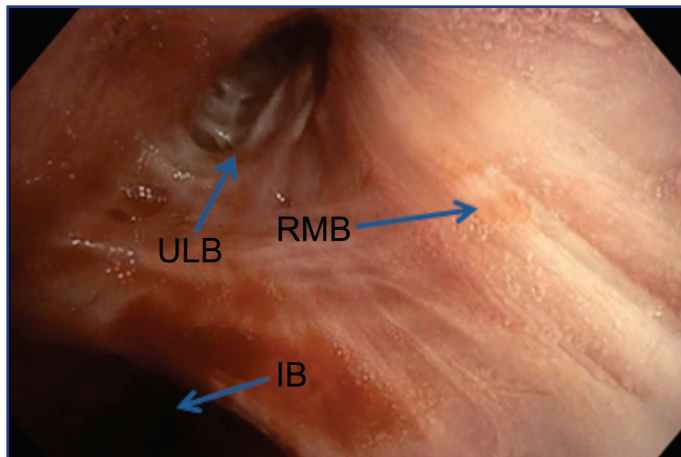


Figure 2 – Preoperative video bronchoscopy of patient S., 68 years old. The arrows indicate ULB (upper lobar bronchus), IB (intermediate bronchus), RMB (right main bronchus)

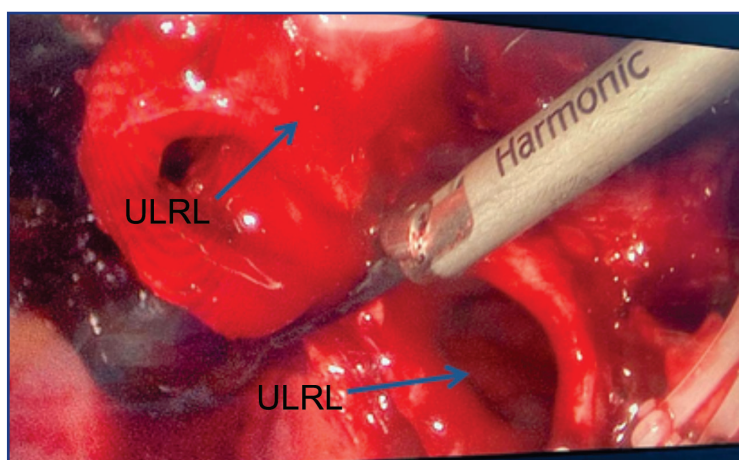


Figure 3 – Stage of circular bronchial crossing. The arrows indicate RMB (right main bronchus), ULRL (upper lobe of the right lung)

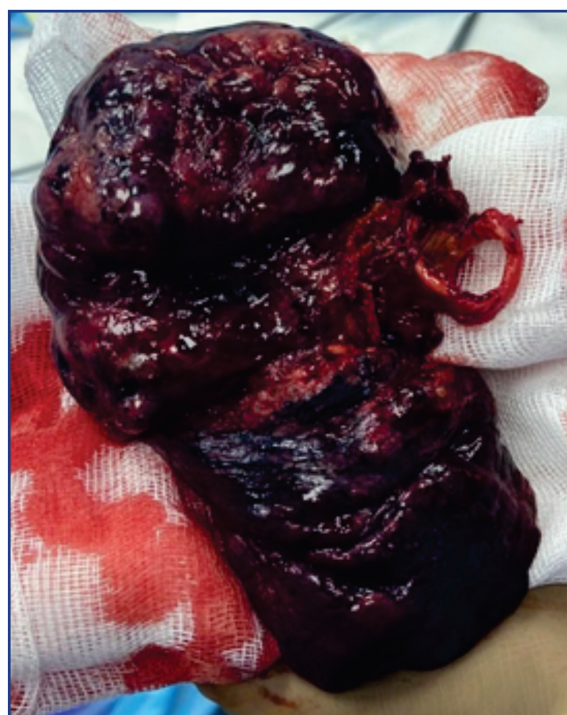


Figure 4 – Macropreparation of the upper lobe of the right lung



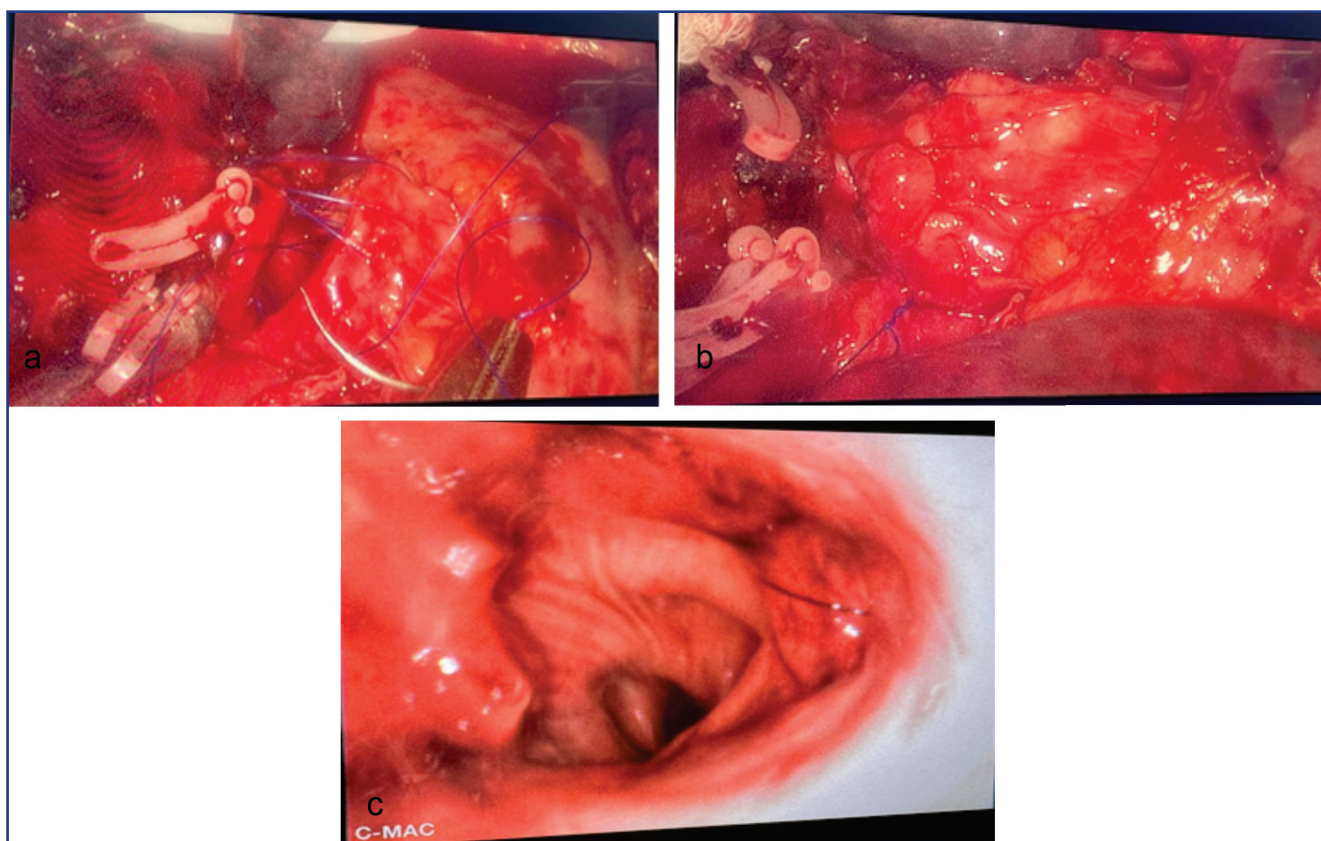


Figure 5 – Stages of applying a circular intrabronchial anastomosis

Notes: a – anastomosis between the intermediate and right main bronchi with a blanket suture of a 4/0 monofilament thread; b – completed anastomosis; c – bronchoscopic image after surgery

**Results:** The postoperative period proceeded without complications, and the draining lasted 6 days due to exudation. The bronchoscopic control examination was conducted on Day 7 after surgery (Figure 6). The patient was discharged on Day 10 after surgery. Scheduled histology

reported a basaloid variant of squamous cell carcinoma of the lung upper lobe, 2.5 cm in the largest dimension, with invasion into the adjacent peribronchial lymph node. The bronchus resection margin was outside the tumor. No metastases were found in 21 removed lymph nodes.

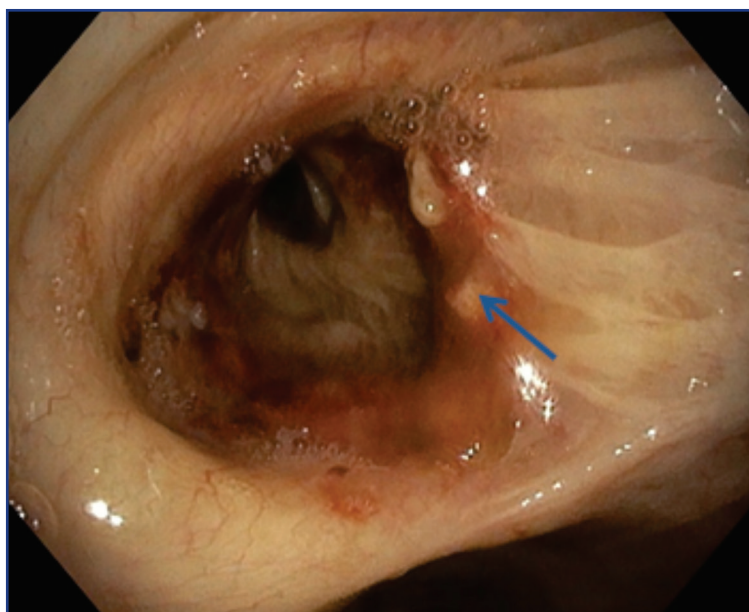


Figure 6 – Bronchoscopic image on Day 7 after surgery. The arrow indicates the anastomosis zone

The timeline of the clinical case described above is presented in Table 1.

**Table 1 – The clinical case timeline of VATS surgery of the bronchoplastic lung lobectomy.**

Stages of examinations, treatment	Timeline
Laboratory and instrumental examinations at the primary level	July 2024
KazIOR Interdisciplinary Team	08/12/2024
1 <sup>st</sup> course of neoadjuvant polychemotherapy	08/13/2024
2 <sup>nd</sup> course of neoadjuvant polychemotherapy	09/03/2024
Surgical treatment	10/03/2024
Patient discharge	10/13/2024

**Discussion:** From the technical point of view, the performance of minimally invasive bronchoplastic surgeries is undoubtedly a challenging surgical intervention. Patients planned for this volume of surgery require careful selection. In addition to the technical special aspects of the operation, the medical facility has to be supplied with all necessary equipment, and the medical personnel should be ready for the peculiarities of the surgical intervention. It is especially known that patients with concomitant pathologies such as COPD, diabetes mellitus, diseases requiring treatment with steroid drugs, etc., have a higher risk of bronchial anastomosis failure [10]. However, despite the presence of COPD in the observed patient S., it did not cause problems with the anastomosis.

**Conclusion:** Bronchoplastic surgery has proven highly efficient and safe in treating patients with centrally located lung tumors. It preserves a significant volume of lung tissue and ensures positive functional and oncological outcomes. The successful outcomes of these interventions confirm them as an important component of modern surgical interventions for lung cancer. The experience gained, and the introduction of advanced technologies minimize the risks of complications and improve patients' quality of life.

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**АНДАТПА**

**VATS БРОНХОПЛАСТИКАЛЫҚ ЛОБЭКТОМИЯНЫ ЖҮРГІЗУДІҢ АЛҒАШҚЫ ТӘЖІРИБЕСІ**

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**Өзектілігі:** өкпенің қатерлі ісігін хирургиялық емдеу тәуелсіз нұсқада да, кешенді және аралас емдеуде де ісікке қарсы терапияның негізгі радикалды әдісі болып табылады. Радикалды хирургиялық емдеу дегеніміз лимфодиссекциямен қоса өкпенің анатомиялық резекциясы болып табылады. Қазіргі заманғы онкохирургия онкологиялық радикализмді қадағалаумен азаны - және функционалдылықты сақтайтын операцияларды орындауға ұмтылуда. Видеоассистирленген торакоскопиялық хирургия (VATS) ашық дәстүрлі әдістерге балама болып табылады, бірақ техникалық жағынан қиынырақ және материалдық жағынан шығындылау. Дегенмен, келесі артықшылықтарға ие: операциядан кейінгі ауырсынуды азайту, плевраны дренаждау уақытын қысқарту, өкпе функциясын жақсырақ сақтау, стационарда аз болу, сондай-ақ науқастың әдеттегі өмір әрекеттеріне тезірек оралуы, хирургиялық қауымдастықты мишинвазивті әдістерді қолдануға көбірек сендіруде. Біз VATS тәсілімен бронхопластикалық лобэктомия операциясының алғашқы бақылауын береміз.

**Зерттеудің мақсаты** – пневмонэктомияға және бронхопластикамен дәстүрлі торакотомиялық лобэктомияға балама ретінде мишинвазивті бронхопластикалық лобэктомия жасау мүмкіндігін көрсету.

**Әдістері:** бұл жұмыста өкпенің ұсақ жасушалы емес қатерлі ісігі (ӨҰЖЕКІ) бар науқасты бейнеторакоскопиялық хирургиялық емдеу жасағайы және операцияның техникалық ерекшеліктері сипатталған.

**Нәтижелері:** мақалада VATS бронхопластикалық лобэктомиясының ең жақын нәтижелері келтірілген, хирургиялық араласудың осы әдісінің тиімділігі көрсетілген.

**Қорытынды:** қазіргі уақытта біз Қазақстанда алғаш рет торакоскопиялық бронхопластикалық лобэктомия операциясын жасадық. Өз тәжірибемізді және шетелдік әріптестеріміздің тәжірибесін біле отырып, біз мұндай араласуды орталық өкпе ісіктері бар науқастар үшін жеткілікті қауіпсіз және тиімді әдіс деп санай аламыз.

**Түйінді сөздер:** VATS, бронхопластика, ӨҰЖЕКІ, sleeve резекциясы, лобэктомия.

## АННОТАЦИЯ

## ПЕРВЫЙ ОПЫТ ПРОВЕДЕНИЯ VATS БРОНХОПЛАСТИЧЕСКОЙ ЛОБЭКТОМИИ

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**Актуальность:** Хирургическое лечение рака лёгкого является основным радикальным методом противоопухолевой терапии, как в самостоятельном варианте, так и в комплексном и комбинированном лечении. Радикальным хирургическим лечением определяется анатомическая резекция легкого с лимфодиссекцией. Современная онкохирургия всё более стремится к выполнению орган- и функционально сохраняющих операций, при этом с сопоставимым онкологическим радикализмом. Видеоассистированная торакоскопическая хирургия (VATS) – альтернатива открытым традиционным методам, но сложнее технически и материально затратнее. Однако имея такие преимущества как: уменьшение послеоперационной боли, сокращение времени плеврального дренирования, лучшее сохранение легочной функции, меньшее пребывание в стационаре, а также более ускоренное возвращение больного к обычной его деятельности, всё более убеждают хирургическое сообщество к применению миниинвазивных методик. Нами приводится первое наблюдение операции VATS лобэктомии с бронхопластикой.

**Цель исследования** – продемонстрировать возможность проведения миниинвазивной бронхопластической лобэктомии как альтернативу пневмонэктомии и традиционной торакотомной лобэктомии с бронхопластикой.

**Методы:** В данной работе описан случай видеоторакоскопического хирургического лечения пациента с немелкоклеточным раком легкого (НМРЛ) и техническими особенностями проведения операции.

**Результаты:** В статье приведены ближайшие результаты VATS бронхопластической лобэктомии, показана эффективность данного метода хирургического вмешательства.

**Заключение:** на настоящий момент нами впервые в Казахстане самостоятельно проведена торакоскопическая бронхопластическая лобэктомия. Имея собственный опыт и зная опыт зарубежных коллег, можем считать такой вид вмешательства достаточно безопасным и эффективным для больных с центральными опухолями лёгких.

**Ключевые слова:** VATS, бронхопластика, НМРЛ, sleeve резекция, лобэктомия.

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