Crossing the bridge to VATS lobectomy

P Tcherveniakov, C Bogdan, N Chaudhuri

Leeds Teaching Hospitals NHS Trust, UK

ABSTRACT

INTRODUCTION The impact of the introduction of video assisted thoroscopic surgery (VATS) on the management of lung cancer 20 years ago has been well documented. However, the uptake of VATS lobectomy in surgical practice worldwide has been slower than expected. We believe that this is partly due to a lack of consensus on how this procedure should be integrated into training programmes. We present our initial experience with a newly developed training model, which could help bridge the divide between open and VATS lobectomy.

METHODS Two surgical registrars were initiated into this model, supervised by a single consultant. All cases were performed using a standardised three-port anterior approach with systematic lymph node dissection. Both registrars were scrubbed for each case, alternating as first surgeon and assistant, with the supervising consultant operating the camera.

RESULTS Over a 6-month period, 22 lung resections for non-small cell lung carcinoma were performed as VATS lobectomies. Thirteen of them were upper lobectomies. There were no emergency conversions to open surgery. The mean operative time for the registrars was 155 minutes compared with 140 minutes for consultant-led operations ($p=0.22$). There was no perioperative mortality. The most common postoperative complications were atrial fibrillation (4 cases) and prolonged air leak (3 cases).

CONCLUSIONS VATS lobectomy involves a team approach. Especially in upper lobectomies, the assistant surgeon plays a significant role in the operation, often helping with the dissection as well as stapling of the bronchial and vascular structures. With a team consisting of two trainees and a supervising surgeon, the teaching process becomes more intuitive and is accelerated. This should reduce the learning curve considerably and improve safety during training.

KEYWORDS

Video assisted thoroscopic surgery – Lobectomy – Lung cancer – Training

Accepted 11 June 2017

CORRESPONDENCE TO

Peter Tcherveniakov, E: pcherv@hotmail.com

The benefits of performing an anatomical lobectomy for non-small cell lung carcinoma (NSCLC) by video assisted thoroscopic surgery (VATS) have been well described^{1,2} and the approach is being advocated as the ‘gold standard’ for surgical treatment of early disease.^{3–5} Several studies have demonstrated that VATS lobectomy can offer shorter hospital stays and improved postoperative pain while not compromising oncological outcomes.^{5–7} However, the uptake of this procedure in the general thoracic surgery population has been slower than expected. In 2013 less than 25% of all lobectomies performed in Europe were by VATS.⁸

We believe that this is partly due to a lack of consensus on how this procedure should be integrated into training programmes. The perception that VATS lobectomy is technically very challenging and the concerns about major intraoperative complications (which can be difficult to control)⁹ have somewhat hindered training. This effect is compounded by the current environment of increased scrutiny on complication rates, waiting times and cost efficiency. Over the last ten years, our unit has slowly transitioned from the conventional approach to VATS as the method of choice in anatomical lung resections for early stage NSCLC. Once all senior surgeons had accomplished the transition, the focus was turned

on to the trainees. We present our initial experience with a newly developed training model, which could help bridge the divide between open and VATS lobectomy.

Methods

Two thoracic trainees in the final stages of their training were initiated into this model, supervised by a single consultant. Both trainees had extensive experience with minor VATS procedures (bullectomy, lung biopsy, pleural biopsy) and had performed more than 20 conventional lobectomies. The selected initial training period was six months, during which time the requests for annual/professional leave were coordinated between team members to minimise disruptions and ensure continuity.

The approach for all cases (pre, intra and postoperative) was standardised. Each patient was discussed on the morning of the scheduled surgery by all three team members in a dedicated time slot with focus on intraoperative planning. Particular attention was paid to the computed tomography and relevant anatomy. Key discussion points were the natural course and presence of abnormalities of the venous drainage and pulmonary artery branches.

All operations were performed using a standardised three-port anterior approach with systematic lymph node dissection or sampling (in patients aged >80 years). An anterior camera port (~1cm) was placed between the medial and middle third of an imaginary line between the xiphoid process and the tip of the scapula. An anterior utility incision (~4cm) was made directly over the hilar vessels under direct vision. A wound protector was used without rib spreading. Finally, a posterior incision (~1cm) was made at the level of the camera port or slightly inferior to it.

Both trainees were scrubbed for each case, alternating as first surgeon and assistant, with the supervising consultant operating the camera (Fig 1). A 30° scope was used in all cases. The major structures (pulmonary vein, pulmonary artery branches and lobar bronchus) were mobilised and divided first, and the fissure was then completed with staplers. Standing anteriorly to the patient, the trainee acting as lead surgeon performed the dissection while the staplers were usually passed through the posterior port and controlled by the assisting trainee. The videos of all operations were used for subsequent review and analysis.

Details for all the cases (including co-morbidities, lung function, operative time and postoperative course) were recorded in a prospective database. The information was analysed after the completion of the first six months of the project.

Results

Of 24 consecutive lung resections undertaken for non-small cell lung carcinoma over a 6-month period, 22 (11 per trainee) were attempted as VATS lobectomies. Thirteen

were upper lobectomies. One case required a bilobectomy for a typical carcinoid tumour and another required a pneumonectomy. In these two instances, a VATS resection was not attempted.

There were 13 female and 9 male patients (mean age 69.4 years). There were no emergency conversions to thoracotomy because of vascular or bronchial injury. There was one case of unplanned intraoperative conversion, necessitated by suspected tumour involvement of the chest wall. Given the significant adhesions overlying the area of the tumour, it was felt that more meticulous palpation of the involved area was required before determining the extent of the resection.

The mean operative time for the registrars was 155 minutes. There was no statistically significant increase (Student's t-test, $p=0.22$) compared with the VATS lobectomies performed by the consultant surgeons in the department (140 minutes). There were no cases of perioperative mortality. The most common postoperative complications were atrial fibrillation (4 cases), which was managed with amiodarone, and prolonged air leak (3 cases). The mean postoperative length of stay was 8 days. One patient developed intestinal obstruction, which prolonged his hospital stay significantly. One case required a 're-do' VATS washout for early empyema. The patient had recently undergone a renal transplant and was on significant immunosuppression. The final histology results showed an adenocarcinoma in 12 cases, squamous cell cancer in 7 cases, and single cases of large cell cancer, a typical carcinoid and an adenosquamous carcinoma.

Over the 6 months, a total of 133 VATS anatomical lung resections were performed in the department. This work was spread between five thoracic consultants with a complement of eight registrars. Forty-nine (36.8%) of the procedures were performed by the registrars.

Discussion

There are multiple advantages of using a VATS approach compared with conventional lobectomy for NSCLC. Cost effectiveness, a shorter hospital stay, improved postoperative pain and facilitation of early administration of adjuvant therapy have been shown to be some of the potential benefits.^{1,2,10}

While most thoracic surgeons agree that VATS lobectomy should be the 'gold standard' for management of early stage NSCLC, no similar consensus exists on how this procedure should be implemented into training programmes. Courses, educational videos and practice models are becoming more readily available. However, the learning curve is still perceived as steep and is associated with potentially catastrophic complications. Although training simulators may play a significant role in improving the learning curve, associated costs still prevent their universal implementation.¹¹

Meyerson *et al* highlighted the importance of having appropriately trained assistants when performing VATS lobectomy.¹² In our model, the assistants have a very active role, which goes beyond providing a good exposure and field of view. They are familiar with the steps of the operation and can anticipate the requirements of the operating surgeon.

Figure 1 Intraoperative setup with the two trainees alternating between operating surgeon and assisting doctor

This could be particularly relevant in a case with an intraoperative complication such as bleeding secondary to vascular injury. We feel that this responsibility allows them to acquire valuable technical skills.

Especially in upper lobectomies, the assistant surgeon plays a significant part in the operation by often helping with the dissection as well as stapling the bronchial and vascular structures. In this way, the learning experience is enhanced and the progress of the two trainees is practically simultaneous. Communication between participants soon becomes streamlined, creating a relaxed environment. Familiarity with the instruments and the key steps of the operation is achieved more quickly. Analysis of video recordings can also play a significant role, particularly in the avoidance of potentially serious intraoperative complications. We focused on those operations deemed technically challenging or when progress was hindered by different issues (eg large lymph nodes or suboptimal port placement).

Training for VATS lobectomy and performing the procedure both require a team approach.^{11–15} Having a dedicated team, standardising the approach and starting with cases involving small, peripheral tumours have been recommended by high volume VATS lobectomy units.¹¹ Establishing a consistent training routine that involves preoperative planning and postoperative debrief is critical. With a team consisting of two trainees and a supervising surgeon, the teaching process becomes more intuitive and is accelerated. It creates a comfortable working environment, which is necessary for developing any new skill. Experience is accumulated more rapidly over a shorter time period. This should reduce the learning curve considerably and improve safety during training.

The reported results show that this model can achieve very good outcomes, without compromising theatre times and therefore departmental productivity. With growing scrutiny on waiting times and patient safety, this could be a key benefit of this model. Potential difficulties with its implementation lie in the ability of having two trainees allocated in the same operating theatre for a long period of time (6 months) and providing optimal patient selection. This could prove challenging and might require significant organisational effort from all involved. However, we feel that these issues are surmountable.

Conclusions

While these are only the initial results of our experience with this model, we firmly believe that it could serve other units that are looking to 'bridge the gap' to performing VATS lobectomy as a standard of care for stage I NSCLC.

Acknowledgement

The material in this paper was presented at the 29th Annual Meeting of the European Association for Cardio-Thoracic Surgery held in Amsterdam, October 2015.

References

1. Nwogu CE, D'Cunha J, Pang H *et al*. VATS lobectomy has better perioperative outcomes than open lobectomy: CALGB 31001, an ancillary analysis of CALGB 140202 (Alliance). *Ann Thorac Surg* 2015; **99**: 399–405.
2. Villamizar NR, Darrabie MD, Burfeind WR *et al*. Thoracoscopic lobectomy is associated with lower morbidity compared with thoracotomy. *J Thorac Cardiovasc Surg* 2009; **138**: 419–425.
3. Detterbeck FC, Lewis SZ, Diekemper R *et al*. Executive summary: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013; **143**(5 Suppl): 7S–37S.
4. Hartwig MG, D'Amico TA. Thoracoscopic lobectomy: the gold standard for early-stage lung cancer? *Ann Thorac Surg* 2010; **89**: S2098–S2101.
5. Whitson BA, Groth SS, Duval SJ *et al*. Surgery for early-stage non-small cell lung cancer: a systematic review of the video-assisted thoracoscopic surgery versus thoracotomy approaches to lobectomy. *Ann Thorac Surg* 2008; **86**: 2,008–2,016.
6. Decaluwe H, Petersen RH, Hansen H *et al*. Major intraoperative complications during video-assisted thoracoscopic anatomical lung resections: an intention-to-treat analysis. *Eur J Cardiothorac Surg* 2015; **48**: 588–598.
7. Walker WS, Codisoti M, Soon SY *et al*. Long-term outcomes following VATS lobectomy for non-small cell bronchogenic carcinoma. *Eur J Cardiothorac Surg* 2003; **23**: 397–402.
8. Falcoz PE, Puyraveau M, Thomas PA *et al*. Video-assisted thoracoscopic surgery versus open lobectomy for primary non-small-cell lung cancer: a propensity-matched analysis of outcome from the European Society of Thoracic Surgeon database. *Eur J Cardiothorac Surg* 2016; **49**: 602–609.
9. Puri V, Patel A, Majumder K *et al*. Intraoperative conversion from video-assisted thoracoscopic surgery lobectomy to open thoracotomy: a study of causes and implications. *J Thorac Cardiovasc Surg* 2015; **149**: 55–61.
10. Jiang G, Yang F, Li X *et al*. Video-assisted thoracoscopic surgery is more favorable than thoracotomy for administration of adjuvant chemotherapy after lobectomy for non-small cell lung cancer. *World J Surg Oncol* 2011; **9**: 170.
11. Petersen RH, Hansen HJ. Learning curve associated with VATS lobectomy. *Ann Cardiothorac Surg* 2012; **1**: 47–50.
12. Meyerson SL, Balderson SS, D'Amico TA. Training assistants improves the process of adoption of video-assisted thoracic surgery lobectomy. *Ann Thorac Surg* 2015; **100**: 401–406.
13. McElroy P, Casali G, Batchelor T, West D. Adopting a standardized anterior approach significantly increases video-assisted thoracoscopic surgery lobectomy rates. *Eur J Cardiothorac Surg* 2014; **46**: 100–105.