Review Article

Video-assisted thoracoscopic surgery in octogenarians

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Abstract: Octogenarians are heterogeneous and have an increasing population. As older adults, they are susceptible to various lung and pleura conditions, which may benefit from video-assisted thoracoscopic surgery (VATS). Common conditions affecting this patient population include benign and malignant diseases such as empyema, bullous emphysema, pneumothorax, and lung cancer. We aim to provide an up-to-date review of the feasibility and outcomes of VATS for various pathologies in octogenarians. The PubMed database was searched using the following keywords: octogenarians, elderly, VATS, empyema, and enhanced recovery after thoracic surgery (ERATS). We limited our search to the time period between 2010 and 2023 to provide the most recent data. Initially, the search yielded over 30 articles; 14 most pertinent articles were included in our review. We did not limit the articles based on study design or sample size. A review of the literature showed that octogenarians can tolerate VATS. Despite their decreased physiological reserve, age alone should not be used to deny the curative operations. Several components of enhanced recovery protocols after thoracoscopy are shown to improve outcomes regardless of patients' age. As an invasive treatment for various conditions, surgery may pose a specific challenge in the elderly population. Risk assessment, thorough preoperative workup, appropriate patient selection, and perioperative management are imperative for successful outcomes.

Keywords: Elderly; video-assisted thoracoscopic surgery (VATS); empyema; non-small-cell lung cancer (NSCLC); lobectomy

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Introduction

The elderly population is generally defined as 65 years and older (1). However, given the aging population, much older patients are reaching the office of thoracic surgeons nowadays. Older people are a heterogeneous and increasing population. Patients in their 80s, called octogenarians, are the fastest-growing population. They are susceptible to various lung and pleura conditions, which may benefit from minimally invasive thoracic surgical treatment. These include benign and malignant diseases such as empyema, bullous disease, pneumothorax, and lung cancer. As an invasive treatment for various conditions, surgery may pose a specific challenge in patients aged 80 and above. Risk assessment, thorough preoperative workup, appropriate patient selection, and perioperative management are imperative to successful outcomes. This paper aims to provide the reader with an up-to-date review of video-assisted thoracoscopic surgery (VATS) in the oldest patient population.

Methods

The PubMed database was searched using the following keywords: octogenarians, elderly, VATS, empyema, and enhanced recovery after thoracic surgery (ERATS). We limited our search to the time period between 2010 and 2023 to provide the most recent data. Initially, the search yielded over 30 articles; 14 most pertinent articles were included in our review. We did not limit the articles based on study design or sample size.

Discussion

VATS—general concept

VATS is surgery in the chest with the assistance of a camera and instruments placed through small incisions. VATS allows for a minimally invasive approach to managing various thoracic pathologies, avoiding the large incision and painful rib spreading required for thoracotomy. VATS was first introduced in 1992. It has progressed from an experimental procedure and is now widely considered equivalent, if not superior, to open surgical approaches. Common indications for VATS include decortication for empyema, pleurodesis as a treatment of recurrent pleural effusion or pneumothorax, volume reduction surgery for emphysema, diagnostic wedge resections for tissue diagnoses, and finally segmentectomies and lobectomies for lung cancer (2). VATS is usually performed under general anesthesia but can also be done under local anesthesia (3). Numerous studies have shown the benefit of a minimally invasive approach compared with an open approach, specifically in elderly patients. These benefits include improved pain control, shorter hospital stays, and fewer post-operative extra-pulmonary complications (4-6).

During a VATS operation, several considerations are pertinent to elderly patients. Frailty is a decreased physiological reserve and inability to tolerate stressors caused by accumulated age-related deficits. The prevalence of frailty increases with increasing age to 26% in patients 85 years and older (7). To help identify frail patients, the frailty index (FI) was developed. The FI is a ratio of patients' present factors and all potential factors contributing to frailty. The contributing factors are clinical signs and symptoms, laboratory and imaging data, and social characteristics (8). Patients with an FI of 0.15 or less are considered robust, while those with an FI of 0.55 or higher are of advanced frailty.

FI has also been shown to correlate with mortality (7). Recognizing weakness in any potential surgical patient is imperative for choosing the appropriate treatment plan. The need for preoperative transfusion, emergency operation, and preoperative weight loss should also be considered and has been documented to best predict morbidity in older adults (9). Operative duration and avoidance of a prolonged operative procedure should be considered in VATS interventions, as longer operative times can lead to poor postoperative outcomes (10). Elderly patients are more susceptible to fractures. Therefore, careful port placement is mandatory. Care should be taken during the procedure to limit the amount of torque put on the instruments, as an accidental fracture can occur. Specimen removal typically occurs through a small incision in the chest. However, it may be beneficial in older adults to enlarge this incision to avoid excessive force, resulting in rib fracture and tissue injury during specimen removal.

VATS for treatment of empyema

Empyema is the presence of purulent fluid in the pleural space. It is associated with high mortality, 10–20% (11,12). Commonly, empyema arises as a complication of pneumonia and frequently affects the elderly population (12). Empyema has three stages: stage I, exudative phase; stage II, fibrinopurulent phase; and stage III, organizing phase. Phase II is characterized by the development of fibrinous adhesions that can prevent full lung expansion and, if not treated, progress to stage III, which is characterized by significant scar formation. Stage I is typically treated with intravenous (IV) antibiotics, tube drainage, and fibrinolytics, while first-line treatment for organized stage III is decortication. Patients in phase II benefit the most from surgical intervention. According to guidelines, patients with stage II empyema benefit from early VATS decortication (13). Minimally invasive decortication involves the removal of fibrinous adhesions, including the diseased lining of the lung, to allow for maximum lung expansion. A randomized control trial over two decades ago showed that early VATS in patients with complex fibro-purulent empyema leads to better treatment efficacy, shorter hospital stays, and lower overall cost (14).

In addition, a separate study reviewing hundreds of patients treated for stage I and II empyemas showed no effect of the stage on mortality, which approached 17%. However, patients with higher stages had a more extended hospital stay (15).

Unfortunately, very few studies focus on VATS for

empyema in the elderly population. In the limited studies that describe utilizing VATS decortication in older adults, the technique provided good results in lung re-expansion and was associated with low mortality (11,12). It is noted that elderly patients have more extended hospital stays and chest tube duration than their younger counterparts (11). More studies on this subject are warranted as clear guidelines on empyema management in older people still need to be provided.

VATS for treatment of non-small cell lung cancer (NSCLC)

Lung cancer is a condition that predominantly affects the elderly population. Lung cancer remains one of the most common cancer diagnoses in the United States and is the number one cause of cancer-related deaths. The largest patient population receiving a lung cancer diagnosis is between 70–74 years old (16). With ongoing advances in medical care, the overall aging population is increasing. Thus, the pool of potential lung cancer patients also continues to grow. Additionally, with the adoption of lung cancer screening for patients aged 50–80 who meet the criteria, we expect to capture an increased percentage of elderly patients with early-stage resectable disease (17).

Special care should be taken to evaluate if elderly patients can tolerate surgical resection. Performance status evaluation is the cornerstone of determining the benefit of treatment for patients with cancer. The Eastern Cooperative Oncology Group (ECOG) performance assessment (18) is the gold standard method of scoring patients. This method assigns a performance status of 0–4 to each patient, where 0 means fully active and able to carry out all pre-disease activities. In contrast, an ECOG score of 4 means completely disabled, unable to perform daily activities, and confined to a bed or chair. Patients with status 0–1 are more likely to tolerate aggressive treatment, including surgery. Patients with status 2, which means the patient has limited physical activity but can perform self-care and is out of bed and about for more than 50% of the time, may be considered for surgery depending on individual evaluation. Patients with performance status 3–4 are poor surgical candidates (18). As an alternative to surgery, patients with ECOG scores of 3–4 may consider non-surgical therapies, including radiation, cryotherapy, and radiofrequency ablation (RFA); however, their overall survival is shorter compared to VATS lobectomy (19).

In addition to the ECOG score, when considering lung resection in the elderly, a thorough preoperative evaluation is essential to assess if the patient can tolerate the procedure. The preoperative assessment should include pulmonary function testing (PFT) and cardiovascular risk evaluation. PFTs not only evaluate the patient's lung reserve but have also been shown to predict mortality in those patients undergoing lung resection in patients undergoing thoracotomy. The forced expiratory volume in one second (FEV1) indicates the volume the patient can exhale in 1 second and assesses the lung recoil. Diffuse lung capacity for carbon monoxide (DLCO) is used to determine the quality of the alveolar membrane and can detect gas exchange abnormality. A percentage predicted value above >60% is preferred. A value below 30% is considered a contraindication for lobectomy (20).

Patients with a diagnosis of NSCLC are also at risk for cancer cachexia. Cancer cachexia is a 5% or more weight loss over 6 months (21). Cancer cachexia is characterized by profound fat and muscle wasting due to cancer-related energy expenditure (22). Furthermore, it is associated with worse outcomes in patients undergoing oncological operations, including survival (21). We should always screen patients presenting to the office for cachexia with a simple question, 'Any recent weight loss?' as appropriate intervention may positively affect outcomes. Management of cancer cachexia is complex and includes pharmacological, nutritional, and psychosocial means (23). Unfortunately, till today, there are no standard guidelines on the management of preoperative cancer cachexia (22).

To complete preoperative optimization, we may consider the involvement of a geriatrician as their input in managing comorbidities, and nutritional optimization can benefit the elderly patient population (24).

Options for surgical treatment utilizing VATS include anatomic surgical resection such as lobectomy and segmentectomy. In some clinical scenarios, non-anatomic/wedge resection may be an acceptable treatment strategy. VATS lobectomy is indicated in all patients with early-stage, stage I, and stage II NSCLC who can tolerate single lung ventilation (25). The exceptions are patients with stage Ia with tumor size less than 2 cm, who can be treated with minimally invasive segmentectomy alone (25). Although VATS lobectomy remains the standard of care in treating early-stage NSCLC, studies showed that limited non-anatomical resection in octogenarians has comparable 5-year survival with lower morbidity (26). High-risk patients can benefit from a limited resection (27). Furthermore, subgroup analysis of a separate study evaluating patients with clinical stage T1cN0M0 showed that octogenarians

had lower mortality and improved 3-year survival when comparing segmentectomy to lobectomy (28). To ensure appropriate staging and management, lymphadenectomy is recommended (29). Even though, in the past, there was a concern for inadequate lymph node sampling with VATS, Lee *et al.* noted that with increasing institutional experience, the lymph node assessment is equally adequate (6,29). Compared to the open approach, the overall survival remains the same. However, a study by Pages *et al.*, which evaluated outcomes after lobectomy in octogenarians, showed patients who underwent VATS lobectomy had significantly lower postoperative mortality than the open approach (30).

Enhanced recovery after surgery (ERAS) in seniors

To improve outcomes after surgical procedures, clinicians developed ERAS protocols. These protocols include early ambulation with the removal of the urinary catheter, early initiation of a liquid diet, judicious use of IV fluids, and limiting the use of narcotics. They have been shown to decrease the length of stay in the hospital and have become popular in various surgical subspecialties. Recently, much attention has been given to these protocols in thoracic surgery. An article by Mazza *et al.* reviewed the feasibility and possible benefits of ERAS protocols in elderly patients undergoing VATS. Despite the elderly population having a more extended stay on average than the younger population, adherence to the protocols is a better predictor of length of stay than the patient's age (31).

Guidelines developed for the general population published in 2019 made several recommendations to improve the outcomes after lung resection. Some of the strong recommendations with high levels of evidence include preoperative screening for nutritional status, continuation of b-blockers regimen if used preoperatively, maintaining perioperative normothermia, use of multimodal analgesia with acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDs) unless contraindicated, use of regional analgesia, and use VATS for early-stage lung cancer (32).

Post-operative care and care after discharge home

Post-operative care in elderly patients is a cornerstone of successful recovery. Elderly patients are at exceptionally high risk for postoperative delirium, which increases their mortality (33). To prevent post-operative delirium, we implement several measures. These include sleep promotion measures, such as limited overnight nursing visits or timing medication so that they do not need to be administered overnight. In addition, allowing a family member to be present overnight and assist with re-orientation helps the patient and decreases the burden on the hospital staff. Timely urinary catheter removal is also recommended to reduce the risk of urinary tract infection. Multimodal post-operative pain control is necessary for patient comfort, chest physical therapy, and early ambulation. Multimodal pain control comprises regional techniques, opioid-sparing analgesics, and opioids (34). Regional analgesia is significant in postoperative pain control in older adults as polypharmacy, which frequently accompanies older patients, can limit the clinician's options in analgesic selection. Additionally, due to an age-related decrease in renal clearance, providers must be cautious with otherwise very effective NSAIDs. Finally, post-operative physical therapy can help the patient return to baseline and determine if the patient will benefit from a brief stay at a rehabilitation facility. Our goal is always, if possible, to discharge the patient home. A recent study evaluating octogenarians who underwent lobectomy either through an open or minimally invasive approach showed patients who underwent lobectomy either through VATS or robotically had significantly higher chances of being discharged home (35). However, it is essential to prepare family members for the level of assistance their loved one might need due to severe decompensation that follows any major operation.

Conclusions

Octogenarians are the fastest-growing population. Current research proves that they can tolerate VATS. Despite their decreased physiological reserve, age alone should not be used to deny the curative operations. Several components of enhanced recovery protocols after thoracoscopy are shown to improve outcomes regardless of patients' age.

As an invasive treatment for various conditions, surgery may pose a specific challenge in the elderly population. Risk assessment, thorough preoperative workup, appropriate patient selection, and perioperative management are imperative for successful outcomes.

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Footnote

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