

# Urgent awake thoracoscopic treatment of retained haemothorax associated with respiratory failure

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**Abstract:** A number of video-assisted thoracoscopic surgery (VATS) procedures are being increasingly performed by awake anesthesia in an attempt of minimizing the surgical- and anesthesia-related traumas. However, so far the usefulness of awake VATS for urgent management of retained haemothorax has been scarcely investigated. Herein we present two patients with retained haemothorax following previous thoracentesis and blunt chest trauma, respectively, who developed acute respiratory failure and underwent successful urgent awake VATS management under local anesthesia through a single trocar access.

**Keywords:** Haemothorax; awake video-assisted thoracoscopic surgery (VATS); nonintubated VATS; respiratory failure; complication; urgent setting

Submitted Apr 07, 2015. Accepted for publication Apr 16, 2015.

doi: 10.3978/j.issn.2305-5839.2015.04.13

View this article at: <http://dx.doi.org/10.3978/j.issn.2305-5839.2015.04.13>

## Authors' introduction:

*Figure 1* is a picture including the authors of the article with other representatives of the ATSRG, a multidisciplinary team aimed at accomplishment and promotion of pioneering and comprehensive clinical investigations focused on awake and nonintubated thoracic surgery.

## Introduction

Adoption of video-assisted thoracoscopic surgery (VATS) for management of chest trauma and haemothorax is increasing (1) since it can obviate complications associated with thoracotomy and can be employed both for diagnostic or therapeutic purposes in patients with haemodynamic stability (2).

Recently, a number of VATS procedures are being increasingly performed by nonintubated or awake anesthesia in an attempt of minimizing at a further extent the overall surgical- and anesthesia-related traumas. However, so far the usefulness of awake VATS for urgent management of retained haemothorax has been scarcely investigated (3).

Having gained experience with elective awake VATS

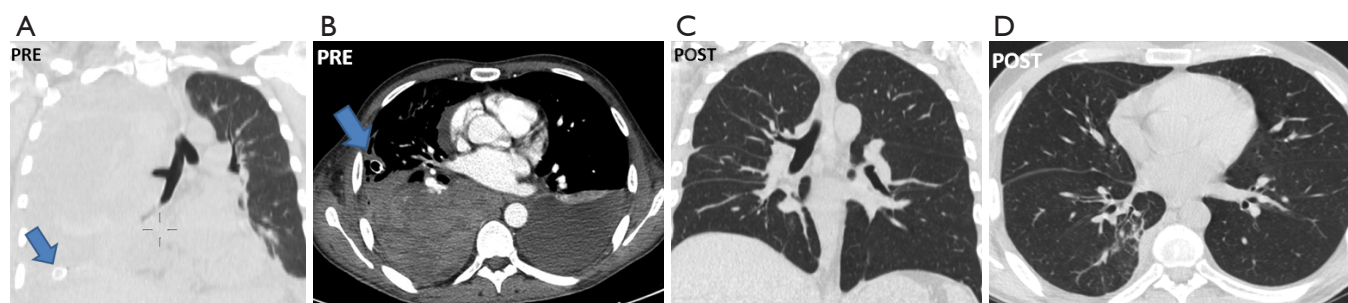
procedures performed in patients with poor respiratory function due to emphysema (4), interstitial lung disease (5) or pleural effusion (6), we have recently expanded its use to selected patients with retained haemothorax in whom simple chest drainage proved an unsuccessful treatment option leading to the development of acute respiratory failure.

## Case 1

A 33-year-old Caucasian male admitted due to acute abdominal pain with peritonitic signs underwent urgent laparotomy and duodenorrhaphy due to duodenal perforation of unknown origin. The postoperative course was complicated by complex abdominal infection requiring reopening of the skin incision and vacuum-assisted-closure (VAC) treatment; and bilateral pleural effusion. By a right-sided thoracentesis 500 cc of serous fluid were drained. Twelve hours later the patient complained of deteriorating dyspnea and anemia (Hb: 8.0 g/dL). A new chest X-ray showed the presence of massive pleural effusion on the right pleural cavity, which was treated by insertion of a chest tube



**Figure 1** Core representatives of the ATSRG. From the left: Drs Benedetto Cristino, Augusto Orlandi, Eugenio Pompeo, Umberto Tarantino, Tiziana Frittelli (General Director of the Policlinico Tor Vergata), Leonardo Palombi, Paola Rogliani, Roberto Massa, Mario Dauri.



**Figure 2** Computed tomography (CT) findings of patient #1. (A) Coronal image showing tension haemothorax causing left-sided mediastinal shifting despite previous insertion of a chest tube (arrow); (B) axial image of the same patient showing right-sided inhomogeneous liquid-solid opacity suggesting clotted haemothorax associated with left-sided pleural effusion and resulting in bilateral lung atelectasis; (C,D) CT of the chest performed 30 days after awake thoracoscopic debridement show complete lung re-expansion with no residual cloths in the pleural cavity.

resulting in evacuation of about 700 cc of blood.

Following an initial mild improvement the patient conditions deteriorated again within 24 h eventually resulting in respiratory failure with room air PaO<sub>2</sub> of 38 mmHg. Repeated blood transfusions maintained Hb concentration to 8.8 g/dL. A chest computed tomography (CT) showed bilateral pleural effusion with a non-homogeneous pattern of density suggesting the presence abundant blood cloths in the right pleural cavity (*Figure 2A,B*). Due to rapidly deteriorating respiratory conditions and the concomitant sepsis, we decided to perform an urgent thoracoscopic exploration of the

pleural cavity under sole local anesthesia. The patient was rapidly transferred from the radiology department to the operating room and was placed in a 30° semi-sitting position. Following injection of lidocaine 2% and bupivacaine 0.5% without sedation, a 5-mm 30°-angled camera was inserted through a single 3-cm long skin incision performed by slightly extending the pre-existent chest tube incision. A total of 1,500 mL of blood and cloths were progressively evacuated with the aid of repeated pleural irrigation. During the procedure the patient did not complain chest pain and was able to talk with the surgeons and breathe comfortably with

Table 1 Operative data		
Parameters	Case 1	Case 2
PaO <sub>2</sub> /FiO <sub>2</sub>		
Pre	160	280
Intra	200	280
Post	360	380
PaCO <sub>2</sub> (mmHg)		
Pre	34	40
Intra	37	42
Post	40	44
SAP/DAP (mmHg)		
Pre	90/60	100/65
Intra	100/80	130/85
Post	110/70	120/80
HR (b/min)		
Pre	120	100
Intra	105	90
Post	84	80
Dyspnea (Borg score*)		
Pre	10	7
Intra	5	3
Post	2	0

\*, Modified Borg dyspnea score. Pre, 5 min before surgery; Intra, during surgical pneumothorax; Post, 60 min post-surgery; SAP, systolic arterial pressure; DAP, diastolic arterial pressure; HR, heart rate.

an oxygen mask. No bleeding site could be identified intraoperatively. At the completion of the procedure which lasted 35 min, one chest tube was inserted in both pleural cavities and the right lung was re-expanded under camera vision, by keeping airtight the chest incision while inviting the patient to breathe more deeply and cough. The postoperative course was uneventful and during the follow-up, a chest CT scan performed at 1 month showed unremarkable findings (*Figure 2C,D*).

## Case 2

A 22-year-old patient was admitted at the emergency department following motor-cycle accident. He was conscious and tachypnoic at rest despite additional O<sub>2</sub> delivery via a Venturi mask (FiO<sub>2</sub>: 50%). A chest CT scan showed multiple rib fractures and massive pleural effusion on the right haemothorax.

A chest drain was immediately inserted resulting in drainage of 600 mL of blood. Blood gases analysis demonstrated hypoxia (PaO<sub>2</sub>: 50 mmHg) and normocapnia. Twenty-four hours later the patient's clinical conditions did not improve meaningfully and a new CT scan suggested the presence of blood clots occupying 2/3 of the right pleural cavity. Room air blood gases showed a PaO<sub>2</sub> of 45 mmHg and a PaCO<sub>2</sub> of 40 mmHg and the patient complained of dyspnea at rest. It was decided to transfer him in the operating theatre and an awake VATS exploration was carried out. The clotted haemothorax was completely evacuated and once revised accurately the hemostasis no active bleeding site could be identified. After surgery the patient oxygenation improved immediately (*Table 1*) and he could be transferred to the ward. The postoperative course was uneventful and the patient was discharged 5 days after the operation.

## Discussion

Haemothorax refers to a blood collection within the pleural cavity. The primary cause is sharp or blunt trauma to the chest whereas iatrogenic haemothorax due to thoracentesis occur rarely with a risk between 0.6% and 1% even in critically ill patients (7,8).

Awake VATS has been advocated as an optimal strategy to perform a number of thoracic surgery procedures. Optimal indications are still widely debated but patients with impaired respiratory function and associated co-morbidity are deemed amongst the ideal candidates (9).

To our knowledge this is the first report entailing urgent awake VATS management of clotted haemothorax. So far, Katlic and Facktor (3) only, reported on VATS performed in spontaneously ventilating patients with haemothorax although in this series unconscious sedation and standard 3-ports approach were employed. Moreover, in the Katlic's series it is not mentioned whether these procedures were performed in an elective or urgent setting.

In our first patient, an iatrogenic haemothorax developing following a thoracentesis did not resolve by simple chest drainage probably due to progressive wedging of clots into the tube fenestrations that obstructed the tube and led to progressive tension haemothorax causing acute respiratory failure.

Overall, the short interval time between the onset of respiratory failure and surgical treatment in our two patients has been facilitated by the avoidance of general anesthesia with tracheal intubation underlining the usefulness of

creation of fast track pathways that may accelerate lifesaving awake VATS procedures in selected instances.

In addition, we considered the awake anesthesia management as an optimal choice to avoid the need of intensive care unit (ICU) stay and risks of mechanical ventilation that may add meaningfully to the overall surgical risk, particularly in patients with multiple co-morbidity including respiratory failure and concomitant sepsis.

Alternative non-surgical treatment options include intrapleural instillation of urokinase, which has shown to resolve retained haemothorax in up to 92% of patients (10) but was deemed unsuitable to be employed in our two patients since urokinase treatment requires some days to be successful and we needed urgent treatment including exploration of the pleural cavity in search of an active bleeding.

Finally, use of single trocar VATS is currently under active scrutiny as an additional strategy aimed at further minimizing the overall invasiveness of awake VATS (11) and proved optimally suited for treatment of retained haemothorax under local anesthesia as shown by the complete lung re-expansion with no residual cloths observed in our patients 1 month after surgery. Single trocar access permitted us to use the pre-existing incision employed to insert the chest tube thus contributing to reduce potential postoperative chest pain triggering points.

In conclusion, awake VATS was quickly, safely and successfully accomplished according to a fast track path in two patients with retained haemothorax complicated by acute respiratory failure. Further detailed investigation is warranted to support our preliminary findings.

## Acknowledgements

We thank Miss Aurora Pompeo for accomplishment of the ATSRG picture.

*Disclosure:* The authors declare no conflict of interest.

## References

1. Boersma WG, Stigt JA, Smit HJ. Treatment of haemothorax. *Respir Med* 2010;104:1583-7.
2. Casós SR, Richardson JD. Role of thoracoscopy in acute management of chest injury. *Curr Opin Crit Care* 2006;12:584-9.
3. Katlic MR, Facktor MA. Video-assisted thoracic surgery utilizing local anesthesia and sedation: 384 consecutive cases. *Ann Thorac Surg* 2010;90:240-5.
4. Pompeo E, Rogliani P, Tacconi F, et al. Randomized comparison of awake nonresectional versus nonawake resectional lung volume reduction surgery. *J Thorac Cardiovasc Surg* 2012;143:47-54.
5. Pompeo E, Rogliani P, Cristino B, et al. Awake thoracoscopic biopsy of interstitial lung disease. *Ann Thorac Surg* 2013;95:445-52.
6. Pompeo E, Dauri M; Awake Thoracic Surgery Research Group. Is there any benefit in using awake anesthesia with thoracic epidural in thoracoscopic talc pleurodesis? *J Thorac Cardiovasc Surg* 2013;146:495-7.
7. Chen CY, Hsu CL, Chang CH, et al. Hemothorax in a medical intensive care unit: incidence, comorbidity and prognostic factors. *J Formos Med Assoc* 2010;109:574-81.
8. Yacovone ML, Kartan R, Bautista M. Intercostal artery laceration following thoracentesis. *Respir Care* 2010;55:1495-8.
9. Pompeo E, Sorge R, Akopov A, et al. Non-intubated thoracic surgery-A survey from the European Society of Thoracic Surgeons. *Ann Transl Med* 2015;3:37.
10. Kimbrell BJ, Yamzon J, Petrone P, et al. Intrapleural thrombolysis for the management of undrained traumatic hemothorax: a prospective observational study. *J Trauma* 2007;62:1175-8; discussion 1178-9.
11. Hung MH, Cheng YJ, Chan KC, et al. Nonintubated uniportal thoracoscopic surgery for peripheral lung nodules. *Ann Thorac Surg* 2014;98:1998-2003.

**Cite this article as:** Pompeo E, Cristino B, Rogliani P, Dauri M; for the Awake Thoracic Surgery Research Group (ATSRG). Urgent awake thoracoscopic treatment of retained haemothorax associated with respiratory failure. *Ann Transl Med* 2015;3(8):112. doi: 10.3978/j.issn.2305-5839.2015.04.13