

Uniportal transcervical video-assisted thoracoscopic surgery (VATS) approach for pulmonary lobectomy combined with transcervical extended mediastinal lymphadenectomy (TEMLA)

Marcin Zieliński¹, Mariusz Rybak¹, Katarzyna Solarczyk-Bombik¹, Michał Wilkojc¹, Wojciech Czajkowski¹, Sylwester Kosinski², Edward Fryzlewicz², Tomasz Nabialek², Juliusz Pankowski³

¹Department of the Thoracic Surgery, ²Department the Anaesthesiology and Intensive Care, ³Department of Pathology, Pulmonary Hospital, Zakopane, Poland

Contributions: (I) Conception and design: M Zieliński; (II) Administrative support: None; (III) Provision of study materials or patients: None; (IV) Collection and assembly of data: All authors; (V) Data analysis and interpretation: M Zieliński; (VI) Manuscript writing: All authors; (VII) Manuscript writing: All authors.

Correspondence to: Marcin Zieliński, MD, PhD. Department of Thoracic Surgery, Pulmonary Hospital, Ul. Gładkie 1, 34 500 Zakopane, Poland. Email: marcinz@mp.pl.

Background: To present the technique of uniportal transcervical video-assisted thoracoscopic surgery (VATS) approach for pulmonary lobectomy combined with transcervical extended mediastinal lymphadenectomy (TEMLA).

Methods: Transcervical extended approach utilizes a typical a 5–8 centimeters collar incision in the neck. The critical technical point enabling a wide access to the chest is an elevation of the sternal manubrium with a special retractor (modified Rochard frame, Asculap–Chifa Company). A bilateral visualization of the laryngeal recurrent and vagus nerves is usually performed to avoid injury of these structures. The uniportal transcervical VATS lobectomy for NSCLC is preceded by TEMLA to enable optimal intraoperative staging of the mediastinal nodes and perform extensive bilateral lymphadenectomy, which theoretically might affect survival. VATS lobectomy is the next step after obtaining results of intraoperative examination of the nodes. Ventilation of the operated lung is disconnected and the mediastinal pleura is opened. Pleural adhesions are divided. The branches of the pulmonary artery and vein and the lobar bronchus are sequentially dissected and managed with endo staplers. The fissure is divided with endo stapler and the resected lobe is removed in endobag.

Results: There were 9 patients operated on in the period 1.2.2016–30.7.2016. In one patient with left lower lobe tumor we had to convert to uniportal VATS left lower lobectomy due to extensive adhesions. There was no mortality and complications occurred in 2 patients. The mean operative time was 258.1 min (200–385 min) for the whole TEMLA procedure with imprint cytology and lobectomy and 168.1 min (110–295 min) for a lobectomy solely.

Conclusions: A uniportal transcervical video-assisted thoracoscopic surgery (VATS) approach for pulmonary lobectomy combined with TEMLA provides an opportunity for radical pulmonary resection and super radical extensive mediastinal lymphadenectomy.

Keywords: Lung cancer; mediastinum; pulmonary resection

Submitted Sep 16, 2016. Accepted for publication Oct 24, 2016.

doi: 10.21037/jtd.2016.12.01

View this article at: <http://dx.doi.org/10.21037/jtd.2016.12.01>

Introduction

Video-assisted thoracoscopic surgery (VATS) pulmonary lobectomy became an accepted method for the treatment of early-stage non-small-cell lung cancer (NSCLC). There are several variants of VATS lobectomy. In recent years the uniportal approach described by Gonzales-Rivas gained a world-wide interest (1). The uniportal VATS approach can be performed through the intercostal incision as has been practiced in vast majority of published cases, but there are also two other approaches, namely the subxiphoid and the transcervical incision (2,3). The last approach was first described by our team in 2007. In that time, we performed right upper lobectomy and afterwards the left upper lobectomy through the transcervical approach combined with single-port intercostal VATS (3,4). Our method was to combine lobectomy with Transcervical Extended Mediastinal Lymphadenectomy (TEMLA), preceding a pulmonary resection with intraoperative examination of the mediastinal nodes with the imprint cytology technique (5,6). From 2016, after adopting the technique of uniportal intercostal lobectomy we started to perform transcervical VATS uniportal lobectomies, without additional intercostal ports. In this report we describe our initial experience and describe in detail for the first time the technique of the right lower lobectomy.

Indications

Transcervical pulmonary lobectomy can be proposed to patients with histologically, or cytologically proven clinical stage I (cI) NSCLC as an alternative to VATS lobectomy.

Contraindications

Patients with NSCLC more advanced than cIB currently cannot have transcervical lobectomy. The other contraindications include severe atherosclerotic lesions of the innominate artery and the aortic arch and previous cardiac surgery. Severe pleural adhesions and calcified intrapulmonary nodes after previous tuberculosis are also technical obstacles for this kind of surgery.

Methods

Preparation

The patient was positioned supine on the operating table with a roll placed beneath the thoracic spine to elevate the

chest and to hyperextend the patient's neck. Under general anaesthesia an endobronchial tube was inserted to conduct selective lung ventilation during the latter part of the procedure.

A transverse 6–8 cm transcervical collar incision was made in the neck in a standard way with division and suture-ligation of the anterior jugular veins bilaterally. The sternal manubrium was elevated with sharp one-tooth hook connected to the Rochard frame (Aesculap-Chifa Company) to widen the access to the mediastinum. The first part of the procedure was TEMLA. The technique of this procedure, and possible pitfalls and the methods of management of intraoperative complications was published elsewhere (5). In brief, the technique of TEMLA included dissection of all mediastinal nodal stations except for the pulmonary ligaments nodes (station 9). The subcarinal nodes, the periesophageal nodes, the right and left lower paratracheal nodes, and the right hilar nodes (stations 7, 8, 4R, 4L and 10R) were removed in the mediastinoscopy-assisted technique and the paraaortic and the pulmonary-window nodes (stations 6 and 5) removed in the videothoracoscopy-assisted technique, with the videothoracoscope inserted through the transcervical incision. The superior mediastinal nodes and upper right and left paratracheal nodes (stations 1, 2R and 2L) were removed in the open surgery fashion under direct eye control. The prevascular and retrotracheal nodes (stations 3A and 3P) were removed in pre-selective cases. Generally, the mediastinal pleura was not violated and no drain was left in the mediastinum. Bilateral supraclavicular lymphadenectomy and even deep cervical lymph node dissection is possible during TEMLA through the same incision.

The nodes removed during TEMLA were sent sequentially to intraoperative pathologic examination with use of the imprint cytology technique, which was described in the other publication. The imprint cytology technique is a highly reliable technique much less consuming than a frozen section analysis. Due to this advantage the time of nodal examinations adds only 15 to 20 minutes to the total time of the operation. After receiving the negative results of the imprint cytology, confirming there were no nodal metastasis the VATS lobectomy part starts. The position of the patient is slightly changed with the introduction of the roll beneath the patient's operating side. Additionally, the operating table is rotated to achieve a semi-lateral position of the patient. The ventilation of the operated lung is disconnected and the mediastinal pleura is opened (*Figure 1*). In this report only the right lower lobectomy is described.



Figure 1 The mediastinal pleura is opened (7).

Available online: <http://www.asvide.com/articles/1357>



Figure 2 Division of the pulmonary ligament which is done with electrocautery hook (8).

Available online: <http://www.asvide.com/articles/1358>



Figure 3 The inferior pulmonary vein is dissected and managed with vascular endostapler (9).

Available online: <http://www.asvide.com/articles/1360>



Figure 4 Blunt dissection with a peanut sponge is continued along the right main and the intermedium bronchus to reach the segment 6 bronchus (10).

Available online: <http://www.asvide.com/articles/1362>



Figure 5 Blunt dissection is performed to visualize the segment 6 artery and the lower trunk of the right pulmonary artery (11).

Available online: <http://www.asvide.com/articles/1364>

The dissection starts from division of the pulmonary ligament which is done with electrocautery hook (*Figure 2*). The inferior pulmonary vein is dissected and managed with vascular endostapler (*Figure 3*). The station 9 nodes are removed. Next step is the incision of the mediastinal pleura covering the right main bronchus caudally to the azygos vein. Blunt dissection with a peanut sponge is continued along the right main and the intermedium bronchus to reach the segment 6 bronchus (*Figure 4*). Further blunt dissection is performed to remove some station 11 nodes to visualize the segment 6 artery (*Figure 5*). The dissection is continued along the pulmonary artery to create a space for introduction of the stapler to divide the posterior part of the oblique fissure, which is made with application of the stapler introduced between the segment 2 and the segment



Figure 6 Application of the stapler introduced between the segment 2 and the segment 6 arterial branches (12). Available online: <http://www.asvide.com/articles/1365>



Figure 9 Division of the lower lobe bronchus with endostapler (15). Available online: <http://www.asvide.com/articles/1368>



Figure 7 The second stapler is applied with much attention paid to avoid injury of the middle lobe artery (13). Available online: <http://www.asvide.com/articles/1366>



Figure 10 Division of the fissure is completed with further application of the stapler (16). Available online: <http://www.asvide.com/articles/1369>



Figure 8 The arterial branches of the pulmonary artery supplying the lower lobe are managed with vascular endostapler, or vascular clips (14). Available online: <http://www.asvide.com/articles/1367>

6 arterial branches (*Figure 6*). Due to division of the fissure the distal part of the artery is visualized. The second stapler is applied with much attention paid to avoid injury of the middle lobe artery (*Figure 7*). All arterial branches of the pulmonary artery supplying the lower lobe are clearly visible. They are managed with vascular endostapler or vascular clips (*Figure 8*). The next step is the division of the lower lobe bronchus with endostapler after preliminary inflation of the lung to ensure that the middle lobe bronchus was not closed (*Figure 9*). Division of the fissure is completed with one or further applications of the stapler (*Figure 10*). The right lower lobe is removed in an endobag (*Figure 11*). Haemostasis is checked and one or two chest tubes are inserted to the chest through the transcervical incision (*Figure 12*). The transcervical incision is closed with approximation of the strap muscles, platysma and skin edges.

Starting from February 1st 2016 till July 31st 2016 we made an attempt to perform 9 transcervical uniportal VATS lobectomies. In one patient with left lower lobe tumor we had to convert to uniportal VATS approach due to extensive adhesions located, especially in the area of the left hilum and the aorta-pulmonary window, which were difficult to manage through the transcervical incision.



Figure 11 The right lower lobe is removed in endobag (17). Available online: <http://www.asvide.com/articles/1370>



Figure 12 Two chest tubes are inserted to the chest through the transcervical incision (18). Available online: <http://www.asvide.com/articles/1371>

In this patient, we performed VATS uniportal left lower lobectomy. The other 8 patients underwent transcervical uniportal VATS lobectomies. The types of the procedures are shown in the *Table 1*. In one patient, we performed a bilateral procedure—a right upper lobectomy with a wedge resection of left upper lobe. There were no intraoperative complications. In two patients, there were postoperative complications. One patient who underwent left upper lobectomy suffered the left laryngeal recurrent nerve palsy, which resulted in severe aspiration of the ingested fluid and acute respiratory distress syndrome (ARDS). The patient necessitated ventilatory support for 10 days. The other patient who underwent right upper lobectomy necessitated chest drainage due to pneumothorax. The mean operative time was 258.1 min (200–385 min) for the whole TEMLA procedure with imprint cytology and lobectomy and 168.1 min (110–295 min) for a lobectomy solely.

Discussion

Introduction of the uniportal approach is probably a final step in development of minimizing of the VATS approach with limitation to only one incision of 3–4 cm. However, there is a disadvantage of uniportal approach which is an intercostal incision, with possible risk of postoperative pain originating from injury of the intercostal nerve. To eliminate this risk the alternative uniportal approaches are currently studied, including subxiphoid and transcervical approaches, both of them avoiding the risk of chronic postoperative pain. Our experience in transcervical and subxiphoid operations assured us that a chronic postoperative pain never occurred in case of these approaches. Regarding the management of postoperative pain in patients undergoing transcervical lobectomies, no epidural or paravertebral analgesia is necessary due to the omission of any intercostal incisions. Our postoperative pain protocol includes treatment with nonsteroid anti-inflammatory drugs

Table 1 Types of transcervical uniportal VATS [1] lobectomies combined with TEMLA [2]

Type of lobectomy	Number of patients	Characteristic of the procedure
Right upper	3	In 1 patient additional wedge resection of the tumor of the left upper lobe
Left upper	2	In 1 patient pleural cavity completely obliterated
Right lower	3	In 1 patient pleural cavity completely obliterated
Overall	8	

1, Video-assisted thoracic surgery; 2, transcervical extended mediastinal lymphadenectomy.

occasionally supplemented with narcotic drug injections, if necessary. In patients undergoing standard VATS lobectomy at our institution, we use epidural or paravertebral catheters. Additionally, these approaches provide an opportunity to reach both pleural spaces and resect bilateral lesions during one procedure (2). A unique advantage of the transcervical approach is the possibility of performance of super-extended bilateral mediastinal lymphadenectomy by TEMPLA preceding a pulmonary resection, with obtaining the results of the study of nodes intraoperatively. In case of the presence of the metastatic nodes it is possible to discontinue the procedure to avoid a resection in case of positive N2. Technical complexity and long duration of the procedures are disadvantages of the transcervical uniportal lobectomies. However, our experience with this kind of operations is still very limited, so with further progress and standardization of the details of surgical technique it is possible that it becomes easier and faster. Transcervical lobectomy is probably a more difficult technique than a uniportal lobectomy. Therefore, the other possible alternative to combine TEMPLA and VATS lobectomy is to perform TEMPLA and a typical uniportal VATS lobectomy independently during one anesthesia. It does not seem possible to perform transcervical lobectomy in non-intubated patients as has been proposed recently (19). Probably, more complex procedures as pneumonectomy, sleeve lobectomy, bronchovascular resections, carinal resection and the chest wall resection will not be possible with use of the transcervical approach (20). Currently, the transcervical approach is suitable only for relatively easy cases. However, it must be stressed that it was possible to perform lobectomy also in patients with total obliteration of the pleura space by adhesions.

This paper is our first, preliminary publication on the uniportal transcervical VATS lobectomy. We found that this approach is feasible not only for the upper lobes, but also for the right lower lobe and possible also for the middle and the left lower lobes, as well. Currently, our limited experience does not allow us to draw any further conclusions.

Acknowledgements

We are grateful to Mr Michael Clark for reviewing the manuscript.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The study is approved by the institutional ethical committee and obtained the informed consent from every patient.

References

- Gonzalez D, Paradela M, Garcia J, et al. Single-port video-assisted thoracoscopic lobectomy. *Interact Cardiovasc Thorac Surg* 2011;12:514-5.
- Song N, Zhao DP, Jiang L, et al. Subxiphoid uniportal video-assisted thoracoscopic surgery (VATS) for lobectomy: a report of 105 cases. *J Thorac Dis* 2016;8:S251-7.
- Zieliński M, Pankowski J, Hauer Ł, et al. The right upper lobe pulmonary resection performed through the transcervical approach. *Eur J Cardiothorac Surg* 2007;32:766-9.
- Zielinski M, Pankowski J. Transcervical Right and Left Upper Pulmonary Lobectomies. Zielinski M, Rami-Porta R (eds). *The Transcervical Approach in Thoracic Surgery*. 2014:159-63.
- Zieliński M. Technical pitfalls of transcervical extended mediastinal lymphadenectomy--how to avoid them and to manage intraoperative complications. *Semin Thorac Cardiovasc Surg* 2010;22:236-43.
- Jakubiak M, Pankowski J, Obrochta A, et al. Fast cytological evaluation of lymphatic nodes obtained during transcervical extended mediastinal lymphadenectomy. *Eur J Cardiothorac Surg* 2013;43:297-301.
- Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. The mediastinal pleura is opened. *Asvide* 2017;4:050. Available online: <http://www.asvide.com/articles/1357>
- Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. Division of the pulmonary ligament which is done with electrocautery hook. *Asvide* 2017;4:051. Available online: <http://www.asvide.com/articles/1358>
- Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. The inferior pulmonary vein is dissected and managed with vascular endostapler. *Asvide* 2017;4:052. Available online: <http://www.asvide.com/articles/1360>
- Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. Blunt dissection with a peanut sponge is continued along the right main and the intermedius bronchus to reach the segment 6 bronchus. *Asvide* 2017;4:053. Available online: <http://www.asvide.com/articles/1362>
- Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. Blunt dissection is performed to visualize the segment 6 artery and the lower trunk of the right pulmonary artery. *Asvide*

- 2017;4:054. Available online: <http://www.asvide.com/articles/1364>
12. Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. Application of the stapler introduced between the segment 2 and the segment 6 arterial branches. *Asvide* 2017;4:055. Available online: <http://www.asvide.com/articles/1365>
 13. Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. The second stapler is applied with much attention paid to avoid injury of the middle lobe artery. *Asvide* 2017;4:056. Available online: <http://www.asvide.com/articles/1366>
 14. Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. The arterial branches of the pulmonary artery supplying the lower lobe are managed with vascular endostapler, or vascular clips. *Asvide* 2017;4:057. Available online: <http://www.asvide.com/articles/1367>
 15. Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. Division of the lower lobe bronchus with endostapler. *Asvide* 2017;4:058. Available online: <http://www.asvide.com/articles/1368>
 16. Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. Division of the fissure is completed with further application of the stapler. *Asvide* 2017;4:059. Available online: <http://www.asvide.com/articles/1369>
 17. Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. The right lower lobe is removed in endobag. *Asvide* 2017;4:060. Available online: <http://www.asvide.com/articles/1370>
 18. Zieliński M, Rybak1a M, Solarczyk-Bombik1a K. Two chest tubes are inserted to the chest through the transcervical incision. *Asvide* 2017;4:061. Available online: <http://www.asvide.com/articles/1371>
 19. Hwang J, Min TJ, Kim DJ, et al. Non-intubated single port thoracoscopic procedure under local anesthesia with sedation for a 5-year-old girl. *J Thorac Dis* 2014;6:E148-51.
 20. Gonzalez-Rivas D, Fieira E, Delgado M, et al. Uniportal video-assisted thoracoscopic sleeve lobectomy and other complex resections. *J Thorac Dis* 2014;6:S674-81.

Cite this article as: Zieliński M, Rybak M, Solarczyk-Bombik K, Wilkojc M, Czajkowski W, Kosinski S, Fryzlewicz E, Nabialek T, Pankowski J. Uniportal transcervical video-assisted thoracoscopic surgery (VATS) approach for pulmonary lobectomy combined with transcervical extended mediastinal lobectomy (TEMLA). *J Thorac Dis* 2017;9(4):878-884. doi: 10.21037/jtd.2016.12.01