Efficacy of Video-Assisted Thoracoscopic Surgery (VATS) for Management of Empyema Thoracis

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Objective: *Empyema thoracis is a frequent clinical problem and share in common a considerable potential for death and morbidity. Video-assisted thoracoscopic surgery [VATS] debridement or decortication become popular and increase the available treatment options. The authors aim is to determine the efficacy and outcome of VATS for management of empyema thoracis in adult patients.*

Material and Method: *A retrospective study of all adult patient treated for empyema between June 2009 to Feb 2011 at Thammasat Hospital was conducted. Recorded data included demographic information, clinical presentation, laboratory data, microbiological data, operative details, postoperative course, follow-up data and complications.*

Results: *A total of 23 patients [5 women, 18 men] underwent VATS debridement and decorication for treatment of empyema thoracis. Their mean age was 57 [35-90] years. 17 [74%] patients received preoperative drainage [percutaneous catheter drainage or tube thoracostomy] and mean duration of preoperative drainage was 7.6 [3-26] days. 8 [35%] patients had stage II empyema and underwent VATS debridement while 15 [74%] patients had stage III empyema underwent VATS decortication. Median postoperative hospital stay was 12.6 [7-48] days. Median time for postoperative intercostals drainage was 5 [3-30] days. Median follow-up time was 5 [1-20] months. Conversion rate to open thoracotomy for stage III empyema was only 13%. There were 3 postoperative complications [13%]: wound infection [n = 1], persistent space [n = 1] and recurrent infection [n = 1]. There was no intraoperative death and 2 [8%] perioperative death [< 30 days] which were mostly unrelated to surgery. Of the 23 patients, 20 patients [87%] achieved satisfactory results with treatment.*

Conclusion: *VATS debridement and decortication is safe and effective treatment in the management of stage II and stage III empyema thoracis.*

Keywords: *Video-assissted thoracoscopic surgery [VATS], Empyema thoracis, Decortication*

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Parapneumonic effusion(PPE) develops in up to 57% of patients hospitalized with bacterial pneumonia[1]. Most of these effusions are resolved with appropriate antibiotics therapy (termed uncomplicated PPE), but severe infection develops in some patients and requires drainage for full recovery (termed complicated PPE). Without effective drainage, complicated PPE progresses into frank intrapleural pus (termed empyema).

Progression of empyema occurs in 3 phases[2]. Stage I is an exudative phase characterized by a clear and sterile pleural effusion; stage II is a fibrinopurulent phase where the fluid becomes thick, infected and purulent and stage III is an organizing phase where granulation is formed and encased the lung

The percentage of PPE which becomes empyema is variable and ranges from 5-20%[3]. Different surgical treatment modalities are used to manage empyema. At present, VATS debridement and decortication are increasingly used as first-line treatment and considered as an effective procedure in both stage II and stage III empyema.

In our retrospective study, the authors aim to review our experience in VATS for treatment of empyema thoracis.

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Material and Method

Patient

A retrospective study involved 23 consecutive adult patients with a diagnosis of empyema who were treated from June 2009 to February 2011 at the department of cardiothoracic surgery, Thammasat university hospital, Thailand. The VATS procedure was utilized for treatment of empyema in all patients

irrespective of the stage of empyema or duration of symptoms. All patients had undergone chest radiographs and computed tomography to localize loculated effusion preoperatively; evidence of pleural adhesion was not a contraindication for VATS.

Procedure

General anesthesia with double lumen endotracheal intubation was employed in all cases with the patient in a full lateral decubitus position. All procedures were performed by single surgeon (BH). After digital exploration, the first thoracoscopic port was placed in the 7th intercostal space at mid-axillary line and 30° thoracoscope was introduced through the first port. In most of the cases adhesion was found after placing the thoracoscope via the first port. The lung was carefully dissected from the chest wall using index finger to create intrathoracic space and the remaining one or two ports were placed under direct vision.

VATS Debridement-mostly the authors performed this procedure by using 2 ports. The lung was fully mobilized using combine blunt and sharp dissection. The empyema cavity was carefully debrided. All of fibrinous exudates and purulent collection were evacuated and specimens were sent for biochemical examination as well as bacterial smear and culture. After irrigation of the pleural space with normal saline, the lung was inflated to be sure that there would be no residual space. If the lung properly re-expanded then it is stage II empyema and that is the end of procedure. If the lung is still covered with fibrous peel and fails to re-expand, then it is stage III empyema and decortication is necessary.

VATS Decortication-the authors usually inserted the 3rd port to facilitate the operation. The authors curettage the lung, chest wall and diaphragm. Then, decortication was carefully done by blunt dissection using peanut and suction.

After the operation was completed, the lung was inflated and air leakage was checked and corrected. Usually 2 intercostal drainage tubes No. 28 were placed at anterior and posterior positions. Patients were extubated at the end of the procedure if possible. At the postoperative period, all of the patients received NSAIDS for postoperative pain control, if there was no contraindication and intravenous morphine for breakthrough pain.

Statistical method

SPSS version 17 software package was used for statistical analysis. Difference between the groups were calculated using t-test and Fisher exact test.

Results

Between June 2009 and February 2011, 23 patients had VATS for treatment of Empyema at Thammasat Hospital. The demographic and clinical characteristics of the patients are recorded at baseline and shown in Table 1. All of the patients received diagnostic thoracocentesis. 17 patients received preoperative drainage (percutaneous catheter drainage

Table 1. Baseline characteristic of the patients

Characteristics	VATS patients
Demographic and clinical characteristic	
Age, yr.	
Mean	57
Range	35-90
Male/Female, No.	18/5
Duration of symptoms[mean], days	6.17
Presenting symptoms, No. (%)	
Chest pain	17 (74)
Dyspnea	13 (56)
Cough	17 (74)
Fever	20 (87)
Comorbidities, No. (%)	
Cirrhosis	9 (40)
DM	7 (30)
COPD	3 (15)
Smoking, No. (%)	
Active	8 (35)
Ex-smoker	4 (17)
Non-smoker	11 (48)
Pleural-fluid characteristics	
Visibly purulent, No. (%)	11 (48)
Positive Gram Stain for bacteria No. (%)	7 (30)
Mean sugar level (mg/dL)	36.6
Mean pH	7.68
Microbiologic characteristics	
Positive blood culture, No. (%)	1 (4.3)
Positive Pre-Op pleural fluid culture, No. (%)	4 (18)
Positive Intra-Op pleural fluid culture, No. (%)	4 (18)
Bacteria isolate from pleural fluid or blood, No. (%)	
Staphylococcus aureus	3 (13)
Streptocoocus spp.	3 (13)
Burkholderia pseudomallei	1 (4.3)
Etiology of infection, No. (%)	
Parapneumonic	22 (96)
Clotted hemothorax	1 (4)

or tube thoracostomy) and the mean duration of preoperative drainage was 7.6 (3-26) days. Mean duration between onset of symptoms to operation was 19.6 (6-36) days. All patients had pleural fluid studies with pleural fluid and blood culture. Pleural fluid characteristics and microbiologic characteristics are shown in Table 1.

At the operation, 8 (35%) patients had stage II empyema and underwent VATS debridement while 15 (65%) patients had stage III empyema and underwent VATS decortication. In the VATS debridement group, mean operative time was significantly shorter when compared to the VATS decortication group [90 vs. 141 min, p = 0.034] as well as mean estimated blood loss was significantly less when compared to VATS decortication group (175 vs. 533 ml, p = 0.009). There was no conversion, no morbidity and mortality in this group.

In the VATS decortication group, 2 (13%) patients needed to convert to open thoracotomy because of failure to complete decortication. There were 3 postoperative complications (13%): wound infection (n = 1), persistent space (n = 1) and recurrent infection (n = 1). Patient with persistent space underwent re-VATS decortication and percutaneous catheter drainage was successfully done for treatment of the patient with recurrent infection. There was no intraoperative death and 2 (13%) perioperative deaths which were mostly unrelated to surgery. One patient died at postoperative day 48 because of TEN (Toxic Epidermal Necrolysis) due to severe drug allergy. Another patient died at postoperative day 18 because of severe hepatic encephalopathy due to underlying child class C alcoholic cirrhosis.

There were no significantly differences between the two surgical groups in the postoperative course including ventilator use, ICU stay, resolve of fever, chest tube duration, air leakage and length of postoperative hospital stay. Table 2 summarizes operative results in both surgical groups. Both groups had mean postoperative pain scores less than 5 at the immediate postoperative period and most of the patients had pain score less than 3 at postoperative day 2 as summarized in Fig. 1.

Median follow-up duration in both groups was 5 (1-20) months. Of the 23 patients, 20 patients (87%) achieved satisfactory results with VATS treatment.

Discussion

Complicated parapneumonic effusion and

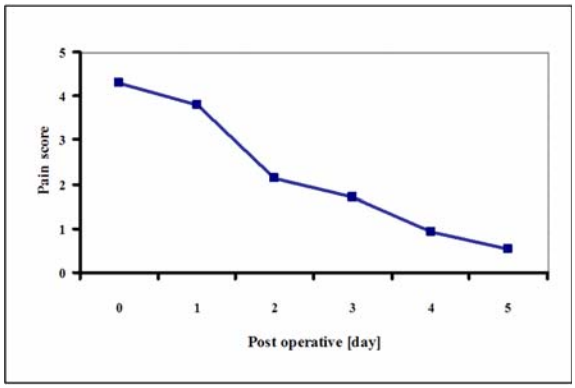

Fig. 1 Postoperative pain score in VATS patients

Table 2. Operative results in both surgical groups

	VATS Debridement	VATS Decortication	p
Number of patients, No. (%)	8 (35%)	15 (65%)	
Operative time, min.	90	141	0.034*
Estimated blood loss, ml.	175	533	0.009*
Conversion rate, No. (%)	0	2 (13)	0.415
Postoperative course			
Ventilator use, days	0.37	0.4	0.959
Postoperative ICU stay, days	0.87	0.95	0.796
Resolve of fever, days	2	1.13	0.238
Chest tube duration, days	5.71	6.53	0.575
Air leakage, days	0	0.73	0.050
Postoperative hospital stay, days	13.62	12.06	0.707
Complications, No. (%)	0	3 (20)	0.257
Perioperative mortality, No. (%)	0	2 (13)	0.415

empyema are conditions commonly managed by general thoracic surgeon. The underlying basic principles of early drainage and complete decortication to facilitate lung expansion have not changed over the decades. Although there are multiple treatment modalities, technologic advances in thoracoscopic surgery have allowed for surgeons to treat these conditions with lower perioperative morbidities and mortality.

In the early phase, VATS was used mainly for debridement of stage II empyema and has become more popular because of less invasive property and better results when compared to conventional treatment such as tube thoracostomy or fibrinolytic treament. The overall success rate, as defined by complete recovery without requiring thoracotomy is 60-100% for stage II empyema[4]. In present study 8 patients were in stage II empyema, based on operative finding. These patients were managed by VATS debridement with a 100% success rate, no conversion rate, no complication and no mortality. Mean operative time was 90 minute and estimated blood loss was 150 ml. Most of the patients were extubated after operation and required postoperative ICU care less than 1 day. The fever is usually resolved within 2 days after surgery. Mean duration of chest tube thoracostomy was 5.71 days.

In stage III empyema, VATS decortication is a feasible treatment when pleural debridement alone is insufficient. Surgical techniques are more difficult, need endoscopic skill and learning curve of the thoracic surgeon. Tong et al[5] had retrospective cohort study of 326 VATS decortication compared to 94 open decortication. VATS decortication had 11.4% conversion rate, significantly fewer postoperative complications and less hospital stay. In present study 15 patients were in stage III empyema. The success rate of VATS decortication was 87%. The rate of conversion to open surgery was 13% while the conversion rate in other recent studies ranged from 3.5-41%[6]. There were 3 postoperative complications and 2 perioperative mortalities which were mostly unrelated to surgery. Overall, the results of the present study compare favorably with other published studies. When one compare VATS decortication to VATS debridement, as the authors expected VATS decortication had significantly longer operative time and more estimated blood loss. But in the aspect of postoperative course including complication rates and mortality, VATS decortication had no significantly different results when compared to the debridement group.

In present study, mean duration of symptoms was 6.17 days and mean duration between onset of symptoms to operation was 19.6 days. This means that at the time of operation, a lot of patients will become stage III empyema (65%) and require more complex operations that increase risk of postoperative complications and mortality. There were some studies reported that early VATS for treatment of empyema as a primary modality instead of tube thoracostomy or fibrinolytic therapy had significantly less operative time, less complications and shorter length of hospital stay[7-9].

The present study is limited by its retrospective nature and small number of patients. A randomized controlled trial might be able to further elucidate the benefit of VATS, especially early primary VATS for treatment of empyema.

Conclusion

VATS debridement and decortication is a safe and effective treatment in the management of stage II and stage III empyema thoracis.

Potential conflicts of interest

None.

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ประสิทธิภาพการรักษาภาวะติดเชื้อในเยื่อหุ้มปอดด้วยวิธีการผ่าตัดส่องกล้อง

บุลวัชร์ หอมวิเศษ

วัตถุประสงค์*: ภาวะติดเชื้อในช่องเยื่อหุ้มปอดเป็นภาวะที่พบได้บ่อยในเวชปฏิบัติทั่วไปโดยที่มีอัตราการเสียชีวิตสูง ถ้าไม่ได้รับการดูแลที่ถูกต้อง การผ่าตัดเพื่อระบายหนองและตัดเนื้อเยื่อที่หุ้มรัดเนื้อปอดอยู่ด้วยวิธีการส่องกล้อง ถือเป็นการผ่าตัดแบบใหม่ที่ปัจจุบันมีความนิยมสูงขึ้น และสามรถเพิ่มทางเลือกในการักษาผู้ป่วยการศึกษานี้ มีวัตถุประสงค์เพื่อศึกษาประสิทธิภาพการรักษาภาวะติดเชื้อในเยื่อหุ้มปอดด้วยวิธีการผ่าตัดส่องกล้อง*

วัสดุและวิธีการ*: เป็นการศึกษาย้อนหลังติดตามและเก็บข้อมูลผู้ป่วยที่เข้ารับการรักษาภาวะติดเชื้อในช่อง เยื่อหุ้มปอด ในโรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติตั้งแต่ มิถุนายน พ.ศ. 2552 ถึง กุมภาพันธ์ พ.ศ. 2554*

ผลการศึกษา*: ผู้ป่วยทั้งหมดจำนวน 23 คน (ผู้หญิง 5, ผู้ชาย 18) มีอายุเฉลี่ย 57 (35-90) ปี ผู้ป่วย 17 คน (74%) ได้รับการระบายหนองก่อนทำการผ่าตัด โดยมีระยะเวลาของการระบายหนองเฉลี่ย 7.6 (3-26) วัน จากผู้ป่วยทั้งหมด พบว่า 8 คน (35%) ได้รับการวินิจฉัยเป็นภาวะติดเชื้อในช่องเยื่อหุ้มปอดระยะที่ 2 ซึ่งจะได้รับการผ่าตัดเพื่อระบายหนองด้วยวิธีการส่องกล้องและอีก 15 คน (65%) ได้รับการวินิจฉัยเป็นภาวะติดเชื้อในช่องเยื่อหุ้มปอดระยะที่ 3 ซึ่งจะได้รับการผ่าตัดเพื่อระบายหนองร่วมกับตัดเนื้อเยื่อที่หุ้มรัดเนื้อปอดด้วยวิธีการส่องกล้อง ผู้ป่วยอยู่โรงพยาบาลหลังผ่าตัดเป็นระยะเวลาเฉลี่ย 12.6 (7-48) วัน ใส่สายระบายหนองหลังผ่าตัดเป็นระยะเวลาเฉลี่ย 5 (3-30) วัน และผู้ป่วยได้รับการติดตามหลังผ่าตัดเป็นระยะเวลาเฉลี่ย 5 (1-20) เดือน พบผู้ป่วยภาวะติดเชื้อในช่องเยื่อหุ้มปอดระยะที่ 3 13% ที่จำเป็นต้องผ่าตัดเปิดช่องอกแบบปกติเนื่องจากไม่สามารถทำแบบส่องกล้องได้และอีก 13% ที่มีภาวะแทรกซ้อนภายหลังการผ่าตัด ในการศึกษานี้ไม่พบผู้ป่วยเสียชีวิตขณะผ่าตัดแต่พบผู้ป่วย 2 (8%) รายที่เสียชีวิตหลังผ่าตัดไม่เกิน 30 วัน โดยที่สาเหตุของการเสียชีวิตไม่ได้สัมพันธ์โดยตรงจากการผ่าตัด จากผู้ป่วยทั้งหมด 23 ราย การรักษาภาวะติดเชื้อในเยื่อหุ้มปอดด้วยวิธีการผ่าตัดส่องกล้องสามารถรักษาผู้ป่วยสำเร็จสูงถึง 20 (80%) ราย*

สรุป*: การรักษาภาวะติดเชื้อในเยื่อหุ้มปอดด้วยวิธีการผ่าตัดส่องกล้องเป็นวิธีการรักษาที่มีประสิทธิภาพและมีความปลอดภัยสูง*