MY JOURNEY TO UNIPORTAL VATS

Diego Gonzalez-Rivas, MD, FECTS
Thoracic Surgery and Lung Transplantation Department
Minimally Invasive Thoracic Surgery Unit (UCTMI), Coruña, Spain
Shanghai Pulmonary Hospital, Tongji University, Shanghai, China
The most dangerous phrase in the language is "we've always done it this way."

Innovation

'There's a way to do it better—find it.'
– Thomas Edison
The story begins here...
Coruña University Hospital
“El viaje de los pioneros”
TED talk-Diego Gonzalez Rivas
Searching for adrenaline..
Surfing big waves..
Review Article

VATS Lobectomy: Surgical Evolution from Conventional VATS to Uniportal Approach

Diego Gonzalez-Rivas

Department of Thoracic Surgery, Coruna University Hospital and Minimally Invasive Thoracic Surgery Unit, 15006 Coruna, Spain

Correspondence should be addressed to Diego Gonzalez-Rivas, diego.gonzalez.rivas@sergas.es

Received 9 November 2012; Accepted 29 November 2012

Academic Editors: K. Y. Song, F. Varoli, and S. Wan

Copyright © 2012 Diego Gonzalez-Rivas. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.
Good friends in this story!
THE PRACTICAL IMPORTANCE OF SURGERY OF THE PERITONEAL AND PLEURAL CAVITIES

By Dr. H. C. Jacobaeus
Professor of Medicine, University of Paris

For the last 10 years I have been using the endoscope in studying the peritoneal and pleural cavities. At first I was interested only in the diagnostic advantages that could be gained with such a method. For instance in cases with ascites, after tapping and replacing the ascitic fluid with air, I could obtain by means of the endoscope a clear and comprehensive picture of the abdominal organs. It was thus easy to study the different conditions of the liver and to diagnose cirrhosis, benign tumor, and to diagnose cirrhosis, benign tumor, and malignant tumors. Furthermore, it was possible to divide a pleuro-pulmonary adhesion.
Videendoscopic pulmonary lobectomy for cancer.
Division of Surgery, University of Milan, Italy.

Abstract
A videothoracoscopic right lower pulmonary lobectomy is reported. The excision was done in a 71-year-old man suffering from an adenocarcinoma of the right lower lobe, with an apparent absence of lymphnodal and systemic metastasis. The procedure has been performed using four 10-mm cannulas and a minimal intramammary thoracotomy (4 cm) by inserting a chip camera linked to the thoracoscope and connected to external monitors. The lobar hilar structures were dissected and then sutured-divided with Endo-GIA R shots. The specimen was extracted through the minimal thoracotomy. The postoperative course was uneventful with minimal postoperative pain, and the patient was discharged after complete surgical recovery with excellent functional and cosmetic results. This procedure in selected patients is a new and promising possibility in chest videendoscopic surgery.
“Intelligence is the ability to adapt to change.”

Stephen Hawking
Video-Assisted Thoracic Surgery Lobectomy: Experience With 1,100 Cases

Robert J. McKenna, Jr, MD, Ward Houck, MD, and Clark Beeman Fuller, MD
Cedars Sinai Medical Center, Los Angeles, California

Background. Although many video-assisted thoracic surgery (VATS) lobectomies have been performed over the 12 years since the first VATS lobectomy, controversies about the procedure remain regarding the safety and associated morbidity and mortality of that procedure. This series is reviewed to assess these issues.

Methods. Between 1992 and 2004, we performed 1,100 VATS lobectomies in 595 women (54.1%) and 505 men (45.9%), with a mean age of 71.2 years. Diagnoses were as follows: benign disease (53), pulmonary metastases (27), lymphoma (5), and lung cancer (1,015). Of the primary lung cancers, 641 (63.1%) were adenocarcinoma. With visualization on a monitor, anatomic hilar dissection and lymph node sampling or dissection were performed, primarily through a 5-cm incision without spreading the ribs.

Results. There were 9 deaths (0.8%), and none was intraoperative or due to bleeding; 932 patients had no postoperative complications (84.7%). Blood transfusion was required in 45 of 1,100 patients (4.1%). Length of stay was median 3 days (mean, 4.78). One hundred eighty patients (20%) were discharged on postoperative day 1 or 2. Conversion to a thoracotomy occurred in 28 patients (2.5%). Recurrence developed in the incisions in 5 patients (0.57%). In 2003, 89% of 224 lobectomies were performed with VATS.

Conclusions. VATS lobectomy with anatomic dissection can be performed with low morbidity and mortality rates. The risk of intraoperative bleeding or recurrence in an incision seems minimal.

Learning VATS?

Where the MAGIC happens!

Your Comfort Zone

SAME OLD WAY

SOMETHING NEW
Begining (2007)

- Visit other hospitals
- Meetings
- Literature, articles
- Wetlab
- Videos
Double port technique
First Uniportal VATS lobectomy
29th June 2010
Video-assisted thoracic surgery lobectomy: 3-year initial experience with 200 cases

Diego Gonzalez*, Mercedes de la Torre, Marina Paradela, Ricardo Fernandez, Maria Delgado, Jose Garcia, Eva Fieira, Lucia Mendez

Department of Thoracic Surgery, Coruna University Hospital, Xubias 84, 15006 Corunna, Spain

Received 9 January 2011; received in revised form 17 February 2011; accepted 22 February 2011; Available online 31 March 2011

Abstract

Objective: To analyse the evolution of the video-assisted thoracoscopic (VATS) approach for lobectomy and results during the first 3 years of program. Methods: From 1st July-2007 to 31st July-2010 we carried out 200 lobectomies by VATS. In February 2009 we started performing VATS lobectomies with only 2 incisions. We have analyzed both annual and overall outcomes regarding type of approach, conversion rate, surgical time, lymphadenectomy and overall survival. Results: Distribution of the cases per year were as follows: first-year 32, second-year 65, third-year 103. Overall conversion rate was 14.5% (first-year 25%, second-year 20%, third-year 7.8%; p = 0.017). Surgical approach was: 4 ports (1 case), 3 ports (99 cases, 100% in first-year), 2 ports (99 cases, 80% in third-year), single-port (1 case, third-year). Mean surgical time in successful VATS was 193.8 min (210.8 first-year, 207.9 second-year, 181.1 third-year; p = 0.011), mean number of lymph nodes were 11.9 (9.3 first-year, 10.1 second-year, 13.9 third-year; p = 0.003) and mean explored stations was 4.2 (3.6 first-year, 3.8 second-year, 4.5 third-year; p < 0.001). Globally median chest tube duration was 3 days. Median length of stay was 4 days. The disease-free survival at 30 months was 85% for Stage I patients and 62% for non-stage I patients. Conclusions: As we gain more experience over time, with more cases performed each year and less invasive approaches, results improve in terms of less surgical time and more extended lymphadenectomies. Furthermore, we have observed a clear evolution in our surgical approach to a less invasive 2-port approach. In selected cases we have implemented the single-port lobectomy.

$^*$ Corresponding author.

© 2011 European Association for Cardio-Thoracic Surgery. Published by Elsevier B.V. All rights reserved.

Keywords: Thoracoscopic/VATS; Lobectomy; Lung cancer surgery; Surgical approach
"In our experience, this technique is possible for lower lobes. For upper lobes, the hilar dissection is possible via one incision but there are difficulties stapling the upper vein, mediastinal trunk and the bronchus. Probably, the development of new technologies (angled optics, angled and curved staplers) will lead to single-port upper lobectomies becoming possible in experienced VATS groups"
Think Uniportal!
First upper lobe resection (after 6 lower lobes)
Completion pneumonectomy (Nov 2010)
Learning curve-fighting
Evolving from conventional video-assisted thoracoscopic lobectomy to uniportal: the story behind the evolution

Diego Gonzalez-Rivas¹,², Eva Fieira¹, Maria Delgado¹, Lucía Mendez¹, Ricardo Fernandez¹,², Mercedes de la Torre¹,²

¹Department of Thoracic Surgery, Coruna University Hospital, Coruna, Spain; ²Minimally Invasive Thoracic Surgery Unit (UCTMID), Coruna, Spain
Correspondence to: Diego Gonzalez-Rivas, MD, FECTS. Department of Thoracic Surgery, Coruna University Hospital, Xubias 84, Coruna 15006, Spain. Email: diego.gonzalez.rivas@sergas.es.

Submitted Jun 12, 2014. Accepted for publication Aug 13, 2014.
doi: 10.3978/j.issn.2072-1439.2014.08.44
View this article at: http://dx.doi.org/10.3978/j.issn.2072-1439.2014.08.44

Diego Gonzalez-Rivas personal experience: how the idea of uniportal VATS lobectomy was born

"Humans are allergic to change. They love to say, we’ve always done it this way. I try to fight that. That’s why I

He went from an aggressive open surgery to a minimally invasive surgery by using only three small incisions enabling the patient to a better postoperative recovery. This revolutionized the world of thoracic surgery. He was criticized for many years by the more traditional surgeons
Single-incision video-assisted thoracoscopic lobectomy: Initial results

Diego Gonzalez-Rivas, MD,a,b Marina Paradela, MD,a Eva Fieira, MD,a,b and Carlos Velasco,c Coruña, Spain

Video-assisted thoracoscopic surgery (VATS) was introduced nearly 2 decades ago and has experienced an exponential increase for lung cancer treatment. The standard approach is performed through three incisions, including a utility incision of about 3 to 5 cm. However, economic and logistical considerations favor the use of single-incision systems. In our experience, especially in the upper lobes, we have moved toward dividing the artery first, when possible, to facilitate the insertion of the staplers along the upper lobe vein later in the procedure (Figure 1, A). We have favored the use of a linear stapler for this first incision. In the case of upper lobes, the incision is placed in the fifth intercostal space in the right axilla. The incision is made in a right lateral decubitus position with just inferior to the breast and below the clavicle. We have used a defined amount of fluid to keep the pleural space open during the procedure. A 30-degree high-definition endoscope was inserted through the utility incision. The instrument was then introduced through the third incision in order to start the detachment of the lung from the chest wall using the generator placed in the axilla. The main stem of the lung was then divided from the trachea. The second incision was placed in the lower lobes. The incision was made in the fifth intercostal space and extended to the posterior axillary line. The instrument was inserted through this incision, and the second division was performed. The patient was discharged from the hospital on the second postoperative day.

Received 27 April 2012; received in revised form 16 June 2012; accepted 25 June 2012


doi:10.1093/ejcts/ezs482

European Journal of Cardio-Thoracic Surgery 0 (2012) 1-3

European Journal of Cardio-Thoracic Surgery

CASE REPORT

Single-port video-assisted thoracoscopic anatomic segmentectomy and right upper lobectomy

Diego Gonzalez-Rivas,a,b,c Eva Fieira,d Lucia Mendez and Jose Garcia a

Abstract

Video-assisted thoracoscopic surgery (VATS) segmentectomies are usually more complex procedures than lobectomies. With the gained experience in the field of thoracoscopic surgery, many thoracic surgery departments have progressively adopted this technique to preserve lung parenchyma, especially in cases of metastases or benign conditions. The majority of surgeons use three incisions but the procedure can be performed by only one port. We report the first anatomic segmentectomy performed by uniportal VATS with no rib spreading.

Keywords: Thoracoscopic/VATS - Minimally invasive surgery - Segmentectomy - Lobectomy - Lung cancer - Surgery/incisions/technique

2. Clinical
diagnosis

A 74-year-old woman presented with a 1.2-cm, partially solid lung nodule on the right lower lobe. She was a former smoker and had a family history of lung cancer. A computed tomography guided core biopsy was performed, revealing a lung adenocarcinoma. As the patient was a non-smoker and with a family history of lung cancer, an early diagnosis was considered most likely. A video-assisted thoracoscopic surgery was performed through a 2-cm incision in the fifth intercostal space. The lung was entered using a Veress needle, and the thoracoscopic examination revealed a non-solid lung nodule without lymph node involvement. The patient was discharged from the hospital on the second postoperative day.

4. Discussion

There is no standardized technique although most centres use a utility incision of about 3 to 5 cm. This incision is used for the lung retraction and for the mobilization of the lung along the fissure. In our experience, especially in the upper lobes, we have moved toward dividing the artery first, when possible, to facilitate the insertion of the staplers along the upper lobe vein later in the procedure (Figure 1, A). We have favored the use of a linear stapler for this first incision. In the case of upper lobes, the incision is placed in the fifth intercostal space in the right axilla. The incision is made in a right lateral decubitus position with just inferior to the breast and below the clavicle. We have used a defined amount of fluid to keep the pleural space open during the procedure. A 30-degree high-definition endoscope was inserted through the utility incision. The instrument was then introduced through the third incision in order to start the detachment of the lung from the chest wall using the generator placed in the axilla. The main stem of the lung was then divided from the trachea. The second incision was placed in the lower lobes. The incision was made in the fifth intercostal space and extended to the posterior axillary line. The instrument was inserted through this incision, and the second division was performed. The patient was discharged from the hospital on the second postoperative day.

Over recent years, there have been many advances in application of VATS to lung cancer treatment. Despite this
Thoracoscopic lobectomy through a single incision

Diego Gonzalez-Rivas, Ricardo Fernandez, Mercedes de la Torre and Antonio E. Martin-Ucar

*Minimally Invasive Thoracic Surgery Unit (UCTM), Coruna, Spain
Department of Thoracic Surgery, Coruna University Hospital, Coruna, Spain
Department of Thoracic Surgery, Nottingham University Hospitals, Nottingham, UK

*Corresponding author. Department of Thoracic Surgery, Coruna University Hospital, Xubias 84, 15006 Coruna, Spain. Tel: +34-981178286; fax +34-981178235; e-mail: diego.gonzalez.rivas@sergas.es (D. Gonzalez-Rivas).

Received 12 September 2011; received in revised form 28 September 2011; accepted 27 October 2011

Fig. 9.1 Surgeons position in front of the patient

with a video-assisted thoracoscopic approach, with no rib spreading.

The surgeon and the assistant must be placed in front of the patient in order to have the same thoracoscopic vision during all steps of the procedure and be more coordinated with the movements (Fig. 9.1).

The camera must be at 30° in order to enable us to achieve a panoramic view (10 mm scope high definition preferred). Instruments must preferably be long and curved to allow the insertion of 3 or 4 instruments simultaneously.

Optimal exposure of the lung is key in order to facilitate the dissection of the structures and to avoid instrument malposition. Even thought the

9.3 Surgical Technique

9.3.1 Lower Lobectomies

Under general anesthesia and double lumen intubation, the patient is placed in a lateral decubitus position as usual for a conventional VATS. A 4-cm incision with no rib spreading is made in
Single-Incision Thoracoscopic Right Upper Lobectomy With Chest Wall Resection by Posterior Approach

Diego Gonzalez-Rivas, MD, ** Ricardo Fernandez, MD, * Eva Feira, MD, * and Lucia Mendez, MD**

Abstract: Lobectomy requiring chest wall resection is usually performed by thoracotomy, but thanks to the advances in the field of thoracoscopic surgery, this procedure can be performed by video-assisted thoracoscopic surgery (VATS). Recent improvements in surgical devices and previous VATS experience have allowed this complex surgery for advanced stages to be undertaken safely. Most of the thoracoscopic lobectomies with rib resection are performed using three to four incisions. We report a different minimally invasive technique for chest wall resection (minimally invasive posterior approach) and VATS right upper lobectomy (single-incision anterior approach).

Key Words: Single-port VATS lobectomy, Chest wall resection, Rib involvement, Thoracoscopic approach, Chemotherapy.

(Surgery 2013;87:71–73)

Interactive CardioVascular and Thoracic Surgery Advance Access published August 9, 2013

CASE REPORT – THORACIC

Single-port video-assisted thoracoscopic lobectomy with pulmonary artery reconstruction

Diego Gonzalez-Rivas*, Maria Delgado, Eva Feira and Lucia Mendez

Department of Thoracic Surgery, Coruna University Hospital, Coruna, Spain

* Corresponding author. Department of Thoracic Surgery, Coruna University Hospital, Arcade 84, 15006 Coruna, Spain. Tel: +34-981782386; Fax: +34-981782323; e-mail: diego.gonzalezrivas@erguren.es (D. Gonzalez Rivas).

Received 18 May 2013; received in revised form 3 July 2013; accepted 12 July 2013

Abstract: Despite the advances in video-assisted thoracoscopic surgery (VATS), vascular reconstruction of the pulmonary artery (PA) is still infrequently performed by thoracic surgeons because of the technical difficulties and the increased operative risk during thoracotomy. The few published reports have been performed by using 3-4 incisions. We present the first report of a pulmonary artery reconstruction procedure performed by a single-incision VATS technique: A 73-year-old male patient was operated on by the thoracoscopic approach through a single 4-cm incision with no rib spreading. The postoperative recovery was uneventful.

Keywords: Thoracoscopic/video-assisted thoracoscopic surgery • Minimally invasive surgery • Pulmonary artery reconstruction • Vascuoplasty • Vascular reconstruction • Surgery/techniques

Uniporal video-assisted thoracoscopic bronchial sleeve lobectomy: First report

Diego Gonzalez-Rivas, MD, FECTS,** Ricardo Fernandez, MD, * Eva Feira, MD, * and LuzDivina Relian, MD, * Coruna, Spain

Video clip is available online.

Thoracotomy is the traditional way to perform a bronchial sleeve lobectomy, but it also can be performed by video-assisted thoracic surgery (VATS). Most of the complex resections inc 2 to 4 incisions, but the surgery can be done using only 1 incision. We report on uniporal VATS sleeve resection.

CLINICAL SUMMARY
A carcinoma in the right upper lobe with bronchial occlusion and distal pneumonitis (Figure 1, A) was diagnosed in a 55-year-old man. After the induction treatment (cisplatin-based therapy), VATS was the proposed approach for the patient (Figure 2, B). We placed the patient in a left lateral decubitus position. The patient had VATS approach through a 3-cm incision in the fifth intercostal space with no rib spreading (no soft tissue retractor and no indirect visualization). A complete parasternal and subclavicular lymph node dissection was initially undertaken. We placed the camera in the posterior portion of the incision, with instrument working below. We performed a right upper lobectomy, leaving the division of the bronchus as the last step of the procedure. We mobilized the interlobar artery to expose the bronchus and then divided the main vein. We made circumferential cuts onto the main bronchi and the intermediate bronchus with a knife on long handle and scissors, removed the lobe, and divided the pulmonary ligament (Video 1).

We started the end-to-end anastomosis with a posterior stitch in the cutaneous-membranous junction to help approximate the intermediate and mainstem bronchi and use it for continuous membranous suture (Video 2). We placed a row of 3.0 interrupted absorbable sutures at the posterior and medial portion of the bronchial cartilage with the help of an endoscopic krasuski pusher. While placing the sutures, we tied the knots. We used continuous suture to close the membranous bronchus (from posterior to anterior). We then placed an interrupted suture in the anterior junction and tied it to the end of the running suture on the membranous wall.

We finished by using interrupted sutures for the anterior cartilaginous portion (Video 2). We did not use any tissue flap to protect the anastomosis. We placed a single chest drain and 4–6 chest tubes in the pleural space and removed them when the drainage was less than 20 cc.

BRIEF COMMUNICATION – THORACIC

Left lower sleeve lobectomy by uniporal video-assisted thoracoscopic approach

Diego Gonzalez-Rivas*, Maria Delgado*, Eva Feira* and Oscar Pato*

* Department of Thoracic Surgery, Coruna University Hospital, Coruna, Spain

** Department of Anesthesia, Coruna University Hospital, Coruna, Spain

* Corresponding author. Department of Thoracic Surgery, Coruna University Hospital, Arcade 84, 15006 Coruna, Spain. Tel: +34-981782386; Fax: +34-981782323; e-mail: diego.gonzalezrivas@erguren.es (D. Gonzalez Rivas).

Received 8 July 2013; received in revised form 28 August 2013; accepted 17 September 2013

Abstract: Endobronchial tumours requiring sleeve resection have been usually considered a contraindication for video-assisted thoracoscopic surgery (VATS). However, with new technical advances and the experience gained in VATS, sleeve lobectomy has been performed by thoracoscopic in experienced VATS centers. Right-sided sleeve anastomosis are easier to perform by VATS than left-sided ones because of the presence of the pulmonary artery and aortic arch on the left side. Most surgeons use a 3 to 4 incision VATS technique for sleeve anastomosis but the surgeon can be performed by using only one incision. This is the first report of a left-sided sleeve lobectomy by uniporal approach.

Keywords: Sleeve lobectomy • Thoracoscopy/video-assisted thoracic surgery • Minimally invasive surgery • Lobectomy • Lung cancer
Segmentectomy 2012
Lobectomy 2011

Pericardial Window & Mediastinal LN bx 2006
Pleurodesis 2005
Wedge resection 2004
Pleural resections 2003
Sympathectomy 2002

Uniporal VATS

No limits

Unisurgeon surgery 2016
Carinal resections 2015
Subxiphoid resections 2015
Non intubated surgery 2014
Double sleeve 2014

Sleeve Resection 2013
PA Resection & Reconstruction 2013
Pneumonectomy 2012
You just need a little help at the beginning to fly and enjoy the way..
What is the best approach?

- THE MOST COMFORTABLE APPROACH FOR THE SURGEON
- THE LEAST INVASIVE APPROACH
"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change."

Charles Darwin
SCANLAN®
Uniportal / Single-Incision
VATS Instruments

As recommended by Diego Gonzalez-Rivas, MD, FETCS

Uniportal (single-incision) VATS surgery
“Avoiding the trocar improves the instrumentation and minimizes the compression of the intercostal nerve”

Dr. Gonzalez-Rivas

Photo courtesy of Dr. Gonzalez-Rivas
Evolution in technique
Incision: fifth intercostal space
POSITION OF INSTRUMENTS

A
Camera
Grasper
Stapler

B
Upper lobe vein management

Small vessels - Click aV-Grena-45 degree
Correct Training!!

- Symposia
- Workshops
- Visiting (Observer)
- Attachments
- Videos
- Training courses (2 weeks)

➢ Train the Team !!!
Mathematics

- Absence of dihedral or torsion angle
- More anatomic instrumentation, ergonomy
Reduced compression to the nerve

**2-3 ports**
- More comfortable for assistant
- Camera lean on trocar

**Single port**
- More uncomfortable for assistant
- Camera is suspended, no trocar
Anatomic instrumentation
OncoLogic technique

Paratracheal Subcarinal
Published in journals, atlas, textbook, etc

Data and survival
Uniportal Video-Assisted Thoracoscopic Lobectomy: Two Years of Experience

Diego Gonzalez-Rivas, MD, Marina Paradela, MD, Ricardo Fernandez, MD, Maria Delgado, MD, Eva Fieira, MD, Lucía Mendez, MD, Carlos Velasco, MD, and Mercedes de la Torre, MD

Department of Thoracic Surgery, Minimally Invasive Thoracic Surgery Unit (UCTMI), and Department of Cardiac Surgery, Coruña University Hospital, Coruña, Spain

Background. A video-assisted thoracoscopic approach to lobectomy varies among surgeons. Typically, 3 to 4 incisions are made. Our approach has evolved from a 3-port to a 2-port approach to a single 4- to 5-cm incision with no rib spreading. We report results with single-incision video-assisted thoracic major pulmonary resections during our first 2 years of experience.

Methods. In June 2010, we began performing video-assisted thoracoscopic lobectomies through a uniportal approach (no rib spreading). By July 12, 2012, 102 patients had undergone this single-incision approach.

Results. Of 102 attempted major resections, 97 were successfully completed with a single incision (operations in 3 patients were converted to open surgery and 2 patients needed 1 additional incision). Five uniportal pneumonectomies were not included in the study. We have analyzed early outcomes of successful uniportal lobectomies (92 patients studied). Right upper lobectomy was the most frequent resection (28 cases). Mean surgical time was 154.1 ± 46 minutes (range, 60–310 minutes), mean number of lymph nodes was 14.5 ± 7 (range, 5–38 nodes), and mean number of explored nodal stations was 4.6 ± 1.2 (range, 3–8 stations). The mean tumor size was 2.8 ± 1.5 cm (0–6.5 cm). The median duration of time a chest tube was in place was 2 days, and the median length of hospital stay was 3 days. There were complications in 14 patients; no postoperative 30-day mortality was reported.

Conclusions. Single-incision video-assisted thoracoscopic anatomic resection is a feasible and safe procedure with good perioperative results, especially when performed by surgeons experienced with the double-port technique and anterior thoracotomy.

Is uniportal thoracoscopic surgery a feasible approach for advanced stages of non-small cell lung cancer?

Diego Gonzalez-Rivas¹,², Eva Ficira¹, Maria Delgado¹, Lucia Mendez¹, Ricardo Fernandez¹,³, Mercedes de la Torre¹,³

¹Department of Thoracic Surgery, Coruña University Hospital, Coruña, Spain; ²Minimally-Invasive Thoracic Surgery Unit (UCTMI), Coruña, Spain. Correspondence to: Diego Gonzalez-Rivas, MD, FECTS. Department of thoracic surgery, Coruña University Hospital, Xubias 94, 15006, Coruña, Spain. Email: diego.gonzalez.rivas@usc.es

Objective: Conventional video-assisted thoracoscopic (VATS) lobectomy for advanced lung cancer is a feasible and safe surgery in experienced centers. The aim of this study is to assess the feasibility of uniportal VATS approach in the treatment of advanced non-small cell lung cancer (NSCLC) and compare the perioperative outcomes and survival with those in early-stage tumors operated through the uniportal approach.

Methods: From June 2010 to December 2012, we performed 163 uniportal VATS major pulmonary resections. Only NSCLC cases were included in this study (130 cases). Patients were divided into two groups: (A) early-stage and (B) advanced cases (≥2 cm, T3 or T4, or nM0; requiring neoadjuvant treatment). A descriptive and retrospective study was performed, comparing perioperative outcomes and survival obtained in both groups. A survival analysis was performed with Kaplan-Meier curves and the log-rank test was used to compare survival between patients with early and advanced stages.

Results: A total of 130 cases were included in the study: 97 (A) vs. 33 (B) patients (conversion rate 1.1% vs. 6.5%; P=0.119). Mean global age was 64.9 years and 73.8% were men. The patient demographic data was similar in both groups. Upper lobectomies (A, 52 vs. B, 21 patients) and anatomic segmentectomies (A, 4 vs. B, 0) were more frequent in group A while pneumonectomy was more frequent in B (A, 1 vs. B, 6 patients). Surgical time was longer (144.9±13.1 vs. 183.2±46.9, P<0.001), and median number of lymph nodes (14 vs. 16, P=0.004) were statistically higher in advanced cases. Median number of nodal stations (5 vs. 5, P=0.165), days of chest tube (2 vs. 2, P=0.595), HOUS (3 vs. 3, P=0.972), and rate of complications (17.3% vs. 14%, P=0.075) were similar in both groups. One patient died on the 55th postoperative day. The 30-month survival rate was 90% for the early stage group and 74% for advanced cases.

Conclusions: Uniportal VATS lobectomy for advanced cases of NSCLC is a safe and reliable procedure that provides perioperative outcomes similar to those obtained in early-stage tumors operated through this same technique. Further long-term survival analysis are ongoing on a large number of patients.

Keywords: Advanced lung cancer; uniportal; thoracoscopy; video-assisted thoracoscopic (VATS) lobectomy; minimally invasive surgery; non-small cell lung cancer (NSCLC)

Submitted Feb 21, 2014. Accepted for publication May 22, 2014. doi: 10.3978/j.issn.2072-1439.2014.05.17

Stage IA-Disease-free survival

![Graph showing disease-free survival over time.]

<table>
<thead>
<tr>
<th>Probability</th>
<th>1 year</th>
<th>2 years</th>
<th>3 years</th>
<th>4 years</th>
<th>5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrence</td>
<td>3.5%</td>
<td>10.8%</td>
<td>16.3%</td>
<td>16.3%</td>
<td>16.3%</td>
</tr>
<tr>
<td>Alive, without recurrence</td>
<td>94.00%</td>
<td>86.70%</td>
<td>81.20%</td>
<td>75.00%</td>
<td>75.00%</td>
</tr>
<tr>
<td>Death without recurrence</td>
<td>2.5%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>8.7%</td>
<td>8.7%</td>
</tr>
</tbody>
</table>
Stage IA-Overall survival

Survival probability

<table>
<thead>
<tr>
<th>Time to follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>0.0</td>
</tr>
</tbody>
</table>

Stage IA-Overall survival probability

<table>
<thead>
<tr>
<th>Probability</th>
<th>1 year</th>
<th>2 years</th>
<th>3 years</th>
<th>4 years</th>
<th>5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival probability</td>
<td>96.3%</td>
<td>96.3%</td>
<td>96.3%</td>
<td>89.4%</td>
<td>89.4%</td>
</tr>
<tr>
<td>Study</td>
<td>Uniportal patients</td>
<td>Multiportal patients</td>
<td>Study design</td>
<td>Operation</td>
<td>Pain &amp; Morbidity</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observational</td>
<td></td>
<td>• Analgesic use – ND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Complications – ND</td>
</tr>
<tr>
<td>Chung et al (2015) [51]</td>
<td>90</td>
<td>60</td>
<td>Retrospective</td>
<td>• Operative time – ND</td>
<td>• Complications – ND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observational</td>
<td>• Nodes dissected – ND</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Blood loss – Uniportal less</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Nodes dissected – Uniportal higher yield</td>
<td></td>
</tr>
<tr>
<td>Zhu et al (2015) [53]</td>
<td>33</td>
<td>49</td>
<td>Retrospective</td>
<td>• Operative time – Multiportal portal faster</td>
<td>• Pain score – Uniportal lower</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observational</td>
<td>• Blood loss – ND</td>
<td>• Complications – ND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Nodes dissected – ND</td>
<td></td>
</tr>
<tr>
<td>Liu et al (2015) [54]</td>
<td>100</td>
<td>342</td>
<td>Retrospective</td>
<td>• Operative time – Uniportal faster</td>
<td>• Complications – ND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observational</td>
<td>• Blood loss – Uniportal less</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Nodes dissected – Uniportal higher yield</td>
<td></td>
</tr>
<tr>
<td>Hirai et al (2015) [55]</td>
<td>60</td>
<td>20</td>
<td>Retrospective</td>
<td>• Operative time – ND</td>
<td>• Pain score – Uniportal lower</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Observational</td>
<td>• Blood loss – ND</td>
<td>• Analgesic use – Uniportal less</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Nodes dissected – ND</td>
<td>• Paresthesia – Uniportal less frequent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shen et al (2015) [56]</td>
<td>100</td>
<td>100</td>
<td>Propensity matched</td>
<td>• Operative time – ND</td>
<td>• Complications – ND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Blood loss – ND</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Nodes dissected – ND</td>
<td></td>
</tr>
<tr>
<td>Mu et al (2015) [57]</td>
<td>47</td>
<td>47</td>
<td>Propensity matched</td>
<td>• Operative time – ND</td>
<td>• Complications – ND</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Blood loss – ND</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Nodes dissected – ND</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations used: ND = no difference; CPK<sub>max</sub> = maximum postop level of creatine phosphokinase; CRP<sub>max</sub> = maximum postop level of C-reactive protein
### Operation

Single-incision Versus Multiple-incision Thoracoscopic Lobectomy and Segmentectomy

* A Propensity-matched Analysis

**Ann Surg** 2015;261:793–799

Transition from a multiport technique to a single-port technique for lung cancer surgery: is lymph node dissection inferior using the single-port technique?

*European Journal of Cardio-Thoracic Surgery* 49 (2016) i64–i72

<table>
<thead>
<tr>
<th></th>
<th>Uniportal VATS</th>
<th>Conventional VATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation times (mins)</td>
<td>170 179</td>
<td>191 208</td>
</tr>
<tr>
<td>Blood loss (ml)</td>
<td>53 56</td>
<td>95 78</td>
</tr>
<tr>
<td>Nodes dissected</td>
<td>27 28</td>
<td>22 25</td>
</tr>
</tbody>
</table>
Preliminary results of single-port versus triple-port complete thoracoscopic lobectomy for non-small cell lung cancer


<table>
<thead>
<tr>
<th>Parameters</th>
<th>Single-port group (n=33)</th>
<th>Triple-port group (n=49)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation time (min)*</td>
<td>181.3±27.5</td>
<td>149.5±30.9</td>
<td>0.007</td>
</tr>
<tr>
<td>Intraoperative blood loss (mL)</td>
<td>90.6±49.3</td>
<td>79.5±45.2</td>
<td>0.840</td>
</tr>
<tr>
<td>Total lymph node harvest</td>
<td>23.6±11.2</td>
<td>25.4±7.3</td>
<td>0.737</td>
</tr>
<tr>
<td>Positive lymph node</td>
<td>1.5±3.1</td>
<td>1.9±4.9</td>
<td>0.971</td>
</tr>
<tr>
<td>Total mediastinal lymph node harvest</td>
<td>16.2±9.2</td>
<td>17.2±6.5</td>
<td>0.731</td>
</tr>
<tr>
<td>Dissection of mediastinal lymph node groups</td>
<td>4.4±1.0</td>
<td>4.4±0.8</td>
<td>0.637</td>
</tr>
</tbody>
</table>
# Pain

**Preliminary results of single-port versus triple-port complete thoracoscopic lobectomy for non-small cell lung cancer**


<table>
<thead>
<tr>
<th>Parameters</th>
<th>Single-port group (n=33)</th>
<th>Triple-port group (n=49)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation time (min)*</td>
<td>181.3±27.5</td>
<td>149.5±30.9</td>
<td>0.007</td>
</tr>
<tr>
<td>Intraoperative blood loss (mL)</td>
<td>90.6±49.3</td>
<td>79.5±45.2</td>
<td>0.840</td>
</tr>
<tr>
<td>Chest drainage duration (d)</td>
<td>4.0±1.5</td>
<td>5.4±3.7</td>
<td>0.256</td>
</tr>
<tr>
<td>POP-VAS</td>
<td>3.6±0.7</td>
<td>5.5±1.0</td>
<td>0.000</td>
</tr>
<tr>
<td>Postoperative hospital stay (d)</td>
<td>6.9±4.0</td>
<td>7.2±3.5</td>
<td>0.631</td>
</tr>
</tbody>
</table>
Single-incision thoracoscopic surgery and conventional video-assisted thoracoscopic surgery: a retrospective comparative study of perioperative clinical outcomes

Kyoji Hirai*, Shingo Takeuchi and Jitsuo Usuda

European Journal of Cardio-Thoracic Surgery 49 (2016) i37–i41
Recovery

Transition from a multiport technique to a single-port technique for lung cancer surgery: is lymph node dissection inferior using the single-port technique?*  
Chia-Chuan Liu, Chih-Shiun Shih, Nicolas Pennarun and Chih-Tao Cheng

Table 2: Surgical outcomes by type of surgery (lobectomy and segmentectomy) and number of ports (single/multiple) (n = 538)

<table>
<thead>
<tr>
<th>Outcome variables</th>
<th>Lobectomy Single port</th>
<th>Lobectomy Multiport</th>
<th>P-value</th>
<th>Segmentectomy Single port</th>
<th>Segmentectomy Multiport</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total dissected lymph node number</td>
<td>28.47 ± 11.77</td>
<td>25.23 ± 11.30</td>
<td>0.013</td>
<td>19.47 ± 10.79</td>
<td>17.91 ± 10.28</td>
<td>0.472</td>
</tr>
<tr>
<td>Blood loss</td>
<td>55.68 ± 52.81</td>
<td>78.28 ± 84.99</td>
<td>0.001</td>
<td>63.88 ± 79.60</td>
<td>59.36 ± 50.23</td>
<td>0.739</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>5.96 ± 1.69</td>
<td>6.80 ± 3.56</td>
<td>0.001</td>
<td>5.76 ± 1.98</td>
<td>6.83 ± 2.21</td>
<td>0.014</td>
</tr>
<tr>
<td>Length of wound</td>
<td>3.92 ± 1.81</td>
<td>4.70 ± 0.77</td>
<td>&lt;0.001</td>
<td>3.66 ± 0.77</td>
<td>4.50 ± 0.56</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Operative time</td>
<td>2.99 ± 0.87</td>
<td>3.47 ± 1.06</td>
<td>&lt;0.001</td>
<td>3.34 ± 0.93</td>
<td>3.45 ± 0.92</td>
<td>0.542</td>
</tr>
<tr>
<td>Residual tumour condition (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R0</td>
<td>98 (22.8)</td>
<td>331 (77.2)</td>
<td>1.000</td>
<td>48 (52.7)</td>
<td>43 (47.3)</td>
<td>0.232</td>
</tr>
<tr>
<td>Microscopic residual tumour</td>
<td>2 (16.7)</td>
<td>10 (83.3)</td>
<td></td>
<td>1 (25.0)</td>
<td>3 (75.0)</td>
<td></td>
</tr>
<tr>
<td>Macroscopic residual tumour</td>
<td></td>
<td></td>
<td></td>
<td>0 (0.0)</td>
<td>1 (100.0)</td>
<td></td>
</tr>
<tr>
<td>Complications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>92 (92.0)</td>
<td>295 (86.3)</td>
<td>0.167</td>
<td>46 (93.9)</td>
<td>39 (83.0)</td>
<td>0.117</td>
</tr>
<tr>
<td>Yes</td>
<td>8 (8.0)</td>
<td>47 (13.7)</td>
<td></td>
<td>3 (6.1)</td>
<td>8 (17.0)</td>
<td></td>
</tr>
</tbody>
</table>

SD: standard deviation. P values less than 0.05 were marked in bold.
Recovery

A Matched Comparison Study of Uniportal Versus Triportal Thoracoscopic Lobectomy and Sublobectomy for Early-stage Nonsmall Cell Lung Cancer

Ju-Wei Mu, Shu-Geng Gao, Qi Xue, Jun Zhao, Ning Li, Kun Yang, Kai Su, Zhu-Yang Yuan, Jie He
Department of Thoracic Surgery, Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100021, China


<table>
<thead>
<tr>
<th>Perioperative data</th>
<th>All patients</th>
<th>Propensity-matched patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uniportal (n = 58)</td>
<td>Triportal (n = 347)</td>
</tr>
<tr>
<td>Operative time (min)</td>
<td>138.83 ± 63.63</td>
<td>135.62 ± 55.51</td>
</tr>
<tr>
<td>Blood loss (ml)</td>
<td>73.58 ± 51.52</td>
<td>74.08 ± 64.53</td>
</tr>
<tr>
<td>Lymph nodes retrieved</td>
<td>7.02 ± 8.60</td>
<td>13.34 ± 9.26</td>
</tr>
<tr>
<td>Number of lymph nodes stations</td>
<td>4 ± 1</td>
<td>6 ± 1</td>
</tr>
<tr>
<td>Conversion to thoracotomy, n (%)</td>
<td>2 (3.4)</td>
<td>8 (2.3)</td>
</tr>
<tr>
<td>Postoperative hospital stay (day)</td>
<td>6.54 ± 3.84</td>
<td>6.29 ± 2.59</td>
</tr>
<tr>
<td>Duration of chest tube (day)</td>
<td>5.02 ± 1.92</td>
<td>5.25 ± 2.16</td>
</tr>
<tr>
<td>Overall complication, n (%)</td>
<td>6 (10.3)</td>
<td>33 (9.5)</td>
</tr>
<tr>
<td>Pulmonary complications, n (%)</td>
<td>3 (5.1)</td>
<td>14 (4.0)</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>0 (0)</td>
<td>4 (1.2)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2 (3.4)</td>
<td>5 (1.4)</td>
</tr>
<tr>
<td>Air leak &gt;7 days</td>
<td>1 (1.7)</td>
<td>5 (1.4)</td>
</tr>
<tr>
<td>Nonpulmonary complications, n (%)</td>
<td>3 (5.1)</td>
<td>19 (5.5)</td>
</tr>
<tr>
<td>Reoperation</td>
<td>0 (0)</td>
<td>4 (1.2)</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>3 (5.1)</td>
<td>15 (4.3)</td>
</tr>
</tbody>
</table>
Uniportal Video-Assisted Thoracoscopic Lobectomy Versus Other Video-Assisted Thoracoscopic Lobectomy Techniques: A Randomized Study


Get Full Text: Journal site

OBJECTIVES: A prospective, randomized study was carried out on patients undergoing lung cancer surgery, with the aim of determining if uniportal video-assisted lobectomy has more favourable postoperative outcomes than other video-assisted thoracoscopic lobectomy techniques (Duke approach and Copenhagen approach).

METHODS: Patients were randomly assigned to two groups; uniportal video-assisted lobectomy (Group A; n = 51) and other video-assisted thoracoscopic lobectomy techniques (Group B; n = 55). The primary outcome measures were: postoperative pain (analog visual scale) and supplementary doses of analgesics (morphine, milligrams); the secondary outcome measures were: the delay in removing the paravertebral catheter and the chest drain, the duration of the postoperative hospital stay, postoperative complications and the operative or 30-day mortality. We assessed postoperative pain during the first 3 days to identify possible differences coinciding with paravertebral catheter removal and with the start of mobilization, and we evaluated the type of resection, R0/R1 (a very important factor in assessing postoperative pain). All continuous data were evaluated for normality, and analysed with the Mann-Whitney U-tests or t-tests. Categorical data were analysed by Fisher's exact test.

RESULTS: One hundred and six lobectomies were completed. Both groups were comparable with respect to different clinical parameters (age, clinical stage and comorbidity), preoperative and pathological variables. The median visual analogue pain score in the first 3 days did not show statistically significant differences (respectively, P = 0.58, P = 0.64, P = 0.85). Likewise, the median morphine use in the first 3 days did not show statistically significant differences (respectively, P = 0.72, P = 0.81, P = 0.64). There was no difference in timing to remove the paravertebral catheter (P = 0.82) and the chest drain (P = 0.05) and the duration of the postoperative hospital stay (P = 0.62). There was no difference in postoperative complications (one reoperation for bleeding in Group B, P = 0.24). There was no operative or 30-day mortality in either group.

CONCLUSIONS: Uniportal video-assisted thoracoscopic lobectomy does not present better postoperative outcomes than other video-assisted thoracoscopic lobectomy techniques.
**Uniportal Versus Triportal Thoracoscopic Lobectomy and Sublobectomy for Early Stage Lung Cancer**

This study is currently recruiting participants. (see Contacts and Locations)

Verified October 2016 by Cancer Institute and Hospital, Chinese Academy of Medical Sciences

**Sponsor:**
Cancer Institute and Hospital, Chinese Academy of Medical Sciences

**Collaborators:**
- Sun Yat-sen University
- Fudan University
- Chinese PLA General Hospital
- Beijing Chest Hospital

**Information provided by (Responsible Party):**
Ju-Wei Mu, Cancer Institute and Hospital, Chinese Academy of Medical Sciences

**ClinicalTrials.gov Identifier:**
NCT02933294

First received: September 23, 2016
Last updated: October 12, 2016
Last verified: October 2016

**Estimated Enrollment:**
356

**Study Start Date:**
May 2015

**Estimated Study Completion Date:**
December 2020

**Estimated Primary Completion Date:**
April 2018 (Final data collection date for primary outcome measure)

---

<table>
<thead>
<tr>
<th>Arms</th>
<th>Assigned Interventions</th>
</tr>
</thead>
</table>
| Active Comparator: Triportal pulmonary resection surgery  
Treated by traditional video assisted thoracoscopic three-port pulmonary resection in the centers with enough experience in VATS and the volume ≥50 cases each year. | Procedure: Triportal pulmonary resection surgery  
Uniportal video-assisted thoracoscopic surgery |

| Active Comparator: Uniportal pulmonary resection surgery  
Treated by minimally invasive video assisted thoracoscopic single-port pulmonary resection in the centers with enough experience in VATS and the volume ≥50 cases each year. | Procedure: Uniportal pulmonary resection surgery  
Triportal video-assisted thoracoscopic surgery |
RECENT ADVANCES IN UNIPORTAL VATS

• Complex hilum (lymph nodes or fibrosis)
• Use of energy devices for vessel dissection and division, new instruments
• Complex segmentectomies and lobectomies
• Sleeve broncho-vascular procedures, carinal
• Bleeding control
• Non intubated lobectomy
• Unisurgeon assisted with robotic arm
Bronchial sleeve

Vascular reconstruction

Direct suture

Patch

Sleeve anastomosis
Uniportal vascular sleeve

RUL and carinal resection
High frequency ventilation jet

Even less invasive..
Non intubated surgery
Non intubated Uniportal VATS lobectomy

Single port is the best approach to stimulate industry to develop new technology.
Open gate to the future
Uniportal Unisurgeon VATS lobectomy
Uniportal UNISURGEON VATS lobectomy

Uniportal VATS left hand double finger technique
Wireless Steerable Endoscope
Magnetic grasper
UNIPORTAL VATS IN 2017
Uniportal VATS in the future

• Improved staplers (electric, more angulated, 5mm)
• Energy devices for vessels and fissure
• Wireless cameras and graspers, remote control
• Robotic instruments (parallel instrumentation)
• 3D technology (naked eye)
• Non intubated surgery
• Portable drainage systems
• Subxiphoid approach, NOTES?
LESS IS MORE
Shanghai Pulmonary Hospital
Lung resections 2004-2016
UNIPORTAL VATS TRAINING PROGRAM
SHANGHAI PULMONARY HOSPITAL

Director: Diego Gonzalez Rivas
Coordinator: Timothy Young
More info: vatsprogram@outlook.com
Keep calm and think uniportal even in the end of the world...

Antarctica, South Pole