

# A brief history of uniportal video-assisted thoracic surgery

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**Keywords:** Uniportal; single incision; minimally invasive surgery; video-assisted thoracic surgery

Received: 17 September 2022; Accepted: 30 November 2022.

doi: 10.21037/vats-22-32

**View this article at:** <https://dx.doi.org/10.21037/vats-22-32>

*“The battlefields of surgery are strewn with the remains of promising new operations which perished in the follow-up clinic.”—Ronald Belsey, MD*

Looking back into history at the first documented use of thoracoscopy, by Jacobeus in 1910, one could take the view that uniportal video-assisted thoracic surgery (uniVATS) is as old as thoracic surgery itself (1,2). Although previous experiences with single-port thoracic surgery had been reported for procedures other than lung resection (3), the first report of patients who underwent pulmonary wedge resection using a properly defined uniVATS approach was published in 2004, comprising patients treated from 2000 to 2003 (4). This innovative approach was based on a new geometrical configuration designed to bring the fulcrum of the thoracoscope and the operative instruments ensemble inside the chest cavity while progressing along a sagittal plane relative to the target lung lesion (4,5). UniVATS has since been found to be safe and reproducible and has become more widely adopted for treatment of an ever-expanding variety of thoracic conditions. A second evolution of the technique occurred when uniVATS was used for anatomic pulmonary resection (6-8).

Gonzalez-Rivas and colleagues reported the first use of uniVATS lobectomy for early-stage lung cancer, in 2010 (6). This pioneering effort was soon followed by several other reports of the use of uniVATS for lung resection, especially in Asia, where uniVATS perfectly matched the Chi philosophy, following the mandate not to disturb the bodily inflammatory and immune functions (9).

Any new technique must meet or exceed established standards for patient safety and surgical and oncological quality. Several studies that compared uniVATS and

multiportal VATS observed no differences in surgical outcomes in terms of blood loss, operative time, conversion rate, and mortality (10-12). Furthermore, compared with multiportal VATS, uniVATS was associated with better postoperative pain, length of stay, overall morbidity, and duration of postoperative drainage (12,13). Although further research on long-term outcomes is warranted to support these findings, we can safely state today that Ronald Belsey's doubts do not apply to uniVATS, which has firmly established its place in the ranks of minimally invasive approaches for thoracic surgery (11,14).

The story of uniVATS does not end there. The growing experience among the early users of uniVATS served as a stimulus to push the boundaries of this technique to include more-complex procedures, such as segmentectomies, sleeve lobectomies, and carinal resections, and, at the same time, to reduce the contraindications for the approach (15). At present, reoperations, resections of tumors with chest wall involvement, and lung resections after induction chemoradiotherapy are no longer considered ineligible for uniVATS (16). Moreover, the use of uniportal pulmonary resection in awake, nonintubated patients (to further minimize surgical impact) has been deemed safe. An important caveat is that such cases require optimal collaboration and communication between the anesthetist and the patient (8,17,18). Finally, gastrointestinal surgeons have recently started to perform the thoracic portion of esophageal resections using uniVATS (19).

Perioperative complications such as bleeding or airway injury can, in the majority of cases, be managed safely and effectively through uniVATS, allowing for completion

of the planned resection without conversion (16). Of importance, the development of instruments specifically designed to aid surgeons in performing uniVATS has greatly facilitated the advancement of this surgical approach and the management of its complications. The introduction of thinner and, specifically, roticulating instruments may help deliver triangularity along the sagittal plane, and modern sealing devices reduce the number of and the need for interchanging instruments. Moreover, the technological advancement of thoroscopes has resulted in more-detailed images, which allows better visualization of important structures (20,21). Finally, as it allows working in a caudocranial perspective plane, uniVATS is associated with reduced neck flexion and rotation and with a restored eye-hand-target axis. Furthermore, multiportal VATS requires more shoulder abduction to reduce interference with the surgical assistant, as well as elbow and wrist flexion. In contrast, uniVATS allows a more natural posture, which reduces the strain and fatigue experienced by the surgeon and helps facilitate more-fluent manipulation (22).

The latest technological advancement to the uniVATS approach was pioneered by the group at Shanghai Chest Hospital, who first performed uniportal robotic-assisted thoracoscopic surgery (RATS) using a conventional robotic platform (23). The intrinsic value of uniVATS has been recognized by the manufacturers of the robotic platforms, as uniVATS holds promise for minimizing the invasiveness of conventional RATS approaches. The ability to combine the precision of RATS with the efficacy of uniVATS could truly achieve the best of both worlds (24).

To ensure that uniVATS remains a viable option that is able to achieve a high level of surgical and oncological quality, it is essential that residents and fellows are taught the art of the technique, as well as its challenges and pitfalls. There is a consensus that, on average, an experience of 50 to 60 procedures is needed to be able to comfortably and consistently perform uniVATS—and, furthermore, that an additional 80 procedures are potentially necessary to truly master the technique. In addition, at least 40 cases should be performed annually to maintain effective proficiency (14,25). Therefore, standardized trainings and modules developed and organized by experts are fundamental. Training should include written and visual material on the technique, tips and tricks, and dry lab and wet lab hands-on training directed by dedicated specialists (2). Preferably, these trainings should be instituted and credentialed by international surgical societies to ensure the quality and consistency of the training curriculum.

We can conclude that uniVATS is here to stay. The results of future research will further support its place among the other minimally invasive techniques, such as multiportal VATS and RATS. More-complex and more-challenging procedures have become possible using uniVATS, and with further technological advancements, the list will only continue to grow. However, it remains of critical importance to be ever mindful of the challenges of adapting the general mindset to this approach and of the necessity of providing qualitative training.

### Acknowledgments

*Funding:* This work was supported, in part, by the National Institutes of Health (Cancer Center Support Grant P30 CA008748).

### Footnote

*Provenance and Peer Review:* This article was commissioned by the Guest Editors (Carlos Galvez Munoz and Paula A. Ugalde Figueroa) for the series “Advanced Uniportal VATS” published in *Video-Assisted Thoracic Surgery*. The article did not undergo external peer review.

*Conflicts of Interest:* Both authors have completed the ICMJE uniform disclosure form (available at <https://vats.amegroups.com/article/view/10.21037/vats-22-32/coif>). The series “Advanced Uniportal VATS” was commissioned by the editorial office without any funding or sponsorship. GR has financial relationships with Scanlan, AstraZeneca, and Medtronic, outside of the work here. 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.

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doi: 10.21037/vats-22-32

**Cite this article as:** Vanstraelen S, Rocco G. A brief history of uniportal video-assisted thoracic surgery. *Video-assist Thorac Surg* 2022.