Video-Assisted Thoracoscopic Surgery (VATS) in the Diagnosis and Treatment of Intrathoracic Diseases at Ratchaburi Hospital

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Objective: *To review the authors' experience and benefit in diagnosis and management of intrathoracic diseases by Video-assisted thoracoscopic surgical procedures (VATS) using a non trocar technique.*
Material and Method: *Retrospective review of sixty-eight consecutive patients who underwent seventy-one VATS procedures between January 1997 and December 2004. Indications included recurrent or persistent pneumothorax (n = 21 patients), empyema thoracis (17), lung nodules or masses (8), clot haemothorax (6), pleural effusion (4), pleural thickening or masses (3), mediastinal masses or cysts (3), pericardial effusion (2), removal of bullets from the pleural cavity (2), bronchiectasis with hemoptysis (1) and inspection of diaphragmatic injury (1) (Table.1). An alternative method of manipulating thoracoscopic instruments without using a trocar was described.*
Results: *Of the 71 VATS procedures in 68 patients, 62 (87.3%) procedures were successfully performed in 59 patients. Three of them underwent VATS bilaterally. (1Tuberculous empyema and 2 spontaneous pneumothorax). Four patients requried conversion to thoracotomy due to bleeding in 1 who had excision lung bleb, extensive adhesion in 2 with chronic empyema thoracis and unlocated lesion in 1 with solitary pulmonary nodule (SPN). There were 5 postoperative complications: prolonged air leak for more than 7 days was seen in 4 patients. This complication occurred in a patient with spontaneous pneumothorax (3 patients) and bilateral tuberculous empyema at the left side (1 patient). Wound infection and mild effusion occurred in 1 patient with unilateral tuberculous empyema (no additional drainage was required).*

VATS in diagnostic procedures were effective in 90% (9 of 10 patients) and the procedures were 4 wedge excision, 3 pleural biopsies, 1 wedge excision for interstitial lung disease 1 inspection of diaphragmatic injury and 1 required conversion. Sixty one therapeutic procedures were effective in 50 patients (85.9%) (50 of 58 patients). None of them had a recurrence of pneumothorax after VATS procedures or other complications. Only small doses of analgesics were needed.

There was no intraoperative mortality. The mean operative time was 67 minutes and the average postoperative hospital stay was 5.4 days for successful VATS group.
Conclusion: *VATS using of a non-trocar technique is a safe and effective method for diagnosis and treatment of intrathoracic diseases. Patients had benefit in reduced postoperative pain, short hospitalization, short recovery times and good cosmetic result.*

Keywords: *Video-assisted thoracoscopic surgical procedures, VATS, A non-trocar technique*

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The technique of thoracoscopy was attributed to Jacobaeus who described it in 1910[1] for diagnosis only. The advent of video-image technology and instruments designed for laparoscopic use, thoracoscopic technique had been dramatically improved in 1990.

Today video-assited thoracoscopic surgery (VATS) has been widely used to perform many procedures in not only the pleural space but also the chest wall, mediastinum pericardium and pulmonary malignancies. The VATS procedures have been used with satisfactory result to obtain biopsies of pleural pulmonary and mediastinum, for treatment of spontaneous pneumothorax, for decortication of empyema thoracis and recently for lobectomy of pulmonary malignancy.

The authors reviewed their experience with VATS to variety of intrathoracic diseases and to evaluate the outcome from 1997 to 2004 in Ratchaburi Provincial Hospital.

Material and Method

Between January 1997 and December 2004, sixty-eight consecutive patients (54 males, 14 females) underwent seventy-one VATS procedures for only diagnostic (n = 10) and therapeutic proposes (n = 61) under general anesthesia at Ratchaburi Hospital. The average age was 42 $\pm$ 15 years with the youngest being 1 year and the oldest 75 years. Each patient elected to try VATS first and was informed that a convertional thoracotomy might be necessary.

Indication included recurrent or persistent primary spontaneous pneumothorax in 21 patients, empyema thoracis in 17, single lung nodule masses in 8, clot haemothorax in 6, pleural effusion in 4, pleural biopsies in 3, mediastinal masses in 3, pericardial effusion in 2, removal of foreign bodies (bullets) from pleural cavity in 2, bronchectasis with hemoptysis in 1 and inspection of diaphragmatic injury in 1. The indications were reported in Table 1.

The VATS procedures included excision blebs (n = 11) and ligation blebs (n = 12) with pleurodesis (23 VATS procedures in 21 patients), 18 decortication (17 patients), 6 clot removal of haemothorax, 6 wedge excision (coin or SPN n = 5), interstitial lung disease (n = 1), 4 pleurodesis in malignant effusion, 3 pleural biopsies, 3 VATS lobectomy, 2 pericardectomy, 2 removal of foreign bodies (bullet) and inspection of diaphragmatic injury (Table.2).

The authors had performed single-stage bilateral VATS for tuberculous empyema in 1 patient and two-stage bilateral VATS for excision bleb in 2 patients with previous right contralateral spontaneous pneumothorax in different episode. Preliminary investigations in most of the patients who underwent VATS included a full blood count serum biochemistry, chest radiography and CT chest (esp. in lung mass, empyema thoracis) aterial blood gas, PT PTT.

Surgical technique

All procedures were performed under general anesthesia in the operating room using a double-lumen endobronchial tube in 67 patients except for a 1-year-old child whose trachea was too small and a single-lumen endotracheal tube was used, instead. The position was accurately checked before and after the patient was turned to a lateral decubitus position. A pulse oximeter was used to maintain O2 saturation more than 90%. CO_2 insufflation was not used in all

Table 1. Video-Assisted thoracic surgery indication for operation

Indication	Number of procedures	Diagnostic	Therapeutic	Percent
		(N = Patients)		
1. Pneumothorax	23		21	32
2. Empyema Thoracis	18		17	25
3. Lung nodules or masses	8	6	2	12
4. VATS in Trauma Clot haemothorax	6		6	9
5. Pleural effusion	4		4	6
6. Pleural mass Thickening	3	3		4
7. Mediastinal masses or cyst	3		3	4
8. Pericardial effusion	2		2	3
9. Removal of foreign body (bullet)	2		2	3
10. Hemoptysis with bronchectasis	1		1	1
11. Inspection of diaphragmatic injury	1	1		1
Total		10	58	
Total	71	68		100

Table 2. Video-Assisted thoracosocpic surgery: Procedures perform in 68 patients

Procedures	N	Percent	Type of procedures
1. Wedge resection or ligation Bleb with Pleurodesis	23*	32.4	T
2. Decortication	18**	25.4	T
3. Clot removal of haemothorax	6	8.5	T
4. Wedge Excision (coin Lesion5, interstitial ligation)	6	8.5	D
5. Pleurodesis in Malignant effusion	4	5.6	T
6. Pleural Biopsy	3	4.2	D
7. VATS Lobectomy	3	4.2	T
8. Excision of mediastinal tumor	3	4.2	T
9. Removeal of foreign body (Bullet)	2	2.8	T
10. Anterior pericardectomy	2	2.8	T
11. Inspection of Diaphragmatic injury	1	1.4	D
Total	71	100.0	

* 2 cases of VATS procedures were performed bilaterally in different period with past history of right contralateral pneumothorax (9 months and 4 years)

** 1 case of bilateral tuberculous empyema was performed by VATS decortication bilaterally

D = Only Diagnostic procedures = 10 in 10 patients; T = Therapeutic procedures = 61 in 58 patients

patients. Video optics consisted of monitor and placed on both sides of the operating table. Using conventional thoracic surgical instrument (general thoracic set), electric cautery, 35 mm and 45 mm endoscopic stapler and thoracoscopic instrumentation, Various procedures can be performed. An incision was made in the 6th or 7th intercostal space in the mid axillary line for insertion of the 10 mm trocar for endoscopy. The second and third incisions were made under vision of the endoscope in the third to the seventh intercostal space along the anterior and posterior axillary lines for manipulating instruments without placement of trocars (Fig. 1, 2).

In case of spontaneous pneumothorax were operated to control source of air leak by excision or ligation bleb (Fig. 2). In case of decortication was performed by VATS procedures in fibrinopurulent phase or stage II empyema (Fig. 3). Pleurodesis was performed using talc in powder and a gauze swab to rub the pleura in different places. In case of biopsy of mediastinal tumor,wedge excision of pulmonary nodules, lobectomy plastic bags were used to retrieve the tissue. The ascess thorocotomy incisions were performed in cases of VATS lobectomy and decortication. Lobectomy, wedge excision and biopsies were taken using a reload 35 and 45-mm Autosuture Endo GIA staplers.

Following the procedure, the chest was irrigated with NSS and the lung was allowed to inflate. The operated site was observed for bleeding and air leak (except in cases of pleurodesis performed after pleural irrigation). One or two 32 F chest tubes were inserted into the thorax, Most patients were extubated in the operating room. Elderly, post decorticated

Fig. 1 Using a non trocar technique

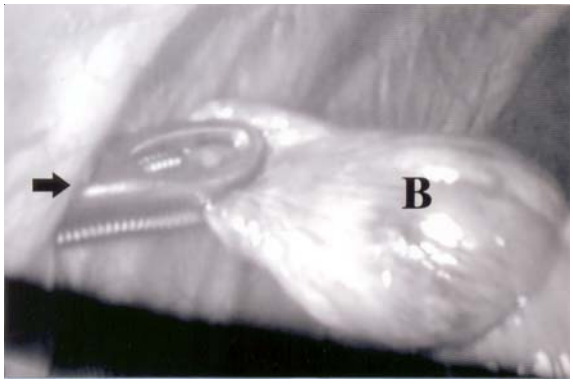

Fig. 2 Ligation subpleural bleb in case of primary spontaneous pneumothorax. B = subpleural bleb, Black arrow = non trocar technique

Fig. 3 VATS decortication in phase II of empyema thoracis

patients were placed in intensive care unit overnight for lung expansion.

Description statistics: range, number, percentage, mean $\pm$ SD were used to summarize the descriptive results.

Results

Of the 68 patients, having 71 VATS procedures 76.47% were male (52 patients). The average age was 42 $\pm$ 15 years (range 1-75 years).

VATS procedures were performed unilaterally in 65 patients and bilaterally in 3 patients the indications of which were bilateral primary spontaneous in 2 and bilaterally tuberculous empyema in 1. 62 of 71 (87.3%) VATS procedures were successfully performed in 59 patients. 10 VATS procedures were used only for diagnostic procedures and included 6 wedge excisions, 3 pleural biopsies, 1 inspection of diaphragmatic injury. These procedures were effective in 90% (9 of 10 patients) one of them required thoracotomy because of the unidentified lesion of arteriovenous mulformation (AVM).

The remaining 61 VATS were used for therapeutic purpose in other 58 patients. The procedures were effective in 50 patients (85.2% 50 of 58 patients) None of them had recurrence of pneumothorax or after VATS.

Mean operating room time was 67 minutes (range 25-240 minutes) intraoperative blood loss ranged from (20-250 ml). Most of them were extubated of endotracheal tubes after operation except in cases with decortication and lobectomy. Morphine was injected to the patents in 24 hours after the operation, followed by oral analgesic. The overall complication rate was 7.4% (5 of 68 patients) the most common complication, persistent air leak (longer than 7 days), occurred in 4 patients and, wound infection with minimal effusion in 1 (Table 3). There was no intraoperative mortality, one of them died as a result of end stage CA lung with respiratory insufficiency on the 15th day of hospitalization.

The mean postoperative hospital stay was 5.4 $\pm$ 1.4 (range 1-18 days) (VATS group only, without complication). The mean length of hospital stay was 6.4 $\pm$ 2.5 days (entire group of 71 procedures). The conversion rate to thoracotomy was 5.8% (4 of 68 patients) (Table 3).

1. Wedge excision or ligation bleb with mechanical pleurodesis for spontaneous pneumothorax (n = 23 in 21 patients)

Of the 21 patients who underwent 23 VATS procedure the patients were divided into two groups. 17 of them were primary spontaneous pneumothorax (2 of them had previous contralateral pneumothorax which the duration between the first and second, episode was 9 months, 4 years respectively). 18/19 (95%) VATS procedures in 17 patients were succesfully done. One patient with unilateral pneumothorax had minimal air leak for 9 days.

Of the 4 with secondary spontaneous pneumothorax underwent excision bleb and mechanical and talc pleurodesis 1 (25%) procedure was sucessfully done, 2 had persistent air leak (16, 18 day), 1 required convertion to open thoracotomy because of bleeding from accidental tear of the thymus. The mean LOS was 6.3 days for the entire group and 5.3 days for the non-complicated VATS group. No recurrence was noted after a mean follow up of 26 months (range 3-63 months)

2. VATS decortication (n = 18 in 17 patients)

Of the 17 patients who underwent 18 VATS decortications of empyema thoracis. Causes of empyema thoracis were parapneumonic in 15 and tuberculous in 2 of which 1 had bilateral tuberculous empyema (Fig. 3) 2 of 15 patients with parapneumonic empyema required conversion to thoracotomy because of massive adhesion of empyema wall. Two patients with tuberculous empyema of which 1 had persistent air leak for 18 days (bilateral empyema at left chest), required conservative treatment and 1 had mixed infection with streptococcus viridan, required treatment with antibiotic and antituberculous drugs.

The mean operative time was 73 minutes in unilateral empyema thoracis and operative time was 250 minutes in bilateral empyema thoracis. The mean

Table 3. Summary of data in specific VATS procedures

Procedures	Number	Conversion	Complication	Operative times (min)		Extubation/ ICU days	Postoperative stay (LOS)	
				Mean	range		Mean	range
1. Wedge excision or ligation bleb with pleurodesis (21 patients)	23	1	3	58	35-90	Imm-P	6.3	1-18
2. Decortication (17 patients)	18	2	2	81	45-250	1-2 day	7.8	4-19
3. Removal blood clot of haemothorax	6	0	0	58	45-67	Imm-P	5.5	4-7
4. Wedge excision	6	1	0	56	32-75	Imm-P	5.5	3-8
5. Pleurodesis in malignant effusion	4	0	D	39	25-60	Imm-P	7.5	4-10
6. Pleural biopsy	3	0	0	35	30-45	Imm-P	3.6	3-4
7. VATS lobectomy	3	0	0	210	180-240	1 day	6.3	5-8
8. Excision of mediastinal tumor	3	0	0	43	35-60	Imm-P	4.6	3-8
9. Anterior pericardectomy	2	0	0	90	80-100	Imm-P	6.5	5-8
10. Removeal of foreign body (Bullet)	2	0	0	32	25-40	Imm-P	4.0	3-5
11. Inspection of diaphragmatic injury	1	0	0	30	-	Imm-P	5.0	-
Total	71	4	5	-				

LOS = 5.4 $\pm$ 1.4 days in successful VATS group and 6.4 $\pm$ 2.5 for entire group
Imm-P = immediate post operation; D = Death from end stage of malignancy

LOS was 7.8 days for entire, 5.6 days in non complicated VATS decortication and 15.3 days in complicated VATS decortication.

3. VATS in chest trauma (n = 9)

VATS was performed to remove a clot haemothorax in 6 patients, removal of bullets in 2 and to inspection of diaphragmatic injury in 1. All the 9 patients were treated successfully without conversion to thoracotomy. The LOS in three groups of chest trauma following haemothorax, retained a bullet in the pleural cavity and inspection of diaphragmatic injury was 5.5, 4 and 5 days respectively.

4. Wedge pulmonary Excision (n = 6)

Of the 6 patients that had wedge excision only (5 for single pulmonary nodules and 1 for interstitial disease), 5 were treated successfully, 1 required conversion to thoracotomy because of unlocated lesion of AVM at the lower lung. Diagnosis had to be confirmed by frozen section biopsy. The mean LOS was 5.5 days. Pathological findings ravealed tuberculous inflammation in 3, chronic bronchiectasis in 1, metastastic papillary adenocarcinoma in 1 and AVM in 1.

5. Malignant pleural effusion (n = 4)

All the 4 were operated on by pleural biopsy, removal of effusion and talc pleurodesis (talc = 4 gm) all procedures were successful but prolonged drainage and long LOS than other group mean LOS was 7.5 days 1 of them died of metastasis adenocarcinoma on the 15th day of hospitalization.

6. Pleural biopsy (n = 3)

VATS was performed in pleural biopsy specimens in 3 patients and all procedures were successful. Pathologic studies disclosed metastatic undifferential carcinoma in 2 and adenocarcinoma in 1. All of them were metastatic from CA lung. LOS was 3.6 days.

7. Major pulmonary resection (VATS lobectomy) (n = 3)

The authors had preliminary experience in VATS lobectomies in 3 patients, 2 had left lower lobectomy for hemoptysis, from bronchectasis in 1 (Fig. 4) and chronic bronchiolitic with abscess formation in 1. The remaining one patient had right middle lobectomy for stage I poorly differentiated squamous cell CA.

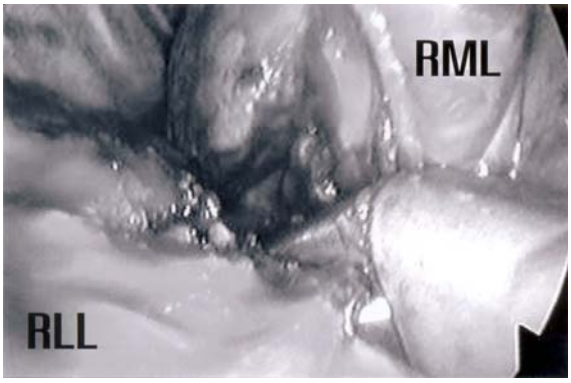

Fig. 4 Major pulmonary resection: Right lower lobectomy RLL= right lower lobe, RML= right middle lobe

Mean operative time was 210 minutes mean LOS was 6.3 days (range 5-8 days) and there was no conversion to thoracotomy.

8. Mediastinum (n = 3)

All the 3 patients who underwent excisional biopsies of posterior mediastinal lesion were sucessful as follows, neurilemmoma in 1, gangioneuroma in 1 and bronchogenic cyst in1. The mean operative time was 43.3 minutes. The mean LOS was 4.6 minutes (range 3-8 days).

9. Pericardial effusion (n = 2)

Two had anterior pericardial drainage and biopsies the pathological finding were non specific pericarditis and chronic granulomatous inflammation. The LOS was 5 and 8 days respectively. There were no recurrences of effusion and no constrictive changes developed during follow up of 1, 1 years respectively.

Discussion

The application of VATS at this time, has expanding application in the field of general surgery[2-5]. An accepted modality of treatment as many procedures have been shown to be technically feasible. In the authors' experience, VATS was useful for diagnosis (pleural biopsy, lung nodules, biopsy of interstitial lung diseases and inspection of pleural cavity for thoracic injury, staging of CA lung and treatment of lung bleb for primary spontaneous pneumothorax, Stage II of empyema thoracis, removal of clotted blood in clot hemothorax, peripheral lung nodule, lobectomy in nonsmall cell CA lung with mass less than 4 cm in diameter small mediastinal mass and anterior pericardectomy in pericardial effusion.

Common VATS procedures

The most common indication for VATS was treatment of spontaneous pneumothorax, this condition is usually caused by the rupture of a subpleural bleb and represents one of the most common elective applications of VATS (32.4%). The authors performed VATS procedures to restore the full expansion of the lung by control air leak and to prevent recurrence by pleurodesis 19 procedures for primary spontaneous pneumothorax (PSA) were performed by excision bleb with endostapler device in 7 and with hand-made Prolene endoloop ligation in 12. Four procedures for secondary spontaneous pneumothorax (SPS) were performed by excision bleb. Surgical plus talc pleurodesis was used in both groups. Prolonged air leak was found in 1patient with PSP and 2 patients in the SSP group. One patient with SSP required open thoracotomy because of bleeding from the thymus. The VATS treatment of spontaneous pneumothorax was effective in more cases of PSP than the SSP group, Similarily de Ves B et al[6] reported that analysis of long term result of spontaneoun pneumothorax proved to be more effective in cases of PSP than SSP. The alternative technique in treatment of sub plural bleb leakage with endoloop ligation was effective in 11 of 12 patients with SPS in the present report. This technique proved to be safe, reliable and cost-effective to bullous disease similar to another report by Liu H D et al[7].

Now new techniques of needlescopic video-assisted thoracoscopic surgery have been reported by Chan J[8] for SPS, this group had less residual neuralgia and better wound satisfaction than the conventional VATS as suggested in selected patients to prevent early recurrence.

The second and third common VATS procedures were, VATS decortication and removal of clotted blood of haemothorax. The authors prefers to operate on patients with the fibrinopurulent phase of empyema. It was found that VATS should be performed instantly in clot hemothorax while in cases of empyema thoracis it should be performed within 2-4 weeks after diagnosis. Two patients who required conversion to thoracotomy had delayed diagnosis (31 and 32 days). Contraindication to VATS decortication include the unsuitable general condition of patients with severe sepsis and significant parenchymal disease in the lung for decortication.

The VATS procedures such as bleb excision[9], pleural biopsy[11,12] lung biopsy[10,13] in interstitial lung disease[10,13] resection of a solitary pulmonary

nodule (SPN)[14,15] Pleurodesis in T 4 or intrathoracic metastasis of CA lung was added to patient management and prevented unnecessary thoracotomy.

VATS for Excisional biopsy (SPN) and others VATS procedures

A noninvasive approach of tranbronchial biopsies provided a diagnosis in only 37 to 50% of cases[16] compared with VATS Peripheral lung biopsy which was as effective as open lung biopsy and provided a diagnosis in 95%[17]. In the present series VATS excisional lung biopsies were effective in 90%. One problem was unlocated pulmonary lesion. Using CT scan for preoperative investigation of SPN, the potential to malignancy depended on old age, size of module irregular surface, if the growth pattern should undergo VATS excisional biopsy. Positron emission tomography (PET scan) is more accurate to detect the difference between benign and malignant SPN[18].

Shin et al[19] reported using TC-99 m depveotide. This agent has been used for imaging SPN in an effort to differentiate malignancies from the infectious process. High tumor uptake in squamous cell carcinoma could be potentially useful in diagnosis and therapeutic guidance.

The major pulmonary resections were performed in patients with a peripheral mass or lesion confined in lobe, mass less than 4 cm, separated pulmonary fissure, and stable hemodynamic condition. Anterior pericardictomies were performed in patients with stable hemdynamic and tolerated one lung ventilation (O2 sat > 90%) These VATS procedures provided a more extensive pericardial resection and managing of associated pulmonary disease esp. effusion.

Using a non trocar technique and access thoracotomy

Despite the benefits of VATS manipulation of the instruments and exposure are also limited using the trocar method the authors found that manipulation of thoracoscopic and some conventional thoracic instruments was easier and that they passed through the incision wound, the ability to feel the lesion was not reduced. The authors performed access or limited thoracotomy incision in cases of empyema thoracis for using conventional thoracic instruments (3-4 cm) and 7-8 cm incision in cases of VATS lobectomy for removing pulmonary specimens.

Conversion rate and Complication after VATS

The conversion rate has been reported to be between 4.1 and 33% depending on the procedure[5,I4,19,20]. In the present report, 5.8 percent of patients (4 patients) required conversion to an open procedure. The reasons for converting was inability to find an AVM in the lung (1), excessive adhesions in the pleural space (2), and active bleeding due to accidental injury (1). Although other series showed higher conversion rates than the authors' because VATS was more frequently performed for malignant pulmonary nodules or masses, where conversion to open procedure is to ensure adequate resection. In the present study, VATS was performed most commonly for spontaneous pneumothorax, phase II empyema thoracis and early clot haemothorax for which conversion is very infrequent.

Most surgical series have reported an incidence of 4-10% of complications resulting from VATS[3,20,21] which are similar to patients that occur after open procedures.The most common complication, prolonged air leaks, which occurred in 5.8% of the patients (4 of 68) in the present study was related mainly to spontaneous pneumothorax and empyema thoracis. The cause of the air leak was from the raw edge of the stapler or from extensive dissection.

In the present study, the mean hospital stay was only 5 days (range 1-18 days). Only small doses of morphine were needed on the first day, followed by oral analgesic. Most of them returned to normal activity after one week, except for patients with malignant effusion and prolonged air leak.

Conclusion

The present results show that VATS has an important role in the diagnosis and treatment of many intrathoracic diseases.The procedures for diagnostic purposes include pleural biopsy, lung biopsy, evaluation of thoracic trauma. The procedures are useful in the therapeutic purposes including excision bleb or ligation bleb, decortication in stage II of empyema thoracis, removal of a blood clot from a clotted hemothorax, excision of SPN, lobectomy in non small cell CA lung (mass less than 4 cm) lobar bronchiectasis, small mediastinal tumors, anterior pericardiectomy in a stable hemodynamic patient. More over, the procedure and use of a non trocar technique is safe with few complications. There was no operative mortality associated with VATS. Patient had benefit in reduced postoperative pain, short hospitalization and short recovery times. One patient with pleural metastasis died of hypoxia after 15 days of hospitalization without being related to VATS procedure.

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การใช้กล้องและวิดีโอช่วยการผ่าตัดเพื่อการวินิจฉัยและการรักษาโรคทรวงอก (A non trocar technique): ประสบการณ์ในโรงพยาบาลราชบุรี พ.ศ. 2540-2547

ชนินทร์ กลิ่นจงกล, วิโรจน์ เพ่งผล

วัตถุประสงค์: *เพื่อประเมินผลการรักษาผู้ป่วย 68 รายโดยการใช้กล้องและวิดีโอช่วยการผ่าตัดโรคทางทรวงอก 71 ครั้ง และผ่าตัดแบบไม่ใช้ Trocar ในโรงพยาบาลราชบุรี ระหว่าง มกราคม พ.ศ. 2540-ธันวาคม พ.ศ. 2547*

วัสดุและวิธีการ: *การศึกษาย้อนหลังในผู้ป่วย 68 ราย ซึ่งได้รับการผ่าตัด 71 ครั้ง ในงานศัลยกรรมทรวงอกระหว่าง พ.ศ. 2540-2547 ผู้ป่วย 3 รายได้รับการผ่าตัด ทั้งสองข้าง ข้อบ่งชี้ในการผ่าตัด ได้แก่ ลมรั่วในช่องปอด 21 ราย โรคหนองในช่องเยื่อหุ้มปอด 17 ราย ก้อนเนื้อในปอด 6 ราย น้ำในช่องเยื่อหุ้มปอด 4 ราย pleural mass/thickening 3 ราย เนื้องอกในช่องอก 3 ราย น้ำในช่องเยื่อหุ้มหัวใจ 2 ราย foreign bodies ในช่องปอด 2 ราย และตรวจพยาธิสภาพในช่องปอด 1 ราย*

ผลการศึกษา: *การผ่าตัดทั้งหมด 71 ครั้งได้ผลดี 62 ครั้งคิดเป็น 87.3% ผู้ป่วยทั้งหมด 68 รายผ่าตัดประสบความสำเร็จ 59 ราย ผู้ป่วยได้รับการผ่าตัดทั้งสองข้าง 3 ราย จากวัณโรคปอด 1 ราย และลมรั่วในช่องปอด 2 ราย ผู้ป่วย 4 ราย ต้องเปลี่ยนการผ่าตัดเป็น open thoracotomy จากสาเหตุ เสียเลือดหลังexcision bleb 1 ราย โรคหนองในช่องปอดเรื้อรัง 2 ราย และหาตำแหน่งก้อนไม่พบ 1 ราย พบภาวะแทรกซ้อน 5 ราย ภาวะแทรกซ้อนที่สำคัญ คือ มีลมรั่วนานเกิน 7 วัน 4 ราย (หลังผ่าตัด ลมรั่วในช่องปอด 3 ราย และวัณโรคปอด bilateral tuberculous empyema ด้านซ้าย 1 ราย) แผลติดเชื้อในวัณโรคปอดด้านเดียว 1 ราย การผ่าตัด VATS เพื่อการวินิจฉัยได้ผลดี 90% และเพื่อการรักษาได้ผลดี 85.9% ไม่พบอัตราตายในการผ่าตัด ระยะเวลาผ่าตัด 67 นาที (25-240 นาที) ระยะเวลารักษาตัวในโรงพยาบาล 5.4 วัน*

สรุป: *การใช้กล้องและวิดีโอช่วยการผ่าตัด และใช้วิธี non trocar technique สามารถทำได้อย่างมีประสิทธิภาพและประหยัด ผู้ป่วยได้รับประโยชน์จากการผ่าตัดคือ อาการปวดและใช้ยาแก้ปวดลดลง แผลผ่าตัดเล็กลง ระยะพักฟื้นหลังผ่าตัดลดลง สามารถ ทำได้ทั้งการรักษาและวินิจฉัยโรคในช่องอก แต่การ ผ่าตัดต้องอาศัยความชำนาญ และระยะเวลานานกว่าการผ่าตัดแบบดั้งเดิม (conventional thoracotomy)*