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THE ROLE OF VIDEO-ASSISTED THORACOSCOPIC SURGERY IN THE TREATMENT OF SPONTANEOUS PNEUMOTHORAX AND THE PREVENTION OF ITS RECURRENCES

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Introduction. Spontaneous pneumothorax is a common thoracic emergency that may present with sudden chest pain, dyspnea, and a risk of life-threatening complications. A particularly high recurrence rate is observed in patients with primary and secondary spontaneous pneumothorax. Traditional management includes conservative approaches such as observation, needle aspiration, or pleural drainage; however, these methods do not always prevent recurrent episodes of the disease.

In this context, considerable attention has been focused on minimally invasive surgical approaches, particularly video-assisted thoracoscopic surgery (VATS). This technique enables simultaneous resection of bullae and bronchial abnormalities, performance of pleurodesis, and reduction of recurrence risk while maintaining minimal surgical trauma. Studies indicate that early use of VATS may shorten hospital stay, reduce postoperative pain, and improve functional outcomes.

Thus, investigating the role of VATS in the treatment of spontaneous pneumothorax and the prevention of its recurrences represents a relevant direction in thoracic surgery and allows optimization of patient management strategies, especially in individuals at high risk of recurrence.

Aim. To evaluate the role of video-assisted thoracoscopic surgery in the treatment of spontaneous pneumothorax and the prevention of its recurrences through an analysis of current scientific data, specifically:

- To study the mechanisms underlying the development of spontaneous pneumothorax and the risk factors for recurrent episodes;
- To summarize clinical outcomes of VATS compared with conservative and traditional surgical methods;
- To analyze various VATS techniques, including bullectomy and pleurodesis;
- To assess the effectiveness of VATS in reducing recurrence rates of spontaneous pneumothorax and improving short- and mid-term clinical outcomes.

Materials and Methods. This study presents a review of available clinical and prospective studies evaluating the use of video-assisted thoracoscopic surgery for the treatment of spontaneous pneumothorax and the prevention of recurrent episodes.

The reviewed studies compared different approaches, including conservative management, traditional open thoracotomy, and VATS, with emphasis on recurrence rates, length of hospital stay, postoperative pain, complications, and recovery time. Techniques applied during VATS-such as bullectomy, mechanical or chemical pleurodesis, and their combinations-were also analyzed.

Inclusion criteria for the analyzed studies comprised clearly defined clinical outcomes, sufficient patient sample sizes, and adherence to contemporary protocols for the management of spontaneous pneumothorax. The conducted analysis provides a comprehensive assessment of the effectiveness of VATS and its role in reducing the risk of disease recurrence.

Results.

1. Mechanisms of spontaneous pneumothorax development and risk factors for recurrence. Spontaneous pneumothorax occurs as a result of sudden rupture of subpleural bullae or weakened areas of the lung, leading to air entry into the pleural cavity and partial lung collapse. Increased alveolar pressure during coughing, physical exertion, or the Valsalva maneuver, as well as microdamage to alveolar tissue, are key mechanisms in disease development. Major risk factors for recurrence include a history of previous episodes, smoking, asthenic body habitus, male sex, presence of multiple or large bullae, and chronic lung diseases [1, 2].

2. Clinical outcomes of VATS compared with conservative and traditional surgical methods. VATS has proven to be a minimally traumatic and effective method for the treatment of spontaneous pneumothorax. Its main advantages include:

- Reduced recurrence rates compared with conservative management;
- Less pronounced postoperative pain compared with open thoracotomy;
- Shorter hospital stay and faster recovery of physical activity.

Table 1. Comparison of treatment methods for spontaneous pneumothorax

Treatment method	Recurrence rate	Postoperative pain	Length of hospital stay	Recovery
Conservative (aspiration, drainage)	30-50%	Low	3-5 days	Slow (high recurrence risk)
Open thoracotomy with pleurodesis	5-10%	High	7-10 days	Moderate
VATS (bullectomy + pleurodesis)	3-10%	Low/Moderate	2-4 days	Rapid

The available evidence demonstrates that VATS is an effective approach for recurrence prevention and provides more favorable short- and mid-term clinical outcomes [1, 3, 5].

3. VATS techniques, including bullectomy and pleurodesis. Video-assisted thoracoscopic surgery encompasses several technical approaches that enable effective treatment of spontaneous pneumothorax and prevention of its recurrences. The most commonly used technique is bullectomy, in which localized bronchoalveolar lesions serving as sources of air leakage are removed using endoscopic instruments. Bullectomy directly eliminates the cause of recurrent lung collapse and significantly reduces recurrence risk [3, 6].

In addition to bullectomy, pleurodesis is frequently performed, either mechanically (pleural abrasion) or chemically (administration of sclerosing agents such as talc). Pleurodesis promotes adhesion between the parietal and visceral pleura, thereby preventing recurrent spontaneous pneumothorax. In clinical practice, the combination of bullectomy and pleurodesis is considered optimal for patients with recurrent or complicated pneumothorax [3, 5].

Less common approaches include apical lung resection in cases of multiple bullae and VATS pleuropexy, in which the lung is fixed to the chest wall without bullectomy. These techniques are applied selectively, depending on disease extent, patient age, and comorbid pulmonary conditions [7].

4. Effectiveness of VATS in reducing recurrence rates and improving clinical outcomes. Studies indicate that integration of VATS into clinical practice significantly reduces recurrence risk, improves short- and mid-term outcomes, accelerates patient recovery, and decreases postoperative pain. Even in patients with multiple bullous lesions, recurrence occurs less frequently after VATS than after conservative treatment [1, 2, 5]. Standardization of techniques and their combination with other surgical

measures allow optimal recurrence prevention, reduction of postoperative pain, and faster rehabilitation [3, 7].

Conclusions. VATS has demonstrated high effectiveness in the treatment of spontaneous pneumothorax, particularly in recurrent or complicated cases. The method reduces the risk of recurrent lung collapse through precise bullectomy and pleurodesis. Its advantages include minimal invasiveness, reduced postoperative pain, shorter hospitalization, and faster recovery compared with conservative or open surgical approaches [1, 3, 5, 7].

Individualization of VATS techniques according to the clinical scenario ensures maximal effectiveness in recurrence prevention. Further research should focus on refinement of techniques, standardization of approaches, and development of integrated management protocols for patients with spontaneous pneumothorax [6, 7].

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