This study was carried out at the Department of Thoracic Surgery, JPMC, Karachi to define the role of VATS in managing retained post-traumatic hemothorax in terms of timing of intervention and patient safety. Early management of retained hemothorax by VATS to avoid empyema and fibrothorax was recommended in a previous study.

The study inclusion criteria were a chest X-ray showing a post-traumatic retained hemothorax or a hemothorax 72 hours after placement of a chest tube. Hemodynamically unstable patients with multiple organ injuries or those with a poor pulmonary reserve shown by a low PO2 and oxygen saturation (SaO2) were excluded from the study. History of having undergone a tube thoracostomy and/or thoracotomy on the same side was regarded as a contraindication for VATS. Patients who had associated major bronchial, esophageal and/or vascular injuries as evidenced by continuous massive air leak, mediastinal air, or ongoing blood loss were excluded from the study and were appropriately managed.

There were 91 males and 19 females. The ages ranged between 16 and 53 years. Thoracic injuries included blunt chest injuries in 78 patients (70.9%) [road traffic accidents = 56 cases; fall from height = 15 cases; direct blunt trauma = 7 cases] and penetrating injuries in 32 patients (29.1%) [gunshot = 19; stabs = 13]. Flail chest was seen in 9 patients, while 65 patients had associated rib fractures. Right sided injuries were seen in 75 patients (68%) while left sided trauma was seen in 35 patients (32%).

A residual clot having a volume of 500 ml or more and/or occupying one-third or more of the hemothorax was defined as a retained hemothorax. VATS was carried out under general anaesthesia with a double lumen endotracheal tube. Size 36 Fr chest tubes were connected to under water seal without negative pressure and were kept patent. Daily measurement of the drainage and colour of effluent was recorded. Chest tubes were removed when there was appreciable lung expansion with minimal (<50 ml) light coloured effluent in 24 hours without air leaks.

Ultrasound evaluation of the chest showed residual clots in the pleural cavity, volumes ranging between 450 – 1120 ml (average = 590 ml). When compared with post VATS clot volume, it was found that ultrasound underestimated the clot volume by approximately 15%.

VATS was performed within the first week of injury in the majority of patients (75/110) and in the rest of the patients it was undertaken during the second week of injury (8 – 14 days). Conversion thoracotomy for decortication was deemed necessary in 8 patients (7.3%) out of the 110 patients. VATS assisted evacuation of clots achieved complete lung expansion in 87 out of 102 patients (85.3%) and it was possible to remove chest tubes early in these patients. It was also seen that there was absence of fluid re-accumulation in these patients.
As seen in Table I, the results of VATS were much better (cumulative complete success rate within 6 days = 96.9% and between 7 – 14 days = 64.9%) when the procedure was performed within the first 6 days of injury (p < 0.001). It was partially successful in 15 patients (14.7%). These patients required multiple ultrasound guided aspirations before acceptable lung expansion was achieved.

VATS operative time ranged between 65 and 104 minutes (average = 73.6 minutes). Chest drains were removed within first week in 100 patients (90.9%) while in 10 patients (9.1%) tubes were removed in the second week. Post VATS duration of hospital stay was 2 weeks in 71 patients (64.5%), 3 weeks in 30 patients (27.3%) and 4 weeks in 9 patients (8.2%). Hospital length of stay (LOS) was significantly lower for patients receiving VATS ≤ 6 days after injury (14 ± 6), as compared to the patients who were converted to thoracotomy (19 ± 8, p < 0.001). Mechanism of injury whether blunt or penetrating had no direct relationship with a successful VATS outcome and in all 8 patients requiring conversion thoracotomy, time interval between injury and VATS (7 or more days) was a significant factor in deciding the final outcome of VATS. Prolonged air leak seen in 2 patients encountered in this series. After discharge from hospital, patients were followed-up in the Outpatient Department. Mean follow-up period was 13 ± 4 months.

During the last two decades, increasing experience with VATS has provided the surgeon with an attractive alternative for accurately assessing and evacuating the retained clots within the pleural cavity and so avoiding the future complications of empyema thoracis. It is well recognized that in up to 20% of patients tube thoracostomy fails to completely evacuate the hemothorax. Thoracoscopic evacuation of retained post-traumatic hemothorax by VATS. The results of evacuating a retained post-traumatic hemothorax by VATS are much better than using a second chest tube or thoracotomy. Clot evacuation was performed within the first 6 days of injury (14 ± 6), as compared to the patients who were converted to thoracotomy (19 ± 8, p < 0.001). Mechanism of injury whether blunt or penetrating had no direct relationship with a successful VATS outcome and in all 8 patients requiring conversion thoracotomy, time interval between injury and VATS (7 or more days) was a significant factor in deciding the final outcome of VATS. Prolonged air leak seen in 2 patients encountered in this series. After discharge from hospital, patients were followed-up in the Outpatient Department. Mean follow-up period was 13 ± 4 months.

Villavicencio and colleagues analyzed 8 studies where use of thoracoscopy was made in managing 99 patients with retained hemothoraces. Clot evacuation was successful in 89 of 99 patients (90%). In this study, very similar results were obtained with 87 patients (85.3%) out of 102 patients and 15 patients (14.7%) having complete and partial lung expansion with resolution of the hemothorax, respectively. Uribe has also achieved similar results (73.4% success rate) in treating retained post-traumatic hemothorax by VATS. Outcome of VATS in retained hemothorax is directly dependant on the timing of intervention. In the review by Villavicencio, the injury- VATS interval varied greatly among various studies (4.3 – 10.8 days). They concluded that VATS was ideally performed with best results within 3 days of injury. In the present series, injury - VATS interval ranged between 4 days and 14 days with better results if VATS was performed within the first 6 days of injury (Table I). A successful VATS thus obviates the need for open thoracotomy and decortication reducing the overall morbidity and postoperative hospital stay. It was observed that the duration of post VATS stay had a direct relationship with the day on which VATS was performed after trauma as shown by the trend line in Figure 1 (p < 0.018).

There are various reasons for technical failure during VATS evacuation of the retained clots namely incomplete lung collapse, dense adhesions with the chest wall and organized clots. Failure is more common if VATS is performed more than 6 days after the injury as loculation of the retained contents is more advanced, achieving lung collapse is more difficult due to advanced dense adhesions and there is an increased risk of thoracic empyema occurrence.

Conversion to thoracotomy was necessary in 8 patients (7.7%) in the present study. The causes of conversion in
most patients were presence of dense adhesions (4 patients) and a thick cortex over the entrapped lung (4 patients).

Early postoperative complications were seen in only 2 patients (1.8%). Both these patients had long-term emphysematous lungs and conservative management with bronchodilation, hydration and prolonged intubation with tube thoracostomy resolved the air leak. Post VATS empyema (non-tuberculous) was seen in 3 patients (2.72%). They underwent definitive treatment with decortication. Follow-up of VATS patients is available for a majority of patients (69/110). There were no significant recurrent pleural collections requiring operative intervention. Only 6 patients had small (< 100 mls) post-VATS collections which were aspirated under ultrasound guidance. Most patients (upto 90%) of VATS were pain free one year after VATS. It seems that this reduction in pain after VATS is due to the fact that no forceful chest wall retraction is needed to perform VATS.

REFERENCES