

Wedge resection and pleurodesis through single-incision videothoracoscopic transmediastinal approach for bilateral spontaneous pneumothorax

Bilateral spontan pnömotoraks için tek insizyondan videotorakoskopik transmediastinal kama rezeksiyon ve plörodezis

Yekta Altumur Karamustafaoğlu¹, Fazlı Yanık², Yener Yörük³

Department of Thoracic Surgery, Medicine Faculty of Trakya University, Edirne, Türkiye

ABSTRACT

In general, in cases of bilateral primary pneumothorax, video-assisted thoracoscopic surgery procedures are performed sequentially on both sides. However, there are only a few reported cases of bullectomy through video-assisted thoracoscopic surgery using a transmediastinal approach for bilateral primary spontaneous pneumothorax. A 20-year-old male patient was admitted to our clinic with a right pneumothorax and developed a left pneumothorax four days later while he was under treatment. He underwent bilateral bullectomy and pleurodesis via a single-incision video-assisted thoracoscopic surgery in the supine position. The patient was discharged uneventfully within 72 h after the procedure. In conclusion, bilateral bullectomy and pleurodesis using single-incision transmediastinal access video-assisted thoracoscopic surgery may be good choices that are technically reliable and provide favorable surgical outcomes.

Keywords: Mediastinum, pleural cavity, pneumothorax, video-assisted thoracoscopic surgery.

Bilateral bullectomy or blebectomy and surgical pleurodesis through mini-thoracotomy or video-assisted thoracoscopic surgery (VATS) have been the main goals of definitive treatment to prevent recurrence in patients with primary spontaneous pneumothorax (PSP). Single-incision VATS through anterior transmediastinal access (TMA) for the contralateral thoracic cavity is a surgical alternative to bilateral PSP (BPSP) and can reduce postoperative pain, incision scarring, and duration of hospital stay compared to bilateral sequential operation.^[1] The transmediastinal VATS (TMA-VATS) approach may be a feasible, safe, and good choice for BPSP. For this procedure, Wu et al.^[1] preferred the anterior

ÖZ

Genellikle bilateral pnömotoraks olgularında, video yardımcı torakoskopik cerrahi her iki tarafa da ardışık olarak uygulanır. Bununla birlikte, çok az sayıda bilateral pnömotoraks için video yardımcı torakoskopik cerrahi ile transmediastinal yolla bullektomi olgusu bildirilmiştir. Yirmi yaşında erkek hasta, sağ pnömotoraks nedeni ile kliniğimize başvurdu ve hastada tedavisi sürmekteyken dört gün sonra sol spontan pnömotoraks gelişti. Supin pozisyonda tek insizyon video yardımcı torakoskopik cerrahi ile bullektomi ve plörodezis yapıldı. Ameliyattan 72 saat sonra hasta sorunsuz bir şekilde taburcu edildi. Sonuç olarak, tek insizyon transmediastinal yol kullanılarak yapılan video yardımcı torakoskopik cerrahi ile bullektomi ve plörodezis teknik olarak güvenilir ve olumlu cerrahi sonuçları olan iyi seçenekler olabilir.

Anahtar sözcükler: Mediasten, plevral kavite, pnömotoraks, video yardımcı torakoskopik cerrahi.

transmediastinal route, while Cho et al.^[2] opted for the posterior transmediastinal route. It may provide advantages for the patient, such as a shorter hospital stay, reduced operative and anesthesia time, a smaller and single incision, and earlier tube removal and mobilization compared to the bilateral sequential VATS (BS-VATS). In a single-incision VATS, it is thought to be difficult to move the thoracoscopic instruments for mediastinal dissection through the single incision; however, the uniportal TMA-VATS can be more easily achievable to the supine position due to the ergonomic advantages and more comfortable to manipulate the instruments and staplers in parallel geometry.

Corresponding author: Yekta Altumur Karamustafaoğlu.
E-mail: altumur@hotmail.com

Doi: 10.5606/tgkdc.dergisi.2023.20843

Received: September 28, 2020

Accepted: January 17, 2021

Published online: April 28, 2023

Cite this article as: Karamustafaoğlu YA, Yanık F, Yörük Y. Wedge resection and pleurodesis through single-incision videothoracoscopic transmediastinal approach for bilateral spontaneous pneumothorax. Turk Gogus Kalp Dama 2023;31(2):295-299. doi: 10.5606/tgkdc.dergisi.2023.20843.

©2023 All right reserved by the Turkish Society of Cardiovascular Surgery.



This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes (<http://creativecommons.org/licenses/by-nc/4.0/>).

In this article, we report our experience on BPSP treatment using TMA-VATS.

CASE REPORT

A 20-year-old man was admitted with his first episode of a right pneumothorax. Thoracic computed tomography (CT) revealed bullae and blebs located at the apex of both upper lobes and a right pneumothorax. The mean heart rate was 92 min and oxygen saturation was 91% at the time of hospital admission. Other system examinations were normal. A chest tube was inserted into the right pleural cavity (Figure 1a). The right lung was nearly fully expanded, but air leak persisted for four days in expiration as minimal. However, a left pneumothorax developed four days later, while the patient was being treated for right pneumothorax (Figure 1b). Pulmonary compression was about 80% for the right lung initially and, then, 20% for the left lung. We did not perform chest tube drainage due to minimal lung collapse for the left lung. Subsequently, a one-stage bilateral surgical intervention was scheduled. The patient was given a detailed face-to-face explanation of the surgical method and its possible risks and benefits before surgery.

Under general anesthesia and double-lumen endotracheal tube intubation, we placed the patient in a semi-supine position and performed a right-side thoracoscopy. A single 4-cm incision was made in the

fifth intercostal space at the midaxillary line of the right side, and a wound retractor was inserted to allow for surgical instruments and a camera. First, the right apical bullae were excised with two 60-mm rotating endoscopic linear stapler devices (Covidien Endo GIA Universal Reticulator 60 4.8 mm; North Haven, CT, USA) (Figure 2a). Then, the anterior mediastinal pleura and surrounding tissue were opened 7 to 10 cm between the sternum and the superior vena cava using a bipolar L-hook probe. The apical bulla or bleb of the left lung was meticulously identified and excised using two 60-mm rotating endoscopic linear staplers (Covidien Endo GIA Universal Reticulator 60 4.8 mm; North Haven, CT, USA) (Figure 2b, c). During the procedure, if controlled single-lung ventilation was needed, selective deflation of the left lung or an apnea period was carried out. Subsequently, bilateral parietal pleural abrasion was performed using gauze with the Foerster lung grasping clamps (SCANLAN®; Scanlan International Inc., MN, USA), and air leaks were checked by inflating the lung, which was immersed in saline solution (Figure 2d). After surgery, a 28F chest tube was inserted through the mediastinal incision into the apex of the left thorax and another 28F chest tube into the right thorax through the same incision (Figure 3). The patient tolerated the whole procedure well. On postoperative Days 2 and 3, the left and right chest tubes were removed, respectively, and the patient was discharged uneventfully. There were no intra- or postoperative complications, and no recurrence of

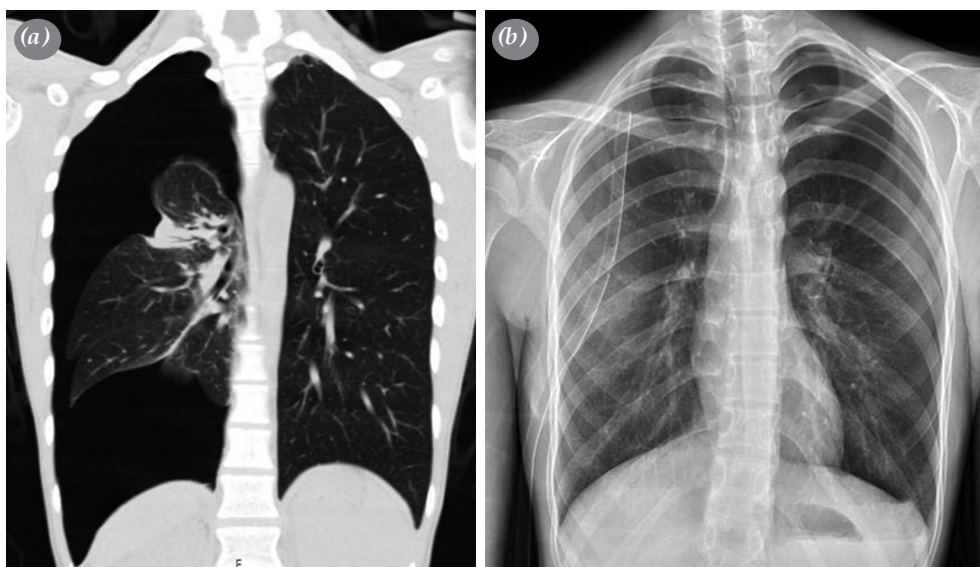


Figure 1. (a) Coronal view of computed tomography showing the total lung collapse of left lung and apical bleb in right lung. (b) Chest X-ray showing the thorax drain in right lung and partial lung collapse in left lung four days after chest tube insertion to right lung.

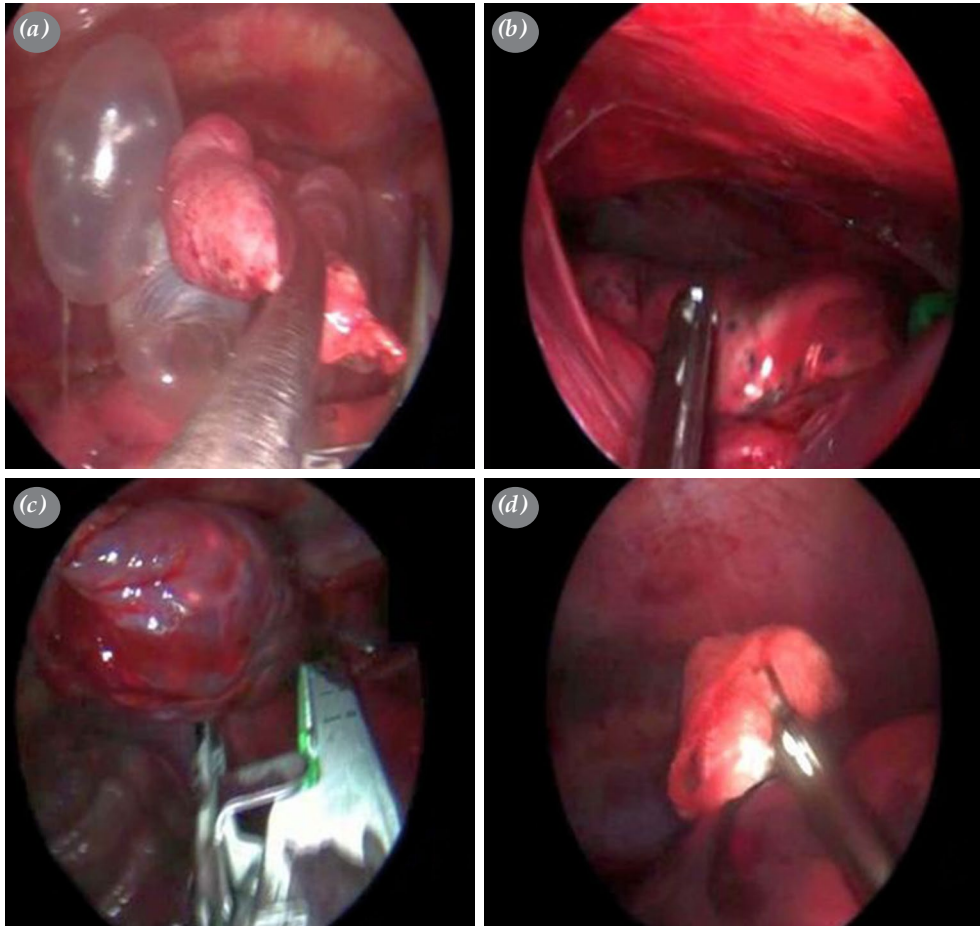


Figure 2. Images taken during the procedure. (a) The right lung bulla is resected with an endostapler. (b) The incision is being made in the mediastinal pleura between the sternum and the pericardium with a hook electrode. (c) Excision of the bleb using an endostapler through transmediastinal access. (d) Pleural abrasion with a gauze-packed long hemostatic clamp.



Figure 3. Postoperative chest X-ray showing the chest tube inserted through the mediastinal incision to the contralateral thoracic cavity.

pneumothorax was observed during the three-month follow-up period.

DISCUSSION

The appropriate choice of surgical approach for BPSP is clinically important and still debatable. Surgical resection of bullae is the most effective treatment for recurrent and bilateral pneumothoraces.^[3,4] The BS-VATS bullectomy and pleurodesis are considered favorable options that are safe and feasible for the treatment of BPSP, although they require longer surgical times and increased risks of intraoperative complications.^[5,6] Moreover, these procedures may cause patients to suffer more pain, multiple bilateral incisional wounds, poorer aesthetic results, and greater discomfort.^[6,7] Conversely, single-incision TMA-VATS has been revealed to be a less invasive, yet reliable method compared to median sternotomy, transverse thoracosternotomy, and staged

bilateral thoracotomies.^[8] Contralateral bullectomy and pleurodesis are obviously more difficult, but feasible with full safety, a better surgical view, and no need for position change despite longer surgery and anesthesia times.^[5,6] Wu et al.^[1] were the first to report the new ipsilateral transmediastinal technique for bilateral bullectomy and pleurodesis through unilateral VATS in four patients. Later, Cho et al.^[9] developed a different method of apicoposterior TMA (between the vertebrae and esophagus) to perform TMA-VATS bullectomy for simultaneous bilateral pneumothoraces. Cho et al.^[2] reported a novel technique for treating BPSP, which they referred to as ipsilateral apicoposterior TMA-VATS, and compared it with bilateral sequential BS-VATS. They noted that the TMA-VATS approach could be a safe and feasible procedure for BPSP. Specifically, TMA-VATS may reduce the duration of surgery, avoid the need for multiple bilateral wounds and long-duration placement of chest tubes, and shorten the length of hospital stay compared to the BS-VATS procedure. However, this procedure has some contraindications such as a history of sternotomy or thoracotomy, intolerance to one-lung ventilation, fatty mediastinum, a remnant large thymus, lung bullae/blebs are located in the hilum and posterior or basal region, cardiac and vascular abnormalities.^[10] Therefore, a meticulous preoperative CT evaluation should be carried out for all patients. The TMA-VATS technique was applied using a multi-port approach for much of the study. Li et al.^[11] reported that 18 patients with simultaneous BPSP or pulmonary bullae were treated with tubeless single-port VATS via the anterior mediastinum. Of note, there are some advantages and disadvantages of single-incision surgery. The main disadvantages include difficulty in moving the thoracoscopic instruments for mediastinal dissection through the minimal single incision, the possibility of incomplete exploration of the contralateral hemithorax, the inability to manage complications in the contralateral hemithorax, and the fact that it may be more easily achievable to the supine position due to ergonomic advantages. Therefore, the pneumothorax recurrence rate in the contralateral hemithorax may be higher compared to that of the side of the incision.^[11] The recurrence rate of contralateral blebs/bullae is reported as 26% in patients undergoing single-incision surgery, compared to 15% for patients with PSP.^[12] On the other hand, the main advantages of single-incision surgery include reduced chronic pain due to only having a single incision, better cosmetic results, shorter surgical time, and reduced intraoperative blood loss. Our technique, which is similar to that

of Cho et al.,^[9] could be suitable for blebs and bullae located in the left apex. Our considerations are consistent with those of Cho et al.,^[9] in that it is better to perform the intervention to the right side of the mediastinum, as the beating heart can impede the movement of endoscopic instruments while inserting them into the left thoracic cavity.

In our case, two closed thoracostomy drains were placed in the left thorax transmediastinally through the same incision. The lungs were nearly fully expanded, allowing the left and right chest tubes to be removed on postoperative Days 2 and 3, respectively. As a result, single-incision surgery was sufficient for our patient and appeared to be more cosmetically satisfactory and less painful to our patient. Moreover, there were no intra- or postoperative complications.

In conclusion, our case demonstrates that bilateral bullectomy and pleurodesis using single-incision transmediastinal access video-assisted thoracoscopic surgery are good choices that are technically reliable and provide favorable surgical outcomes. This is because of their potential to expedite chest tube removal, shorten hospital stays, facilitate postoperative mobilization, and provide better cosmetic results for patients with bilateral primary spontaneous pneumothorax. This procedure may be indicated in patients with bilateral blebs/bullae requiring surgical resections.

Patient Consent for Publication: A written informed consent was obtained from patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript: Y.A.K. All authors discussed the results and final manuscript.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Wu YC, Chu Y, Liu YH, Yeh CH, Chen TP, Liu HP. Thoracoscopic ipsilateral approach to contralateral bullous lesion in patients with bilateral spontaneous pneumothorax. *Ann Thorac Surg* 2003;76:1665-7. doi: 10.1016/s0003-4975(03)00965-2.
2. Cho DG, Lee SI, Chang YJ, Cho KD, Cho SK. Thoracoscopic bilateral bullectomy for simultaneously developed bilateral primary spontaneous pneumothorax: Ipsilateral

- transmediastinal versus bilateral sequential approach. *Thorac Cardiovasc Surg* 2017;65:56-60. doi: 10.1055/s-0035-1562939.
3. Treasure T. Minimally invasive surgery for pneumothorax: The evidence, changing practice and current opinion. *J R Soc Med* 2007;100:419-22. doi: 10.1177/014107680710000918.
 4. Ng CS, Lee TW, Wan S, Yim AP. Video assisted thoracic surgery in the management of spontaneous pneumothorax: The current status. *Postgrad Med J* 2006;82:179-85. doi: 10.1136/pgmj.2005.038398.
 5. Lang-Lazdunski L, de Kerangal X, Pons F, Jancovici R. Primary spontaneous pneumothorax: One-stage treatment by bilateral videothoracoscopy. *Ann Thorac Surg* 2000;70:412-7. doi: 10.1016/s0003-4975(00)01552-6.
 6. Ayed AK. Bilateral video-assisted thoracoscopic surgery for bilateral spontaneous pneumothorax. *Chest* 2002;122:2234-7. doi: 10.1378/chest.122.6.2234.
 7. Chen YJ, Luh SP, Hsu KY, Chen CR, Tsao TC, Chen JY. Video-assisted thoracoscopic surgery (VATS) for bilateral primary spontaneous pneumothorax. *J Zhejiang Univ Sci B* 2008;9:335-40. doi: 10.1631/jzus.B0720235.
 8. Kodama K, Higashiyama M, Yokouchi H, Takami K, Doki Y, Kabuto T. Transmediastinal approach to exploring the lung contralateral to the thoracotomy site. *Jpn J Thorac Cardiovasc Surg* 2001;49:267-72. doi: 10.1007/BF02913131.
 9. Cho DG, Cho KD, Kang CU, Jo MS, Kim YH. Thoracoscopic simultaneous bilateral bullectomy through apicoposterior transmediastinal access for bilateral spontaneous pneumothorax: A challenging approach. *World J Surg* 2011;35:2016-21. doi: 10.1007/s00268-011-1157-9.
 10. Song N, Jiang G, Xie D, Zhang P, Liu M, He W. Bilateral bullectomy through uniportal video-assisted thoracoscopic surgery combined with contralateral access to the anterior mediastinum. *J Bras Pneumol* 2013;39:32-8. doi: 10.1590/s1806-37132013000100005.
 11. Li X, Wang X, Zhang H, Cheng H, Cao Q. Unilateral single-port thoracoscopic surgery for bilateral pneumothorax or pulmonary bullae. *J Cardiothorac Surg* 2019;14:71. doi: 10.1186/s13019-019-0894-y.
 12. Liu YW, Chang PC, Chang SJ, Chiang HH, Li HP, Chou SH. Simultaneous bilateral thoracoscopic blebs excision reduces contralateral recurrence in patients undergoing operation for ipsilateral primary spontaneous pneumothorax. *J Thorac Cardiovasc Surg* 2020;159:1120-7.e3. doi: 10.1016/j.jtcvs.2019.08.009.