

Robotic-assisted thoracic surgery versus uniportal video-assisted thoracic surgery: is it a draw?

Sara Ricciardi¹, Carmelina Cristina Zirafa², Federico Davini², Franca Melfi²

¹Unit of Thoracic Surgery, ²Unit of minimally invasive and robotic thoracic surgery, Robotic Multispecialty Center for Surgery, University Hospital of Pisa, Pisa, Italy

Correspondence to: Sara Ricciardi. Unit of Thoracic Surgery, University Hospital of Pisa, Pisa, Italy. Email: ricciardi.sara87@gmail.com.

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In the last two decades the role of minimally invasive surgery (MIS) for non-small cell lung cancer (NSCLC) treatment has grown considerably and numerous studies comparing the surgical results of MIS with open surgery, have confirmed that the MIS constitutes an excellent approach for the treatment of lung cancer, especially in early stages.

The upsurge of mini-invasive thoracic surgery is broadly due to the provided benefits in terms of less post-operative pain, better cosmetic result, shorter hospitalization, lower morbidity and perioperative mortality when compared with open surgery (1,2). Nowadays, according to the National Comprehensive Cancer Network (NCCN) guidelines, MIS should be highly considered for all patients who undergo resection for NSCLC (3).

In their paper Yang *et al.* have compared robotic-assisted thoracic surgery (RATS) with uniportal video-assisted thoracic surgery (UVATS) in a series of 153 patients affected by NSCLC who underwent major lung resection (segmentectomy/lobectomy), performed by the same surgeon (4).

Both RATS and UVATS are relatively recent minimally invasive techniques, representing an evolution of the more established video-assisted thoracic surgery (VATS).

Since the first VATS lobectomy in 1992 (5), several authors have applied MIS for major lung resections. Currently, there is no standardized VATS approach and the VATS lobectomy technique for NSCLC diverges amongst

hospitals: the majority of surgeons perform a totally-endoscopic technique with three or four incisions, fewer use only two incisions, whereas in some centres a 3–5 cm utility incision is used. In 2011 Gonzalez-Rivas for the first time described the uniportal VATS lobectomy, named UVATS, developed in order to reduce nerve injuries, paraesthesia and post-operative pain (6). Moreover, when moving the camera within the same incision (3–4 cm in length at 5th intercostal space) as the one used for the thoracoscopic instruments, the procedure performed by the surgeon results similar to open surgery (7).

As often happens for any new technical innovation, uniportal VATS has gained both heightening disapproval and increasing consent from the scientific community. The supporters of UVATS argue that the uniportal approach leads to shorter recovery with less pain and morbidity (8,9); conversely, the opponents have claimed that this upstart technique can compromise the patients' safety and that the lack of clear oncologic results does not guarantee the long-term efficacy of UVATS lobectomy. Moreover, the necessity of using dedicated uniportal instruments could potentially increase the surgical costs.

Most of the raised objections have actually been solved by comparative studies and meta-analysis that have shown the non-inferiority in terms of safety and efficacy of uniportal VATS compared with multiportal VATS (10,11). Obviously, the 7-year old UVATS lobectomy still needs long-term follows up studies to compare the oncological

outcomes of the patients who underwent this approach.

Whereas for RATS, the first robot-assisted lobectomy was performed in 2001 (12). Since then several studies have described the feasibility, safety and good results of robotic lung resections, henceforth the use of robotic surgery for NSCLC disease has noticeably increased. Thanks to robotic system features (high-definition 3D vision, tremor filtration and 7-degree articulation of the instruments) this technique is considered the latest evolution of less-invasive surgery, overstepping the technical restrictions of VATS approach (2D vision and poor instruments manoeuvrability). Several authors have described different port-mapping with three or four-arms technique, with or without utility incision (13-16). Yang *et al.* technique consists in four thoracoscopic incisions (8th intercostal space at midaxillary line, the camera port, 5th at the anterior axillary line, 8th at the posterior axillary line and 8th 2-cm laterally to the spine) plus 1 utility incision between the camera port and the anterior ports (4). Arguably, a reduction in the number of incisions could decrease the docking time and the analgesic usage during postoperative stay. A standardized port mapping, applicable to any kind of lung resection and on both sides, would be also useful to reduce the learning curve and the overall operating time of the robotic surgery.

The comparative propensity score-matched analysis conducted on RATS and UVATS, has shown similar early outcomes in terms of morbidity, mortality and postoperative clinical course, confirming one more time that both MIS techniques are safe and feasible procedures (4). Nevertheless, the advanced robotic features (3D-high definition vision with up to $\times 10$ magnification, tremor filtration and wristed instruments) consent to perform surgical interventions with a uniquely meticulous dissection, accuracy and safety, allowing the execution also of complex procedures with less blood loss and lower conversion rate to thoracotomy when compared to VATS and UVATS approaches (4,17).

Despite the unquestionable benefits of MIS in relation to shorter hospitalization, less post-operative pain, lower morbidity and perioperative mortality compared with thoracotomy, the radicality of RATS and UVATS lobectomy for NSCLC still appear as an ongoing controversy and further data on the oncologic outcomes should be collected (2).

Generally, the number of lymph nodes removed, and the nodal upstaging are considered an accepted surrogate of the oncologic radicality of surgical resection. Several studies have shown lower median number of harvested lymph nodes and fewer nodal upstaging in VATS lobectomy when

compared to open surgery (18-20), nevertheless two recent papers have reported a higher number of yielded nodes during UVATS lobectomies compared to multiportal video thoracoscopic surgery (21,22). Albeit this data, the overall-survival and disease-free-survival of NSCLC treated by VATS are similar to open surgery, supporting once again the efficacy of MIS procedures (10).

Robotic lymphadenectomy seems to guarantee a superior radicality during resection of regional lymph nodes, by virtue of a better manoeuvrability of the instruments and the 3D vision, as well as a higher nodal upstaging compared to VATS (23). Notwithstanding the higher number of nodal stations dissected and of lobar lymph nodes resected during RATS procedures compared to UVATS, the authors have found no statistically significant differences in nodal upstaging between the two techniques (4). Nevertheless, the robotic approach gives a better and more meticulous dissection compared to UVATS, allowing a greater safety during surgical procedures and fewer operative morbidities.

However, major lung resections for lung cancer treatment by MIS (RATS, VATS and UVATS) provides benefits for the patients, guaranteeing a superior postoperative quality of life to the one provided by open surgery when performed in specialized high-volume centers and in the hand of skilled surgeons (10,15,24).

Nevertheless, RATS and UVATS should be considered techniques still in their infancy, therefore only multicenter prospective randomized trials will be able to give a decisive response upon the current debate on the superiority of robotic assisted over uniportal VATS technique.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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