

Uniportal video assisted thoracoscopic lobectomy: going directly from open surgery to a single port approach

Marco Anile¹, Daniele Diso¹, Sara Mantovani¹, Miriam Patella¹, Emanuele Russo¹, Carolina Carillo¹, Ylenia Pecoraro¹, Ilaria Onorati¹, Tiziano De Giacomo¹, Erino A. Rendina^{1,2}, Federico Venuta^{1,2}

¹Department of Thoracic Surgery, University of Rome Sapienza, Rome, Italy; ²University of Rome Sapienza, Fondazione Eleonora Lorillard Spencer Cenci, Rome, Italy

Correspondence to: Federico Venuta, MD. University of Rome Sapienza, Fondazione Eleonora Lorillard Spencer Cenci, Policlinico Umberto I, Cattedra di Chirurgia Toracica, V.le del Policlinico 155, 00161 Rome, Italy. Email: federico.venuta@uniroma1.it.

Abstract: Uniportal video-assisted thoracoscopy (VATS) has gaining a special place in the thoracic surgery scenario; nowadays even major pulmonary resections can be performed through this approach. We hereby review our initial experience with uniportal VAT lobectomy, performed passing directly from the open approach to a single port approach. We attempted 26 lobectomies through VATS with a single incision of about 5 cm and 22 of them were completed: eight left lower lobectomies, six right upper lobectomies, five left upper lobectomies and three right lower lobectomies. At pathological staging all but four patients were stage I; three patients were T₂N₁M₀ and one had a micrometastasis in a lymph node of station 7 (T₁N₂M₀—Stage IIIA) and they all underwent adjuvant chemotherapy. No perioperative mortality was observed. One patient had a myocardial infarction in the first postoperative day requiring placement of four stents and another one required thoracentesis after drainage removal. The mean time for drainage removal was 3 days and the length of hospitalization was 4.2±1.1. Pain as measured by the visual analogical scale (VAS) scale was graded as 4.9, 2.6 and 0.5 during the first postoperative day, at discharge and after 1 month respectively.

Keywords: Uniportal thoracoscopy; single port thoracoscopy; pulmonary lobectomy; lung resection; video-assisted thoracoscopy (VATS); lung cancer

Submitted May 31, 2014. Accepted for publication Aug 12, 2014.

doi: 10.3978/j.issn.2072-1439.2014.08.28

View this article at: <http://dx.doi.org/10.3978/j.issn.2072-1439.2014.08.28>

During the last three decades video-assisted thoracoscopy (VATS) has completely changed the approach to surgical treatment of thoracic disorders. This procedure has been increasingly proposed to perform procedures with increasing technical complexity: from sympathectomy to major lung resections, including bronchial sleeve resections (1) with a technique almost identical to that used in open surgery (2). The increasing complexity of the surgical procedures performed with this minimally invasive approach has been accompanied by the reduction in the number of incisions (ports), from three to two to a single one (3). Also lung resections can now be performed with a single port video assisted approach, even in awake patients (4) and complete ambulatory setting. However, it was only recently that a robust series of patients undergoing major lung resection (lobectomy

and pneumonectomy) was published showing encouraging results (5,6). This approach, although technically demanding, has completely changed our minimally invasive view. In terms of accuracy, efficacy and safety the uniportal approach is certainly comparable to the standard multiple port VATS, but the geometric configuration of the approach is completely different (7). The use of a single port favors a translational approach of VATS instruments along a sagittal plane; it enables the instruments to move in the direction of two parallel lines on that plane and approach the target lesion from a cranio-caudal perspective. This allows bringing the operative fulcrum inside the chest, in a fashion similar to open surgery (7). These geometrical and ergonomic advantages are accompanied by the obvious reduction of surgical trauma with a single port incision of 4–5 cm, and the

consequent reduction of postoperative pain.

We hereby review our initial experience with uniportal VAT lobectomy, performed passing directly from the open approach to a single port approach.

Patients and Methods

From December 2012 to February 2014 we performed 26 lobectomies through VATS with a single incision of about 5 cm without rib spreading (with the exception of first two patients, when we used an Alexis retractor) in patients with lung cancer. Only patients with clinical stage I or II lung cancer were considered for this minimally invasive approach. The incision was made anteriorly, at the level of the 5th intercostal space. Complete mediastinal lymphadenectomy was performed removing all the accessible lymph node stations as for the open procedure. Preoperative workup included routine blood tests, cardiac assessment, pulmonary function tests, arterial blood gas analysis, chest X-ray and total body computed tomography (CT) scan. In patients scheduled for a video-assisted approach, the completeness of fissures was carefully evaluated at CT scan, although its radiological absence was not considered a contraindication. Sixteen patients were women (61.5%) and ten were men (38.5%); the mean age was 63.4 ± 12 years (range, 39–76 years). Fifteen patients (58%) were active or former smokers and six (23%) had a previous history of cancer (breast and bowel) treated with surgery and adjuvant chemotherapy. Eight patients (30%) presented an increased cardiovascular risk (previous myocardial infarction, arrhythmia, high blood pressure). In the majority of cases (22/26, 85%) a preoperative diagnosis of lung cancer was obtained with fine needle CT guided biopsy or fiberoptic bronchoscopy; in the other four patients (15%) intraoperative frozen sections were obtained to confirm diagnosis before performing lobectomy. The telescope was a 30 degrees 10-mm high definition scope. In all patients complete mediastinal lymph node dissection was performed after the lobectomy. At the end of the procedure the wound was infiltrated with naropine and lidocaine and postoperative analgesia was administered with an elastomeric pump loaded with morphine. Postoperative pain was assessed using the visual analogical scale (VAS) based on colorimetric graduation administered to patients during the first and third postoperative day, at discharge and after 1 month.

Results

No perioperative mortality was observed. In four patients

(15.3%), we were unable to complete the operation with the uniportal approach: in two cases conversion to thoracotomy was required because of bleeding from the Boyden artery during right upper lobectomy and in another patient for a massive hemothorax due to a subclavian artery injury related to central vein catheter misplacement during induction of anesthesia; in another patient undergoing right lower lobectomy the procedure was converted in a 2-port approach because of widespread pleural adhesions. We completed eight left lower lobectomies, six right upper lobectomies, five left upper lobectomies and three right lower lobectomies. Adenocarcinoma was the most frequent histologic type (67%). At pathological staging all but four patients were stage I; three patients were $T_2N_1M_0$ and one had a micrometastasis in a lymph node of station 7 ($T_1N_2M_0$ —stage IIIA) and they all underwent adjuvant chemotherapy. The operatory time was 160.7 ± 39 minutes (range, 110–220 minutes). One patient had a myocardial infarction in the first postoperative day requiring placement of four stents and another one required thoracentesis after drainage removal. The mean time for drainage removal was 3 days and the length of hospitalization was 4.2 ± 1.1 . Pain as measured by the VAS scale was graded as 4.9, 2.6 and 0.5 during the first postoperative day, at discharge and after 1 month respectively.

Discussion

Since video-assisted thoracoscopic lobectomy (VATS) was first reported in 1993 (8,9), many advances in minimally invasive surgery have been proposed. The instrumentation and technology completely changed; now we have dedicated surgical instruments specifically designed for thoracoscopy. The numbers of ports have been progressively reduced, and after Rocco published his report on uniportal VATS, there was a rise of interest for single port VATS lobectomy. There are certainly some advantages with this approach; particularly, since only one intercostal space is involved, some authors reported a decrease in postoperative pain when minor procedures are performed (10); this might speed recovery and return to work. However, no such data are yet available for the lobectomy population of patients. On the other hand, it has been clearly demonstrated that pulmonary lobectomy is feasible and is safe when performed through a single port approach, even in patients with incomplete fissures (11); also complete mediastinal lymph node dissection can be performed in the same way it is done through an open approach or through multiple port VATS. However, long-term survival data in patients undergoing

pulmonary lobectomy are still lacking. Also more complex procedures like pneumonectomy (12) and bronchial sleeve resections (1) have been reported and are technically feasible with the uniportal approach.

From the technical point of view the use of thoracoscopic linear staplers certainly helps to section the vessels, although in some situations other solutions need to be adopted; particularly, we have found useful the use of a TA vascular stapler to close the upper pulmonary vein when there are technical difficulties to do it with the linear one (13). Also the use of self-locking clips (14) and energy delivering devices helps to speed the procedure.

The single port approach has been thoroughly studied also from the geometrical point of view (7), and striking differences have been found when compared to the standard three port VATS. In fact, the geometric configuration of the latter approach generates interference with the optical source, the telescope; this creates a plane with a torsion angle unfavorable on the flat 2-dimensional vision that we currently have. On the other hand, the uniportal approach allows a translational approach of instruments along a sagittal plane. As a consequence, this enables VATS instruments to draw two parallel lines on that plane, bringing them to approach the target (the lesion to be resected) from a caudo-cranial perspective achieving a projective plane. This allows the surgeon to bring the operative fulcrum inside the chest to reach the lesion in a way more similar to open surgery (7).

Our initial experience confirms the feasibility and safety of this approach. The converted cases were all within the first 10 procedures and since then no other conversion to open surgery occurred. There is certainly a learning curve that might be a little longer if the operating surgeon and his team move straightforward from open surgery to the uniportal approach, without progressively reducing the number of incision. However, if the uniportal approach has been previously considered and used for minor procedures and lesser resections (sympathectomy, surgery for pneumothorax, wedge resections) the learning curve would be certainly shorter. Training at centers with major experience might be crucial to speed the process.

Acknowledgements

Disclosure: The authors declare no conflict of interest.

References

1. Gonzalez-Rivas D, Delgado M, Fieira E, et al. Left lower

- sleeve lobectomy by uniportal video-assisted thoracoscopic approach. *Interact Cardiovasc Thorac Surg* 2014;18:237-9.
2. Ibrahim M, Maurizi G, Venuta F, et al. Reconstruction of the bronchus and pulmonary artery. *Thorac Surg Clin* 2013;23:337-47.
3. Rocco G, Martin-Ucar A, Passera E. Uniportal VATS wedge pulmonary resections. *Ann Thorac Surg* 2004;77:726-8.
4. Rocco G, Romano V, Accardo R, et al. Awake single-access (uniportal) video-assisted thoracoscopic surgery for peripheral pulmonary nodules in a complete ambulatory setting. *Ann Thorac Surg* 2010;89:1625-7.
5. Gonzalez-Rivas D, de la Torre M, Fernandez R, et al. Single-port video-assisted thoracoscopic left upper lobectomy. *Interact Cardiovasc Thorac Surg* 2011;13:539-41.
6. Gonzalez-Rivas D, Paradela M, Fernandez R, et al. Uniportal video-assisted thoracoscopic lobectomy: two years of experience. *Ann Thorac Surg* 2013;95:426-32.
7. Bertolaccini L, Rocco G, Viti A, et al. Geometrical characteristics of uniportal VATS. *J Thorac Dis* 2013;5:S214-6.
8. Roviato G, Varoli F, Rebuffat C, et al. Major pulmonary resections: pneumonectomies and lobectomies. *Ann Thorac Surg* 1993;56:779-83.
9. Kirby TJ, Mack MJ, Landreneau RJ, et al. Initial experience with video-assisted thoracoscopic lobectomy. *Ann Thorac Surg* 1993;56:1248-52; discussion 1252-3.
10. Salati M, Brunelli A, Rocco G. Uniportal video-assisted thoracic surgery for diagnosis and treatment of intrathoracic conditions. *Thorac Surg Clin* 2008;18:305-10.
11. Gonzalez D, Delgado M, Paradela M, et al. Uni-incisional video-assisted thoracoscopic left lower lobectomy in a patient with an incomplete fissure. *Innovations (Phila)* 2011;6:45-7.
12. Gonzalez-Rivas D, Delgado M, Fieira E, et al. Uniportal video-assisted thoracoscopic pneumonectomy. *J Thorac Dis* 2013;5:S246-52.
13. Anile M, Diso D, De Giacomo T, et al. Uniportal thoracoscopic lobectomy. *Ann Thorac Surg* 2013;96:745.
14. Lucchi M, Duranti L, Melfi F, et al. Polymer self-locking clips for vascular control during minimally invasive pulmonary lobectomies. *J Thorac Cardiovasc Surg* 2010;139:1345-6.

Cite this article as: Anile M, Diso D, Mantovani S, Patella M, Russo E, Carillo C, Pecoraro Y, Onorati I, De Giacomo T, Rendina EA, Venuta F. Uniportal video assisted thoracoscopic lobectomy: going directly from open surgery to a single port approach. *J Thorac Dis* 2014;6(S6):S641-S643. doi: 10.3978/j.issn.2072-1439.2014.08.28