

# Interactive CardioVascular and Thoracic Surgery

## **A method of assessing reasons for conversion during video-assisted thoracoscopic lobectomy**

Sayf Gazala, Ian Hunt, Azim Valji, Kenneth Stewart and EricL.R. Bédard  
*Interact CardioVasc Thorac Surg* 2011;12:962-964; originally published online Mar 9, 2011;  
DOI: 10.1510/icvts.2010.259663

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://icvts.ctsnetjournals.org/cgi/content/full/12/6/962>

*Interactive Cardiovascular and Thoracic Surgery* is the official journal of the European Association for Cardio-thoracic Surgery (EACTS) and the European Society for Cardiovascular Surgery (ESCVS). Copyright © 2011 by European Association for Cardio-thoracic Surgery. Print ISSN: 1569-9293.

## Institutional report - Thoracic oncologic

# A method of assessing reasons for conversion during video-assisted thoracoscopic lobectomy

Sayf Gazala\*, Ian Hunt, Azim Valji, Kenneth Stewart, Eric L.R. Bédard<sup>1</sup>

*Division of Thoracic Surgery, University of Alberta, Edmonton, AB, Canada*

Received 24 November 2010; received in revised form 10 February 2011; accepted 14 February 2011

### Abstract

Conversion rates during video-assisted thoracoscopic lobectomy are reported, but no previous publications have classified the cause of conversion. The aim of the study was to develop a quality assessment tool [vascular, anatomy, lymph node, technical (VALT) 'Open'] to evaluate reasons and nature of conversion during the development of a video-assisted thoracoscopic lobectomy program. Between 2006 and 2008, 237 patients with a median age of 65 years underwent video-assisted thoracoscopic lobectomy primarily for lung. The number of video-assisted thoracoscopic lobectomy cases over open cases has increased over the period. Conversion rate has dropped from 15% (2006) to 11% (2008). A total of 32 cases required conversion. The VALT 'Open' classification for reason to convert and nature of conversion was used. The average length of stay was shorter for non-converted cases. No uncontrolled conversions where the patient was unstable were required, and in the 14 cases converted following some difficulty, such as pulmonary artery injury. A pattern to the learning curve became predictable. The quality assessment tool used (VALT 'Open') will allow cause of conversion and nature of conversion to be tracked and audited during the development of a video-assisted thoracoscopic surgery lobectomy program.

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

**Keywords:** Video-assisted thoracoscopic surgery; Lobectomy; Conversion

### 1. Introduction

Anatomical lung resection or lobectomy for lung cancer by video-assisted thoracoscopic surgery (VATS) was first described nearly 20 years ago [1–4] and has become an increasingly popular minimally invasive operation [5]. It offers equivalence in terms of survival and recurrence rates, and advantages in terms of recovery time over a thoracotomy. Its adoption worldwide has been variable often due to perceived technical challenges when compared to an open approach [6]. In particular if concerns remain regarding patient safety, notably the need for intraoperative conversion to open thoracotomy leading to potential adverse consequences [6].

Published intraoperative conversion rates to open thoracotomy range from 2% to 20% [5, 7–9], but reasons for conversions during VATS procedures have not been widely described. If mentioned, typically as part of discussion in case series [5] the reasons given include vascular injury usually to branches of the pulmonary artery (PA), occasionally injury to the pulmonary vein (PV), dense adhesions and failure to progress/poor visualization. The aim was to retrospectively review the reasons for conversion in a recently established VATS lobectomy program, and changes during the evolution of that program.

Quality improvement methods are essentially ways to bring a quality product to market, with efficacy, efficiency, and safety. Quality is improved by a cycle that defines the objective, establishes measures of quality, applies these standards to the production and delivery of the product, evaluates the outcomes, and, finally, improves quality by continuous learning from the process [10]. From our analysis a quality assessment tool [vascular, anatomy, lymph node, technical (VALT) 'Open' classification] for conversion reason was developed which we believe will aid subsequent audit of a VATS lobectomy program (Table 1).

### 2. Materials and methods

#### 2.1. Patient population

From January 2006 to October 2008, clinical data of 493 consecutive patients who underwent anatomical lung resection for cancers (predominantly primary lung cancer) were collected retrospectively. Patient selection for VATS or thoracotomy was by the surgeon preference with no changes noted over time. Patients who underwent a thoracotomy (256) were excluded from the study. The remaining patients (male:female ratio 114:123; median age 65 years, range 22–88 years) were considered for further analysis. Patient demographics were similar between the three years with an age mean (S.D.) of 63 (11), 66.4 (10.4) and 66.5 (8.3) years for 2006, 2007 and 2008, respectively.

<sup>1</sup>Financial disclosures: Consultant for Ethicon, Johnson & Johnson, Canada.

\*Corresponding author. 2090 Haddow Drive, Edmonton, AB T6R 3B8, Canada.  
Tel.: +1-780-6287485; fax: +1-780-7354245.

E-mail address: gazala@ualberta.ca (S. Gazala).

Table 1. VALT 'Open' classification system

VALT
Vascular
Pulmonary artery (PA) injury
Pulmonary vein (PV) injury
Other vascular injury (e.g. intercostal vessel)
Anatomy
Adhesions/visualization
Tumor (size and location)
Lymph nodes
Bulky, sticky, calcified
Technical
Stapler misfire
Equipment failure
'Open'
Elected to open with anticipation of difficulties
Controlled and opened following difficulty
Uncontrolled open with cardio-respiratory instability

In terms of male sex percentages, it was 55%, 49% and 52% for the three years, respectively.

Lobectomy was performed for right upper lobe (RUL) cancers in 36%, right middle lobe (RML) in 8%, right lower lobe (RLL) in 15%, left upper lobe (LUL) in 27%, left lower lobe (LLL) in 9%, with 5% bilobectomies and pneumonectomies.

The average maximum diameter of the resected tumor was 2.8 cm (range 0.6–10 cm). Fourteen patients had previous chest surgery involving breach of the pleura on the same side of the VATS, excluding chest tube insertions.

In terms of pathological staging which is based on the final pathology report, for patients with primary lung cancer 164 were stage I (69%), 29 were stage II (12%), 21 patients were stage III (9%), 12 patients had metastectomies (5%), and the rest were for benign conditions (5%). Overall patient demographics and stage of cancer appear similar to other previously reported series [5].

## 2.2. Surgical procedures

Our VATS approach is an anterior approach that involves anatomical hilar dissection with individual ligation of lobar vessels and bronchus as well as hilar lymph node dissection or sampling without ribs spreading and it is monitor based

so that the surgeon is not looking through the 5 cm utility incision.

Since the initiation of the VATS lobectomy program in 2006 the ratio of VATS to open thoracotomy has increased from 59/198 (30%) in 2006, to 99/176 (56%) in 2007 and 78/118 (67%) during the first nine months of 2008. Conversion rate has dropped from 15% in 2006 to 11% in the later part of 2008. In the first two years, approximately half the cases were performed with two attending thoracic surgeons present.

A total of 32 cases were converted to open thoracotomy, 80% of the converted cases were through an extension of trans-axillary utility incision while the other 20% were through a posterolateral thoracotomy as a separate incision.

## 2.3. Outcome measures

We developed a VALT 'Open' classification system to allow qualification and assessment of reasons for conversion and the nature of surgical control at the time of conversion to an open case. The VALT 'Open' classification system has been used as a quality assurance tool in monitoring the development of the VATS lobectomy program over the past three years (Table 2).

## 3. Results

Two hundred and thirty-seven consecutive VATS lung resections were performed from January 2006 to October 2008 by three thoracic surgeons; a total of 131 cases required two thoracic surgeons performing the procedure. Thirty-two cases (13.5%) were converted to an open thoracotomy. There was no age difference between the two groups with an average age of 65.4 years; more males were converted (60%). Tumor size was 2.88 cm and 3.21 cm for the successful and for the converted cases, respectively. There was no significant difference between stage I (a/b) lung cancers needing conversion with 69.5% of the successful VATS lung resections and 67.5% of the converted being stage I (a/b).

Despite the increased ratio of elective VATS lobectomy to thoracotomy lobectomy procedures, the total number of

Table 2. Cause of conversion and nature of control when converting to open procedure

	2006	2007	2008 (10 m)
Vascular			
Pulmonary artery (PA) injury	3 (5%)	6 (6%)	3 (4%)
Pulmonary vein (PV) injury	0	0	0
Other vascular injury (e.g. intercostal vessel)	0	0	1 (1.4%)
Anatomy			
Patient (adhesions) – minor, moderate, major	1 (1.66%)	6 (6%)	3 (4%)
Tumor (size and location)	3 (5%)	1 (1%)	0
Lymph nodes			
Bulky, sticky and/or calcified	1 (1.66%)	2 (2%)	0
Technical			
Staple misfire	1 (1.66%)	0	1 (1.4%)
Equipment failure			
Total	9 (15%)	15 (15%)	8 (11%)
'Open'			
Elected to open with anticipation of difficulties	5 (8.3%)	10 (10%)	3 (4%)
Controlled and opened following difficulty	4 (6.7%)	5 (5%)	5 (7%)
Uncontrolled open with cardio-respiratory instability	0	0	0

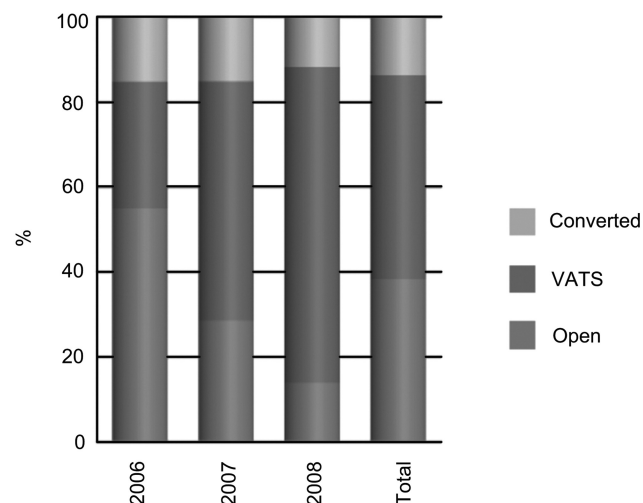


Fig. 1. Development of a VATS lobectomy program and conversion rates. VATS, video-assisted thoracoscopic surgery.

conversions has decreased (Fig. 1). With experience the nature of the indication for conversions has changed during the three years with fewer conversions for vascular injury and anatomy (Table 2).

Of the 14 patients who had previous thoracic surgery, six were converted to open thoracotomy (42%), the presence of adhesions was the most common reason for conversion in this situation (50%).

By late 2008 we have attempted VATS lobectomy or pneumonectomy in 237 patients. Seventeen cases (53%) were converted for reasons of anatomy (A) or lymph nodes (L) and 13 cases (41%) were converted for vascular (V) (usually PA) injury. Technical failure (T) was unusual as a cause of conversion. The average length of stay was shorter for non-converted cases (5.77 days vs. 6.25 days) but overall morbidity was not significantly different.

No intraoperative deaths occurred, with only VATS lobectomy death within 30 days from respiratory failure. No uncontrolled conversions where the patient was cardiovascularly unstable were required, and in the 14 cases converted following some difficulty, such as PA injury, only two patients required intraoperative blood transfusion with a blood loss of approximately 1–1.5 l in both cases.

#### 4. Discussion

This is the first publication examining specifically the cause of conversion and how the nature of the conversion was dealt with in patients undergoing VATS lobectomy. The reasons for conversion during VATS lobectomy are well known though poorly described in previous publications. The quality assessment tool used (VALT 'Open') has allowed a simple method of tracking and auditing the unit's developing VATS lobectomy program. The number of patients undergoing VATS lobectomy as opposed to an open proce-

dures has significantly increased over three years (Fig. 1) but conversion rates have fallen. The anticipated learning curve for an advanced minimally invasive procedure can be clearly tracked. Cause of conversion initially was for a variety of reasons but with experience and as confidence levels increased reason for conversion for anatomical reasons also increased possibly reflecting bolder patient selection or discomfort with a perceived anatomical problem, such as chest wall adhesions. In addition, there are 'oncological' reasons a decision to convert may be taken with tumor size (which was larger in the converted group) and tumor location being obvious markers. But as the program developed, despite increasing numbers of VATS resections, conversion for anatomical reasons fell as did conversion for vascular injury.

The nature of the conversion and whether conversion is controlled is important both for the obvious safety aspects of the patient but also how smoothly the minimally invasive approach is perceived amongst colleagues as well as the confidence of the surgeons performing the VATS lobectomy. We believe performing the majority of the VATS procedures with two attending thoracic surgeons, particularly in the first two years, has had a significant impact in the successful implementation of the VATS lobectomy program as reflected by the nature of control during conversion.

In conclusion, for units wishing to develop a VATS lobectomy program and in units with established programs, detailed examination of cause and nature of conversion beyond a simple rate is necessary if deviations from expected 'learning curves' are to be detected and standards maintained. The VALT 'Open' classification will allow a simple stratification of conversions and is a quality assurance tool for auditing conversions.

#### References

- [1] Roviato G, Rebuffat C, Varoli FC, Mariani C, Maciocco M. Videoendoscopic pulmonary lobectomy for cancer. *Surg Laparosc Endosc Percutan* 1992;4:244–247.
- [2] Landreneau RJ, Hazelrigg SR, Ferson PF. Thoroscopic resection of 85 pulmonary lesions. *Ann Thorac Surg* 1992;5:415–419.
- [3] Stantley DG. Thoroscopic lobectomy. *Tenn Med* 1992;2:463–464.
- [4] Lewis RJ, Sisler GE, Caccavale RJ. Imaged thoracic lobectomy: should it be done? *Ann Thorac Surg* 1992;4:80–83.
- [5] McKenna RJ, Houck W, Fuller CB. Video-assisted thoracic surgery lobectomy: experience with 1100 cases. *Ann Thorac Surg* 2006;6:421–426.
- [6] McKenna RJ Jr, Houck WV. New approaches to the minimally invasive treatment of lung cancer. *Curr Opin Pulm Med* 2005;11:282–286.
- [7] Walker WS, Codispoti M, Soon S-Y, Stamenkovic S, Carnochan F, Pugh G. Long-term outcomes following VATS lobectomy for non-small cell bronchogenic carcinoma. *Eur J Cardiothorac Surg* 200;6:397–402.
- [8] Gharagozloo F, Tempesta B, Margolis M, Alexander EP. Video-assisted thoracic surgery lobectomy for stage I lung cancer. *Ann Thorac Surg* 2003;7:1009–1015.
- [9] Nomori H, Horio H, Naruke T, Suemasu K. What is the advantage of a thoroscopic lobectomy over a limited thoracotomy procedure for lung cancer surgery? *Ann Thorac Surg* 2001;6:879–884.
- [10] Rendon SE, Pories WJ. Quality assurance in bariatric surgery. *Surg Clin North Am* 2005;15:757–771.

**A method of assessing reasons for conversion during video-assisted thoracoscopic lobectomy**

Sayf Gazala, Ian Hunt, Azim Valji, Kenneth Stewart and EricL.R. Bédard  
*Interact CardioVasc Thorac Surg* 2011;12:962-964; originally published online Mar 9, 2011;  
DOI: 10.1510/icvts.2010.259663

**This information is current as of December 2, 2011**

<b>Updated Information &amp; Services</b>	including high-resolution figures, can be found at: <a href="http://icvts.ctsnetjournals.org/cgi/content/full/12/6/962">http://icvts.ctsnetjournals.org/cgi/content/full/12/6/962</a>
<b>Subspecialty Collections</b>	This article, along with others on similar topics, appears in the following collection(s): <b>Lung - cancer</b> <a href="http://icvts.ctsnetjournals.org/cgi/collection/lung_cancer">http://icvts.ctsnetjournals.org/cgi/collection/lung_cancer</a> <b>Lung - other</b> <a href="http://icvts.ctsnetjournals.org/cgi/collection/lung_other">http://icvts.ctsnetjournals.org/cgi/collection/lung_other</a>
<b>Permissions &amp; Licensing</b>	Requests to reproducing this article in parts (figures, tables) or in its entirety should be submitted to: <a href="mailto:icvts@ejcts.ch">icvts@ejcts.ch</a>
<b>Reprints</b>	For information about ordering reprints, please email: <a href="mailto:icvts@ejcts.ch">icvts@ejcts.ch</a>

# Interactive CardioVascular and Thoracic Surgery