

Single-port inflatable video-assisted mediastinoscopic transhiatal esophagectomy for esophageal cancer in a patient with left upper lobe destruction secondary to remote pulmonary tuberculosis: a case report

Chutong Huang

Xuancheng Hospital Affiliated to Wannan Medical University

Bigang Chen

Xuancheng Hospital Affiliated to Wannan Medical University

Yijun Sun

3055607236@qq.com

Xuancheng Hospital Affiliated to Wannan Medical University

Case Report

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Abstract

Background

Surgical resection is the cornerstone of curative treatment for resectable esophageal cancer. However, transthoracic esophagectomy (TTE) requires one-lung ventilation (OLV), which may be poorly tolerated by patients with severely impaired pulmonary function. Inflatable video-assisted mediastinoscopic transhiatal esophagectomy combined with laparoscopy (IVMTE), which avoids OLV, may offer an alternative surgical approach for these patients.

Case presentation

A 70-year-old man presented with a 1-month history of dysphagia. Endoscopic biopsy confirmed mid-thoracic esophageal squamous cell carcinoma (ESCC). He had a history of pulmonary tuberculosis with radiographic evidence of left upper lobe destruction. Pulmonary function testing revealed severe restrictive ventilatory impairment with impaired diffusing capacity, rendering him unable to tolerate transthoracic surgery. Following multidisciplinary evaluation, he underwent single-port inflatable video-assisted mediastinoscopic transhiatal esophagectomy combined with laparoscopy (SP-IVMTE), with an uneventful intraoperative course and no oxygen desaturation. Histopathology revealed a moderately differentiated squamous cell carcinoma invading the adventitia, with negative margins and no lymph node metastasis (pT3N0M0). The patient had an uneventful postoperative recovery and was discharged on postoperative day 14. The patient had an uneventful postoperative recovery. Follow-up CT scans through 24 months showed no evidence of recurrence or metastasis, and at the 29-month clinical follow-up, he remained asymptomatic with normal oral intake.

Conclusions

For patients with severely compromised pulmonary reserve who are unable to tolerate a transthoracic approach, IVMTE may provide a feasible individualized surgical option for curative treatment of esophageal cancer.

Introduction

Esophageal cancer is one of the most common malignancies worldwide, ranking 11th in incidence and 7th in mortality among all cancers, and continues to impose a substantial global disease burden[1]. For patients with resectable esophageal cancer, surgical resection remains the cornerstone of curative treatment[2]. However, esophagectomy is a technically demanding and complex procedure that places substantial demands on patients' physiological reserve and perioperative tolerance. Eligibility for curative surgery depends not only on tumor stage and local extent of invasion, but also on baseline cardiopulmonary function and overall physical condition. Consequently, patients with severe cardiopulmonary dysfunction or other major organ impairment may be unable to tolerate conventional esophagectomy, thereby facing limited access to potentially curative surgical treatment[3].

Over the past several decades, minimally invasive techniques have been widely adopted in esophageal surgery, and minimally invasive esophagectomy (MIE) has gradually become an important surgical approach for esophageal cancer. Compared with conventional open esophagectomy, MIE is associated with less surgical trauma, fewer postoperative complications, faster recovery, and shorter hospital stays[4]. The two most widely used MIE approaches are the Ivor-Lewis and McKeown procedures, both of which require one-lung ventilation (OLV) during the thoracic phase. However, in patients with severe pulmonary dysfunction or pulmonary parenchymal destruction, OLV may impose additional respiratory and circulatory stress, rendering them unable to tolerate transthoracic esophagectomy (TTE) and potentially precluding curative surgical treatment[5]. To address this clinical challenge, Fujiwara et al.[6] first introduced inflatable video-assisted mediastinoscopic transhiatal esophagectomy combined with laparoscopy (IVMTE) in 2015. As a non-transthoracic surgical approach, IVMTE avoids entry into the thoracic cavity and thereby eliminates the physiological burden associated with OLV, providing a potential curative treatment option for patients who are unable to tolerate or are considered unsuitable for TTE[7]. Previous studies have demonstrated acceptable perioperative safety and clinical feasibility of IVMTE in patients with impaired pulmonary reserve[8]. Herein, we report a case of esophageal cancer with pulmonary tuberculosis-associated destruction of the left upper lobe. Because of severely impaired pulmonary function, the patient was unable to tolerate transthoracic esophagectomy and subsequently underwent IVMTE with favorable perioperative and follow-up outcomes. In conjunction with a review of the available literature, we further discuss the technical characteristics, appropriate patient selection, and clinical value of IVMTE in high-risk patients with esophageal cancer.

Case presentation

A 70-year-old man presented with a 1-month history of dysphagia. Gastroscopy revealed an irregular elevated lesion located 28–32 cm from the incisors, involving approximately half of the esophageal circumference and causing luminal stenosis (Fig. 1A); biopsy confirmed esophageal squamous cell carcinoma (ESCC) (Fig. 2A). The patient had a history of pulmonary tuberculosis 15 years earlier and a 30-year smoking history. Preoperative contrast-enhanced chest computed tomography (CE-CT) showed irregular wall thickening and heterogeneous enhancement of the middle thoracic esophagus (Fig. 3), destruction of the left upper lobe, scattered fibrotic and nodular lesions in the left lung, pulmonary bullae in the left lung, and thickening of the left pleura (Fig. 4). Positron emission tomography-computed tomography (PET-CT) demonstrated wall thickening of the middle thoracic esophagus at the T8–T9 level with abnormally increased fluorodeoxyglucose (FDG) uptake ($SUV_{max} = 18.4$), with no abnormal FDG uptake in the regional lymph nodes; upper gastrointestinal contrast examination revealed an irregular filling defect in the middle thoracic esophagus with focal mucosal disruption, with the lesion measuring approximately 5.6 cm in length (Fig. 5A). Pulmonary function testing showed a forced vital capacity (FVC) of 1.37 L, a forced expiratory volume in 1 second (FEV_1) of 0.95 L, an FEV_1/FVC ratio of 69.48%, and a single-breath diffusing capacity for carbon monoxide (DLCO-SB) of 3.67 mmol/min/kPa, indicating severe restrictive ventilatory impairment and markedly impaired diffusing capacity.

Given the patient's severely impaired pulmonary function, a multidisciplinary preoperative assessment was performed, and single-port inflatable video-assisted mediastinoscopic transhiatal esophagectomy combined with laparoscopy (SP-IVMTE) was selected. The procedure was completed uneventfully, with no intraoperative oxygen desaturation. No additional anatomical difficulties attributable to the patient's previous pulmonary tuberculosis were encountered during esophageal mobilization (Fig. 6).

Postoperative histopathological examination revealed a moderately differentiated ulcerative squamous cell carcinoma (Fig. 2B), measuring 4.6 cm × 4.0 cm × 0.8 cm, with invasion into the esophageal adventitia but no vascular or perineural invasion. The proximal and distal resection margins and the anastomotic rings were negative for tumor involvement. None of the 21 retrieved lymph nodes showed metastatic involvement, resulting in a final pathological stage of pT3N0M0.

On postoperative day 1, the patient was started on total parenteral nutrition and gastrointestinal decompression; enteral nutrition combined with parenteral nutritional support was initiated on postoperative day 2. The nasogastric tube was removed on postoperative day 6. On postoperative day 7, esophagography demonstrated a patent anastomosis, and an oral liquid diet was initiated. The cervical drainage tube was removed on postoperative day 10, and the patient was discharged uneventfully on postoperative day 14. No adjuvant anticancer therapy was administered postoperatively. 6 months postoperatively, upper gastrointestinal endoscopy confirmed patency of the anastomosis (Fig. 1B), and an upper gastrointestinal contrast examination was performed at 12 months (Fig. 5B). Follow-up chest and abdominal CT scans through 24 months showed no evidence of recurrence or metastasis. At the 29-month clinical follow-up, the patient remained asymptomatic and maintained normal oral intake.

Discussion

TTE remains a major surgical approach for patients with resectable esophageal cancer but generally requires OLV. Patients with severely impaired pulmonary function due to conditions such as advanced chronic obstructive pulmonary disease, thoracic deformities, or unilateral pulmonary destruction may be unable to tolerate OLV and thus may not be suitable candidates for transthoracic esophagectomy. Even when transthoracic surgery can be completed, these patients remain at substantially increased risk of serious postoperative pulmonary complications, including hypoxemia, pulmonary infection, and pneumothorax[9].

IVMTE provides a potential solution for such high-risk patients. Esophageal mobilization through the mediastinal route minimizes mechanical interference with the lungs and cardiopulmonary structures, thereby reducing the impact of surgical manipulation on respiratory function. Because the thoracic cavity is not entered, IVMTE also avoids postoperative pain associated with chest wall incisions and intercostal nerve injury, which may facilitate postoperative recovery[9, 10]. In the present case, pulmonary tuberculosis had resulted in destruction of the left upper lobe, and extensive pleural adhesions were likely to be present on the affected side. A left-sided transthoracic approach would therefore have substantially increased the technical difficulty of adhesiolysis and the risk of postoperative pulmonary complications, whereas a right-sided transthoracic approach could have increased the risk of

intraoperative hypoxemia given the patient's severely limited pulmonary reserve. Considering both his pulmonary function and thoracic anatomical conditions, IVMTE was therefore a reasonable approach for achieving curative surgical resection. In 2022, Yibulaiyin et al.[11] reported a patient with esophageal cancer who had previously undergone left pneumonectomy and was successfully treated with IVMTE, further highlighting the potential utility of this approach in patients with severely compromised pulmonary function. Compared with that case, the present patient had destruction of the left upper lobe secondary to remote pulmonary tuberculosis, with extensive pleural adhesions on the affected side. A transthoracic approach would consequently have posed greater challenges in anatomical dissection and a potentially higher risk of perioperative pulmonary complications, further underscoring the clinical value of IVMTE in this extremely high-risk setting.

However, IVMTE has several technical limitations. The relatively confined mediastinal working space can make hemostasis challenging in the event of vascular injury. The limited operative space also poses challenges for mediastinal lymphadenectomy, particularly for the dissection of lymph nodes along the right recurrent laryngeal nerve and subcarinal lymph nodes, where IVMTE may offer less operative convenience than the transthoracic approach. Because adequate regional lymphadenectomy is an essential component of curative surgery for esophageal cancer, these limitations may restrict the broader clinical application of IVMTE. Nevertheless, available evidence suggests that these technical limitations do not necessarily compromise oncological adequacy. In a consecutive single-institution cohort study, mediastinoscopic radical esophagectomy was associated with fewer severe postoperative complications than open esophagectomy, without a significant reduction in lymph node yield or deterioration in long-term cancer-specific survival[12]. To address these challenges, several centers have introduced technical modifications, including the use of an additional auxiliary port and sternal elevation to enlarge the operative space and provide a more stable surgical field[7, 13]. Notably, a 2026 study evaluating a triple-instrument cervical approach for single-port mediastinoscopic radical esophagectomy demonstrated that this technical modification significantly increased the median number of mediastinal lymph nodes retrieved from 16 to 22 ($P = 0.048$), without increasing blood loss, recurrent laryngeal nerve palsy, or hospital stay[14].

At present, IVMTE, as a novel minimally invasive non-transthoracic approach to esophagectomy, has shown potential advantages in improving perioperative safety, reducing pulmonary complications, and facilitating postoperative recovery in high-risk patients. However, the procedure remains in the stages of clinical evaluation and wider adoption, and high-quality, large-scale, multicenter prospective comparative studies are still lacking. In addition, existing studies have primarily focused on short-term perioperative outcomes, whereas long-term oncological follow-up data remain limited. Consequently, the rates of long-term tumor recurrence, overall survival, and postoperative complications have not yet been adequately established. Further high-level evidence is therefore needed to validate the long-term safety and oncological benefits of IVMTE.

Conclusions

IVMTE provides a minimally invasive, non-transthoracic option that avoids one-lung ventilation for patients with esophageal cancer and severely compromised pulmonary function who are unable to tolerate transthoracic surgery. Unilateral pulmonary destruction secondary to remote pulmonary tuberculosis represents an extremely high-risk clinical setting in which transthoracic esophagectomy may be difficult or infeasible. However, reports describing the use of IVMTE for esophageal cancer in patients with pulmonary destruction remain limited, making the present case clinically noteworthy. In this patient with pT3N0M0 esophageal squamous cell carcinoma and destruction of the left upper lobe, IVMTE enabled curative resection with negative margins and an uneventful perioperative course. Follow-up CT scans through 24 months showed no evidence of recurrence or metastasis, and the patient remained clinically well at 29 months. This case suggests that IVMTE is technically feasible in this extremely high-risk setting and may serve as an individualized surgical option for selected patients with severely compromised pulmonary reserve who require curative treatment but are unable to tolerate a transthoracic approach.

Declarations

Ethics statement

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Availability of data and materials

All data generated or analyzed during this study are included in this published article. Additional clinical data are not publicly available to protect patient privacy but may be available from the corresponding author on reasonable request.

Authors' contributions

HCT collected the clinical data and drafted the manuscript. CBG and HCT performed the surgery. SYJ critically revised the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2024;74:229–63. <https://doi.org/10.3322/caac.21834>.
2. van Hagen P, Hulshof MCCM, van Lanschot JJB, Steyerberg EW, van Berge Henegouwen MI, Wijnhoven BPL, et al. Preoperative chemoradiotherapy for esophageal or junctional cancer. *N Engl J Med.* 2012;366:2074–84. <https://doi.org/10.1056/NEJMoa1112088>.
3. Elliott JA, Guinan E, Reynolds JV. Measurement and optimization of perioperative risk among patients undergoing surgery for esophageal cancer. *Dis Esophagus Off J Int Soc Dis Esophagus.* 2024;37:doad062. <https://doi.org/10.1093/dote/doad062>.
4. Biere SSAY, van Berge Henegouwen MI, Maas KW, Bonavina L, Rosman C, Garcia JR, et al. Minimally invasive versus open oesophagectomy for patients with oesophageal cancer: a multicentre, open-label, randomised controlled trial. *Lancet Lond Engl.* 2012;379:1887–92. [https://doi.org/10.1016/S0140-6736\(12\)60516-9](https://doi.org/10.1016/S0140-6736(12)60516-9).
5. Reichert M, Schistek M, Uhle F, Koch C, Bodner J, Hecker M, et al. Ivor Lewis esophagectomy patients are particularly vulnerable to respiratory impairment - a comparison to major lung resection. *Sci Rep.* 2019;9:11856. <https://doi.org/10.1038/s41598-019-48234-w>.
6. Fujiwara H, Shiozaki A, Konishi H, Kosuga T, Komatsu S, Ichikawa D, et al. Single-Port Mediastinoscopic Lymphadenectomy Along the Left Recurrent Laryngeal Nerve. *Ann Thorac Surg.* 2015;100:1115–7. <https://doi.org/10.1016/j.athoracsur.2015.03.122>.
7. Huang J-S, Lin W-W, Zhong Q-H, Guo F-L, Wu J-Y, Zhang Z-Y, et al. Single-port inflatable mediastinoscopy combined with laparoscopic esophagectomy via right cervical auxiliary operating port and sternal lifting: a safe and reliable surgical method. *J Thorac Dis.* 2025;17:1481–90. <https://doi.org/10.21037/jtd-24-1380>.
8. Yin Z, Yang R-M, Jiang Y-Q, Chen Q, Cai H-R. Perioperative Clinical Results of Transcervical and Transhiatal Esophagectomy versus Thoracoscopic Esophagectomy in Patients with Esophageal Carcinoma: A Prospective, Randomized, Controlled Study. *Int J Gen Med.* 2022;15:3393–404. <https://doi.org/10.2147/IJGM.S347230>.
9. Song S, Shen C, Hu Y, He Y, Yuan Y, Xu Y. Application of Inflatable Video-Assisted Mediastinoscopic Transhiatal Esophagectomy in Individualized Treatment of Esophageal Cancer. *Biomedicines.* 2023;11:2750. <https://doi.org/10.3390/biomedicines11102750>.
10. Wang G, Tao S, Sun X, Wang J, Li T, Chen Z, et al. Comparative study of acute and chronic pain after inflatable videoassisted Mediastinoscopic Transhiatal esophagectomy and minimally invasive McKeown Esophagectomy: A propensity score matching analysis. *Heliyon.* 2024;10:e33477. <https://doi.org/10.1016/j.heliyon.2024.e33477>.
11. Yibulayin X, Xu K, Yibulayin W, Abulaiti A, Wu Z, He D, et al. Single-port inflatable mediastinoscopic esophagectomy is a cure for esophageal cancer patients: Case report. *Med (Baltim).* 2022;101:e31619. <https://doi.org/10.1097/MD.00000000000031619>.

12. Komatsu S, Konishi T, Ogawa S, Matsumoto Y, Fujita Y, Matsuo H, et al. Short- and Long-term Outcomes of Mediastinoscopic Radical Esophagectomy Compared with Open Esophagectomy for Esophageal Cancer: A Consecutive Single-Institution Cohort Study. *J Gastrointest Surg Off J Soc Surg Aliment Tract*. 2026;102557. <https://doi.org/10.1016/j.gassur.2026.102557>.
13. Tokairin Y, Nagai K, Fujiwara H, Ogo T, Okuda M, Nakajima Y, et al. Mediastinoscopic subaortic and tracheobronchial lymph node dissection with a new cervico-hiatal crossover approach in thiel-embalmed cadavers. *Int Surg*. 2015;100:580–8. <https://doi.org/10.9738/INTSURG-D-14.00305.1>.
14. Komatsu S, Konishi T, Ogawa S, Matsumoto Y, Fujita Y, Matsuo H, et al. Lymphadenectomy through a triple-instrument cervical approach: a technical advance in single-port mediastinoscopic radical esophagectomy for esophageal cancer. *J Gastrointest Surg Off J Soc Surg Aliment Tract*. 2026;30:102296. <https://doi.org/10.1016/j.gassur.2025.102296>.