Role of video-assisted thoracic surgery in the evaluation and management of thoracic injuries

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Abstract

The aim of this study was to evaluate the experience of our institution with the use of video-assisted thoracic surgery (VATS) in chest trauma. Between January 1999 and September 2004, 25,213 patients presented with chest trauma to the emergency room, and 2304 were admitted to our service. Twenty-three hemodynamically stable patients (1%) underwent VATS. They were 19 men and 4 women with an average age of 42 years (range, 19–67 years). Indications included post-traumatic hemothorax in 11 patients, and post-traumatic empyema in 3, treated after 24 h of trauma. Indications for exploratory VATS in the acute phase included suspected diaphragmatic injury in 3 patients, persistent pneumothorax in 2, continued hemorrhage in 2 and removal of intrathoracic foreign body in 2. There was no mortality and complications occurred in 3 patients (13%). Management of hemodynamically stable thoracic injuries by using VATS provides diagnostic accuracy and therapeutic efficacy. It can be successfully applied in the trauma setting and surgeons should gain experience with its use.

Keywords: VATS; Chest trauma; Thoracic

1. Introduction

Thoracic trauma accounts for 25% of trauma associated deaths and contributes significantly in another 25% of deaths related to trauma. The majority of patients with thoracic injuries are initially treated with tube thoracotomy and observation. Approximately 10–20% of patients who sustain chest trauma will eventually need thoracotomy [1,2]. Thoracoscopy as a method of exploration in penetrating thoracic injuries was originally reported by Branco in 1946. In the early 1990s, with the evolution of minimally invasive surgery and video technology, VATS was introduced in the trauma setting, in a series evaluating diaphragmatic injuries [3].

The aim of this study was to review the experience obtained at our institution with the use of VATS in the evaluation and management of thoracic injuries.

2. Materials and methods

The study was conducted at the ‘KAT’ General Hospital of Attica, which is the busiest Level I trauma center of our country. Between January 1999 and September 2004, 25,213 patients with chest trauma were presented in the Emergency Department (ED) and 2304 of them were admitted to our service. Twenty-three hemodynamically stable patients (1%) underwent VATS for diagnosis or treatment of thoracic injuries. We analyzed their medical records regarding age, sex, clinical presentation, mechanism of injury, injury severity score (ISS), indications for VATS procedures, morbidity, mortality and length of hospital stay.

All patients were assessed and stabilized by the trauma team of our hospital upon arrival in the ED. Apart from the baseline chest X-ray all 23 patients underwent a CT chest scan in order to rule out cardiovascular injury. They also underwent tube thoracostomy depending on the clinical or radiologic evidence of pneumothorax or hemothorax. Referrals were made to other specialties for assessment and management of extra-thoracic injuries and further radiologic or laboratory studies were carried out accordingly.

Following a complete clinical and laboratory assessment in the ED, patients were considered for VATS if they were hemodynamically stable, there was an indication for exploration and no contraindication to VATS for trauma [2,4]. With regard to indications for VATS within 24 h of trauma we excluded patients requiring laparotomy or other surgical procedure for extra-thoracic injuries, because they were considered unstable.

3. Results

During the study period 112 patients underwent emergency thoracotomy for blunt or penetrating thoracic trauma with VATS employed in 19 men and 4 women with an average age of 42 years (range, 19–67 years).

We sorted out two groups of patients: group I consisted of 9 patients treated within 24 h of trauma; group II

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comprised 14 patients treated 5 to 21 days following their injury.

All 9 patients were males in group I; in 6 patients penetrating trauma (PT) resulted from stab wounds while in one it resulted from a shot-gun. Three patients sustained blunt trauma (BT) following a traffic accident. Indications for exploratory VATS included not major but continued haemorrhage (<200 ml/h), lasting more than 3 h (with initial chest tube output <500 ml), in 2 hemodynamically stable patients, persistent air leak and pneumothorax following a stab wound in the ‘Box’ area in 2, after an observation period of 24 h (intra-operative bronchoscopy had ruled out tracheobronchial injury), suspected diaphragmatic injury (DI) in 3, and removal of intra-thoracic foreign body in 2. Procedures included evacuation of hemothorax in all patients, coagulation of bleeding intercostal vessels in 3, stapled lung resection in 4, removal of foreign bodies (lead shot and rib fragment) in 2, and suture repair of a small diaphragmatic laceration (2 cm) in one. Inspection for diaphragmatic laceration was negative in 1 patient. The procedure was converted to open thoracotomy in one patient with BT who sustained a large rupture (6 cm) of the right hemi-diaphragm. He also sustained brain and liver contusion but he had a negative for intra-peritoneal bleeding diagnostic peritoneal lavage (DPL). All patients in group I had a negative for cardiovascular injury spiral CT scan of the chest and either a negative CT scan of the abdomen or a negative, for intra-peritoneal bleeding, DPL. Only the patient with the removed bone fragment developed a postoperative complication (pneumonia) that was treated conservatively.

Group II comprised 11 patients who presented with a posttraumatic hemothorax and 3 with a posttraumatic empyema that were treated with VATS after 24 h of trauma. Nine of these patients sustained BT while 5 suffered PT. Extra-thoracic injuries were observed in 6 out of these 9 patients with BT and included brain contusion in 3, liver contusion in 2, long bone fractures in 2, and spleen rupture (requiring splenectomy) in 2. Posttraumatic hemothorax or empyema was diagnosed within 5 to 21 days (average 11 days), following the initial injury. All patients had undergone tube thoracotomy, and they became symptomatic following its removal. The decision to proceed with VATS exploration was based on the time elapsed (suspected fibropurulent stage), and the clinical or radiologic findings (loculations). Debridement and delocalization of the clotted hemothorax or the empyema using VATS was rewarding in 9 patients with clotted hemothorax and in 2 with posttraumatic empyema. Decortication of the lung via thoracotomy was necessary in 2 patients with hemothorax and in one with empyema, because of a thick peel preventing lung re-expansion. It is worthy to mention that they were diagnosed 15, 18, and 21 days after their injury. Complications occurred in 2 patients and included pneumonia and postoperative bleeding, both treated conservatively with success.

Looking at both groups together, mean ISS in patients with PT was 13 (range, 9–25) as compared with 32 (range, 16–50) for patients with BT. There was no procedure related or hospital mortality and the morbidity was 13% (complications were observed in 3 out of the 23 patients). VATS procedures were converted to open thoracotomies in 4 out of the 23 patients (17%). The average postoperative hospital stay was 7.6 days (range, 4–15 days).

4. Discussion

Although the use of VATS in the management of most of the thoracic diseases has gained wide acceptance, its role in the setting of thoracic trauma is not well established.

As regards the efficiency of VATS in the management of thoracic trauma, Manlulu et al. managed to treat 19 patients with sustained chest injuries by using VATS exclusively, and without the need to convert to an open procedure [3]. In our series, 17% of the patients necessitated thoracotomy (one for repair of a diaphragmatic rupture and three for decortication). As Lang-Lazdunski et al. recommended, only surgeons with extensive experience in VATS should use it in trauma, and great prudence is required in some cases (for example when removing a clot), because the need for immediate conversion to thoracotomy might emerge. They had a 24% conversion rate [4].

In hemodynamically stable patients with traumatic hemothorax and continued bleeding, having excluded cardiovascular injury, the commonest causes of bleeding are the intercostal vessels or lung lacerations which are both amenable to videothoracoscopic control via diathermy, clips or staplers [3–5]. In our series, two stable patients with BT and PT, one each, presented with ongoing but not significant bleeding, had a successful evacuation of their hemothoraces with coagulation of their bleeders, and were spared thoracotomy. The use of VATS proved safe and efficient in the evaluation of two other patients with PT in the ‘Box’ area, which is defined between the midclavicular lines (medially of the nipples), in front, and between the scapulae on the back. Mediastinal injuries were ruled out and a successful stapling of small but deep pulmonary lacerations was performed avoiding thoracotomy. Many authors have found VATS useful in the management of air leaks and traumatic pneumothoraces, accelerating patients’ recovery (particularly those intubated), reducing hospital stay and morbidity, and restricting the number of thoracotomies [3–5].

In regards to DI, which is observed in 1–7% of the cases after BT and in 10–15% after PT, the diagnosis is missed in 12–66% of these injuries using the common diagnostic modalities (chest X-ray, CT chest and DPL), and there is even a 30% rate of false negative for DI laparotomies in cases of penetrating thoracoabdominal trauma [4,6,7]. In the largest published series of patients undergoing VATS to exclude a DI after PT, Freeman et al. concluded that VATS is a safe technique that can rapidly assess the diaphragm [8]. We also found VATS advantageous in identifying or excluding DI in 3 patients and in repairing a small DI in one of them.

The application of VATS was also effective and versatile in the removal of intrathoracic foreign bodies in two patients with BT (rib fragment), and PT (lead shot), one each, that otherwise would have needed thoracotomy. Similarly, other investigators agree that VATS should not be an argument to remove intrathoracic foreign bodies even in asymptomatic patients, after chest trauma [3,4].
The traditional initial treatment for patients with post-traumatic hemothoraces or empyemas is chest tube drainage. Placement of tube thoracostomy in trauma patients is reported to be associated with a 36% overall complication rate, including empyema in 3%, retained hemothorax in 18% and recurrent pneumothorax in 24% [9]. The use of intra-pleural fibrinolysis in the resolution of clotted hemothoraces is reported to be associated with an overall success rate of 92% and it is recommended by some authors as an alternative to surgery [10]. We have no such experience in our hospital. In a controlled randomized trial, Meyer et al. compared patients who sustained traumatic hemothoraces treated only with additional tube thoracostomy with patients treated with early VATS. They demonstrated that intent to treat early with VATS decreased duration of chest tube drainage, length of hospitalization and hospital costs [11]. We managed to treat successfully 9 patients with clotted hemothorax and 2 with empyema. We believe that time elapsed from trauma is important and we have a low threshold for converting to thoracotomy when the lung is entrapped during VATS.

In conclusion, VATS for specific indications in chest trauma is associated with improved outcomes, decreased morbidity and mortality, and shortened hospital stay. It can be successfully applied in the acute and chronic phase of hemodynamically stable thoracic injuries. It provides diagnostic and therapeutic benefits and thoracic surgeons should be encouraged to incorporate it into their armamentarium and gain experience with its use.

References