

## Experiences of Video-assisted Thoracic Surgery in Trauma

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**Purpose:** Nowadays, Video-Assisted Thoracic Surgery (VATS) is widely used for its benefits, low post-operative pain, excellent anesthetic result and complete visualization of intrathoracic organs. Despite of these advantages, VATS has not yet been widely used in trauma patients. In this study, we aimed to investigate the usefulness of VATS in the chest trauma area.

**Methods:** From January 2016 to December 2016, 203 patients underwent surgical treatment for chest trauma. Their medical records were analyzed retrospectively.

**Results:** Eleven patients underwent thoracic surgery by VATS. Six patients were unstable vital sign in the emergency room. Two patients underwent emergency surgery and the rest patients underwent planned surgery. The common surgeries were VATS hematoma evacuation and wedge resection. There was no conversion to thoracotomy. The surgery proceeded without any problems for all patients.

**Conclusions:** VATS would be an effective diagnostic and therapeutic modality in chest trauma patients. It can be applied to retained hemothorax, persistent pneumothorax, suspicious diaphragm injury and even coagulation of bleeder.

**Keywords:** Thoracic injuries; Video-assisted thoracic surgery

## INTRODUCTION

The technique of thoracoscopy was first described by Jacobeus in 1910, who used a cystoscope to examine the pleural space [1]. Although thoracoscopy was initially performed for diagnostic purpose, it evolved later into a therapeutic procedure [2]. The

development of endoscopic instruments, particularly endoscopic staplers, enabled surgeons to perform major operations using minimally invasive techniques [2]. Nowadays, Video-Assisted Thoracic Surgery (VATS) is applied to simple lung wedge resection, pulmonary lobectomy, pulmonary segmentectomy and even atrial septal defect closure [3,4].

VATS provides low post-operative pain, excellent aesthetic result, complete visualization of intrathoracic organs including diaphragm, pericardium, mediastinum, and prevents extensive surgery and its complications [5-7]. Despite of these advantages, VATS has not yet been widely used in trauma patients [5]. We therefore aimed to investigate the usefulness of VATS in the trauma area.

## METHODS

From January 2016 to December 2016, 203 patients underwent surgical treatment for chest trauma at Pusan National University Hospital, Trauma Center. We exclude the surgical treatment through traditional thoracotomy. All the patients who underwent VATS from beginning were enrolled in this retrospective study. All medical records and operative notes of these patients were reviewed. Descriptive statistics were expressed as mean±standard deviation unless otherwise specified.

**Table 1.** Patients characteristics

Variables	Patients (N =11)
Age (year)	48.18±16.46
Sex (M:F)	6:5
Injury mechanism (blunt : penetration)	10:1
Associated injury	
Brain	2
Abdomen	1
Extremity	4
Injury severity score	19.55±10.63
Hemodynamic unstable at emergency room	6
Emergency video-assisted thoracic surgery	2
Operation time (min)	106.10±58.67

Values are presented as mean±deviation or number.

## Operative technique

The operation was performed under general anesthesia with a double lumen endotracheal intubation. The patients were positioned supine or lateral decubitus according to patient's condition. The video equipment was 5-mm 30-degree or 10-mm 30-degree scope (Karl Storz, Tuttlingen, Germany). The chest tube drainage site was always used to introduce the first thoraco-port. The number and the site of ports were determined by operative findings. When operating on a single port, the surgery was performed by extending the first thoraco-port incision by 3-4 cm, without rib spreading.

## RESULTS

Eleven patients underwent thoracic surgery by VATS. Table 1 summarizes the demographic data. The average age was 48.18±16.46. Ten patients were injured by blunt trauma and one patient was injured by penetrating trauma. Most of the associated injured areas were part of the extremities. The average Injury Severity Score (ISS) was 19.55±10.63. Six patients showed unstable vital signs in the emergency room. Two patients were put into emergency surgery and the others underwent planned surgery. In these two patients, surgical indication was continuous bleeding from chest drain but the vital sign of these patients were stable. The average operation time of VATS was 106.10±58.67 min.

The most common surgery was hematoma evacuation (Table 2). Most surgeries were performed through a three port (Table 3). There was no conversion into thoracotomy.

**Table 2.** Operative procedures of video-assisted thoracic surgery

Operative procedure	Emergency	Planned
Hematoma evacuation	0	3
Wedge resection	0	3
Decortication and adhesiolysis	0	2
Lung repair	1	0
Diaphragm repair	0	1
Bleeding control	1	0
Total	2	9

Values are presented as number.

**Table 3.** The numbers of the thoraco-port

Thoraco-port	Numbers
Single port	3
Two ports	3
Three ports	5
Total	11

my. The surgery proceeded without any problems for all patients and there were no complications and deaths.

## DISCUSSION

We successfully performed the VATS procedure for 11 patients who had chest trauma. And there was no conversion into conventional thoracotomy, nor was there morbidity or mortality. Two cases of VATS were performed on an emergency basis, and the rest were carried out in planned surgeries. In these two patients, surgical indication was continuous bleeding from chest drain but the vital sign of these patients were stable, and we could find bleeders in computed tomography (CT) scan. In hemodynamically stable patients, VATS provides accurate assessment of intra-thoracic organ injuries and can be utilized to manage them definitely and effectively [5]. Additionally, VATS for chest trauma would be applicable for bleeding that persists even after drainage of the thoracic cavity, when there were no findings in the diagnostic images that would indicate injury to the great vessels [5]. Penetrating chest trauma which met some criteria could be treated through emergency VATS [8]. However, the usefulness of emergency VATS has not yet been identified [5,6]. Usually the conditions like hemodynamic instability, profound shock, major hemorrhage and uncontrolled air-leakage requires thoracotomy for satisfactory outcome [9]. Thoracotomy seems to be more appropriate for unstable vital sign. However, if surgical technique or surgical instruments are improved, VATS can be applied to unstable vital sign.

VATS can provide complete visualization of intra-thoracic organs including diaphragm, pericardium and mediastinum [5-7]. Therefore, VATS was mainly used for evacuation of retained hemothorax, wedge resection of

lung, decortication of empyema and repair of diaphragm [5,6,10,11]. Our results were similar to the previous reports: operative procedures included evacuation of clotted hemothorax (3 cases), wedge resection (3 cases), adhesiolysis and decortication (2 cases), hemostasis of intrathoracic bleeders (1 case), repair of diaphragm (1 case) and suture repair of the lacerated lung (1 case). We planned most of the surgeries, if possible, by taking CT preoperatively. CT is generally considered as an initial diagnostic method to evaluate the injured organs.

We preferred to use single or two-port access, by extending the chest drainage site. Thoracotomy incision, by itself, may cause a prolonged recovery and severe morbidity even in patients with mild intrathoracic injury [6,11]. Minimally invasive surgery was considered to be beneficial in trauma patients, especially in multiple severe traumas. So, we performed the VATS through the chest drainage site for the minimally invasive surgery. VATS shortened duration of chest tube drainage and length of hospital stay, ultimately lowered costs in patients with retained traumatic hemothoraces [12]. Patients who underwent VATS had less pain, early recovery and superior rate of return to normal life than those who underwent conventional thoracotomy [6]. We attempted to perform VATS using a single port or two ports, which would be beneficial to trauma patients. We believe that the smaller invasiveness leads to the better outcome of the trauma patient.

## CONCLUSION

VATS would be an effective diagnostic and therapeutic modality in chest trauma patients. It can be applied to retained hemothorax, persistent pneumothorax and suspicious diaphragm injury. Even coagulation of bleeder by VATS may be possible to apply if reliable bleeder is found on CT scan with stable vital sign. However, a careful clinical assessment and a reliable diagnostic imaging are required before performing VATS on a chest trauma patient. And it is necessary to add further study by increasing the case of a VATS.

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