ORIGINAL ARTICLE

Early Experience of Video-Assisted Thoracoscopic Surgery

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Summary

Consecutive 25 patients (M/F:18/7) underwent video-assisted thoracoscopic surgery (VATS) for various chest illnesses. These included nine cases of pneumothorax, three cases of pericardial effusion, three cases of pleural effusion, four cases of lung lesion requiring either incisional or excisional biopsy, two cases of empyema, one case of traumatic haemothorax, and three cases of mediastinal lesion. The mean age was 36.2 years (range 19-78 years). A total of forty-three procedures were performed. The mean durations of intrapleural chest-tube requirement and hospitalisation following VATS alone were 4.5 days (range: 0-13 days) and 8.3 days (range: 2-25 days) respectively. No intraoperative complication and VATS procedure-related mortality reported. Apart from simple analgesics such as paracetamol or tramadolol, no opiate analgesia was given to patients undergoing only VATS. The results support that VATS is a safe and effective procedure in the management of pulmonary, mediastinal, pericardial and pleural diseases and the treatment of persistent and recurrent spontaneous pneumothorax.

Key Words: Video-assisted thoracoscopic surgery

Introduction

With adaptation from cystoscopy, H.C. Jacobaeus[1] introduced the use of thoracoscopy in the early 1900s. Its clinical usage however was limited in that only one person could view the pleural cavity at a time and therefore its application was mainly confined to the lysis of adhesions in the treatment of tuberculosis and diagnostic biopsies of pleura and mediastinum. The advances and miniaturisation made in the chip technology in the past decades have resulted in the improvement of endoscopy and video imaging. Together with the availability of the recently developed endoscopic instruments, these have allowed gynaecologists and general surgeons to perform minimally invasive techniques such as appendectomy[2] and cholecystectomy[3] which would otherwise require laparotomy. Similarly, video-assisted thoracoscopic surgery (VATS) is fast becoming an accepted modality and has made an important impact on the practice of thoracic surgery[4,5]. It is reported to reduce postoperative pain, hospitalisation and recovery time. We report our early experience of VATS performed at the Universiti Hospital, Kuala Lumpur with the results reviewed retrospectively. The aims are to determine whether VATS is a safe and effective procedure, and whether the technique is beneficial and justifiable in the local context in view of the expensive instruments needed.

Methods and Materials

Consecutive twenty-five cases of elective VATS performed between November 1993 and January 1995 were reviewed retrospectively. Preoperative investigations included full blood count, blood urea and serum electrolytes and creatinine, plain X-ray of the chest, lung function test and computed tomographic (CT) scan of the thorax when indicated. Informed consent was obtained from all patients including discussion relating to the possibility of a conventional thoracotomy in addition to the VATS.

Operative methods

All procedures were performed under general anaesthesia with double lumen endotracheal tube intubation in order to permit one-lung ventilation of the contralateral side during surgery of the affected hemithorax. Pulse oximetry provided the additional monitoring in addition to the routine monitoring during the general anaesthesia. All patients were positioned, prepared and draped in the lateral decubitus position with 30° flexion of the operating table in the middle in order to open up the intercostal spaces. Upon positioning, ventilation to the lung of the operative side was stopped before the insertion of the thoracoscope. This minimises the risk of traumatic injury of the lung by the thoracoscope. Prophylactic antibiotic (cefuroxime 750 mg, intravenously) was given at induction.

Video equipment consisted of an Olympus 10 mm straight viewing rigid telescope (Olympus Singapore Ltd, Singapore) with an attached auto exposure camera and light source (Olympus camera connector and power source – Olympus Singapore Ltd, Singapore). The camera was wired to a video cassette recorder to allow for recording when required and a medical grade video monitor. The latter was positioned opposite the surgeon for viewing. The lens of the thoracoscope was coated in an antifog solution before it was inserted into the chest.

One to four stab-incisions of length 10-20 mm were made on the chest wall. The first was usually made on the mid-axillary line one to two finger breath below the inferior angle of the scapula. This was followed by blunt widening of the incision into the pleura with a haemostat forceps. A blunt end trocar with a 12 mm-port was then inserted and through the latter the thoracoscope was introduced for viewing and inspection of the interior. Depending on the procedure performed and the preliminary findings of the interior, additional stab-incisions and insertions of trocars and ports were then made under the direct vision of the thoracoscopic imaging in order to avoid injury to the viscera. We avoided using port of size greater than 12 mm in order to minimise the theoretical risk of pressure related intercostal neuritis.

Using a combination of endoscopic instruments including endoscopic-stapler Multifire EndoGIA30™, shear, grasper, tissue forceps, scissors, cautery, suction and probe (Auto Suture, USA), a variety of procedures were performed (see Table I). At the completion of the procedure, the lung of the operative side was reinflated under the direct vision of thoracoscopic imaging. A single or two intercostal chest-tube(s) were placed for drainage and the incisions were infiltrated with 0.5% bupivacaine and closed with interrupted sutures. All patients were extubated immediately following the procedure.

Follow-up

Patients were reviewed at least daily through their hospitalisation, and again at two to four weeks at the follow-up clinic after being discharged from the hospital.

Parameters obtained for analysis were: the operating time of the procedure (minutes), duration of chest-tube requirement (days), the hospital stay (days), type and amount of analgesia given following procedure, the complication related to and following the procedure.

Results

Patients

Table I is a summary of the demographic data and the indication for surgical intervention of the twenty-five patients. These included nine cases of pneumothorax (eight spontaneous pneumothorax and one traumatic pneumothorax), three cases of pericardial effusion, three cases of pleural effusion, four cases of lung lesion requiring either incisional or excisional biopsy, two cases of empyema, one case of traumatic haemothorax, and three cases of mediastinal lesion. There were 18 males and 7 females. The mean age was 36.2 years (range 19-78 years).

A total of forty-three procedures were performed (see Table II). The mean duration of intrapleural chest-tube requirement and hospitalisation following VATS alone were 4.5 days (range: 0-13 days) and 8.3 days (range: 2-25 days) respectively. There was no intraoperative complication and VATS procedure-related mortality. Apart from simple analgesics such as paracetamol or tramadolol, no opiate analgesia was given to patients undergoing only VATS. Additional opiate analgesia consisting of morphine or pethidine were given to those patients who required thoracotomy.

Table I
Demographic data of patients and indication for surgery

Patients	Sex	Age	Indication for surgery
1.	Female	30	Pulmonary fibrosis
2.	Male	20	Spontaneous pneumothorax
3.	Female	50	Malignant pleural effusion
4.	Female	48	Malignant pleural effusion
5.	Male	71	Spontaneous pneumothorax
6.	Male	65	Early empyema
7.	Male	29	Spontaneous pneumothorax
8.	Male	36	Pericardial effusion (TB)
9.	Female	54	Hilar lymphadenopathy
10.	Male	34	Post-radiotherapy pleural and pericardial effusions
11.	Male	21	Recurrent pneumothorax
12.	Male	36	Traumatic haemothorax
13.	Male	55	Bronchopleural fistula following radiotherapy
14.	Female	67	Previous hepatoma and lung 2°
15.	Male	19	Pleural effusion (TB)
16.	Male	26	Mediastinal tumour
17.	Male	24	Spontaneous pneumothorax
18.	Female	61	Fibrosing alveolitis
19.	Male	33	COAD and persistent pneumothorax
20.	Female	78	Meningioma & lung 2°
21.	Male	28	Posterior mediastinal tumour
22.	Male	19	Spontaneous pneumothorax
23.	Male	47	Post-traumatic persistent pneumothorax
24.	Male	54	Pericardial tamponade (TB)
25.	Male	19	Spontaneous pneumothorax

Table II
Details of VATS performed

Procedure(s)	Case(s)
Elimination of bullae and pleurodesis	7
Adhesiolysis and pleurodesis	1
Pericardial biopsy and window	2
Pleural biopsy	1
Pleural biopsy and pleurodesis	2
Lung biopsy	2
Evacuation of pus	1
Evacuation of blood and adhesiolysis	1
Mediastinal biopsy	2
Excision of mediastinal tumour	1
Thoracoscopy and other procedure	5

Pneumothorax

Seven of the eight patients with spontaneous pneumothorax underwent VATS with bleb elimination (two patients with endoloop suture ligation and the remaining with endostapler-excision) and pleurodesis (one with tetracycline and the remaining with pleural abrasion). The spontaneous pneumothorax of the eighth patient was associated with chronic obstructive airway disease. During thoracoscopic imaging, extensive and large bullae were found in both upper and lower lobes along the transverse fissure with close proximity to the pulmonary artery. Therefore it was viewed unsuitable for endostapler excision and consequently thoracotomy, bullae excision and pleural abrasion were performed. The ninth patient with persistent pneumothorax following chest trauma underwent VATS with adhesiolysis and pleural abrasion. The mean

Table III
Advantages of VATS over thoracotomy

1. Less postoperative discomfort/pain.
2. Early morbility and theoretically less morbidity from deep vein thrombosis.
3. Less morbidity from atelectasis and pulmonary infection[6].
4. Allow excellent view of interior of chest for both surgeon and assistant.
5. Less tissue destruction, e.g., muscle division or retraction, spreading of ribs and trauma to intercostal neurovascular structures.
6. Operating time may be shorter as it does not require "opening" and "closing" of chest.
7. Shorter hospital stay.
8. Smaller scar and improved cosmesis.

duration of procedure for VATS alone was 30 minutes (range: 25-45 min) and the corresponding mean requirement of chest tube requirement and hospital stay were 2.9 days (range: 0-13 days) and 7.3 days (range: 2-25 days) respectively. There was no evidence of recurrence with a mean follow-up of 9.4 months.

Pericarditis with effusion

One of the three pericardial effusion was due to irradiation following treatment for Hodgkin's disease and the other two were tuberculous in origin. VATS, pericardial biopsy and pleuro-pericardial window were performed through the left chest in the first irradiation case and one of the two tuberculous cases. The time taken for the procedures were 45 and 55 minutes respectively. Neither of the patients require any further pericardiocentesis or open drainage after VATS. The second case of the tuberculous pericarditis required left anterior thoracotomy and open pleuro-pericardial window as the pericardium was thicken and fibrous and proved to be difficult for VATS.

Pleural effusion

One of the three cases of pleural effusion patients was due to tuberculosis and the remaining two were due to metastasis secondary to breast cancer. Pleural biopsy were taken in all three cases and talc pleurodesis performed in the malignant disease. The time taken for the procedures were 20, 30 and 30 minutes respectively.

Pulmonary infiltration

Two patients with fibrosing alveolitis underwent wedge biopsy of the lung for histopathological diagnosis before commencement of further medical treatment. The time taken for the procedure were 30 and 35 minutes respectively. The third patient was diagnosed to have miningioma of the brain and radiological imaging of the chest showed an ill-defined infiltration of the left upper lobe of the lung. It was not possible to identify the lesion with the thoracoscopic imaging and therefore an open lung biopsy was performed. The fourth patient had previously undergone partial liver resection for primary hepatocellular cancer and presented with a solitary pulmonary metastasis of the left upper lobe. Wedge resection with VATS was planned but the pulmonary metastasis proved to be too huge and central with this minimal invasive technique. Therefore thoracotomy and lobectomy was carried up subsequently.

Empyema and post-traumatic haemothorax

VATS were performed to evacuate pus in a case of early empyema and blood and lysis of adhesion in a case of posttraumatic haemothorax. The time taken for procedures were 30 and 45 minutes respectively. In the second case of empyema, the patient had previously had pneumonectomy performed for non-small cell lung cancer. He subsequently underwent adjuvant radiotherapy treatment for involvement of chest wall and following which he developed bronchopleural fistula and empyema. During thoracoscopic imaging, the pus was evacuated. However, it was not possible to identify the fistula and therefore rib resection was carried up.

Mediastinal lesions

Three cases of mediastinal lesion were referred for surgery. Biopsies were obtained in two cases (one with hilar lymphadenopathy due to sarcoidosis and the other, an anterior mediastinal tumour of seminoma). The time taken for the procedures were 35 and 25

minutes respectively. The third was a case of posterior mediastinal lymphoproliferative tumour (Castleman's disease) and resection was carried up with an operating time of 105 minutes.

Discussion

VATS is becoming an important diagnostic and therapeutic modality with application to an increasing number of intrathoracic conditions. Like other minimally invasive procedures, VATS has many theoretical advantages over thoracotomy as summarised in Table III. These include less postoperative pain, early mobilisation, less pulmonary complications, less tissue destruction, shorter hospital stay and improved cosmesis. There are disadvantages too which include cost and the two dimensional visual perception of the operative field. The cost to a larger extent is off-set by the advantages gained with the VATS and the visual perceptive problem can be overcome with more experience.

The type of the patients encountered and the procedures performed in this study are fairly similar to two other experiences[7,8] published recently from the Asia-Pacific region. This preliminary experience with VATS has been proven to be safe. It is the treatment of choice for spontaneous pneumothorax. It is the preferred procedure for diagnosis of infective and metastatic pleural diseases when other means fail. Pleurodesis with talc could be performed at the same sitting for the latter. Similarly, satisfactory pericardial drainage and window, and biopsy and resection of mediastinal lesion and pulmonary pathology can be performed with VATS.

This initial experience also indicates that VATS is not a minor procedure. It involves intrathoracic manipulation and associated risks as in thoracotomy. Five patients in this report initially planned for VATS subsequently required other procedures. Therefore VATS should be performed by those who have the ability to convert it to thoracotomy if necessary. Its role for diagnostic procedure is well defined but as for therapeutic surgery, it is still being defined. As such, VATS should not be viewed mutually exclusive from open procedure. It represents a different end of spectrum of thoracic procedures and therefore complement the open procedure in the treatment of chest diseases. Hence, one should not view the conversion to open thoracotomy from initially planned VATS a failure. Consent for possible thoracotomy should be routinely obtained from all patients.

Conclusion

The results support that VATS is a safe and effective procedure in the management of pulmonary, mediastinal, pericardial and pleural diseases and the treatment of persistent and recurrent spontaneous pneumothorax.

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