



Non-intubated awake uniportal VATS: how to start?

Fabrizio Minervini¹, Luca Bertolaccini², Davide Patrini³, Benedetta Bedetti⁴, Lidia Libretti⁵, Marco Scarci⁵

¹Department of Thoracic Surgery, McMaster University, Hamilton, Ontario, Canada; ²Department of Thoracic Surgery, Maggiore Hospital, Bologna, Italy; ³Department of Thoracic Surgery, University College London Hospitals, London, UK; ⁴Department of Thoracic Surgery, Malteser Hospital, Bonn, Germany; ⁵Department of Thoracic Surgery, San Gerardo Hospital, Monza, Italy

Correspondence to: Marco Scarci. Department of Thoracic Surgery, San Gerardo Hospital, Monza, Italy. Email: marco.scarci@mac.com.

Received: 05 June 2018; Accepted: 21 June 2018; Published: 05 July 2018.

doi: 10.21037/vats.2018.06.03

View this article at: <http://dx.doi.org/10.21037/vats.2018.06.03>

Introduction

The history of thoracoscopic surgery started more than 100 years ago when Hans Christian Jacobaeus, a Swedish internist, performed and described in 1910 a procedure to treat pleural adhesions and tuberculosis. After the 1950s with the success of the medical treatment against tuberculosis, the “Jacobaeus operation” was gradually abandoned until the 1970s when some pulmonologists became the reference persons for the thoracoscopy, especially in Continental Europe.

Over the last decade there has been an incredible evolution in thoracic surgery with the introduction and development of minimally invasive techniques, like multiportal and uniportal video assisted thoracic surgery (VATS).

General anesthesia with double lumen endotracheal tube and single lung ventilation has been always considered the gold standard required to allow the surgeon to perform a safe and feasible surgery.

Nevertheless, along with the progress of the thoracic surgery, new anaesthesia techniques have been developed to achieve enhanced recovery pathways after surgical procedures.

In recent years, there has been a growing interest among thoracic surgeons and anesthesiologists in non-intubated awake procedures performed on lightly sedated patients under spontaneous ventilation.

The non-intubated uniportal VATS could potentially combine the benefits of the minimal invasive surgery, such as less pain or paresthesia, with the reduced adverse effects of intubation and ventilation related injuries.

General anesthesia together with use of muscle relaxants are also associated with systemic side effects that do not occur in awake or minimally sedated patients receiving a regional anesthesia.

Interestingly, this recently developed technique is a “Back...to the past” following the footsteps of Jacobaeus who performed thoracoscopy in spontaneously breathing patients using a local anesthetic.

The kickoff

To start a new non-intubated awake uniportal VATS program without incurring in high mortality and morbidity rates it is advisable initially to perform simple procedures, like pleural biopsy or abrasion, resection of bullae or pulmonary biopsy for interstitial lung disease, prior to perform lobectomies or more complex oncological resections.

The decision to perform a non-intubated uniportal awake VATS major resection is based on the previous team's experience and should only be taken if the team is very proficient in intubated VATS anatomical resections and minor non-intubated procedures (1).

The patients' safety must be always kept in mind as a priority according to the Hippocratic “primum non nocere”.

The cornerstone of a non-intubated uniportal VATS is, therefore, the experience of the surgical and anesthesiological team.

The communication between the whole team in the operating room along with a careful patient selection are

the key points in order to provide a safe surgery with this new technique.

Three different types of contraindications for awake or non-intubated uniVATS have been identified, specifically, patient related (e.g., obesity, neurological conditions, uncontrolled gastroesophageal reflux, central hypoventilation syndrome, persistent cough or mucus retention, haemodynamic instability or severely hypoxia/hypercapnia), anesthesiologist-related (e.g., difficult intubation, technical contraindications to general anaesthesia, need to protect the contralateral lung from endobronchial contents and inexperienced team) and surgeon-related (e.g., experience in uniportal VATS surgery, previous surgery or radiations with the risk of possible adhesions) (2).

The thoracic surgeon should be skilled in uniportal VATS and the anesthesiologist well experienced and comfortable with the insertion of double lumen endotracheal tube in a lateral position just in case a conversion to general anesthesia and lung isolation should be suddenly required. Induction and emergency drugs must be available along with the intubation equipment including a bronchoscope, a single and double lumen tube.

The development of a non-intubated uniportal VATS program requires the establishment of a comprehensive protocol that include inclusion/exclusion criteria, a consent form, the anesthetic procedure and the criteria for conversion to general anesthesia (3).

A dedicated consent form should be developed and the patient should be informed about the pros and cons of this awake procedure because his cooperation during the surgery is crucial. During the surgical procedure both the surgeon and the anesthesiologist usually reassure the patient updating him/her about the progress of the procedure. Low-volume classic music could be diffused in the operating room: perception of a calm environment may have a very high impact on patients' acceptance of the non-intubated procedure (4).

Anesthesia

The monitoring employed should be correlated to the patient comorbidities and the type of surgical procedure. The minimum monitoring standard should be represented by a 3 lead-electrocardiogram, a pulse oximetry, a blood pressure monitoring (invasive or not invasive) and an end-tidal CO₂ by insertion of one detector into a nostril. End tidal carbon dioxide monitoring is generally recommended

to ensure airway patency, spontaneous ventilation and confirm respiratory rate and pattern. Repeated blood gas analysis throughout the operation are mandatory especially in the case of procedures prolonging over 30 minutes for early detection of hypercapnia.

In order to avoid cough reflex, just before surgery an aerosolized 5 mL solution of 2% lidocaine could be administered (4). Alternatively, a vagal block with 2 mL Bupivacaine 0.5% could be performed, especially in case of major anatomical resection when it's mandatory to perform a safe dissection of the hilar structures. The duration of the vagal blockade can last more than 3 hours.

Patients are operated under awake regimen through conscious sedation (Ramsay sedation scale 1–2) with remifentanyl infusion 0.05–0.1 µg/kg/min and intravenous bolus of 1–2 mg of midazolam. The advantage of remifentanyl is the ultra-short half-time of 3 min and the possibility to antagonize it with naloxone in case of rapid desaturation.

Supplemental oxygen is delivered through a laryngeal mask to maintain oxygen saturation above 90%. The use of a laryngeal mask instead of facemask or nasal cannulas could potentially have the advantage of protect the airways and allow rescue positive pressure ventilation.

Several local and regional anesthesia techniques can be used for non-intubated awake procedures: local wound infiltration, serratus anterior plane (SAP) block, selective intercostal block, thoracic paravertebral blockade (PVB) and thoracic epidural analgesia (TEA).

The classical preferred type of regional anesthesia in the majority of the reports is TEA used to achieve somatosensory and motor block between the T1–T8 level while preserving diaphragmatic motion. Even if this technique is widely used to provide effective pain relief, it's related with several complications like haematomas, nerve injuries and hypotension. Precisely because of hypotension, the patients can require needs of fluids or vasopressor slowing down the enhanced recovery programs.

The use of alternative loco regional anesthesia techniques, e.g., PVB or SAP along with local block of the incision site, can be useful to achieve better outcomes avoiding the TEA-related complications.

Considering that patients are awake, it would not be feasible to the re-expand the lung at the end of the procedure with the recruitment manoeuvre.

However, at the end of surgery, lung re-expansion can be performed by progressive application of positive end-expiratory pressure via non invasive ventilation (NIV). In the absence of air leaks, NIV should also be continued in

the recovery room in the immediate postoperative period to prevent atelectasis (5).

Surgical procedure

The patient is in lateral decubitus position with the surgeon and the assistant usually positioned in front of the patient in order to have the same thoracoscopic view during all steps of the procedure. After the injection with a mixture of short- and long-acting local anesthetics, the incision, about 2–4 cm long, is performed preferably in the 5th intercostal space in the anterior position causing the creation of an iatrogenic pneumothorax that is needed to have enough space for the surgery. The induction of the pneumothorax is always followed by a sudden tachypnea, a physiological way of compensation that usually resolves after a couple of minutes (1). The anesthetist must be aware of it avoiding additional sedation that would stop the patient breathing. For most of the surgical steps a 5 mm 30 degrees' camera is usually placed at the posterior part of the incision (6).

The equipment needed to perform a uniportal VATS is based on the surgeon's preferences.

Several reports in the literature showed that this technique is feasible not only for minor procedures but even for major lung resection. The choice to perform a major anatomical resection with a non-intubated uniportal awake technique should be just avoided at the beginning of the learning curve leaving it to an experienced and proficient team.

Pulmonary biopsies, metastatectomies and pneumothorax are for sure a good starting point to find out the main difficulties and the possible solutions.

Conclusions

Non-intubated uniportal awake VATS surgery seems to be safe and feasible and can provide an attractive alternative for the treatment of several lung diseases.

There are still many concerns regarding the selection of the patients, and the potential pros, due to the lack of randomized controlled studies and, thus, further trials are warranted to evaluate the outcomes of the awake uniportal VATS resections.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Video-Assisted Thoracic Surgery* for the series “VATS Special Issue dedicated to the 4th international VATS Symposium 2017”. The article did not undergo external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/vats.2018.06.03>). The series “VATS Special Issue dedicated to the 4th international VATS Symposium 2017” was commissioned by the editorial office without any funding or sponsorship. MS served as the unpaid Guest Editor of the series and serves as an unpaid editorial board member of *Video-Assisted Thoracic Surgery* from Mar 2017 to May 2019. LB serves as an unpaid editorial board member of *Video-Assisted Thoracic Surgery* from Jul 2016 to May 2019. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Open Access Statement: This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

References

1. Bedetti B, Patrini D, Bertolaccini L, et al. Uniportal non-intubated thoracic surgery. *J Vis Surg* 2018;4:18.
2. Rocco G. Non-intubated uniportal lung surgery†. *Eur J Cardiothorac Surg* 2016; 49 Suppl 1:i3-5.
3. Gonzalez-Rivas D, Bonome C, Fieira E, et al. Non-intubated video-assisted thoracoscopic lung resections: the future of thoracic surgery? *Eur J Cardiothorac Surg* 2016;49:721-31.
4. Mineo TC, Sellitri F, Fabbi E, et al. Uniportal non-intubated lung metastasectomy. *J Vis Surg* 2017;3:118.

5. Kiss G, Castillo M. Nonintubated anesthesia in thoracic surgery: general issues. *Ann Transl Med* 2015;3:110.
6. Gonzalez-Rivas D, Fieira E, Delgado M, et al. Uniportal

video-assisted thoracoscopic lobectomy. *J Thorac Dis* 2013;5 Suppl 3:S234-45.

doi: 10.21037/vats.2018.06.03

Cite this article as: Minervini F, Bertolaccini L, Patrini D, Bedetti B, Libretti L, Scarci M. Non intubated awake uniportal VATS: how to start? *Video-assist Thorac Surg* 2018;3:27.