ISSN 2765-1606 (Print)
ISSN 2765-1614 (Online)

JOURNAL of CHEST SURGERY

Vol. 58 No. Supple 1

Asia-Pacific Innovative Thoracic Surgery Symposium 2025

May 29 (Thu) – 30 (Fri), 2025
Seoul Dragon City Hotel, Seoul, Korea

https://apits.org/

Journal of Chest Surgery Asia-Pacific Innovative Thoracic Surgery Symposium 2025
Vol. 58 No. Supple 1

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S1-1
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S1

S1-1

History of Single-Port Thoracic Surgery

Dr. Alan D. L. Sihoe

MBBChir, MA (Cantab), FRCSEd (CTh), FCSHK, FHKAM, FCCP, FACS
Consultant, CUHK Medical Centre, Hong Kong, China
Honorary Consultant, Gleneagles Hospital, Hong Kong, China

The single greatest disruptive advance in the history of thoracic surgery has arguably been the advent of video-assisted thoracic surgery (VATS) in the 1990s. The proven benefits of a minimally invasive chest surgery have prompted more intrepid innovators to further minimize surgical access trauma, such as by having smaller or fewer wounds.

A number of credible claims exist over who was first to use only a single incision to perform VATS for simpler operations such as biopsies, wedge resections, and pneumothorax surgery. In contrast, there is greater consensus over the 'father' of single-port VATS lobectomy: Diego Gonzalez Rivas. Not only did he formulate this uniportal approach for more complex thoracic surgery, he also propagated it to every corner of the globe through his tireless travels to it over the last 10 years.

Two essential lessons have emerged when analyzing the successful rise of uniportal VATS:

First, a key element underlying the rapid rise of uniportal VATS is that it is an evolution (rather than revolution) from earlier generations of multiport VATS. Not only are the hardware and operating room setup familiar to VATS surgeons, but the fundamental technical principles are also similar. Although some specific skillset adjustments must be made, transitioning to uniportal is therefore readily learnable and teachable.

Second, the success of single-port VATS was also enabled by the systematic, stepwise accumulation of clinical and scientific evidence to support its use. In just over a decade, an unprecedented volume of literature has been published by practitioners of uniportal VATS, convincingly demonstrating its safety, benefits, and treatment efficacy. This is a strong affirmation of the power and necessity of the scientific process in modern evidence-based surgery.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S1-2
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S2

S1-2

History of Asian Single Port VATS Symposium

Prof. Calvin S. H. Ng

Department of Surgery, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong SAR, China

The 1st Asian Single Port VATS Symposium (ASPVS) took place in March 2013 at Prince of Wales Hospital, The Chinese University of Hong Kong. The idea came after the report of world's first single-port video-assisted thoracic surgery (VATS) lobectomy published in 2011 by Dr Diego Gonzalez-Rivas. After performing Hong Kong's first single port VATS lobectomy on 16th May 2012, it became apparent that better communication was needed between those interested in this approach. After contacting Diego, a consensus was that a symposium should be hosted, and the rest was history. For the first ASPVS, speakers included Dr Diego Gonzalez Rivas, Dr Gaetano Rocco and Dr Thomas D'Amico, Dr Hyunkoo Kim, Dr Alan Sihoe and myself, as well as live-surgery being the highlight.

Following the success of the first meeting, Dr Hyunkoo Kim & Dr Jhingook Kim in conjunction with 21st Conference of Korean Association for Thoracic Surgical Oncology (KATSO) co-hosted the 2nd ASPVS with Wetlab at Daejeon, Korea in April 2014. Subsequently, 3rd ASPVS with Live Surgery of non-intubated uniportal lobectomy, and introduction of subcostal and subxiphoid concepts, was again hosted by Prince of Wales Hospital, Hong Kong in March 2015 (www.surgery.cuhk.edu.hk/VATS2015/), and the presentations were published in *European Journal of Cardio-Thoracic Surgery* supplement "The 3rd Asian Single Port VATS Symposium & Live Surgery: Redefining the Future of Minimal Invasive Thoracic Surgery" (Volume 49, Issue suppl_1, January 2016; ISSN 1010-7940, EISSN 1873-734X).

The 4th ASPVS was held in conjunction with 24th Annual Meeting of Asian Society for Cardiovascular and Thoracic Surgery (ASCVTS) and 9th American Association for Thoracic Surgery/ASCVTS Postgraduate Course in Taipei Convention Center, Taiwan in April 2016 with Dr Liu Chia-Chuan as Symposium Director, with scientific abstract presentations and Live Surgery. The 5th ASPVS took place in Shanghai, China 16th–19th March 2017, with Dr. Zhu Yuming as Director and Prof Gening Jiang from Shanghai Pulmonary Hospital as Honorary Advisor to great attendance.

The 6th ASPVS took place in Manila, Philippines 23rd–24th March 2018, themed "Past, Present, Future of Single Port VATS: Withstanding the Test of Time" with Dr. Federico C. Sanchez, Honorary Chair of the Organizing Committee. The presentations were later published in Journal of Visualized Surgery supplement (https://jovs.amegroups.org/post/view/dedicated-to-the-6th-asian-single-port-vats-symposium-2018). With developing interest in single port VATS in Japan, the 7th ASPVS was hosted at Nagoya, Japan on 24th–25th May 2019, by Symposium Director Prof Takashi Suda. The live surgery broadcasted from Shanghai China, active discussions and entertainment were the highlights. For the 8th ASPVS, it was time to return to Hong Kong, and planned for 7th–9th May 2020. Unfortunately, it was cancelled because of coronavirus disease 2019 (COVID-19). The years of void during COVID-19 may in fact be blessing in disguise, because technological advancements have been exponential during that period. Prof HyunKoo Kim and Prof Chang Hyun Kang have reignited the meeting, renaming it Asia-Pacific Innovative Thoracic Surgery Symposium this year to reflect and encompass other technologies.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S2-1
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S3

S2-1

Single-Port Video-Assisted Thoracic Surgery

Prof. Calvin S. H. Ng

Department of Surgery, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong SAR, China

Thoracic surgery has witnessed a revolution with single-port video-assisted thoracic surgery (VATS), a change not seen since the 1990s when major lung resection became possible through minimally invasive "keyhole" surgery in the form of VATS instead of open thoracotomy. Rocco was the first to challenge the multi-port VATS approach to lung resection by performing the first uniportal VATS (wedge) lung resection. In 2006, the team from Duke University Medical Center published their experience of performing almost 500 cases of VATS major lung resection using only 2 ports. The article inspired Gonzalez-Rivas from Spain to visit Duke University, and he, in his own words, once said, "It is impossible to perform lobectomy with only 2 ports." In 2010, Gonzalez-Rivas successfully performed the first uniportal VATS lobectomy for early-stage lung cancer. Since then, he and his team have championed and refined this approach, with subsequent publications of the first pneumonectomy, sleeve lobectomy, and vascular sleeve lobectomy—all performed through a single small incision of 5 cm or less. Furthermore, advances in uniportal technique and equipment now allow less challenging uniportal anatomical lung resections to be performed through an ultra-mini 2.5 cm single incision. Meta-analyses have shown the uniportal approach to be at least as safe as conventional VATS. In some studies, postoperative pain was also less following uniportal VATS compared with the conventional 3-port technique in the early postoperative period. Furthermore, data have so far shown at least equivalent disease-free survival at follow-up for patients with early-stage non-small cell lung carcinoma who received uniportal VATS surgery.

The success of the uniportal strategy has reignited interest from industry to design instruments and equipment to facilitate this procedure. The development of subcostal single-incision access to the thoracic cavity to avoid intercostal nerve injury, and robotic thoracic surgery through a single incision, have all, at least in part, been fueled by the uniportal VATS evolution. In addition, the spirit of reinvention has extended into multidisciplinary collaboration with anesthetists, in the form of non-intubated uniportal VATS lung resection to achieve quicker postoperative recovery, and also with radiologists in the hybrid operating theatre using cone beam computed tomography to guide uniportal VATS procedures and improve surgical accuracy.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S2-2
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S4

S2-2

Single-Port Robotic-Assisted Thoracoscopic Surgery Using da Vinci Xi

Takashi Suda

Fujita Health University Okazaki Medical Center, Okazaki, Japan

The da Vinci Xi Surgical System is currently the most widely used robotic surgical system worldwide. Major lung resection and thymectomy using this system are performed via the lateral intercostal or subxiphoid approach, with ports inserted at 3 to 5 locations. We report the technique of single-port robotic-assisted thoracoscopic surgery using the da Vinci Xi.

For major lung resection, the patient is placed in the lateral position. A 4 cm skin incision is made in the axillary line at the 6th intercostal space. Only 3 arms are used. The key to operating the device is to move the camera and both hands together when adjusting the field of view. If the field of view is shifted, the range of motion of the hands changes; therefore, if the forceps' range of motion is restricted, adjust the view as needed to facilitate operation. The assistant inserts 2 curved suction tubes or curved cotton swabs through the gaps in the wound to open the surgical field and perform suction. Assistant support is extremely important in single-port robot-assisted lung cancer surgery.

For thymectomy, the patient is positioned supine with arms and legs spread apart. A 4 cm vertical incision is made 1 cm caudal to the xiphoid process. CO_2 insufflation is performed at 8 mm Hg. During port insertion, the left and right robotic arms are crossed into the wound, with the camera, left hand, and right hand inserted in that order from the anterior chest to the dorsal side. To reduce interference between the ports at the head, a key technique is to pull the camera port forward to prevent collisions with the other ports.

This single-port robot-assisted surgery using the Xi system requires only one incision, which is expected to reduce pain, and has the potential to be an ideal surgical method that also provides the excellent operability of the da Vinci system. However, with the current method, interference between instruments and limitations in the range of motion of the forceps may occur, so further improvements are required.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S2-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S5

S2-3

Single-Port Robot-Assisted Thoracic Surgery Using da Vinci SP

Hyun Koo Kim

Korea University Guro Hospital, Seoul, Korea

Conventional robot-assisted thoracic surgery (RATS) is typically performed using 3 or more ports with 3–5 arms, which is limited by the number of incisions when compared to single-port (SP) video-assisted thoracic surgery. Previously, we attempted to reduce the number of ports in RATS and reported the clinical outcomes of 2-port RATS lobectomy in patients with early-stage lung cancer.

The da Vinci SP surgical system was developed to perform SP surgery using a fully-wristed robotic endoscope and 3 fully-wristed, elbowed arms. However, there are 2 main limitations in using the da Vinci SP surgical system for major pulmonary resections. First, the SP surgical system does not include a robotic stapler. Second, the size of the SP cannula is 2.5 cm, which makes it impossible to perform surgery using an intercostal approach.

To overcome these limitations, we have developed a subcostal approach using the SP surgical system, allowing for the placement of both the SP cannula and endostapler together in the thoracic cavity through a single 4-cm incision. Although the extra-thoracic approach may be unfamiliar to thoracic surgeons, it offers a viable option with the potential benefit of reducing postoperative pain by avoiding intercostal nerve injury. Furthermore, once dedicated endostaplers and energy devices become available in the near future, this procedure could be applied to more complex operations.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S3-1
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S6

S3-1

Mediastinal Tumor Resection: Challenging Cases by Multiport Robotic-Assisted Thoracoscopic Surgery and Video-Assisted Thoracic Surgery

Toshihiko Sato

Fukuoka University, Fukuoka, Japan

It is commonly accepted that the least invasive approach to mediastinal tumor resection is the sub-xyphoid-uniport approach with da Vinci SP or a thoracoscope, which does not require sternal incision or thoracotomy. On the other hand, in cases of invasions to the lungs and adjacent blood vessels, thoracotomy or multiport approaches should be considered. We routinely perform mediastinal tumor resection with 3–4 ports, which can be adapted to challenging cases. In this symposium, we would like to present the cases of da Vinci Xi and thoracoscopic resection for adjacent organ invasion cases and discuss their limitations and feasibility.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S3-2
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S7

S3-2

Subxiphoid Single-Port Video-Assisted Thoracoscopic Surgery

Takahiro Homma

St. Marianna University School of Medicine, Kawasaki, Japan

Uniportal video-assisted thoracoscopic surgery (VATS) thymectomy can be performed via 2 approaches: lateral and subxiphoid approach. I generally prefer the subxiphoid approach for its versatility—accommodating various tumor sizes and consistencies, providing excellent visualization of both phrenic nerves, and offering compatibility with combined pericardial or pulmonary resection. It also ensures greater safety should conversion to open surgery become necessary. The lateral approach is reserved for cases without myasthenia gravis and with unilateral tumor predominance, occasionally chosen for cosmetic reasons after discussion with the patient.

This session focuses on the subxiphoid uniportal VATS thymectomy, sharing its tips and pitfalls.

Procedure: A 3 cm subxiphoid midline incision is made. After incising the linea alba, the xiphoid process is exposed and the posterior sternal surface is dissected. The Alnote Lap Single (Alfresa Pharma) is inserted for CO2 insufflation. The inferior pole of the thymus is dissected from the pericardium. Incision of the mediastinal pleura provides a wider surgical field and ensures visualization of the phrenic nerve. However, thymectomy can be performed without incising the mediastinal pleura.

Devices: The Alnote Lap Single (Alfresa Pharma) and the Caiman (B. Braun Aesculap) are used. The Caiman's flexible tip facilitates access. The Olympus Elite III YE mode may minimize residual fat.

Pitfalls: Changing the CO_2 insufflation setting intraoperatively alters vascular compression, necessitating careful dissection around vessels. Incising the mediastinal pleura carries a risk of long-term dissemination. Bilateral pleural incisions create communication between the pleural cavities, potentially affecting future lung resections.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S3-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S8

S3-3

Subxiphoid Single-Port Robotic-Assisted Thoracoscopic Surgery Using da Vinci SP: Early Experiences

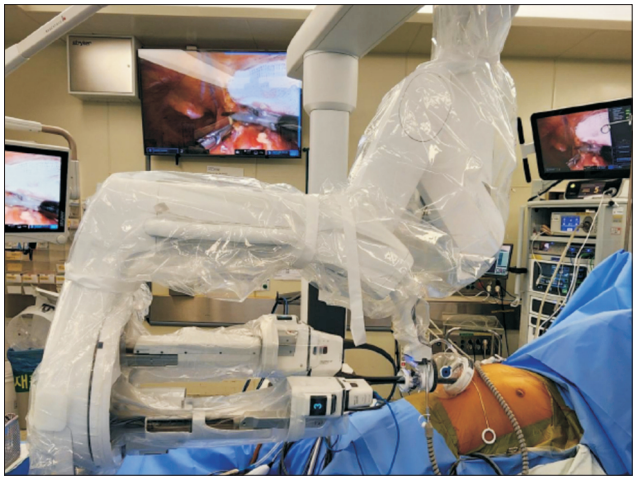
Jae Kwang Yun

Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, Ulsan University College of Medicine, Seoul, Korea

The da Vinci single-port (SP) system is the latest advancement in robotic surgery, designed to perform complex procedures through a single incision. This system offers improved dexterity, enhanced visualization, and reduced surgical trauma compared to conventional multiport robotic systems. While the da Vinci SP system has shown promising outcomes in urology, general surgery, and gynecology, its application in thoracic surgery is still emerging. This presentation aims to report our initial experiences with the da Vinci SP system via the subxiphoid approach in patients who underwent thymectomy for anterior mediastinal masses.

Between October 2020 and April 2025, a total of 9 patients were included in this study. The mean age was 54.6±9.9 years, and 4 patients (44.4%) were male. The mean body mass index was 24.5±3.5 kg/m^2, and 3 patients had myasthenia gravis. Complete resection was achieved in all cases without conversion to multiport or open surgery. The mean operation time was 136.9±49.8 minutes. Seven patients (77.8%) were diagnosed with thymoma, with a mean tumor size of 33.8±16.3 mm. The mean peak Numeric Rating Scale score was 3.8±1.4. The mean durations of chest drainage and hospital stay were 1.8±0.7 days and 2.8±0.8 days, respectively. No postoperative complications were observed.

The da Vinci SP system enables safe and feasible resection for thymectomy with minimal surgical trauma and rapid recovery. With its potential for improved patient outcomes, further clinical experience and technological advancements are essential for expanding its indications in general thoracic surgery.



JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S3-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S9

S3-4

Refining Subxiphoid Thymectomy: Transitioning from da Vinci Xi to SP Platform

Yin-Kai Chao

Chang Gung Memorial Hospital-Linkou, Taoyuan, Taiwan

Subxiphoid thymectomy has become an increasingly favored approach for anterior mediastinal surgery, offering improved visualization of bilateral phrenic nerves and less postoperative pain compared to intercostal approaches. The da Vinci Xi system has played a critical role in establishing the feasibility and safety of the subxiphoid route, utilizing a multiport technique that allows excellent instrument articulation, stable visualization, and precise dissection in the anterior mediastinum.

Building on this foundation, the da Vinci single port (SP) system introduces a refined technique that enables thymectomy through a single 2.5 cm subxiphoid incision. With 3 multi-jointed instruments and a fully wristed camera delivered through a single cannula, the SP platform reduces chest wall trauma and eliminates the need for additional ports. Early experience with SP thymectomy has shown comparable oncologic outcomes with the potential benefits of improved cosmesis, reduced postoperative discomfort, and a shorter hospital stay.

This presentation outlines the evolution of subxiphoid thymectomy from the Xi to the SP system, highlighting key differences in setup, instrument handling, and operative workflow. The transition to SP represents a technological advancement that may further optimize minimally invasive mediastinal surgery and enhance patient-centered outcomes.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S4-2
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S10

S4-2

Initial Experience of Esophagectomy Using the da Vinci SP System via Subcostal Approach

Hiroyuki Daiko

Esophageal Surgery Division, National Cancer Center Hospital, Tokyo, Japan

Background: The da Vinci single-port (SP) robotic system offers enhanced maneuverability and visualization through a single access site. Although its use in esophagectomy is still in its early stages, the subcostal approach may provide a minimally invasive and ergonomic access route to the mediastinum. We report our initial experience with esophagectomy using the da Vinci SP system via a subcostal approach.
Methods: Three patients with thoracic esophageal cancer underwent da Vinci SP robotic esophagectomy via a right subcostal incision for the thoracic phase. Key surgical outcomes, including operative time, intraoperative events, and short-term postoperative results, were assessed.
Results: All procedures were completed successfully without conversion to multiport or open surgery. The median thoracic operative time was 120 minutes. No intraoperative complications were observed. R0 resection was achieved in all patients.
Conclusion: Esophagectomy using the da Vinci SP system via a subcostal approach is technically feasible and safe in selected patients. This novel access route may facilitate single-port thoracic procedures with favorable short-term outcomes.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S4-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S11

S4-4

Transthoracic Single-Port Robotic-Assisted Thoracoscopic Surgery Esophagectomy Using da Vinci SP

Seong Yong Park, MD, PhD

Department of Thoracic and Cardiovascular Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

The da Vinci single-port (SP) robotic system is equipped with three flexible instruments and a stereoscopic binocular camera, all housed within a 2.5-cm-diameter cannula. This system has been applied in pulmonary resections and mediastinal mass excisions, with several case series published in the field of thoracic surgery. However, regarding esophagectomy, only a single case report has been published.

SP esophagectomy can be performed using either a transcervical or subcostal approach. The transcervical approach, which involves surgery through a cervical incision without entering the thoracic cavity, offers the theoretical advantage of reducing respiratory complications. However, it presents challenges for surgeons due to unfamiliarity with the relevant anatomical structures. Conversely, the subcostal approach closely resembles conventional semi-prone robotic esophagectomy, offering surgical familiarity but with potential limitations in achieving adequate upper mediastinal dissection.

The author aimed to extend the application of the SP system to esophageal cancer after its initial use in esophageal mobilization via the subcostal approach. The surgical technique was designed with a focus on achieving sufficient upper mediastinal dissection while maintaining oncologic outcomes comparable to those of multiport robotic esophagectomy. As a result, the author adopted a transthoracic approach for SP esophagectomy.

This presentation outlines the development of this procedure and shares insights from an initial case series.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S4-5
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S12

S4-5

Single-Port Robot-Assisted Thoracic Surgery Esophagectomy Using the da Vinci SP System

Olga Meier, MD (Fellow under Professor Peter Grimminger)

University Medical Center Mainz, Mainz, Germany

Background: Single-port (SP), subcostal (SC) robot-assisted minimally invasive esophagectomy (RAMIE) aims to further reduce surgical trauma compared with multiport RAMIE, yet clinical evidence is still emerging.
Methods: We reviewed our initial clinical series of SP SC RAMIE procedures performed with the da Vinci SP platform. Feasibility criteria were an R0 resection and an adequate lymph-node harvest. Operative times, pain levels, complications, length of stay, and short-term mortality were recorded.
Results: All operations achieved radical resection and met the predefined lymph-node target. No intra-operative conversions occurred. Thoracic console times and total operative durations were comparable to established multiport RAMIE benchmarks. Postoperatively, patients reported low pain scores and most were mobilized on the first day. Serious complications were infrequent and managed without reoperation. There was no perioperative mortality, and hospital discharge was generally within the first postoperative week.
Conclusion: Early experience indicates that SP SC RAMIE with the da Vinci SP system is technically feasible and safe, combining oncological soundness with low postoperative pain and rapid recovery. These findings warrant confirmation in larger prospective studies and suggest that future SP-specific stapling and vessel-sealing tools could further optimize the technique.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S5-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S13

S5-3

Single-Port Thoracic Surgery in the Philippines: Innovations, Outcomes, and Future Directions

Edmund E. Villaroman

Lung Center of the Philippines, Quezon, Philippines

Single-port video-assisted thoracic surgery (SPVATS) has transformed minimally invasive thoracic surgery in the Philippines, addressing unique clinical challenges such as the high prevalence of infectious and inflammatory thoracic diseases. This presentation explores the evolution of VATS in the country, highlighting innovations such as the application of SPVATS for inflammatory disorders and the use of indocyanine green to enhance vascular identification in cases of severe pleural adhesions. Clinical outcomes demonstrate the safety, efficacy, and benefits of SPVATS, leading to improved patient recovery and reduced morbidity. Looking ahead, the integration of THOR, sublobar resection, and ablation techniques—along with the emerging role of uniportal robotic-assisted thoracic surgery—presents new opportunities for advancing minimally invasive thoracic surgery in the Philippines.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S5-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S14

S5-4

The Journey of a Resident to a Consultant as a Single-Port Video-Assisted Thoracoscopic Surgery Surgeon in Singapore

Harish Mithiran

Neumark Lung & Chest Surgery Centre, Gleneagles Hospital, Singapore

The transition from resident to consultant uniportal video-assisted thoracoscopic surgery (U-VATS) surgeon in Singapore is a rigorous process characterized by specialized training and technical mastery. This presentation delineates the pathway through Singapore's competitive thoracic surgery landscape, encompassing an accredited joint residency program by the Academy of Medicine Singapore and the Royal College of Surgeons of Edinburgh. Trainees progress through rotations in general surgery, cardiothoracic surgery, and intensive care, developing skills in patient management and multidisciplinary collaboration. Under mentorship, residents master U-VATS techniques, advancing from basic procedures like wedge resections to complex segmentectomies, lobectomies, and mediastinal tumor resections—navigating a steep learning curve that demands proficiency in advanced endoscopic techniques and adaptation to evolving technologies.

As consultants, they assume leadership roles, driving clinical excellence, research, and education in Singapore's premier medical institutions. Challenges include meeting high patient expectations, managing resource constraints, and staying current with innovations in minimally invasive surgery. This journey highlights resilience, continuous learning, and a commitment to enhancing patient outcomes—establishing U-VATS surgeons as key contributors to Singapore's healthcare system and delivering precise and compassionate care.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S5-5
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S15

S5-5

The Current Status of Single-Port Video-Assisted Thoracic Surgery in Japan

Takahiro Homma

St. Marianna University School of Medicine, Kawasaki, Japan

Uniportal video-assisted thoracic surgery (VATS) was introduced to Japan by a few surgeons in the 2010s, gaining broader recognition after the 1st Japanese Association for Chest Surgery (JACS) Fellowship in 2018. The Japanese Uniportal VATS Interest Group (JUVIG) was subsequently established in April 2018 to promote its safe introduction and dissemination. JUVIG's activities—including educational materials, hands-on and web seminars, academic conferences, social media engagement, publications, and device development—have contributed to the increasing adoption of uniportal VATS across institutions. Active discussions now occur at major domestic conferences like JACS, and JUVIG members have initiated several nationwide multicenter collaborative studies.

Concurrently, robotic-assisted thoracic surgery (RATS) gained insurance coverage in Japan in 2018 and has become more prevalent than uniportal VATS. Despite the significant cost associated with RATS, its adoption rate surpasses that of uniportal VATS due to institutional policies and the perceived ease of implementation. While standard RATS involves 4–5 ports, reduced-port RATS is gaining popularity, particularly among JUVIG members, blurring the lines between RATS and uniportal VATS. Nevertheless, multiport VATS remains the dominant approach in many institutions.

Since beginning uniportal VATS in 2013, I have applied it to various procedures and conditions, including bronchoplasty, completion lobectomy, complex segmentectomy, and pediatric surgery. This session will report on the current status of uniportal VATS in Japan, incorporating my personal experience.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-1
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S16

S6-1

Multiport versus Single-Port Video-Assisted Thoracic Surgery for Pulmonary Resection

Dr. Alan D. L. Sihoe

MBBChir, MA (Cantab), FRCSEd (CTh), FCSHK, FHKAM, FCCP, FACS
Consultant, CUHK Medical Centre, Hong Kong, China
Honorary Consultant, Gleneagles Hospital, Hong Kong, China

Video-assisted thoracic surgery (VATS) has traditionally been performed using multiple small incisions. However, over the past decade, the single-port VATS approach has emerged as an alternative that is even preferred by many surgeons around the world. This status has been achieved through the stepwise accumulation of clinical and scientific evidence. Such evidence for uniportal VATS has now demonstrated key features compared to multiportal VATS:

- **Safety:** Real-world experience from around the world for over a decade has shown no increased risk of adverse events.
- **Patient outcomes:** Results show no difference in most parameters but consistent benefit in some categories such as reduced postoperative pain.
- **Measurable objective benefits:** There is limited emerging evidence of less harm measured by certain quantifiable metrics.
- **Treatment efficacy:** Statistics show non-inferiority in terms of adequacy of lymph node dissection and short-/medium-term survival for lung cancer.
- **Training:** Learning curves for transitioning from multiportal to uniportal VATS are comparable to those for thoracotomy to VATS.

There have been 2 prevailing arguments when considering the above comparisons:

First, it is pointed out that such comparisons are ultimately pointless because there may be more than one single 'best' approach that will help patients and all approaches have their benefits. This is certainly true. However, it sidelines the vital fact that in striving to find 'better' ways to serve patients, surgical innovations must always be compared to previous gold standards. Proving that each innovation is the 'best' should not be the goal, but the understanding gained about which parameters are most important for patients makes the exercise beneficial for future surgical development.

Second, it has been argued that since uniportal VATS appears to offer no substantial benefit over multiportal VATS, there is no requirement for all surgeons to now switch to using a single port only. Indeed, the technique each surgeon chooses must depend on what that surgeon feels most comfortable and safe performing. However, what is usually overlooked is the counter-argument: if there is no significant difference in using only one incision, then why is it necessary to inflict extra trauma (incisions) on the patient?

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-2
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S17

S6-2

Robotic-Assisted Thoracoscopic versus Video-Assisted Thoracoscopic Lobectomy: RVlob Randomized Controlled Trial

Hecheng Li

Department of Thoracic Surgery, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China

Background: The comparative effectiveness of robotic-assisted lobectomy (RAL) versus video-assisted lobectomy (VAL) for non-small cell lung cancer (NSCLC) remains a critical clinical question. The RVlob trial aimed to prospectively compare perioperative outcomes, quality of life, and long-term survival between these minimally invasive approaches.
Methods: This single-center, open-label, randomized controlled noninferiority trial enrolled patients aged 18–80 years with resectable NSCLC (American Society of Anesthesiologists Physical Status I–III). Exclusion criteria included prior oncologic treatment, concurrent malignancies, or non-NSCLC pathology. Participants were randomized to RAL or VAL, with primary endpoints of 3-year overall survival (OS) and lymph node dissection extent. Secondary endpoints included disease-free survival (DFS), operative outcomes, postoperative pain (visual analog scale), and quality of life (EORTC QLQ-C30/LC13 [European Organization for Research and Treatment of Cancer-Quality of Life Questionnaire/Lung Cancer 13], European Quality of Life-5 Dimensions).
Results: Among 305 patients (82.3%; stage I), RAL demonstrated noninferior 3-year OS (absolute difference, 2.96%; 95% confidence interval, −2.68 to 8.61; $p<0.01$) and comparable DFS ($p>0.05$) versus VAL. RAL was superior in median lymph node retrieval (N1 stations: $p<0.001$), with reduced intraoperative blood loss and lower 4-week postoperative pain scores ($p<0.05$), albeit with higher costs and chest tube output. Perioperative morbidity (30-day mortality: 0.53 vs. 0.57, $p=0.045$) and quality of life were similar.
Conclusion: RAL is a safe, oncologically noninferior alternative to VAL, offering advantages in nodal staging and early postoperative recovery. Limitations include single-center design and predominance of stage I disease, warranting multicenter validation.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S18

S6-3

Robotic-Assisted Thoracoscopic Surgery versus Video-Assisted Thoracoscopic Surgery for Thymectomy

Kwon Joong Na

Seoul National University Hospital, Seoul, Korea

Minimally invasive surgery (MIS) has revolutionized thymectomy, offering significant advantages over open approaches in reducing surgical morbidity, hospital stay, and recovery time. Video-assisted thoracoscopic surgery (VATS) and robotic-assisted thoracoscopic surgery (RATS) are the 2 predominant MIS techniques for thymectomy, each with distinct benefits and challenges.

The adoption of MIS for thymectomy has been steadily increasing, driven by advancements in technology and growing surgical expertise. While VATS thymectomy has been widely practiced for years, RATS thymectomy is gaining traction due to its enhanced visualization, wristed instrumentation, and ergonomic benefits. These advantages translate into more precise dissection, improved access to the mediastinum, and potentially better outcomes, particularly in extended thymectomies and complex cases.

Comparing RATS and VATS thymectomy reveals both commonalities and differences. Both techniques offer reduced perioperative morbidity compared to open surgery, but RATS provides superior dexterity and visualization, potentially reducing conversion rates and improving oncologic completeness. However, VATS remains a cost-effective and well-established approach with broad accessibility. Current literature suggests comparable long-term outcomes, though ongoing studies continue to refine patient selection criteria and evaluate cost-effectiveness.

This presentation will review the evolution of MIS in thymectomy, discuss the key advantages and limitations of RATS and VATS, and analyze recent trends in their application. By understanding the strengths of each technique, thoracic surgeons can better tailor their approach to individual patient needs, optimizing outcomes in thymic surgery.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S19

S6-4

Hybrid versus Total Robot-Assisted Esophagectomy in the Single-Port Era

Dr. Olga Meier, MD

University Medical Center Mainz, Mainz, Germany

Background: Single-port (SP) subcostal robot-assisted minimally invasive esophagectomy minimizes thoracic access trauma. However, performing a fully robotic SP abdominal phase remains challenging due to the lack of commercially available SP-compatible staplers and advanced energy devices. Consequently, a hybrid approach combining SP thoracic resection with conventional laparoscopic gastric mobilization ("hybrid-SP") is currently preferred. Alternative methods include fully robotic multiport esophagectomy ("total-MP") and a 2-robot strategy ("dual-robot"). Although a purely SP procedure ("total-SP") is technically feasible, it significantly increases procedural complexity and duration without clear clinical benefit.

Methods: We systematically compared hybrid-SP, total-MP, and dual-robot approaches with respect to operative workflow, procedural cost-effectiveness, and short-term clinical outcomes.

Results: All evaluated procedures fulfilled feasibility criteria. The total-MP approach provided the most streamlined workflow and lowest disposable costs; however, multiple thoracic incisions potentially increased postoperative pain and pulmonary morbidity compared to hybrid-SP. The hybrid-SP demonstrated comparable operative durations and costs to total-MP while notably reducing thoracic trauma, necessitating laparoscopic abdominal mobilization as a practical compromise. The dual-robot approach substantially increased operative duration and costs without measurable clinical advantages.

Conclusion: Until SP-specific stapling and vessel-sealing devices become available, performing the abdominal phase laparoscopically remains preferable to fully SP or dual-robot techniques. The anticipated introduction of comprehensive SP instrumentation may shift future practice toward fully robotic SP esophagectomy.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-5
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S20

S6-5

Advancing Evidence through Collaboration: An Overview of Multicenter Trials in Robotic Esophageal Surgery

Yin-Kai Chao

Chang Gung Memorial Hospital-Linkou, Taoyuan, Taiwan

The adoption of robotic-assisted techniques in esophageal surgery has accelerated over the past decade, driven by the promise of enhanced precision, superior visualization, and potential improvements in patient outcomes. However, widespread implementation has been challenged by variability in surgical expertise, institutional resources, and the need for high-quality comparative data. In this context, multicenter trials play a pivotal role in validating the clinical value of robotic esophagectomy across diverse practice settings.

This presentation provides an overview of key multicenter trials—both completed and ongoing—that investigate robotic esophageal surgery, including RAMIE (robotic-assisted minimally invasive esophagectomy) and other robotic platforms. We highlight trial designs, endpoints, and early results related to oncologic efficacy, perioperative outcomes, learning curves, and quality of life metrics. Furthermore, the collaborative nature of these studies enables more robust subgroup analyses, standardization of surgical protocols, and greater generalizability of findings.

Lessons learned from multicenter initiatives underscore the importance of structured training, credentialing pathways, and data sharing networks. As robotic surgery continues to evolve, multicenter collaborations will remain essential to defining evidence-based standards, ensuring patient safety, and guiding the next phase of surgical innovation in esophageal cancer management.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-6
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S21-S22

S6-6

SCOPE (Superior Pulmonary Vein Competency Using Objective Performance Evaluation): An Assessment Tool to Assess Trainee Performance Using Objective Performance Data in a Perfused Porcine Model

Daniel S. Oh

University of Southern California, Los Angeles, CA, USA

Background: Surgical education requires assessment tools as part of competency-based education (CBE). In robotic surgery, Objective Performance Indicators (OPIs) are a novel and objective method of measuring surgeon performance. We developed SCOPE (superior pulmonary vein competency using objective performance evaluation), which combines video review and OPIs to assess cardiothoracic (CT) fellow competency in superior pulmonary vein (SPV) dissection during lobectomy.

Methods: CT fellows completed a robotic lobectomy (RL) on an ex vivo perfused porcine model at the Society of Thoracic Surgeons Resident Boot Camps in 2019 and 2023. Synchronized video and kinematic data were captured to calculate OPIs. Seven thoracic surgery attendings completed the RL in 2019 to provide expert-level OPI data. We designed a 12-item assessment with 4 levels of increasing difficulty: completion, safety, economy of motion, and optimized performance (Fig. 1). Video review for items 1–6, scored as 0 or 1, was done by 2 surgical residents with an inter-rater reliability of 91%. OPIs can be broadly divided into 6 categories (e.g., wrist articulation, instrument movement, energy, smoothness, clutching, and instrument time). We defined a score cutoff as ±2 standard deviations from the expert mean, resulting in 6 scores of 0 or 1. We then utilized item response theory and internal structure evidence to provide reliability and validity evidence.

Results: We assessed 2 cohorts of cardiothoracic trainees (2019: n=50, 2023: n=59). Most trainees had prior robotic console simulation (97/107 [91%]) and clinical console experience (94/108 [87%]). Sixty percent (65/109) had complete recorded data. Reliability was high (Expected A Posteriori=0.90). Fourteen trainees scored in the completion range, 10 in the safety range, 17 at the level of economy of motion, and 24 achieved optimized performance. For internal structure evidence, items at each level performed similarly, and all items appropriately increased in difficulty (Spearman's rho coefficient=0.93).

Conclusion: We developed a novel robotic surgery assessment that integrates video review with objective performance data, demonstrating strong reliability and validity, to provide a performance score that facilitates CBE. Future work will focus on translating this method to real case data and other surgical procedures.

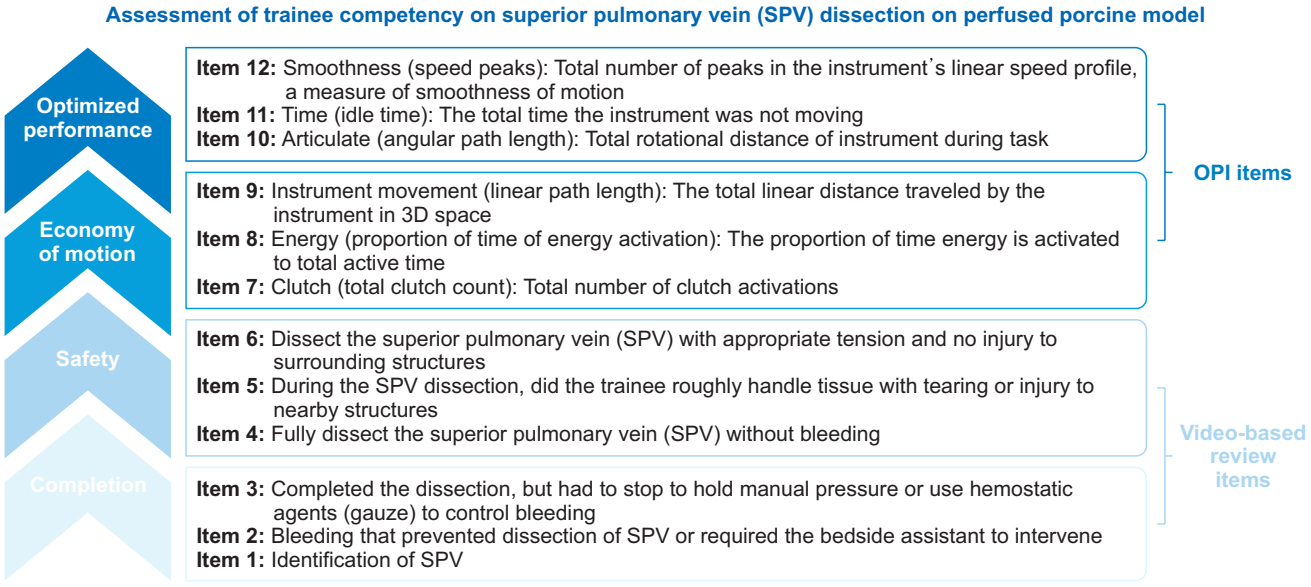


Fig. 1. Novel assessment tool (SCOPE; superior pulmonary vein competency using objective performance evaluation) measuring trainee competency on superior pulmonary vein dissection on perfused porcine model. Items 1–6 are video based review items and 7–12 are Objective Performance Indicator (OPI) items.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-7
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S23

S6-7

Minimally Invasive Surgery for Lung Cancer in Japan: Video-Assisted Thoracic Surgery and Various Robots

Toshihiko Sato

Fukuoka University, Fukuoka, Japan

Thoracoscopic surgery (including robot-assisted surgery) accounts for 70% of lung cancer surgeries performed in Japan. In the majority of institutes, a thoracoscopic technique that combines a 3–4 cm skin incision with or without several ports is practiced. There is another approach that is unique to Japan: the hybrid thoracoscopic approach. This approach uses a thoracoscope with a small thoracotomy of about 8 cm under direct vision. The rationale for this approach is that there is no significant difference in postoperative pain and recovery. However, it has been pointed out that only the operator can see what is happening during the procedure, which can sometimes provoke serious consequences.

Under these circumstances, the endoscopic surgical skill qualification system was launched in 2021. Candidates' unedited right upper lobectomy videos are reviewed by 3 independent reviewers and scored. Up to 400 surgeons have been certified to date, with approaches varying from uniportal to robotic. It is a system focused on evaluating surgeons' skills with an emphasis on safety.

The number of robotic-assisted thoracoscopic surgery (RATS) lung cancer procedures has grown rapidly since public insurance reimbursement for lobectomy and segmental resection began in 2017. More than 20% of total lung cancer surgeries are now performed using the RATS approach. Partial pneumonectomy is not yet covered under RATS.

Despite these minimally invasive approaches being accepted as the standard of surgical care for lung cancer, Japan's guidelines for lung cancer treatment still only weakly recommend RATS and video-assisted thoracic surgery for Stage I non-small cell lung cancer. Advanced institutes, including ours, are actively treating complex cases that require bronchoplasty, N2 nodal resection, neoadjuvant chemotherapy, and more. We believe that these minimally invasive approaches to advanced lung cancer represent the new frontier to be explored.

In this session, the author would like to introduce our efforts in performing difficult cases using minimally invasive techniques and 2 Japanese-made surgical robots: the pneumatic Saroa and Hinotori.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-7
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S24

S6-7

Minimally Invasive Surgery for Lung Cancer in Japan: Video-Assisted Thoracic Surgery and Various Robots

Toshihiko Sato

Fukuoka University, Fukuoka, Japan

Thoracoscopic surgery (including robot-assisted surgery) accounts for 70% of lung cancer surgeries performed in Japan. In the majority of institutes, a thoracoscopic technique that combines a 3–4 cm skin incision with or without several ports is practiced. There is another approach that is unique to Japan: the hybrid thoracoscopic approach. This approach uses a thoracoscope with a small thoracotomy of about 8 cm under direct vision. The rationale for this approach is that there is no significant difference in postoperative pain and recovery. However, it has been pointed out that only the operator can see what is happening during the procedure, which can sometimes provoke serious consequences.

Under these circumstances, the endoscopic surgical skill qualification system was launched in 2021. Candidates' unedited right upper lobectomy videos are reviewed by 3 independent reviewers and scored. Up to 400 surgeons have been certified to date, with approaches varying from uniportal to robotic. It is a system focused on evaluating surgeons' skills with an emphasis on safety.

The number of robotic-assisted thoracoscopic surgery (RATS) lung cancer procedures has grown rapidly since public insurance reimbursement for lobectomy and segmental resection began in 2017. More than 20% of total lung cancer surgeries are now performed using the RATS approach. Partial pneumonectomy is not yet covered under RATS.

Despite these minimally invasive approaches being accepted as the standard of surgical care for lung cancer, Japan's guidelines for lung cancer treatment still only weakly recommend RATS and video-assisted thoracic surgery for Stage I non-small cell lung cancer. Advanced institutes, including ours, are actively treating complex cases that require bronchoplasty, N2 nodal resection, neoadjuvant chemotherapy, and more. We believe that these minimally invasive approaches to advanced lung cancer represent the new frontier to be explored.

In this session, the author would like to introduce our efforts in performing difficult cases using minimally invasive techniques and 2 Japanese-made surgical robots: the pneumatic Saroa and Hinotori.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S6-8
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S25

S6-8

Thoracic Surgery Applications of Robotic Bronchoscopy

Jae Yul Kim, MD

City of Hope Cancer Center, Duarte, CA, USA

There has been an increase in the number of pulmonary nodules detected by computed tomography (CT) scans, either incidentally or for lung cancer screening. Most pulmonary nodules are in the periphery of the lung. Biopsy has usually been performed percutaneously or by surgical excision. Percutaneous biopsy has up to a 20% incidence of pneumothorax and excisional biopsy is much more invasive. Transbronchial biopsy for periphery nodules has been limited by loss of vision in peripheral airways, lack of precise navigation, and CT to body divergence. Electromagnetic guided navigational bronchoscopy has had relatively low rates for diagnostic yield for small nodules (<2 cm) and peripheral nodules. Newer robotic bronchoscopy systems have increased diagnostic yield due to improved stability, increased precision, and vision to the periphery. Adjuncts such as radial endobronchial ultrasound and cone beam CT can increase diagnostic yield to >95% even for small, peripheral nodules. Robotic bronchoscopy allows for (1) more efficient diagnosis and staging of lung cancers, (2) accurate and efficient dye marking of nodules for resection, (3) biopsy and resection under a single anesthetic, and (4) precise transbronchial ablation of lung tumors. In our institutional experience of >1,000 robotic bronchoscopies, the diagnostic yield rate is 96% with a pneumothorax rate <1%. The success rate for dye marking localization is 100%.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S7-1
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S26

S7-1

Subxiphoid Video-Assisted Thoracoscopic Surgery and Robotic-Assisted Thoracoscopic Surgery Thymectomy

Takashi Suda

Fujita Health University Okazaki Medical Center, Okazaki, Japan

Endoscopic thymectomy is generally performed via the lateral intercostal space, but the usefulness of the subxiphoid approach has recently been reported. The advantage of the subxiphoid approach is that the camera is inserted from the midline of the body, making it easy to obtain a view of the bilateral phrenic nerves and the upper pole of the thymus. In addition, subxiphoid uniportal thymectomy (SUT) is performed with only a single incision of 4 cm or less in the subxiphoid region; hence, it does not involve the intercostal space, resulting in minimal pain with no chronic pain or numbness due to intercostal nerve damage. However, despite these benefits, SUT has not been widely adopted because it requires familiarity with the procedure and has a long learning curve. Conversely, in subxiphoid robotic thymectomy (SRT), a camera is inserted through a subxiphoid incision, and the arms are inserted via the lateral intercostal spaces. This method combines the excellent view from the subxiphoid approach with the operational ease of the robotic system, enabling complex surgeries such as vascular anastomosis. However, a drawback is that the robotic arms pass through the intercostal spaces, which can cause intercostal nerve damage. We report the techniques of SUT, SRT, and subxiphoid uniportal robotic thymectomy using the da Vinci Xi system.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S7-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S27

S7-3

Outcomes of 102 Patients Who Underwent Robotic-Assisted Thoracoscopic Surgery Pulmonary Resection via the Subcostal Approach

Woohyun Jung, MD, Jae Hyun Jeon, MD, Sukki Cho, MD, PhD, Kwhanmien Kim, MD, PhD

Division of Thoracic Surgery, Department of Thoracic and Cardiovascular Surgery, Seoul National University Bundang Hospital, Seongnam, Korea

Background: In 2022, we implemented the subcostal approach using the da Vinci robotic surgical system. This study analyzes the operative outcomes and immediate follow-up results of subcostal robot-assisted thoracic surgery (subRATS).
Methods: A total of 102 patients underwent subRATS pulmonary resection from 2022 to 2024 at our institution. We collected and analyzed clinical characteristics, intraoperative outcomes, short-term complications, and postoperative pulmonary function. A cumulative sum (CUSUM) model was used to assess the learning curve.
Results: The mean age was 63 years, with 45.0% (46/102) of patients being male. Lobectomy was performed in 90.2% (92/102) of patients and segmentectomy in 9.8% (10/102). Regarding pathology, 96.0% (98/102) of patients had lung cancer, 2.0% (2/102) had a lung abscess, 1.0% (1/102) had a pulmonary arteriovenous malformation, and 1.0% (1/102) had pulmonary sequestration. The mean operation time was 157±72 minutes. CUSUM analysis demonstrated a learning curve for operation time, indicating the reproducibility of subRATS pulmonary resection. Operative time significantly decreased with surgical experience ($p<0.001$). The mean estimated blood loss was 169±375 mL. There was 1 case of in-hospital mortality due to postoperative myocardial infarction and 1 case requiring conversion to thoracotomy due to intraoperative bleeding. One patient developed postoperative chylothorax. The mean length of hospital stay was 4±3 days. The mean decrease in forced expiratory volume in 1 second was 409.4 mL at 1 month and 311.6 mL at 3 months postoperatively. No cases of postoperative diaphragmatic hernia were observed.
Conclusion: SubRATS represents a novel access strategy for pulmonary resection that potentially leads to faster recovery. This study demonstrates its reproducibility and feasibility in clinical practice.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S7-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S28

S7-4

Bilateral Transcervical Mediastinoscopic-Assisted Transhiatal Laparoscopic Esophagectomy versus Thoracolaparoscopic Esophagectomy: A Propensity Score-Matched Analysis

Hiroyuki Daiko

National Cancer Center Hospital, Tokyo, Japan

Background: This study aimed to compare the surgical outcomes of bilateral transcervical mediastinoscopic-assisted transhiatal laparoscopic esophagectomy (BTC-MATLE) and traditional thoracoscopic-laparoscopic esophagectomy (TLE) using propensity score matching (PSM) to minimize selection bias.
Methods: From 2017 to 2022, 392 patients underwent R0 resection for esophageal cancer. After excluding open, salvage, conversion, and 2-stage cases, 32 BTC-MATLE and 360 TLE cases were identified. PSM was performed based on age, performance status, and clinical stage, resulting in 27 matched pairs.
Results: Baseline characteristics were well balanced between the groups. Operative time was significantly shorter in the BTC-MATLE group (254±104 minutes) compared to the TLE group (342±55 minutes, p<0.001). Intensive care unit (ICU) stay was also significantly shorter in the BTC-MATLE group (median=1 day) than in the TLE group (median=3 days, p=0.002). There were no significant differences in blood loss, anastomotic method, complication rates, length of hospital stay, or readmission rates.
Conclusion: BTC-MATLE demonstrated shorter operative time and ICU stay compared to TLE, with comparable safety outcomes. This technique may be a feasible minimally invasive approach for esophagectomy.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S7-5
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S29

S7-5

Robot-Assisted Transcervical Esophagectomy

Takeo Fujita, MD, PhD, FACS

Division of Esophageal Surgery, National Cancer Center Hospital East, Kashiwa, Japan

Background: Cervical manipulation during mediastinoscopic esophagectomy often results in a relatively high rate of recurrent laryngeal nerve (RLN) paralysis, despite advancements in neuromonitoring (NIM). To address this, the use of a robotic-assisted cervical approach, particularly around the RLN, has been proposed to enhance precision and safety. Additionally, a robotic transhiatal approach can facilitate detailed dissection of the middle and lower mediastinum. This study evaluates 50 cases of robot-assisted cervical esophagectomy (RACE) performed at our institution.

Methods: The study analyzed 50 cases of RACE conducted between 2023 and 2024. Mediastinoscopic esophagectomy, including RACE, is typically performed on patients for whom thoracoscopic approaches are challenging, such as those with prior thoracic conditions or poor performance status. All cases utilized bilateral cervical approaches with NIM monitoring. The procedures were performed sequentially, starting with the right side, followed by the left. The RACE procedures employed the da Vinci Xi system for bilateral cervical approaches, with systematic dissection of mediastinal lymph nodes according to the 12th edition of the Japanese Classification of Esophageal Cancer guidelines, excluding 106tbL nodes unless clinically indicated.

Results: Patients had a mean age of 73.8 years, with a male-to-female ratio of 43:7. Clinical stages were distributed as follows: I (19 cases), II (6), III (20), and IV (5). Neoadjuvant chemotherapy was administered in 52% of cases, and over 80% had prior systemic or pulmonary conditions. All RACE procedures were completed without intraoperative complications. Postoperative complications included RLN paralysis in 12.0% (Clavien-Dindo Classification [CD] Grade ≥1) and pneumonia in 6.0% (CD Grade ≥2). RLN paralysis occurred equally on the right and left sides.

Conclusion: RACE was found to be a relatively safe and feasible procedure, with acceptable rates of RLN paralysis and respiratory complications. The robotic transhiatal approach also enabled precise dissection of the mediastinum. However, cases with anatomical challenges—such as a narrow mediastinum, short neck, thyroid enlargement, or a history of cervical chemoradiotherapy—posed technical difficulties. Future studies will focus on improving reproducibility in such challenging cases and investigating mid-term outcomes.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S7-6
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S30

S7-6

Intercostal Approach for Robotic Lung Surgery Using the da Vinci SP System

Junghee Lee

Division of Thoracic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

Robotic lung surgery using the da Vinci SP (single-port [SP]) system has been performed via extrathoracic routes, such as the subcostal or subxiphoid approach, based on the belief that the size of the SP cannula precludes access through the narrow intercostal space. However, at Samsung Medical Center, we challenged this assumption and successfully performed lobectomies using an intercostal approach. To date, we have completed more than 15 cases using this method, demonstrating its technical feasibility and safety.

The intercostal SP approach was performed through a 4-cm incision at the 5th intercostal space for the SP port, supplemented by a 12-mm assist port at the 8th intercostal space. This configuration provided direct access to the thoracic cavity with a familiar operative view and sufficient working space.

In this presentation, we will share our surgical technique, port configuration, and docking strategies, along with operative videos and early outcomes. We will also discuss the technical challenges encountered during this transition and how they were overcome. Our experience suggests that the intercostal approach may offer a more versatile and ergonomic option for SP robotic lung surgery and could expand the applicability of this platform in thoracic procedures.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S8-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S31

S8-3

Bronchoscopic-Guided Ablative Therapy for Lung Cancer

Prof. Calvin S. H. Ng

Department of Surgery, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong SAR, China

Bronchoscopic ablative therapy is a form of local therapy for the management of lung tumors. Use of ablation energy delivered by catheters or needles to central airways via fiberoptic bronchoscopy or via the percutaneous route to treat lung tumors and pathology has been around for several decades. One of the drawbacks of the percutaneous route is the high risk of pleural-based complications, such as pneumothorax and bronchopleural fistula, ranging from 11% to 52%. Recent advances in navigational bronchoscopy—including virtual airway anatomy, electromagnetic navigation, and intraoperative imaging—have allowed clinicians to reach distal areas of the lung with greater accuracy for diagnostic and therapeutic purposes. The recent development of robotic-assisted bronchoscopy with additional shape-sensing technology and image-integrated navigation correction for computed tomography–body divergence also aids in precision navigation. The options for ablating peripheral (and central) tumors have grown lately, with the "traditional" radiofrequency ablation (RFA) and microwave ablation (MWA) remaining the predominant methods. Single-arm retrospective studies have shown transbronchial MWA ablation of lung tumors to be safe and effective, with a local recurrence rate of around 8% at follow-up of up to 5 years (median follow-up=2.3 years), which is comparable to radiation therapy.

Other ablation options that are available through the transbronchial route include saline "infused" RFA, cryoablation, pulsed electric field, vapor (steam) ablation, photodynamic therapy, and laser ablation. Currently, many of these still lack robust evidence and long-term data and require careful consideration. Nevertheless, some of these ablative energy options may provide potential advantages such as immune stimulation (local and systemic) and abscopal effects. Other ablative approaches being investigated include local brachytherapy by implantation of radiation seeds into the tumor, and injection of pharmacological agents to produce direct cytotoxic effects or to augment the efficacy of adjunct treatments (e.g., radiosensitizers). Large prospective comparative studies are needed to better delineate the role of these ablative technologies and to select appropriate patients.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S8-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S32-S33

S8-4

Nanotheranostics for Targeted Lung Cancer Surgery and Treatment

Hak Soo Choi

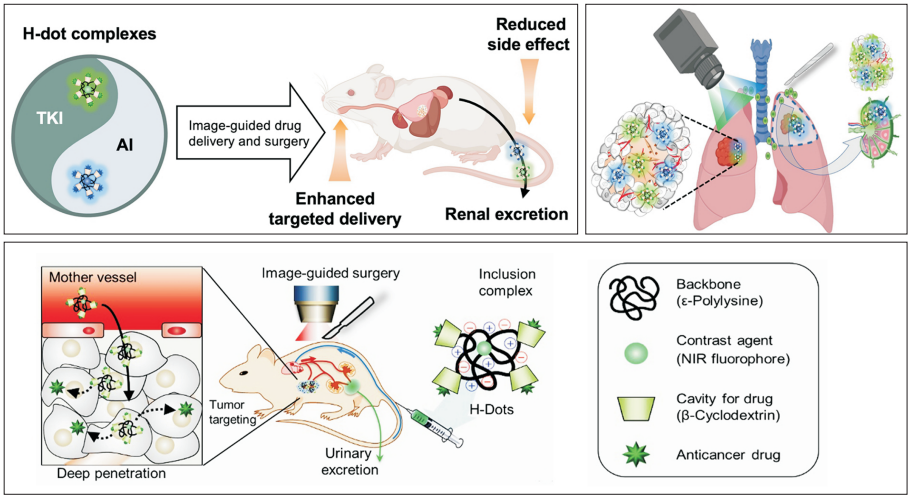
Harvard Medical School, Boston, MA, USA

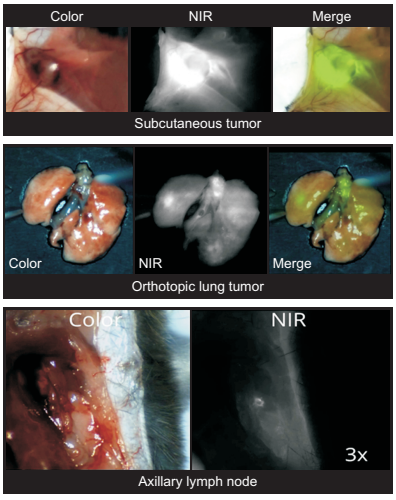
Incomplete tumor excision or residual positive surgical margins often lead to recurrence and metastasis in cancer patients. Although techniques such as endobronchial ultrasound-guided transbronchial needle aspiration and positron emission tomography/computed tomography have been employed for preoperative tumor evaluation, they are inadequate for precisely localizing tumor boundaries or lymph node metastases (LNM) that are not visible to the naked eye during surgery. As such, there is a critical need for intraoperative tools that provide accurate tumor and LNM localization to enable complete and safe surgical excision. Real-time near-infrared (NIR) fluorescence imaging represents a promising solution, offering high spatial resolution and intraoperative adaptability.

In this study, we introduced a multifunctional theranostic nanoplatform, Harvard dots (H-dots), to facilitate image-guided lung cancer and LNM surgery while enabling targeted combination therapy. H-dots co-loaded with gefitinib (Gef) and genistein (Gen) provided real-time dual-channel NIR fluorescence image guidance, aiding both surgical and pathological workflows. Simultaneously, they delivered epidermal growth factor receptor tyrosine kinase inhibitors and aromatase inhibitors to tumor sites for synergistic therapeutic effects. In orthotopic lung tumor and subcutaneous tumor mouse models, the H-dot platform exhibited high tumor-specific accumulation, reduced nonspecific uptake in normal tissues, and minimized adverse effects. Additionally, the pH-responsive release of drugs in the acidic tumor microenvironment was confirmed, enhancing therapeutic precision.

This innovative approach offers a noninvasive, targeted theranostic solution with several advantages, including improved water solubility and bioavailability, precise biodistribution, rapid renal clearance, and reduced systemic toxicity. Our results demonstrated that the Gef/H-dot and Gen/H-dot combination represents a potent nanoplatform for tumor imaging, growth suppression, and toxicity reduction. Furthermore, this system enables dual-channel NIR fluorescence-guided staging detection, surgical intervention, and pathological assistance, along with the simultaneous delivery of synergistic anti-tumor agents.

In summary, the H-dot-based theranostic system presents significant potential for advancing personalized cancer treatment by combining precision imaging with targeted drug delivery. Future investigations will focus on elucidating the underlying mechanisms of H-dot drug delivery and optimizing strategies to enhance the bioavailability of multiple therapeutic agents for a broad range of clinical applications.


H-dot complexes
TKI
AI
Image-guided drug delivery and surgery
Reduced side effect
Enhanced targeted delivery
Renal excretion
Mother vessel
Deep penetration
Image-guided surgery
Tumor targeting
Urinary excretion
Inclusion complex
H-Dots
Backbone (ε-Polylysine)
Contrast agent (NIR fluorophore)
Cavity for drug (β-Cyclodextrin)
Anticancer drug


Color
NIR
Merge
Subcutaneous tumor
Color
NIR
Merge
Orthotopic lung tumor
Color
NIR
3x
Axillary lymph node

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S8-5
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S34

S8-5

Artificial Intelligence and Image-Guided Esophageal Surgery

Takeo Fujita

Division of Esophageal Surgery, National Cancer Center Hospital East, Kashiwa, Japan

Recurrent laryngeal nerve (RLN) palsy is a common complication following esophageal cancer surgery, significantly impacting postoperative quality of life and increasing the risk of pneumonia. In response, we are developing an artificial intelligence (AI)-based surgical navigation system to mitigate RLN palsy.

Unlike navigation systems in radiological imaging or endoscopy, AI surgical navigation must address the complex process of progressively revealing hidden structures that dynamically change during dissection. Our current software demonstrates navigation accuracy comparable to that of experienced esophageal surgeons. The next challenge lies in improving the system's ability to detect critical structures early and reliably during surgery.

Anastomotic leakage is another critical complication that greatly influences postoperative outcomes. Indocyanine green (ICG) imaging remains the most widely used method for evaluating gastric conduit perfusion, playing a key role in leakage prevention. However, ICG imaging has limitations, including difficulty in assessing congestion, a lack of objective metrics, and potential biases related to ICG injection or camera positioning.

To address these limitations, we are exploring tissue oxygen saturation (StO_2) imaging as a novel approach. This technique allows for objective, repeatable assessments of gastric conduit perfusion, providing quantifiable data on congestion levels. We are currently evaluating StO_2 imaging in thoracic esophagectomy and comparing its effectiveness with ICG-based perfusion evaluation.

This presentation highlights 2 innovative imaging technologies: AI-based intraoperative navigation for RLN protection and StO_2 imaging for gastric conduit perfusion assessment. These advancements aim to improve the precision, safety, and outcomes of esophageal cancer surgery, offering new solutions to enhance both surgeon performance and patient care.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S8-6
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S35-S36

S8-6

The Role of Artificial Intelligence in Modern Surgical Techniques

Kyungsang Kim

Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

Artificial intelligence (AI) has great potential to advance modern surgical techniques by enhancing precision, efficiency, and patient outcomes through integration with robotic platforms such as the da Vinci system. AI-driven advancements in intraoperative imaging, robotic assistance, and real-time decision support are transforming surgical workflows. Machine learning algorithms improve image processing by enabling noise reduction, contrast enhancement, and real-time segmentation of anatomical structures, which aids in tumor and lung segment delineation and thoracic lesion localization. In minimally invasive thoracoscopic procedures, AI can enhance navigation, tissue identification, and task execution, thereby reducing surgical trauma and accelerating recovery.

Our core applications feature AI-assisted surgical assistant systems designed for thoracoscopic lung resections. During surgical procedures with the da Vinci system, clinicians' hands and eyes remain fully engaged in critical tasks, making voice interaction an essential interface for operation. Therefore, we integrate AI-powered voice recognition to streamline task execution. This hands-free assistance minimizes workflow interruptions, optimizing both surgical efficiency and cost-effectiveness for clinical teams.

Technically, we have developed a LangGraph-based (by OpenAI) agent framework combined with voice control that leverages natural language processing to interpret verbal commands, enabling hands-free operation for downstream tasks such as displaying patient information and images for surgeons managing complex thoracic anatomy or multitasking during operations. Voice-enabled AI agents require several detailed steps, including real-time voice recognition, voice-to-text modeling, command reasoning, and task selection.

Despite these advancements, challenges persist, including the need for robust clinical validation of autonomous algorithms in thoracic oncology and improved data quality through standardized surgical recordings. The rapid evolution of AI-robotic synergy, marked by autonomous suturing, adaptive instrumentation, and predictive analytics, positions AI as the backbone of next-generation thoracoscopic surgery. These innovations promise to elevate global standards of care through safer, more efficient, and personalized interventions.

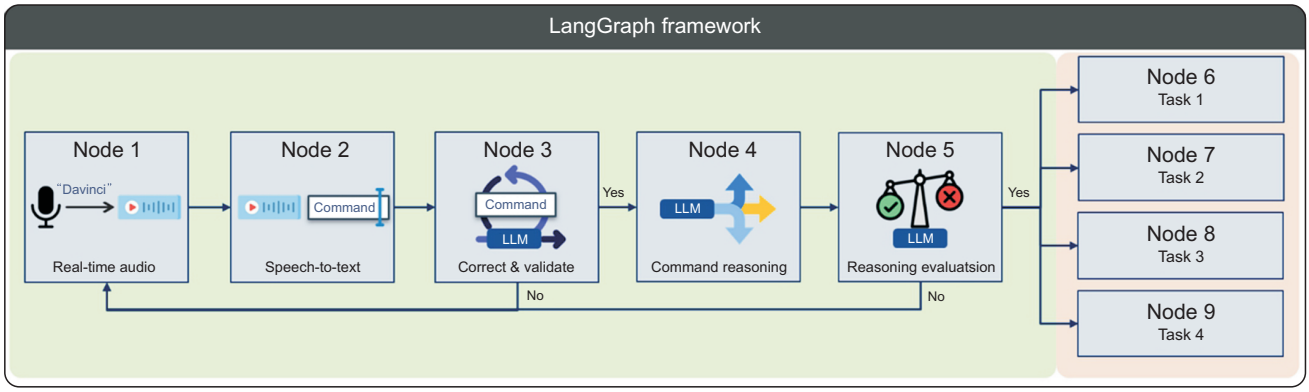


Fig. 1. LangGraph-based voice-enabled agent framework.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S9-1
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S37

S9-1

Clinical Impact of Randomized Trials on Sublobar Resection

Hisashi Saji, MD, PhD

Department of Thoracic Surgery, St. Marianna University School of Medicine, Kawasaki, Japan

Background: Sublobar resection, including segmentectomy and wedge resection, has gained increasing attention as a potential alternative to lobectomy for early-stage non-small cell lung cancer (NSCLC). Previous randomized trials, such as JCOG0802 and CALGB140503, have provided significant evidence supporting the role of sublobar resection. JCOG0802 demonstrated the superiority of segmentectomy over lobectomy in terms of overall survival in patients with small (≤2 cm) peripheral NSCLC, while CALGB140503 established the non-inferiority of sublobar resection compared to lobectomy. Meanwhile, JCOG0804 and JCOG1211 highlighted the survival benefits of limited resection in populations with non-invasive disease.

Recent Developments: More recently, new trials such as JCOG2217 and WJOG16923L have further refined our understanding of the clinical impact of sublobar resection. JCOG2217 is evaluating the role of segmentectomy versus lobectomy for NSCLC with radiological solid-predominant tumors containing a ground-glass opacity component, measuring >2–3 cm. In contrast, WJOG16923L investigates the efficacy of segmentectomy versus lobectomy in NSCLC with purely solid radiological characteristics (2–3 cm), assessing whether the benefits of sublobar resection extend beyond smaller tumors.

Clinical Implications: The results of these trials are expected to influence future surgical guidelines by further refining patient selection criteria. While segmentectomy has been shown to preserve pulmonary function without compromising oncologic outcomes in selected patients, ongoing studies will provide critical data on long-term survival, recurrence patterns, and quality of life. Additionally, integrating molecular biomarkers and novel imaging techniques may enhance patient stratification, leading to more individualized treatment approaches.

Conclusion: The paradigm of surgical management for early-stage NSCLC is evolving, driven by robust randomized evidence. While JCOG0802 and CALGB140503 have established the foundation for sublobar resection, ongoing trials such as JCOG2217 and WJOG16923L will provide further insights into optimizing surgical strategies. These findings will ultimately contribute to more personalized treatment approaches, improving patient outcomes in early-stage NSCLC.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S9-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S38

S9-3

Advanced Techniques for Complex Segmentectomy

Chang Young Lee

Department of Thoracic and Cardiovascular Surgery, Severance Hospital, Yonsei University College of Medicine, Seoul, Korea

Complex segmentectomy has emerged as a critical surgical approach in managing primary lung cancer, particularly for peripheral T1abN0 tumors, as recommended by the latest National Comprehensive Cancer Network guidelines (version 3.2025). While sublobar resection, including segmentectomy and wedge resection, offers potential benefits in preserving lung function, concerns about locoregional recurrence (LRR) remain prominent. These concerns are primarily associated with insufficient resection margins, a low number of lymph nodes (LNs) being examined, lack of analysis of adjacent LNs, and the absence of intraoperative frozen section analysis of margins and segmental LNs.

This presentation delves into advanced techniques in complex segmentectomy aimed at minimizing locoregional recurrences after sublobar resection. Drawing upon two pivotal randomized controlled trials by Saji H et al. (Lancet 2022) and Altorki N et al. (NEJM 2023), as well as supplementary analyses from various studies, we explored the critical factors influencing LRR. Key factors identified include the tumor-to-margin ratio (M/T ratio), segment localization, solid-to-ground-glass nodule (C/T) ratio, spread through air spaces (STAS), and lymph node involvement.

The findings suggest that margin/tumor ratios of less than 1 are significantly associated with higher recurrence rates, highlighting the necessity for achieving adequate surgical margins during segmentectomy. Radiologically invasive tumors, particularly those presenting as pure solid or with high standardized uptake value uptake, in anatomically challenging regions such as the right upper lobe, left upper division, and right basal segment, exhibited a higher propensity for LRR. Additionally, STAS presence combined with tumor margins less than 1.0 cm emerged as a substantial risk factor for local recurrence.

To address these challenges, a meticulous surgical strategy is essential when performing complex segmentectomy in high-risk anatomical segments. Lymph node dissection should not only include lobar and segmental LNs (station 11, 12, 13) but also extend to adjacent segmental LNs to avoid underestimation of metastatic spread. When intraoperative frozen sections reveal LN metastasis, immediate conversion to lobectomy should be considered to improve long-term outcomes.

In conclusion, while segmentectomy remains a viable surgical option for selected early-stage non-small cell lung cancer patients, particular caution is needed when handling radiologically pure solid tumors or those located in anatomically complex segments. By adopting advanced techniques and adhering to rigorous surgical principles, thoracic surgeons can significantly reduce the risk of locoregional recurrence, optimizing both oncological safety and functional outcomes for patients undergoing complex segmentectomy.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S9-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S39

S9-4

Advanced Technical Considerations for Robotic Pulmonary Segmentectomy

Marion Durand, MD, PhD

Groupe Hospitalier Ambroise Paré Hartmann, Neuilly Sur Seine, France

Robotic pulmonary segmentectomy requires both technical and non-technical skills due to the management needs of the platform (distance to the patient, conflict management, lack of palpation) and the specificity of segmentectomy (nodule localization, vascular control, intersegmental plan management). In this article, we present tips, tricks, and our routine approach for managing these patients.

A systematic port placement strategy is essential for operating room efficiency and team safety. Nodule localization can be achieved through 3-dimensional reconstruction during preoperative planning.

Vascular control can be achieved through bimanual ligation using non-resorbable sutures (linen or silk), with a double-row technique for arteries and double ligation with resorbable sutures for veins. This approach enables precise, distal dissection while preserving anatomy and accommodating vessel sizes that often do not match standard staplers. Cost-effectiveness is another advantage of this technique, and it helps maintain a high level of surgical proficiency.

Pulmonary main artery clamping is also a technique that must be mastered by the surgeon to allow safe dissection in cases of tricky adhesions or nodal involvement. This situation is more likely to occur in post–neoadjuvant patients (increasing in the era of immunotherapy) and with proximal lesions, as the use of the robotic approach is extended. This can be performed with a 20 cm vessel loop, double tip-up fenestrated grasper, and non-robotic green Hem-o-lok.

Intersegmental plane management is facilitated by indocyanine green marking with infrared imaging to define anatomical boundaries. Once again, maintaining the axis of each plane is critical to prevent tearing of vascular hilar structures and to optimize stapler load usage. When performed through a lower assistant port, 60 mm stapler loads can be used, thereby reducing the total number of cartridges. A posterior hand port can also be utilized for minor or sublobar fissures when necessary (Fig. 1).

Being systematic and leveraging the full potential of the robotic platform, along with advanced surgical skills such as clamping, suturing, and knot tying, is highly valuable for thoracic surgeons in this new era of tailored surgery.

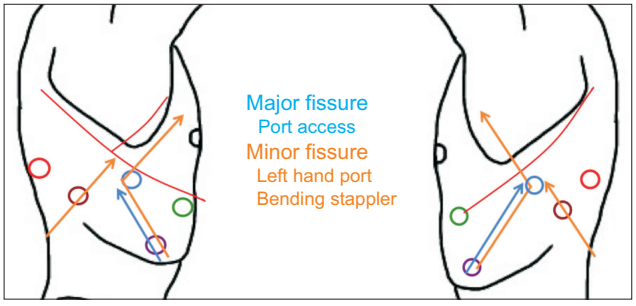


Fig. 1. Port placement and fissure management.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S9-5
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S40

S9-5

Spread through Air Spaces and Pleural Invasion in Sublobar Resection

Junghee Lee

Division of Thoracic Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

Sublobar resection (SLR), including wedge resection and segmentectomy, is increasingly adopted for selected patients with early-stage non-small cell lung cancer (NSCLC). However, its oncologic adequacy in tumors with high-risk pathological features—such as spread through air spaces (STAS) and visceral pleural invasion (VPI)—remains uncertain.

In one single-institution retrospective study of 421 patients, those with stage I NSCLC and STAS who underwent sublobar resection had significantly worse 5-year overall survival (OS) (73%) than those without STAS (87%) or those treated with lobectomy (90%). In contrast, survival after lobectomy was unaffected by STAS, suggesting a potential interaction between resection extent and tumor biology.

A recent meta-analysis of 15 studies involving 8,054 patients with tumors ≤3 cm further demonstrated that SLR was associated with worse 5-year OS and recurrence-free survival (RFS) compared to lobectomy in patients with STAS (hazard ratio [HR] for OS, 2.58; HR for RFS, 2.42), and modestly worse outcomes in VPI (HR for OS, 1.25). However, when SLR was limited to anatomical segmentectomy, outcomes were comparable to lobectomy regardless of STAS or VPI. In tumors ≤2 cm with VPI, no significant difference in survival was observed between the 2 approaches.

These findings highlight the importance of histopathologic features in surgical decision-making. However, all current evidence is based on retrospective data, and both STAS and VPI are typically confirmed only after surgery. Emerging studies using radiomics and imaging-based models have shown promise in predicting these features preoperatively, but their clinical utility remains limited.

This presentation will summarize key data on STAS and VPI in sublobar resection and discuss how future advancements in preoperative risk assessment may guide surgical strategies in early-stage NSCLC.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S9-6
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S41

S9-6

Nodal Upstaging and Safety Margins in Sublobar Resection

Agathe Seguin-Givelet

Thoracic Surgery Department, Thorax Institute-Curie-Montsouris, Paris, France

The evolving landscape of early-stage non-small cell lung cancer has resulted in a renewed focus on sublobar resections, specifically wedge resection and segmentectomy, as potential alternatives to lobectomy in selected patients. Historical concerns regarding the adequacy of oncological outcomes have been countered by recent data demonstrating the potential for comparable results, contingent upon specific conditions.

Nodal upstaging remains a key determinant of prognosis and surgical quality. Large-scale analyses, including SEER-based studies, demonstrate a strong correlation between the number of lymph nodes examined during sublobar resection and both overall and disease-specific survival, with the potential for this correlation to be more pronounced than the type of resection. However, nodal sampling is often suboptimal in wedge resections, underscoring the need for systematic lymph node evaluation regardless of surgical extent.

Margin adequacy is another cornerstone of oncologic resection. A substantial body of research has repeatedly demonstrated that margins of at least 10–15 mm can effectively reduce the likelihood of local recurrence following wedge resection for tumours measuring ≤2 cm. Segmentectomy, being anatomical, more reliably achieves this. Nevertheless, wedge resection may still be considered oncologically sound when wide parenchymal margins are achieved in patients without radiologic or pathologic high-risk features, such as spread through air spaces or lymphovascular invasion.

Randomised trials such as CALGB 140503 and JCOG0802/WJOG4607L have contributed to the redefinition of the role of sublobar resection. The CALGB trial demonstrated non-inferiority of sublobar resection to lobectomy in terms of disease-free and overall survival for tumours ≤2 cm. Conversely, the JCOG trial demonstrated a survival benefit for segmentectomy over lobectomy, yet it explicitly excluded wedge resections. The trials underscore the significance of meticulous patient selection, the establishment of adequate margins, and the implementation of rigorous intraoperative staging in achieving optimal outcomes.

The integration of radiomics, artificial intelligence, and molecular profiling has the potential to facilitate earlier insights into tumour behaviour, aggressiveness, and nodal involvement. These tools have the potential to facilitate anticipation of surgical complexity, guide the extent of resection, and support more precise, personalised decisions in sublobar oncologic surgery.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S10-1
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S42

S10-1

Lung Cancer Surgery after Neoadjuvant Immunotherapy

Hong Kwan Kim

Department of Thoracic and Cardiovascular Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea

Lung cancer remains the leading cause of cancer-related mortality worldwide, with non-small cell lung cancer (NSCLC) comprising approximately 85% of all cases. While the management of advanced NSCLC has dramatically evolved with the advent of targeted therapies and immune checkpoint inhibitors, recent evidence suggests that these systemic therapies are also playing an increasing role in earlier stages of the disease.

For patients with early-stage NSCLC, surgical resection remains the cornerstone of curative treatment. Historically, adjuvant chemotherapy has offered a modest survival benefit in resected stage II–III disease. However, the integration of immunotherapy—especially in the neoadjuvant setting—has opened new opportunities to improve long-term outcomes by reducing micrometastatic disease and enhancing antitumor immune responses prior to surgery.

Recent randomized trials have demonstrated promising results with neoadjuvant immune checkpoint blockade, showing increased rates of major pathologic response and potential survival benefit. These advances raise important clinical questions regarding patient selection, optimal timing and sequencing of therapy, surgical feasibility after immunotherapy, and the management of associated toxicities.

This lecture will explore the emerging role of neoadjuvant immunotherapy in resectable NSCLC, review the current evidence from key clinical trials, and discuss its impact on surgical planning and multidisciplinary decision-making. Special emphasis will be placed on practical considerations for thoracic surgeons, including operative challenges, response assessment, and future directions in integrating systemic therapy with surgery in the era of personalized medicine.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S10-2
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S43

S10-2

Experience of Induction Immunotherapy Video-Assisted Thoracoscopic Surgery/Robotic-Assisted Thoracoscopic Surgery for Advanced Lung Cancer

Jessica Donington, MD

Department of Surgery, University of Chicago, Chicago, IL, USA

Minimally invasive surgery (MIS) via video-assisted or robotic-assisted techniques has become the standard of care for stage I non-small cell lung cancer (NSCLC) due to improvements in short-term outcomes. Evidence supporting the use of MIS for locally advanced NSCLC is less clear. Successful MIS in locally advanced disease is complicated by the extent of disease, nodal involvement, and hilar fibrosis from neoadjuvant treatment. The inability to successfully complete MIS anatomic resection is cited as a reason by surgeons to defer induction therapy, despite the growing evidence for the benefit of neoadjuvant and perioperative immune checkpoint inhibition for locally advanced NSCLC. Evidence suggests that fibrosis related to immunotherapy is not increased compared to other systemic therapies. In experienced hands, 70%–80% of resections following immunotherapy can be completed using MIS techniques. Involved N1 nodes and radiographic response to treatment are markers for increased technical challenge. MIS for locally advanced disease and in the post-induction setting requires nuanced patient discussion, communication with the anesthesia team, careful operative technique, and a willingness to pivot to an open approach rather than compromise R0 resection or safety.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S10-3
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S44

S10-3

Multiport Video-Assisted Thoracoscopic Surgery

Agathe Seguin-Givelet

Ambroise Paré Hartmann Private Hospital, Neuilly-sur-Seine, France

Fissure-based multiportal video-assisted thoracoscopic surgery (VATS) lobectomy after neoadjuvant chemo-immunotherapy

The fissure-based full thoracoscopic lobectomy, developed by Dr. Gossot, is a precise, multiportal technique that avoids a utility incision while preserving the anatomical logic of open surgery. The key principle is a wide opening of the fissure to allow direct and safe exposure of the pulmonary artery and its branches, reducing the risk of anatomical misjudgment. The technique typically involves 3 or 4 small-diameter ports (3–12 mm), with standardized port placement. The use of micro-instruments with ergonomic pen-style handles and short shafts improves precision while minimizing intercostal trauma. Dissection proceeds from the fissure toward the hilum, following the artery–bronchus–vein sequence. It also facilitates a thorough and systematic mediastinal lymphadenectomy, adhering to oncologic principles.

However, performing this procedure after neoadjuvant chemo-immunotherapy introduces significant technical challenges. Immune checkpoint inhibitors combined with chemotherapy induce robust inflammatory and fibrotic changes, particularly in the hilum and mediastinum. As a result, surgeons often encounter obliterated fissures, adherent or friable vascular structures, and bulky, necrotic lymph nodes. These changes may obscure anatomical planes and increase the risk of vascular or bronchial injury. In fact, dissection around the pulmonary artery and bronchus can become technically demanding, especially in centrally located tumors or in the presence of calcified nodes. Conversion to open thoracotomy may be required in up to 20%–30% of such cases, depending on the extent of post-treatment fibrosis and the surgeon's experience. Despite these obstacles, the fissure-based VATS approach remains feasible and oncologically sound in well-selected patients. Key to success is careful preoperative imaging review, meticulous surgical planning, and advanced thoracoscopic skills. When performed in expert hands, this technique preserves the benefits of minimally invasive surgery while adapting to the complexities introduced by modern neoadjuvant protocols. It represents a valuable surgical option in the evolving landscape of non-small cell lung cancer management.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S10-4
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S45

S10-4

Surgical Experience with Single-Port Video-Assisted Thoracic Surgery after Neoadjuvant Immunotherapy

Edmund E. Villaroman

Lung Center of the Philippines, Quezon City, Philippines

Neoadjuvant immunotherapy has transformed lung cancer surgery, enhancing pathological responses and potentially improving survival. This presentation showcases the surgical experience using the uniportal video-assisted thoracic surgery (VATS) approach for lung resection after neoadjuvant immunotherapy, highlighting technical challenges such as hilar fibrosis and immune-related nodal changes. Despite these complexities, uniportal VATS remains a feasible and safe option in experienced hands, offering benefits such as reduced morbidity and faster recovery. The discussion will focus on surgical strategies, patient selection, and outcomes, providing insights into optimizing minimally invasive techniques while maintaining oncologic efficacy.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S10-7
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S46-S47

S10-7

Single-Port Robotic-Assisted Thoracic Surgery Using da Vinci Single-Port System

Jun Hee Lee

Korea University Guro Hospital, Seoul, Korea

Background: Neoadjuvant immunotherapy is an emerging approach for patients with non-small cell lung cancer (NSCLC), showing promise in reducing recurrence rates and improving survival outcomes. Recent clinical trials have demonstrated encouraging pathological response rates and the feasibility of surgery following immunotherapy. However, the safety and feasibility of robotic-assisted thoracic surgery (RATS) after neoadjuvant immunotherapy remain controversial. In the present study, we aimed to evaluate the feasibility of RATS in NSCLC patients after neoadjuvant immunotherapy.
Methods: This retrospective study reviewed patients with NSCLC who underwent RATS following neoadjuvant immunotherapy between January 2022 and December 2024 at a single center. The primary outcomes included total operative time, conversion to open thoracotomy, and postoperative complications.
Results: A total of 14 patients were included in the study, of whom 6 underwent single-port robotic surgery using the da Vinci single-port robotic system, while the remaining 8 underwent multi-port surgery using the da Vinci Xi system. All patients were male, with a median age of 66 years (interquartile range [IQR], 61–68 years). The R0 resection rate was 100%. The median operative time was 262 minutes (IQR, 162–302 minutes). Conversion to thoracotomy was required in 1 case, while conversion to VATS was performed in 2 cases. The median postoperative hospital stay was 6 days (IQR, 3–8 days), and the median duration of chest tube placement was 4 days (IQR, 2–6 days). Major postoperative complications, defined as Clavien-Dindo grade ≥IIIb, occurred in only 1 patient.
Conclusion: Our study suggests that RATS following neoadjuvant immunotherapy is both safe and feasible for patients with NSCLC. While further large-scale studies are needed to refine patient selection criteria and validate long-term efficacy, continuous advancements in robotic technology and surgical techniques may further establish RATS as a promising treatment strategy.

Table 1. Patient data summary (n=14)

Characteristic	Value
Age (yr)	64 (61–68)
Sex (male)	14 (100)
Tumor location	
Right upper lobe	3 (21)
Right lower lobe	3 (21)
Left upper lobe	4 (29)
Left lower lobe	4 (29)
Type of robotic system	
Single-port system	6 (43)
Xi system	8 (57)
R0 resection rate	14 (100)
Total operative time (min)	262 (162–302)
Conversion	
To open	1 (7)
To VATS	2 (14)
Total no. of LNs harvested	19 (14–32)
Chest tube duration	4 (2–6)
Postoperative hospital stays (day)	6 (3–8)
Major postoperative complications	
IIIb	1 (7)
Pathological response	
MPR	4 (29)
pCR	7 (50)
Non-MPR	3 (21)

Values are presented as median (interquartile range) or number (%).
VATS, video-assisted thoracic surgery; LNs, lymph nodes; MPR, major pathologic response; pCR, pathologic complete response.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.S10-8
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S48

S10-8

Feasibility of Induction DCF plus Nivolumab Followed by Conversion Surgery for Initially Unresectable Esophageal Cancer

Hiroyuki Daiko

National Cancer Center Hospital, Tokyo, Japan

Background: This study evaluated the feasibility and treatment outcomes of induction chemotherapy using a combination of docetaxel, cisplatin, and 5-fluorouracil (DCF) plus nivolumab (referred to as IC-DCF+Nivo) in patients with initially unresectable esophageal cancer.
Methods: A total of 23 patients received IC-DCF+Nivo. The primary endpoint was the rate of conversion to resectable disease and subsequent surgery.
Results: Eighteen patients (78%) completed all 3 cycles of IC-DCF+Nivo. Fourteen patients (61%) were judged resectable after treatment. Of these, 10 patients (44%) underwent conversion surgery, with R0 resection achieved in 9 cases and R1 in 1 case (followed by definitive chemoradiotherapy [dCRT]). One patient experienced disease progression prior to surgery, and 3 were still awaiting surgery at the time of analysis. Four patients (17%) remained unresectable and received either dCRT (n=3) or chemotherapy (n=1). Among them, 1 patient later underwent delayed conversion surgery.
Conclusion: Induction therapy with DCF plus nivolumab appears feasible and enables conversion surgery in a substantial proportion of patients with initially unresectable esophageal cancer.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0014
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S49-S50

25S-0014

Feasibility of Uniport Robotic-Assisted Thoracic Surgery for Lung Cancer: Comparison with Multiport Robotic-Assisted Thoracic Surgery

In Ha Kim, Jae Kwang Yun

Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: Background: Conventional robot-assisted thoracic surgery (RATS) pulmonary resection has been performed using a multiport approach; however, there is a growing trend toward reducing the number of ports. This study aims to evaluate the safety and feasibility of uniport RATS compared to multiport RATS.
Methods: We retrospectively reviewed patients with non-small cell lung cancer who underwent RATS pulmonary resection between June 2022 and December 2024. Perioperative outcomes were analyzed and compared between uniport and multiport RATS.
Results: A total of 102 patients were included in this study, with all surgeries performed by a single surgeon. Among them, 21 patients (20.6%) underwent uniport RATS, while 81 patients (79.4%) underwent multiport RATS. Baseline characteristics were similar between the 2 groups. All procedures achieved complete resection, and no conversions were observed. The surgical extent, histologic type, number of harvested lymph nodes, and harvested lymph node stations were comparable between the 2 groups. However, the operation time was shorter in the uniport RATS group (122.0 [113.0–130.0] min vs. 143.0 min [119.0–167.0], p=0.037). There were no significant differences in chest drainage duration, postoperative hospital stay, or complication rates. However, postoperative pain scores were significantly lower in the uniport RATS group on postoperative days 0, 1, and 2. In our institution, a stepwise reduction in the number of ports was achieved and uniport RATS was successfully implemented. Over time, the proportion of uniport RATS procedures steadily increased.
Conclusion: The early outcomes of uniport RATS are comparable to those of multiport RATS. Although reducing the number of ports requires a learning curve, uniport RATS is a safe and feasible technique.

Keywords: Robotic-assisted thoracic surgery, Uniport, Multiport, Lung neoplasms

Table 1. Comparison of characteristics between multiport and uniport thoracoscopic surgery patients

Characteristic	Multiport (N=81)	Uniport (N=21)	p-value
Age (yr)	65.0 (60.0–68.0)	65.0 (60.0–69.0)	0.700
Sex			0.706
Male	34 (45.7)	8 (38.1)	
Female	44 (54.3)	13 (61.9)	
Body mass index (kg/m^2)	24.8 (23.0–26.6)	23.8 (22.7–27.1)	0.469
Smoking history	35 (43.2)	5 (23.8)	0.170
No. of comorbidities			0.729
0–1	55 (67.9)	13 (61.9)	
2	19 (29.6)	5 (23.8)	
≥3	7 (8.6)	3 (14.3)	
FEV1 (%)	92.0 (81.0–100.0)	90.0 (82.0–94.0)	0.537
DLCO (%)	86.0 (76.0–98.0)	87.0 (78.0–104.0)	0.852
Clinical tumor size (mm)	27.0 (22.0–34.0)	25.0 (20.0–26.0)	0.144
Laterality			0.942
Right	47 (58.0)	13 (61.9)	
Left	34 (42.0)	8 (38.1)	
Location			0.054
Right upper lobe	31 (38.3)	4 (19.0)	
Right middle lobe	3 (3.7)	4 (19.0)	
Right lower lobe	13 (16.0)	5 (23.8)	
Left upper lobe	24 (29.6)	4 (19.0)	
Left lower lobe	10 (12.3)	4 (19.0)	
Operation time (min)	143.0 (119.0–167.0)	122.0 (113.0–130.0)	0.037
Complete resection	81 (100.0)	21 (100.0)	1.000
Conversion	0 (0)	0 (0)	1.000
Surgical extent			0.952
≥Lobectomy	64 (79.0)	16 (76.2)	
Sublobar resection	17 (21.0)	5 (23.8)	
Histologic type			0.353
Adenocarcinoma	68 (84.0)	20 (95.2)	
Non-adenocarcinoma	13 (16.0)	1 (4.8)	
Harvested LNs	26.0 (18.0–33.0)	25.0 (18.0–31.0)	0.444
Harvested LN stations	8.0 (7.0–9.0)	8.0 (6.0–9.0)	0.139
Pathologic tumor size (mm)	25.0 (19.0–33.0)	24.0 (21.0–26.0)	0.179
Clavien-Dindo complication			0.668
0	71 (87.7)	19 (90.5)	
I	1 (1.2)	1 (4.8)	
II	3 (3.7)	0 (0)	
IIIa	4 (4.9)	1 (4.8)	
IIIb	2 (2.5)	0 (0)	
Chest drainage (day)	3.0 (2.0–3.5)	3.0 (2.0–4.0)	0.892
Hospital stay (day)	4.0 (3.0–5.0)	4.0 (3.0–5.0)	0.652
NRS pain score			
POD 0	3.0 (3.0–5.0)	3.0 (3.0–3.0)	0.020
POD 1	3.0 (3.0–4.0)	3.0 (2.0–3.0)	0.013
POD 2	3.0 (2.0–3.0)	2.0 (2.0–3.0)	0.022
POD 3	2.0 (2.0–3.0)	2.0 (2.0–2.0)	0.105

Values are presented as median (interquartile range) or number (%).
FEV1, forced expiratory volume in 1 second; DLCO, diffusing capacity of the lung for carbon monoxide; LN, lymph node; NRS, Numeric Rating Scale; POD, postoperative day.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0061
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S51-S52

25S-0061

Initial Experiences of Single-Port Robotic Segmentectomy Using the Single-Port Robotic System via a Subcostal Approach

Byung Mo Gu, Jun Hee Lee, Hyun Koo Kim

Department of Thoracic and Cardiovascular Surgery, Korea University Guro Hospital, Seoul, Korea

Background: Single-port robotic-assisted thoracoscopic surgery (RATS) is an emerging minimally invasive approach for anatomic pulmonary resection. We previously reported our initial experience of RATS anatomical pulmonary resection using the single-port system. However, the feasibility of segmentectomy using this technique has not yet been validated. Therefore, this study aimed to evaluate the feasibility and safety of single-port robotic segmentectomy using the single-port robotic system via a subcostal approach.
Methods: Between January 2023 and December 2024, a total of 48 patients underwent robotic segmentectomy using the single-port robotic system at a single center. Patient demographics, intraoperative outcomes, and postoperative outcomes including complications were retrospectively analyzed.
Results: Among the 48 patients (mean age, 61.4±10.6 years), there were 20 males (41.7%) and 28 females (58.3%). Pathological diagnoses included adenocarcinoma in 34 patients (70.8%), squamous cell carcinoma in 4 (8.3%), and metastatic cancer in 10 (20.8%). The mean tumor size was 2.3±1.1 cm, and the mean operation time was 126.8±36.7 minutes. The median postoperative hospital stay was 4.0 days (interquartile range [IQR], 3.0–6.0), and the median chest tube duration was 2.0 days (IQR, 2.0–3.0). R0 resection was achieved in all patients (100%), with no conversions to thoracotomy. Major postoperative complications (Clavien-Dindo grade ≥IIIb) occurred in 2 patients (4.2%), and there was no 30-day mortality.
Conclusion: In the present study, we demonstrated the feasibility and safety of single-port robotic segmentectomy using a subcostal approach. This approach can serve as a viable alternative for anatomical segmentectomy. Although further large-scale studies are necessary to validate the efficacy of this technique, the potential of this approach remains highly promising, particularly with continued advancements in robotic systems.

Keywords: Lung cancer, Single-port surgery, Robotic surgery, Segmentectomy, Subcostal approach

Table 1. Patient demographics and perioperative outcomes (n=48)

Variable	Value
Age (yr)	61.4±10.6
Sex	
Male (%)	20 (41.7)
Female (%)	28 (58.3)
Preoperative FEV1 (%)	82.7±14.8
Pathological type	
Adenocarcinoma	34 (70.8)
Squamous cell carcinoma	4 (8.3)
Metastatic cancer	10 (20.8)
Tumor size (cm)	2.3±1.1
Resected segment	
Right side (n=24)	
RS1/RS2/RS3	4/5/4
RS 6	3
RS7/RS8/RS10	1/2/4
RS 9+10	1
RS 7+8+9+10	1
Left side (n=16)	
LS1/LS2/LS3	3/3/4
LS 1+2	1
LS 1+2+3	1
LS 4+5	2
LS 6	3
LS 8	1
LS 9+10	1
LS 7+8+9+10	1
Resection margin (mm)	15.1±12.2
Total operative time (min)	126.8±36.7
Postoperative hospital stay (day)	4.0 (3.0–6.0)
Chest tube duration (day)	2.0 (2.0–3.0)
Total no. of LN harvested	9.2±5.4
In primary lung cancer	10.1±5.7
In metastatic cancer	7.8±4.9
R0 resection	48 (100.0)
Conversion to thoracotomy	0
Additional resection due to close margin	4 (8.3)
Major postoperative complications (Clavien-Dindo grade ≥IIIb)	2 (4.2)

Values are presented as mean±standard deviation, number (%), or median (interquartile range).
FEV1, forced expiratory volume in one second; LN, lymph node.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0050
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S53-S54

25S-0050

Learning Curve Analysis of Robotic Lung Anatomical Resection: Impact of Prior Video-Assisted Thoracoscopic Surgery Experience

Donghee Kim, Geun Dong Lee, Hyeong Ryul Kim, Jae Kwang Yun

Department of Thoracic and Cardiovascular Surgery, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Background: The adoption of robotic-assisted thoracoscopic surgery (RATS) for lung cancer is increasing, but the learning curve and impact of prior video-assisted thoracoscopic surgery (VATS) experience remain unclear. This study evaluates the learning curve of robotic lung anatomical resection by comparing outcomes among 3 surgeons with varying VATS experience.

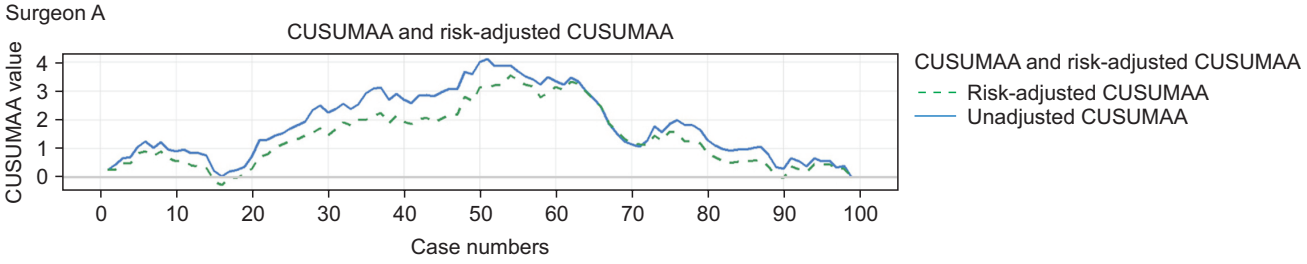
Methods: We retrospectively analyzed patients undergoing robotic lung anatomical resection performed by 3 surgeons with different VATS experience levels: surgeon A (VATS: 1,500 cases), surgeon B (VATS: 350 cases), and surgeon C (VATS: 50 cases). The learning curve was assessed using operative time, complication rates, lymph node count, and hospital stay. Change points were determined for each parameter, and outcomes before and after the change point were compared.

Results: All surgeons showed a significant reduction in operative time after reaching the learning curve threshold. Surgeon A had the longest learning curve (54 cases) but maintained a shorter operative time from the start, reducing from 150.1 to 128.3 minutes (p=0.001). Surgeons B and C reached the learning curve faster (35 and 34 cases, respectively) and showed significant reductions in operative time (B: 170.3 to 142.9 minutes, p<0.001; C: 164.9 to 138.7 minutes, p=0.001). Complication rates for surgeon A decreased from 16.2% to 1.9%, while surgeons B and C showed an increase in complications after reaching the learning curve (B: 3.5% to 8.3%; C: 5.3% to 15.4%). Lymph node harvest improved for Surgeons B and C (B: 25.7 to 32.0, p=0.002; C: 24.6 to 29.2, p=0.074), but decreased slightly for surgeon A (29.1 to 25.9, p=0.144). Hospital stay increased for all surgeons post-learning curve (A: 4.4 to 5.3 days; B: 4.1 to 5.0 days; p=0.001, C: 4.3 to 5.0 days).

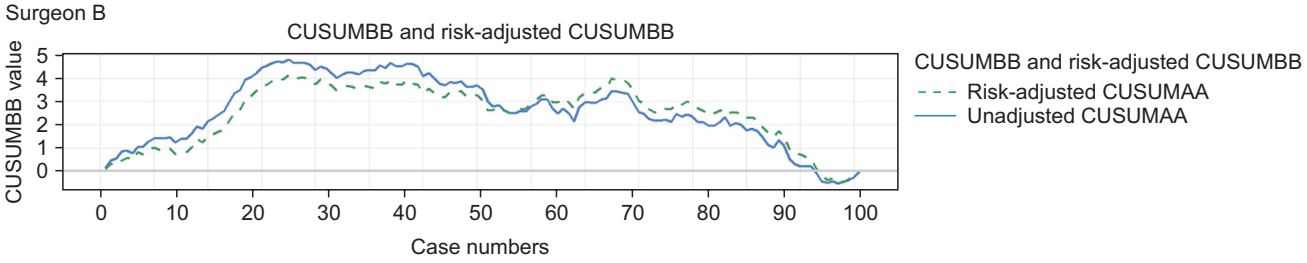
Conclusion: The learning curve for robotic lung anatomical resection varies among surgeons with different levels of prior VATS experience. The learning curve is influenced by factors such as surgery frequency, case complexity, and proctoring. Structured, risk-adjusted training programs can optimize the learning process and minimize complications.

Keywords: Robotic-assisted thoracoscopic surgery, Lung cancer resection, Surgeons' learning curve, Prior experience, Cumulative sum analysis

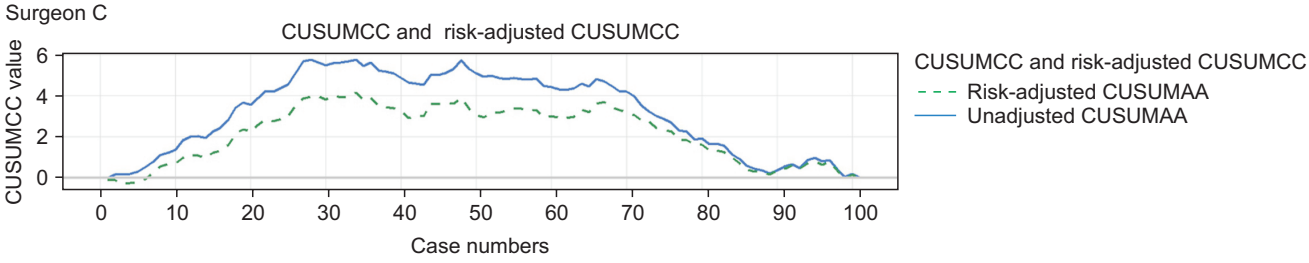
Surgeon A

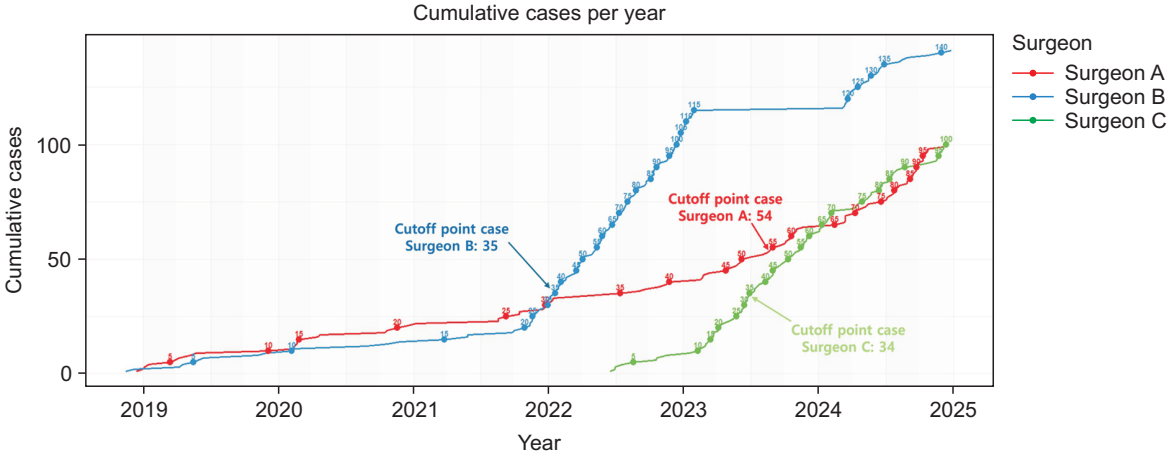


Surgeon B



Surgeon C





JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0057
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S55-S56

25S-0057

Robot-Assisted Minimally Invasive Esophagectomy Using the Single-Port Robotic System via the Subcostal Approach: A Single-Center Retrospective Study

Jun Hee Lee, Byung Mo Gu, Hyeong Hun Song, Hyun Koo Kim

Department of Thoracic and Cardiovascular Surgery, Korea University Guro Hospital, Korea University College of Medicine, Seoul, Korea

Background: Robot-assisted minimally invasive esophagectomy (RAMIE) has gained global popularity. Two recent randomized controlled trials demonstrated that RAMIE leads to shorter operative times and a greater number of dissected lymph nodes than conventional minimally invasive esophagectomy (MIE). This study presents initial experience with single-port RAMIE (SRAMIE) performed via the subcostal approach using the single-port (SP) robotic system. The study aimed to assess the feasibility and perioperative outcomes of SRAMIE compared with multiport RAMIE (MRAMIE) using the Xi robotic system and video-assisted thoracic surgery esophagectomy (VAE).
Methods: This retrospective study included patients who underwent MIE for esophageal cancer at Korea University Guro Hospital between February 2017 and December 2024. Patients were divided into 3 groups: SRAMIE (n=17), MRAMIE (n=13), and VAE (n=23). The primary outcome was the incidence of postoperative complications. Secondary outcomes included chest tube duration, length of postoperative hospital stay, postoperative pain, and 30-day mortality.
Results: No conversions to thoracotomy or VAE occurred in the SRAMIE group. Compared with VAE, SRAMIE resulted in significantly shorter chest tube duration (p=0.038), shorter postoperative hospital stays (p=0.036), and lower peak postoperative pain (p=0.003). No significant differences were observed among the 3 groups regarding total operative time, the number of resected lymph nodes, or the incidence of postoperative complications.
Conclusion: SRAMIE using the SP robotic system is a feasible approach offering advantages over VAE in recovery and postoperative pain. The noninferior perioperative outcomes indicate that SRAMIE may serve as a viable alternative to conventional MIE, warranting further large-scale studies.

Keywords: Esophageal neoplasm, Esophagectomy, Robot-assisted minimally invasive esophagectomy, Single-port, Da Vinci single-port robotic system

Table 1. Patient summary

Characteristic	SRAMIE (n=17)	MRAMIE (n=13)	VAE (n=23)	p-value		
				SRAMIE vs. MRAMIE	SRAMIE vs. VAE	MRAMIE vs. VAE
Age (yr)	67 (55–72)	64 (61–65)	65 (61–70)	0.713	0.829	0.415
Sex (male)	16 (94)	11 (85)	21 (91)	0.565	1.000	0.609
Operative types				0.713	0.680	0.265
Ivor-Lewis	10 (59)	6 (46)	15 (65)			
McKeown	7 (41)	7 (54)	8 (35)			
Thoracotomy conversion	0	1 (8)	1 (4)	0.433	1.000	1.000
R0 resection	16 (94)	12 (92)	21 (91)	1.000	1.000	1.000
Total operative time (min)	465 (430–542)	427 (395–538)	455 (378–510)	0.187	0.389	0.877
Console time (min)	258 (231–279)	250 (226–346)		0.613		
Anastomosis technique				0.002	0.003	0.020
Linear stapling						
Totally stapled	3 (18)	8 (62)	3 (13)			
Partially stapled	13 (76)	2 (15)	7 (30)			
Circular stapling	1 (6)	3 (23)	12 (52)			
Handsewn	0	0	1 (4)			
No. of LNs resected						
Total LNs	32 (26–42)	30 (20–35)	27 (20–37)	0.240	0.404	0.714
Let RLN LNs	2 (2–4)	2 (1–3)	1 (1–3)	0.265	0.072	0.668
Right RLN LNs	3 (2–4)	2 (1–3)	2 (1–4)	0.207	0.655	0.512
Chest tube duration (day)	7 (6–11)	8 (7–11)	11 (8–16)	0.406	0.019	0.082
Postoperative LOS (day)	13 (10–17)	15 (13–18)	18 (14–41)	0.214	0.030	0.228
Postoperative pain (VAS)						
Peak	4 (3–5)	6 (3–7)	6 (5–7)	0.459	0.003	0.255
POD 0	3 (3–5)	3 (3–7)	5 (3–7)	0.349	0.108	0.928
POD 1	3 (3–4)	3 (3–5)	3 (3–5)	0.703	0.286	0.622
POD 2	3 (2–3)	3 (2–6)	3 (3–5)	0.436	0.557	0.798
POD 3	3 (2–3)	3 (2–3)	3 (2–3)	0.910	0.919	1.000
POD 7	2 (1–3)	3 (1–3)	2 (1–4)	0.420	0.332	0.992
Postoperative complications						
Major complications	2 (12)	1 (8)	5 (22)	1.000	0.677	0.385
Anastomotic leakage	1 (6)	1 (8)	4 (17)	1.000	0.373	0.634
Vocal cord palsy	4 (24)	3 (23)	7 (30)	1.000	0.725	0.709
Pneumonia	3 (18)	4 (31)	7 (30)	0.666	0.471	1.000
Reoperation	1 (6)	1 (8)	2 (9)	1.000	1.000	1.000

Values are presented as median (interquartile range) or number (%).
SRAMIE, single-port plus one-port robot-assisted minimally invasive esophagectomy using the single-port robotic system; VAE, video-assisted thoracoscopic esophagectomy; LN, lymph node; RLN, recurrent laryngeal nerve; LOS, length of stay; VAS, visual analog scale; POD, postoperative day.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0015
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S57-S58

25S-0015

Quality of Life and Chronic Neuropathic Pain after 'Outside-the-Cage' Subcostal Uniportal Robotic Anatomical Lung Resection

Yin-Kai Chao

Department of Thoracic Surgery, Chang Gung Memorial Hospital-Linkou, Taoyuan, Taiwan

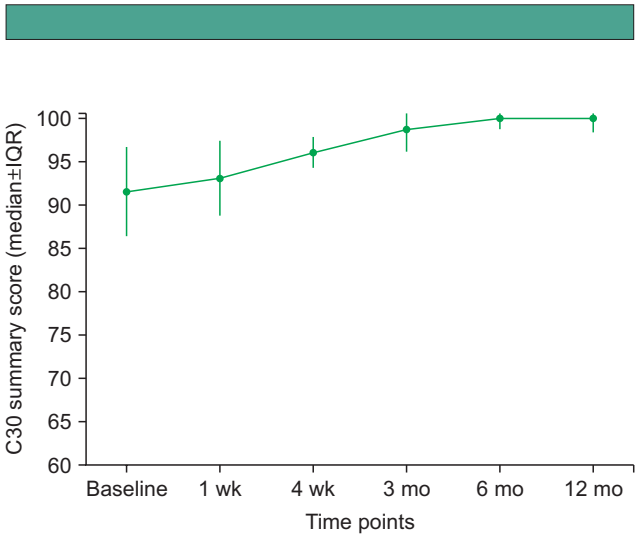
Background: Conventional robotic techniques for pulmonary resections typically involve intercostal incisions that can lead to intercostal nerve injury and chronic neuropathic pain. Implementing a subcostal approach that avoids intercostal instrumentation may reduce both the incidence and severity of chronic pain, thereby potentially enhancing postoperative quality of life (QOL).

Methods: This study constitutes a prespecified secondary analysis of a clinical trial (NCT05535712) assessing pain and QOL following subcostal uniportal robotic anatomical lung resection using the da Vinci SP single-port robotic system. Chronic pain was defined as persisting for more than 3 months postoperatively. The Chinese version of PainDETECT Questionnaire was used to determine the prevalence of chronic pain and its neuropathic components 3, 6, and 12 months after surgery. QOL was evaluated using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire-Core 30 (EORTC QLQ-C30) summary score. Assessments were carried out at baseline and at 4 weeks, 1, 3, 6, and 12 months after surgery.

Results: Among the 33 patients who completed the surgery through subcostal resection, chronic pain prevalence was 60.6%, 48.5%, and 27.2% at 3, 6, and 12 months, respectively. The majority of pain severity scores were mild, with most participants indicating they "hardly noticed" the pain. PainDETECT scores were below 12 in all cases, suggesting the absence of neuropathic pain according to the "not likely neuropathic pain" classification. Longitudinal analysis showed no significant deterioration in QLQ-C30 summary scores, indicating stable overall quality of life across multiple function and symptom domains over the 12-month follow-up period.

Conclusion: Subcostal uniportal robotic lung resection appears to be associated with a relatively low incidence of chronic pain, which is mainly mild and non-neuropathic. Postoperative QOL also remains stable over time. The uniformly low PainDETECT scores further underscore the potential benefit of this surgical approach in minimizing long-term nerve-related discomfort.

Keywords: Subcostal surgery, Uniportal robotic surgery, Davinci SP


C30 summary score (median±IQR)
100
95
90
85
80
75
70
65
60
Baseline
1 wk
4 wk
3 mo
6 mo
12 mo
Time points

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0062
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S59

25S-0062

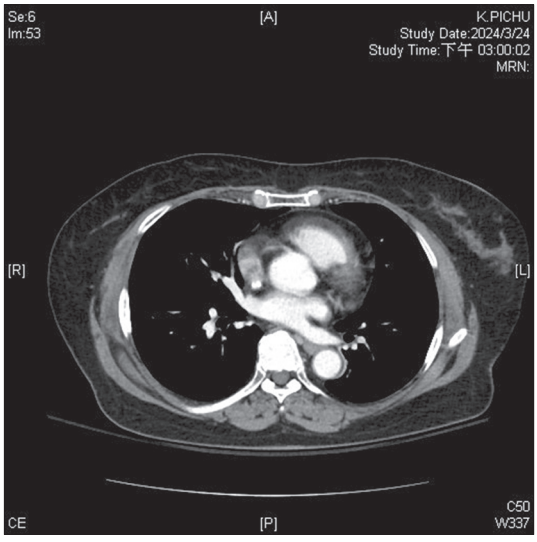
En-bloc Resection of Advanced Thymic Carcinoma with Innominate Vein and Aorta Adhesion: Video and Case Sharing

Ruei Ti Ke, Yu Chen

Department of Thoracic and Cardiovascular Surgery, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Background: This 70-year-old female was diagnosed with thymic carcinoma, modified Masaoka stage IIa, with innominate vein and aorta adhesion. Primary treatment plan was neoadjuvant treatment first then salvage surgery. However, she underwent septic shock during the chemotherapy. Hence, operation resection was considered.
Methods: We positioned the patient in the supine position, and performed robotic assisted thoracoscopic total thymectomy combined tumor en-bloc resection from subxiphoid route.
Results: The patient tolerated the entire operation smoothly. Pathology report revealed tumor en-bloc resection with clear margin. The postoperative complication was swelling in the left upper arm due to innominate vein ligation, which improved after 1 month.
Conclusion: Robotic-assisted thoracoscopic surgery was safe enough for the patient, who was considered necessary to undergo a sternotomy for the safety of en-bloc tumor resection. In the meanwhile, complications are acceptable.

Keywords: Thymic carcinoma, Robotic-assisted thoracoscopic surgery, Subxiphoid, Case reports



JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0008
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S60-S61

25S-0008

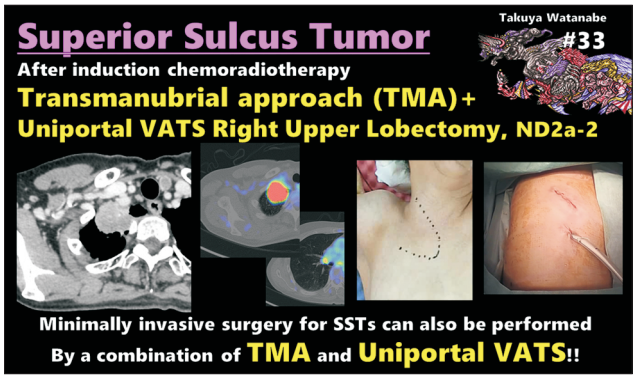
Minimally Invasive Surgery to Superior Sulcus Tumor after Induction Chemoradiotherapy: The Combination of Transmanubrial Approach and Uniportal Video-Assisted Thoracic Surgery

Takuya Watanabe, Eriko Suzuki, Naoko Yoshii, Takuya Kohama, Kensuke Iguchi, Takumi Endo, Masayuki Tanahashi

Division of Thoracic Surgery, Seirei Mikatahara General Hospital, Hamamatsu, Japan

Background: Superior sulcus tumor (SST) is a locally advanced lung cancer requiring challenging surgery. Extensive thoracotomy is typically needed but is highly invasive. We present a case where minimally invasive surgery for SST was achieved by combining transmanubrial approach (TMA) and uniportal video-assisted thoracic surgery (VATS) following induction chemoradiotherapy (ICRT).
Methods: Case presentation: A 61-year-old woman with right SST (suspected subclavian artery invasion, cT4N1M0 stage IIIA) underwent ICRT after ineffective immune checkpoint inhibitor therapy. Two cycles of cisplatin/vinorelbine with concurrent radiotherapy (40 Gy) resulted in 19% tumor shrinkage.
Results: TMA: TMA involved an inverted L-shape incision, sternum, and first rib transection to access the tumor. While significant fibrosis was observed around the subclavian vessels due to radiotherapy, vascular reconstruction was unnecessary, and the tumor could be dissected. Uniportal VATS: The patient was repositioned in the lateral position, and a 4 cm uniport was set in the sixth intercostal space. After lower mediastinal lymph node dissection (LND), pulmonary vein, pulmonary arteries, and the upper-bronchus were dissected sequentially. Then, the interlobar fissure between the upper and middle/lower lobes was divided, completing the right upper lobectomy. Finally, upper mediastinal LND was performed, the surgery was achieved (operation time: 378 minutes). Postoperative course: Pain was mild, with no analgesics needed after postoperative day (POD) 7. The patient was discharged without complications on POD 15. Pathology: ypT-1aN0 with 1% viable tumor cells (almost complete response).
Conclusion: In the era of minimally invasive lung cancer surgery, surgeons must master diverse approaches and select the most appropriate one tailored to individual cases. A surgical video is presented.

Keywords: Superior sulcus tumor, Induction therapy, Transmanubrial approach, Uniportal video-assisted thoracic surgery, Minimally invasive surgery, Case reports


Superior Sulcus Tumor
Takuya Watanabe
#33
After induction chemoradiotherapy
Transmanubrial approach (TMA)+
Uniportal VATS Right Upper Lobectomy, ND2a-2
Minimally invasive surgery for SSTs can also be performed
By a combination of TMA and Uniportal VATS!!

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0005
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S62

25S-0005

Robotic Left Upper Lobectomy with Combined Chest Wall and Great Vessel Resection Following Neoadjuvant Immunochemotherapy for a Superior Sulcus Tumor

Hitoshi Igai, Akinobu Ida, Kazuki Numajiri, Kazuhito Nii, Mitsuhiro Kamiyoshihara

Department of General Thoracic Surgery, Japanese Red Cross Maebashi Hospital, Maebashi, Japan

Background: Surgical resection for superior sulcus tumors is technically challenging. We present a case of successful robotic left upper lobectomy with combined chest wall and great vessel resection following neoadjuvant nivolumab and platinum-based chemotherapy.
Methods: A patient with a superior sulcus tumor (squamous cell carcinoma, cT3N0M0, stage 2B) underwent 3 cycles of neoadjuvant nivolumab combined with platinum-based chemotherapy. Follow-up imaging showed significant tumor shrinkage, and the stage was reassessed as ycT3N0M0, stage 2B.
Results: In the supine position, an L-shaped incision was made around the neck and sternal manubrium. The right clavicle and the first 2 ribs were transected near the sternal manubrium. After dividing the left second rib and the horizontal sternum, the left clavicle and first rib were transected. Tumor invasion into the left innominate, internal jugular, and subclavian veins was confirmed, and each vessel was divided using a stapler. A wide wedge resection of the left upper lobe was performed, followed by removal of the invaded chest wall and reconstruction with an artificial sheet. The patient was repositioned to the decubitus position for a robotic left upper lobectomy with lymphadenectomy. The procedure lasted 410 minutes (Console time: 87 minutes) with 400 mL of blood loss. Postoperative recovery was uneventful, and the patient was discharged on postoperative day 9 with good mobility in the right upper limb. Final pathology revealed ypT3N0M0, stage 2B, with a major pathological response (Ef2).
Conclusion: Surgical resection after neoadjuvant nivolumab combined with platinum-based chemotherapy is a feasible option for superior sulcus tumors. A robotic approach offers less invasiveness, even for advanced non-small cell lung cancer.

Keywords: Superior sulcus tumor, Robotic approach, Neoadjuvant immunochemotherapy, Case reports

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0018
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S63-S64

25S-0018

Modification of Dual Port Robotic-Assisted Thoracic Surgery: Introduction of Neo Dual Port Robotic-Assisted Thoracic Surgery

Jun Suzuki[1], Satoshi Shiono[1], Hikaru Watanabe[1], Satoshi Takamori[1], Takayuki Sasage[1], Kaito Sato[1], Kohei Abe[1], Kazumasa Hoshijima[1], Hiroki Ebana[2], Tetsuro Uchida[1]

[1]Division of Thoracic Surgery, Department of Surgery, Yamagata University Faculty of Medicine, Yamagata; [2]Department of Thoracic Surgery, Tokyo Metropolitan Bokutoh Hospital, Tokyo, Japan

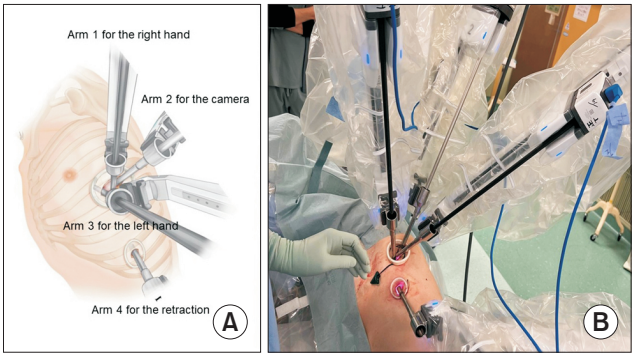
Background: Robotic-assisted thoracic surgery (RATS) has gained attention for its precision and minimally invasive approach. Recent advancements include the dual-port RATS (DRATS) technique, which reduces invasiveness while maintaining robotic precision. Building upon this, the neoDRATS (non-assistant help operation in dual-portal) method introduces a non-assistant operation to enhance surgical field exposure and flexibility. This report demonstrates the application of neoDRATS in performing a left segment 6 (S6) segmentectomy for early-stage lung cancer in a patient with an incomplete fissure.

Methods: A 60-year-old female patient with a ground-glass nodule in the left lower lobe (S6) underwent neoDRATS. Preoperative imaging revealed an incomplete fissure, requiring a non-fissure approach. All 4 robotic arms were independently utilized, using a 4 cm working port and a 1.8 cm secondary port. Pulmonary dissection was performed systematically, and the intersegmental plane was delineated using indocyanine green fluorescence. Key vessels and bronchi were transected with robotic staplers under direct visualization. The total operative time was recorded, and the patient's postoperative course was closely monitored.

Results: The neoDRATS procedure took 2 hours and 33 minutes, with a console time of 2 hours and 11 minutes. The patient was mobilized within 2 hours after surgery, and the chest drain was removed on postoperative day 1. She was discharged on postoperative day 2 without complications. Pathological examination confirmed the predominant lepidic adenocarcinoma, pT1aN0M0 (TNM 8th edition). The neoDRATS approach demonstrated efficiency and safety in addressing anatomical challenges like incomplete fissures.

Conclusion: neoDRATS offers a viable and efficient solution for complex thoracic surgeries. By minimizing invasiveness while maintaining robotic precision, this technique enhances surgical flexibility and reduces reliance on manual assistance. Its adaptability to challenging anatomical scenarios, such as incomplete interlobar fissures, underscores its potential as a refined approach in robotic thoracic surgery.

Keywords: Robotic-assisted thoracic surgery, Neo-dual-port robotic-assisted thoracic surgery, Segmentectomy, Lung cancer, Incomplete fissure, Case reports


Arm 1 for the right hand
Arm 2 for the camera
Arm 3 for the left hand
Arm 4 for the retraction
A
B

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0048
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S65

25S-0048

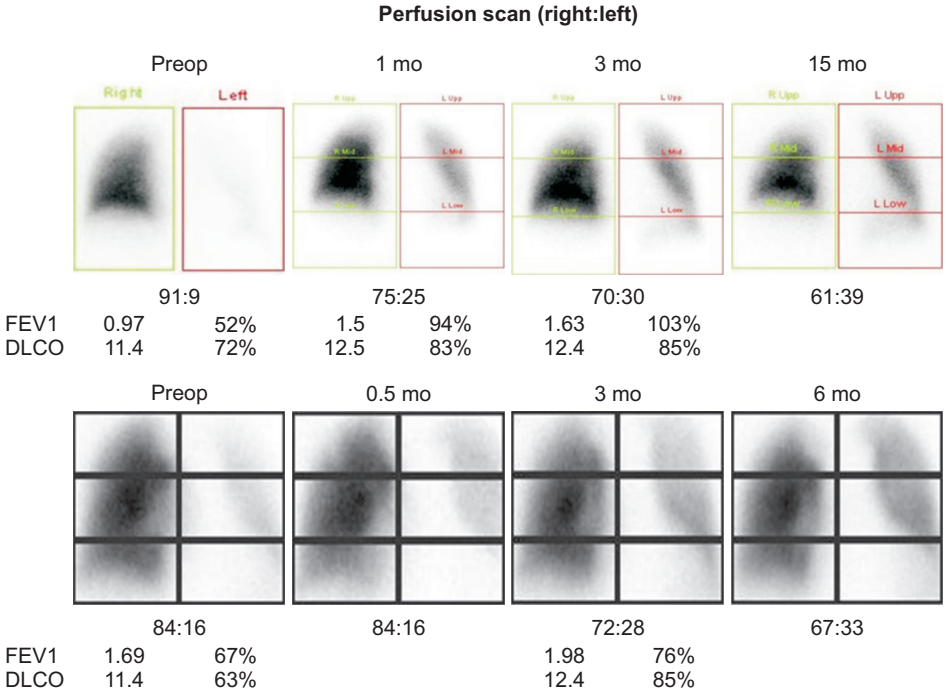
Pulmonary Perfusion Recovery Pattern after Resection of Endobronchial Tumor by Serial Perfusion Scan

Yeon Soo Kim, Seung Hwan Soong, Hyo Jun Jang, Hyeon Soo Kim, Hyeok Kim

Department of Thoracic and Cardiovascular Surgery, Hanyang University Hospital, Seoul, Korea

Background: We report the lung perfusion pattern after main endobroncial tumor resection.
Methods: Lung perfusion scans were performed at multiple time points around the time of surgery.
Results: In one patient, lung perfusion at the lesion site improved from 9% at baseline to 25%, 30%, and 39% at 1, 3, and 15 months postoperatively. In another patient, perfusion improved from 16% at baseline to 16%, 28%, and 33% at 0.5, 3, and 6 months.
Conclusion: Recovery of reduced lung perfusion after tumor resection may take several months.

Keywords: Lung perfusion, Endobronchial tumor, Bronchial resection



JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0049
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S66

25S-0049

Invasive Mucinous Adenocarcinoma Combined with Pulmonary Sequestration

Miura Kenji, Iwanaga Koichiro

Department of Thoracic Surgery, Kakogawa Central City Hospital, Kakogawa, Japan

Background: It is rare for lung cancer to be associated with pulmonary sequestration.
Methods: A 33-year-old man with a history of a lung abscess 8 years ago presented with sputum and was referred for further examination. Chest computed tomography (CT) revealed an emphysematous cyst with a 51 mm×44 mm mass in the left S10, adjacent to the aorta. The cysts exhibited contrast enhancement, with aberrant arteries suggesting an abnormal vascular structure. Initially diagnosed with left pulmonary interlobar sequestration or an infected giant cyst, surgery was indicated. Intraoperatively, 2 aberrant arteries arising from the descending aorta were identified, consistent with alveolar fractionation.
Results: A 4-port video-assisted left lower lobectomy was performed, and the patient was discharged on the 8th postoperative day. Postoperatively, histopathology revealed the pulmonary cyst to be combined with invasive mucinous adenocarcinoma, measuring 50 mm×35 mm. No lymph node metastasis was observed. As the lung cancer was not suspected by preoperatively by CT, a systematic work-up was conducted postoperatively. The patient was diagnosed with T2bN0M0 and stage IIA. He declined postoperative adjuvant chemotherapy and remained recurrence-free for 4 years.
Conclusion: Invasive mucinous adenocarcinoma is difficult to diagnose preoperatively due to its diverse clinical feature. Although rare, there have been reports of lung cancer coexisting with pulmonary sequestration. We present this case, discussing relevant previous reports and the unique aspects of the diagnosis.

Keywords: Invasive mucinous adenocarcinoma, Pulmonary sequestration, Video-assisted thoracic surgery, Case reports

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0069
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S67

25S-0069

Application of Cautery Ligating Vessels in Uniport Robot-Assisted Segmentectomy

Bin Hu, Shaohua Xie, Jinsong Bai, XIn Wei, Bo Tian, Xiaozun Yang

Department of Thoracic Surgery, Sichuan Cancer Hospital and Institute, University of Electronic Science and Technology Affiliated Cancer Hospital, Chengdu, China

Background: In multiport robot-assisted thoracic surgery (RATS) (Da Vinci), the ligation of small blood vessels may be performed by the surgeon or assistant using a Hemlock or clamps. After Gonzales initiated uni-port RATS (URATS), the surgeons often use the Maryland Bipolar Forceps in ligation to avoid the assistant's difficulty in operating space and angle. We prefer to use the cautery for dissection, so we explore the method of ligation of the vessels with the hook and barbed wire (Stratafix Spiral).
Methods: Dissecting along the sheath of the interlobar artery to preserve the anatomy of the nodule and target vessels. A 1 cm length of perivascular gap was dissected and left to ensure the threading of the barbed wire and the safe stump. Preparation of the wire, it threaded the coil into a circle, so it can be placed on the tip of the hook for pulling and knotting. Cut the needle end about 5 cm. The bipolar forceps delivered the coil through the perivascular gap, and the cautery hooked out of the coil. The forceps and hook completed the looping and tightening of the surgical knot. The oblique fissure was dissected and part of the posterior segment was excised. After exposing and severing the dorsal artery, dorsal segmentectomy ensured a complete removal of the nodule, which located right between the interlobar vein and dorsal artery.
Results: Ligating and severing the target interlobar vein and dorsal artery, the ground glass nodule was completely resected at a safe range. And the pathology was microinvasive adenocarcinoma.
Conclusion: The barbed wire knotting is reliable and can withstand large pulling force, without knot shifting and vessel tearing. Using a hook to ligate vessels increases flexibility in URATS. To save instruments such as Maryland forceps and needle holders in ligation have carbon reduction values as well.

Keywords: Uniport robot-assisted thoracic surgery, Cautery hook, Barbed wire, Knotting, Case reports

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0032
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S68

25S-0032

Thoracic Wall Tuberculosis: A Rare Entity with Varied Presentations and Favorable Outcomes

Mouad Gourti, Elmehdi Maidi

Department of Surgery, HASSAN II Medical Center, Medical University of Agadir, Agadir, Morocco

Background: Thoracic wall tuberculosis, though rare, may present as cold abscesses. We reviewed 11 patients over a 2-year period, using imaging, polymerase chain reaction, or histological analysis for confirmation.
Methods: Treatment combined anti-tuberculosis therapy with surgical drainage.
Results: Despite varied presentations, outcomes remained favorable.
Conclusion: This underscores the importance of timely diagnosis, appropriate care, and consistent follow-up.

Keywords: Atypical chest wall mass, Tuberculosis, Abscess, Case reports

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0030
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S69

25S-0030

Primary Dedifferentiated Pleural Based Liposarcoma: A Case Management Experience

Arlyze Gaile Arenas

General Surgery, Manila Doctors Hospital, Manila, Philippines

Background: Liposarcomas are one of the most common types of sarcoma arising in adult soft tissues, accounting for 15%–25% of all types of sarcoma. Usually observed in the extremities and the retroperitoneum, rarely, liposarcomas are seen in the pleura, posing challenges in its diagnosis and management. Imaging modalities such as computed tomography or magnetic resonance imaging may be used to initially assess the mass, but tissue diagnosis remains the mainstay for accurate diagnosis. For well differentiated liposarcomas, complete surgical resection may be offered if feasible, but for dedifferentiated liposarcomas that are otherwise unresectable, chemotherapy with anthracycline agents may be offered.
Methods: The patient underwent video-assisted thoracic surgery (VATS) with excision of the mass and resection of the 4th rib segment, followed by repeat VATS and biopsy of the pleural-based tumor.
Results: A 49-year-old male was incidentally found to have a pleural-based mass during a pre-employment workup. Excision of mass with resection of the 4th rib was done, revealing well differentiated liposarcoma. On surveillance positron emission tomography scan, new masses were observed and confirmed to be dedifferentiated liposarcoma on repeat biopsy.
Conclusion: Dedifferentiated pleural-based liposarcoma is an exceedingly rare entity, characterized by its unique location and histological features. Its presentation in the pleura poses diagnostic challenges due to its rarity and resemblance to other pleural-based malignancies.

Keywords: Dedifferentiated liposarcoma, Pleura, Case reports

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0013
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S70

25S-0013

The Impact of 12th Rib Dysplasia and the 13th Rib on Intercostal Identification in Thoracoscopic Surgery

Mizuki Morota, Takahiro Negi, Daisuke Tochii, Sachiko Tochii, Takashi Suda

Department of Thoracic Surgery, Fujita Health University Okazaki Medical Center, Okazaki, Japan

Background: In Thoracoscopic surgery via intercostal approach, it is important to identify the correct intercostal space because an incorrect intercostal approach can negatively affect the surgical procedure.
Methods: A total of 339 patients who were hospitalized in our department between January 2024 and January 2025 and who had undergone chest computed tomography (CT), were examined for ribs by CT. The accessed intercostal space was checked by image test who had abnormal ribs and underwent uniportal video-assisted thoracoscopic surgery.
Results: Five patients (1.5%) had a 12th rib defect, 9 patients (2.7%) had a 12th rib less than 3 cm, and 16 patients (4.7%) had a 13th rib (lumbar rib). There were 6 cases of 13th ribs with 3 cm or more in length, with a maximum of 10 cm. The patients with the 12th rib defect were all female, and 78% of short 12th rib patients were female. In surgical cases, 3 of 4 patients with a 12th rib defect accessed from incorrect intercostal space. And 5 of 8 patients with short 12th rib, 1 of 3 patients with 13th rib (with 3 cm or more in length) accessed from the wrong intercostal space.
Conclusion: The impact of 12th rib dysplasia and the existence of 13th rib on intercostal identification was determined. The results suggest that there is a high risk of miscarriage of intercostal identification, especially in cases of 12th rib dysplasia. This was thought to be because the most caudal rib that can be detected by palpation is used as the 12th rib when the patient is in the lateral recumbent position. Especially in women in the lateral recumbent position, the sternal angle and upper ribs are difficult to identify due to breasts and subcutaneous fat. As a method of countermeasure, we have begun to use preoperative CT to confirm the number of ribs and the length of the most caudal rib, and to identify the intercostal space under echo-guide if necessary.

Keywords: Intercostal identification, 12th rib dysplasia, 13th rib, Lumbar rib, Thoracoscopic surgery

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0064
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S71-S72

25S-0064

Optimizing Dual Mesh in Conjunction with Pedicled Latissimus Dorsi Flap for Anterior Thoracic Wall Reconstruction: Insights and Common Challenges

Haryo Aribowo[1,2], Divva Aurelia Azhalisita Amelinda[1,2]

[1]Division of Thoracic, Cardiac, and Vascular Surgery, Department of Surgery, Faculty of Medicine, Universitas Gadjah Mada; [2]Division of Thoracic, Cardiac, and Vascular Surgery, Department of Surgery, Dr. Sardjito General Hospital, Yogyakarta, Indonesia

Background: Preventing lung herniation and maintaining a stable thoracic cage remain significant challenges in thoracic wall reconstruction, whilst reconstruction options vary and are tailored to each patient's needs.
Methods: A 66-year-old female diagnosed with phyllodes tumor extending to the 4th and 5th rib undergoes wide excision and partial resection of the 4th and 5th shaft costae, leaving a defect sizing ±10 cm×6 cm. Hernia (polypropylene) mesh sizing 1 mm was implanted underlay the remaining costae, fixated with stainless steel wires, to prevent lung herniation. Additional semi-rigid titanium mesh sizing 2 mm was implanted onlay the previous hernia mesh to prevent paradoxical movement. A pedicle-based latissimus dorsi flap was raised to reconstruct the soft tissue defect, closed in a multi-layered manner. Periodic assessments were performed to evaluate respiratory function and monitor for potential complications.
Results: Adequate chest expansion was observed by the 9th postoperative day, with no indications of paradoxical movement, dehiscence, infection, or seroma noted up to the 14th postoperative day.
Conclusion: This study offers compelling evidence that the combination of dual mesh and the latissimus dorsi flap represents a safe and effective method for reconstructing thoracic defects up to 10 centimeters in diameter. Our ongoing research will further examine similar case cohorts to validate these findings and assess the long-term sustainability of these innovative techniques.

Keywords: Polypropylene mesh, Titanium mesh, Latissimus dorsi flap, Anterior thoracic cage reconstruction


InCollage

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0063
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S73

25S-0063

Simple to Complex Video-Assisted Thoracic Surgery Esophageal Submucosal Tumor Resection

Kyung Soo Kim

Department of Thoracic Surgery, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: Various techniques have been developed for minimally invasive resection of esophageal submucosal tumors. However, conventional video-assisted thoracic surgery (VATS) techniques may be challenging for managing lobulated, adhesive type tumors based on their size and location. We present our simple to complex VATS experiences focused on preserving mucosa.

Methods: Between November 2023 and July 2024, a total of 4 patients (1 male and 3 females) with an average age of 51.7 years (range, 40–64 years) underwent minimally invasive VATS for esophageal submucosal tumor. VATS was performed for 3 esophageal tumors and 1 esophagogastric junction (EGJ) tumor using single to 3 ports. All procedures were conducted utilizing an ultrasonic device for effective sharp dissection. In 1 case involving a lobulated leiomyoma, an articulating instrument was employed to preserve the entire mucosal layer.

Results: Mean tumor size on computed tomography scan was 4.6 cm (largest diameter, 2.4–6.5 cm), and pathologic tumor size was 4.0 cm (range, 2.2–5.5 cm) with 3 leiomyomas and 1 gastrointestinal stromal tumor at EGJ. Mean operation time was 145 minutes (range, 70–200 minutes), and intraoperative endoscopy was performed in 2 patients without showing leakage or mucosal defect. Postoperative courses were uneventful without any leakage or pulmonary complications in all cases. Length of hospital day was 5.7 days (range, 4–7 days), and all patients discharged with tolerable diet.

Conclusion: We experienced simple to complex esophageal submucosal tumors which were all successfully managed with VATS procedures. Outstanding application of multi-articulating instrument with ultrasonic device produced successful cost-effective VATS, mimicking robotic-assisted thoracoscopic surgery (RATS), especially preserving mucosal layer to decrease complications. Further study is needed to compare outcomes of articulating instrument assisted VATS and RATS methods.

Keywords: Esophageal surgery, Submucosal tumor, Minimally invasive video-assisted thoracic surgery

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0033
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S74

25S-0033

Similar Survival after Endoscopic Submucosal Dissection and Esophagectomy in Early Esophageal Cancer and Synchronous or Metachronous Head and Neck Cancer

Ruei-Ti Ke, Chien-Ming Lo

Department of Thoracic and Cardiovascular Surgery, Kaohsiung Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Background: Early-stage esophageal cancer is treated using endoscopic submucosal dissection and esophagectomy. Field cancerization in patients with early-stage esophageal squamous cell carcinoma (ESCC) affects treatment outcomes and causes synchronous or metachronous head and neck (H&N) cancer. We hypothesized that esophagectomy could provide better outcome in patients with ESCC and synchronous or metachronous H&N cancer.
Methods: We retrospectively identified patients with early esophageal squamous cell carcinoma and synchronous or metachronous H&N cancers. We separated the patients into endoscopic submucosal dissection and esophagectomy groups to compare overall and relapse-free survivals.
Results: The study included 106 patients, 25 of whom underwent endoscopic submucosal dissection and 81 underwent esophagectomy. Overall and relapse-free survivals did not show significant differences between the 2 groups for both synchronous and metachronous H&N cancers.
Conclusion: Endoscopic submucosal dissection could provide similar overall and relapse-free survivals in patients with esophageal cancer and synchronous or metachronous H&N cancer.

Keywords: Esophageal cancer, Esophagectomy, Endoscopic submucosal dissection, Field cancerization

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0006
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S75-S76

25S-0006

A Nationwide Survey of Uniportal Thoracoscopic Anatomical Pulmonary Resections in Japan

Hitoshi Igai[1,2], Takuya Watanabe[2,3], Takahiro Homma[2,4], Takashi Suda[2,5], Toshiaki Morikawa[2,6]

[1]Department of General Thoracic Surgery, Japanese Red Cross Maebashi Hospital, Maebashi; [2]Japanese Uniportal VATS Interest Group, Okazaki; [3]Division of Thoracic Surgery, Respiratory Disease Center, Seirei Mikatahara General Hospital, Hamamatsu; [4]Department of Thoracic Surgery, St. Marianna University School of Medicine, Kawasaki; [5]Department of Thoracic Surgery, Fujita Health University Okazaki Medical Center, Okazaki; [6]Department of General Thoracic Surgery, Tokyo General Hospital, Tokyo, Japan

Background: A uniportal thoracoscopic approach for anatomical pulmonary resections is gradually being adopted in various institutions in Japan due to its minimally invasive nature. Th Japanese Uniportal VATS Interest Group (JUVIG) conducted a nationwide retrospective survey to evaluate the feasibility and safety of this procedure. Additionally, perioperative outcomes were compared between patients undergoing lobectomy and segmentectomy.

Methods: A total of 3,969 patients who underwent uniportal thoracoscopic anatomical pulmonary resections at 43 institutions from April 2018 to March 2023 were analyzed. Patients were categorized into lobectomy (n=2,956) and segmentectomy (n=1,013) groups. Annual trends in the proportions of these procedures were evaluated. Perioperative outcomes were compared between the 2 groups, with a focus on clinical stage 0/1A non-small cell lung cancer (NSCLC) cases (n=2,530). After matching patient backgrounds, outcomes for lobectomy and segmentectomy were further analyzed in a subset of 334 patients per group. The primary endpoint was the incidence of surgical procedure-related complications, while secondary endpoints included operative time, blood loss, postoperative drainage duration, and hospital stay.

Results: The overall incidence of surgical procedure-related complications was 13.6%. From 2018 to 2022, both the total number of cases (97, 545, 976, 1,154, and 1,197, respectively) and the proportion of segmentectomies (15.5%, 23.5%, 22.4%, 24.9%, and 30.4%) increased (Fig. 1). Segmentectomy demonstrated significantly better perioperative outcomes than lobectomy, including shorter operative time, reduced blood loss, shorter drainage duration, and shorter hospital stays (all $p<0.001$). These findings were consistent in clinical stage 0/1A NSCLC cases ($p=0.006$, <0.001, <0.001, and <0.001, respectively). The incidence of surgical procedure-related complications was lower in the segmentectomy group (9.7%) compared to the lobectomy group (15%) ($p<0.0001$). Among clinical stage 0/1A NSCLC patients, the rates were 9% and 15%, respectively ($p=0.023$).

Conclusion: Uniportal thoracoscopic anatomical pulmonary resections in Japan yielded acceptable perioperative outcomes. Segmentectomy outperformed lobectomy in most perioperative parameters, making it a preferable option for suitable patients, including those with clinical stage 0/1A NSCLC.

Keywords: Uniportal thoracoscopic approach, Lobectomy, Segmentectomy, Surgical procedure-related complications

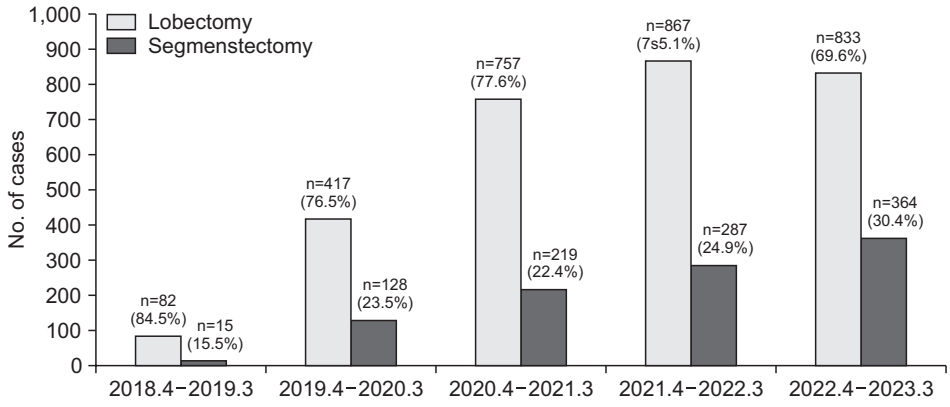


Fig. 1. The total number of cases and the proportion of segmentectomies.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0029
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S77-S78

25S-0029

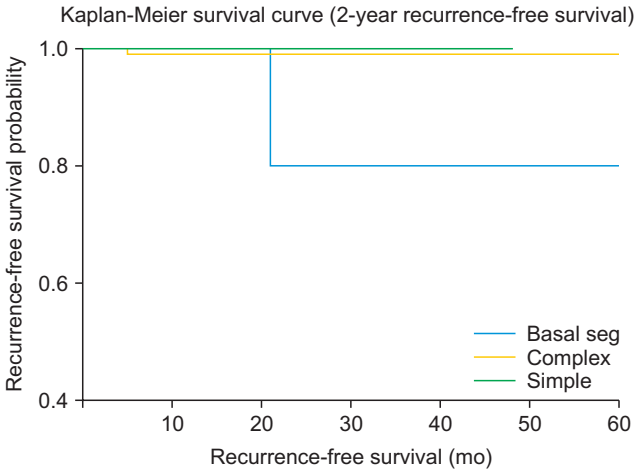
Uniportal Video-Assisted Thoracoscopic Surgery Simple versus Complex Segmentectomy: Mid-Term Surgical and Early Oncological Outcomes

Seha Ahn, Youngkyu Moon

Department of Thoracic and Cardiovascular Surgery, Eunpyeong St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea

Background: Performing complex segmentectomy via uniportal video-assisted thoracoscopic surgery (VATS) is more demanding than simple segmentectomy or lobectomy. This study evaluates the safety and feasibility of uniportal VATS complex segmentectomy by analyzing mid-term surgical outcomes and early oncological results.
Methods: We retrospectively reviewed patients who underwent uniportal VATS simple or complex segmentectomy between May 2019 and December 2024. Patient and tumor characteristics, operative and postoperative outcomes, and recurrence patterns were compared.
Results: Among 513 patients, 135 underwent simple segmentectomy, and 355 had complex segmentectomy via uniportal VATS. Both groups had comparable patient and tumor characteristics, operative outcomes, and postoperative outcomes, except for increased postoperative stay and bleeding in the complex segmentectomy group. Surgical margin distances were not significantly different from prior studies. Among 181 patients with at least 2 years of computed tomography surveillance, 1 recurrence occurred in the complex segmentectomy group and another 5 months postoperatively in the basal segmentectomy group. Both recurrent cases were adenocarcinomas with moderate differentiation and a C/T ratio ≥0.5, despite adequate margins.
Conclusion: Uniportal VATS complex segmentectomy is a safe and feasible procedure with oncological outcomes comparable to simple segmentectomy. The low recurrence rate supports its viability as a surgical option. Extended follow-up is required for further validation.

Keywords: Uniportal video-assisted thoracoscopic surgery, complex segmentectomy, lung cancer, surgical outcomes, oncological outcomes


Kaplan-Meier survival curve (2-year recurrence-free survival)
Recurrence-free survival probability
1.0
0.8
0.6
0.4
10
20
30
40
50
60
Recurrence-free survival (mo)
Basal seg
Complex
Simple

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0058
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S79

25S-0058

Assessment of Pulmonary Function Changes in Left Upper Lobectomy Patients Using Computational Fluid Dynamics: A Comparative Analysis of Pulmonary Ligament Dissection versus Preservation

Hyo Yeong Ahn[1], Ho Seong Cho[1], Chiseung Lee[2], Min Su Kim[3]

[1]Department of Thoracic and Cardiovascular Surgery, Pusan National University Hospital, Pusan National University; [2]Department of Biomedical Engineering, Pusan National University Hospital, Biomedical Research Institute, Pusan National University School of Medicine; [3]Department of Biomedical Engineering, Pusan National University Graduate School, Busan, Korea

Background: Dissection of pulmonary ligament during left upper lobectomy quickly induces expansion of the residual lung but may result in decreased lung function. While preservation induces lung expansion more slowly but has the advantage of achieving lung expansion without significant structural deformation. Therefore, this study aims to evaluate and analyze the dissection and preservation methods for the left upper lobectomy, a commonly known surgical procedure, through computational fluid dynamics (CFD).

Methods: Computed tomography scans of patients who underwent left upper lobectomy will be used to create 3-dimensional (3D) models. The torsion and cross-sectional area of the bronchial models before and after surgery will be analyzed using relative coordinates of the centerline. The 3D bronchial models will be converted into finite volume models to generate a mesh for CFD analysis. For the lung function analysis through simulations, the forced expiratory volume in 1 second (FEV1) graph from pulmonary function tests will be analyzed and converted into mass flow rate as the initial input physical quantity.

Results: In this study, we measured and analyzed the flow rate, velocity, and pressure for each model before and after surgery concerning geometric deformation. Torsion of the left lower lobe shows a correlation of 0.7 with the reduction ratio of cross-sectional area, 0.84 with the reduction ratio of FEV1, and 0.76 with the reduction rate of CFD left lower lobe volume. The reduction ratio of the cross-sectional area shows a high correlation of 0.89 with the reduction ratio of FEV1 and 0.91 with the reduction ratio of CFD left lower lobe volume. In contrast, it shows a low and insignificant correlation with pressure and velocity. Pressure and velocity are more highly correlated with the absolute values of cross-sectional area measurements rather than the reduction ratio, with smaller cross-sectional areas indicating higher pressure and velocity.

Conclusion: In group D, the tendency for higher torsion and cross-sectional area reduction was observed, suggesting geometric constraints on airflow, which were analyzed using CFD. Similarly, models with congenitally smaller bronchi tended to exhibit higher pressure. Therefore, preserving the pulmonary ligament may be more advantageous in preventing bronchial diseases such as bronchial stenosis that can occur after upper lobectomy.

Keywords: Left upper lobectomy, Computational fluid dynamics, Inferior pulmonary ligament

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0010
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S80

25S-0010

Thymic Carcinoma Resected via a Subxiphoid Uniportal Approach

Hiroyuki Kaneda, Aki Kobayashi, Takahito Nakano, Tomohiro Murakawa

Department of Thoracic Surgery, Kansai Medical University Medical Center, Hirakata, Japan

Background: Thymic carcinomas are rare tumors that are rarely diagnosed pathologically following surgical resection. Recently, subxiphoid uniportal video-assisted thoracoscopic surgery (VATS) and robotic-assisted thoracoscopic surgery (RATS) have been reported as lesser invasive approaches for anterior mediastinal tumors. In cases where thymic carcinoma is diagnosed intraoperatively, the possibility of transitioning from VATS to median sternotomy for extended thymectomy is currently under discussion. In this review, we present the cases of thymic carcinoma and discuss appropriate management strategies.

Methods: Thymic carcinoma cases surgically resected via the subxiphoid approach at our institution from August 2018 to December 2024 were retrospectively reviewed. We confirmed patients to be free of metastasis, as verified by positron emission tomography (PET) scans. In both VATS and RATS, a single 3–4 cm longitudinal skin incision was made beneath the xiphoid process, and a wound protector was employed to ensure a proper seal and facilitate CO2 insufflation. A 30° angled endoscope was utilized during the procedure. In RATS, 3 robotic arms were inserted through the uniport. In this presentation, we will outline our surgical techniques.

Results: Five patients were included in the study. The patient characteristics were as follows: 4 males and 1 female, mean age of 67 years and a mean tumor size of 22 mm. The surgical approaches were 4 VATSs and 1 RATS. According to the World Health Organization pathological staging, 3 cases were classified as stage I, and 2 cases were classified as stage IIIa, involving the lung and left innominate vein. One patient exhibited relapse of the inferior mediastinal and subaortic lymph nodes 17 months after surgery, whereas 4 cases did not exhibit any obvious recurrence.

Conclusion: Subxiphoid uniportal VATS and RATS are lesser invasive approaches that are technically feasible. In 1 case, recurrence was noted at the subaortic lymph node, which was outside the area of the extended thymectomy. When a PET scan shows no metastasis following complete resection of thymic carcinoma, the significance of an additional extended thymectomy remains unclear.

Keywords: Thymic carcinoma, Subxiphoid uniportal approach, Video-assisted thoracoscopic surgery, Robotic-assisted thoracoscopic surgery

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0007
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S81-S82

25S-0007

Postoperative Pain Reduction and Clinical Value of Uniportal Video-Assisted Thoracic Surgery: A Secondary Analysis of the J-RATSIG 01 Study

Takuya Watanabe[1], Masayuki Tanahashi[1], Masato Chiba[2], Kumiko Hashimoto[3], Noriaki Sakakura[4], Mikio Okazaki[5], Shoichi Mori[6], Masaki Hashimoto[7], Toyofumi Chen-Yoshikawa[8], Masahiro Miyajima[9], Isao Matsumoto[10], Masayuki Shitara[11], Motoshi Takao[12], Koji Kawaguchi[12]

[1]Division of Thoracic Surgery, Seirei Mikatahara General Hospital, Hamamatsu; [2]Division of Thoracic Surgery, Kindai University Faculty of Medicine, Osakasayama; [3]Department of Thoracic Surgery, Toyohashi Municipal Hospital, Toyohashi; [4]Department of Thoracic Surgery, Aichi Cancer Center, Nagoya; [5]Department of General Thoracic Surgery and Breast and Endocrinological Surgery, Dentistry and Pharmaceutical Sciences, Okayama University Graduate School of Medicine, Okayama; [6]Department of Thoracic Surgery, Nagoya Daiichi Hospital, Japanese Red Cross Aichi Medical Center, Nagoya; [7]Department of Thoracic Surgery, Hyogo Medical University, Nishinomiya; [8]Department of Thoracic Surgery, Nagoya University Graduate School of Medicine, Nagoya; [9]Department of Thoracic Surgery, Sapporo Medical University, Sapporo; [10]Department of Thoracic Surgery, Kanazawa University, Kanazawa; [11]Department of Thoracic Surgery, Toyota Memorial Hospital, Toyota; [12]Department of Thoracic and Cardiovascular Surgery, Mie University, Tsu, Japan

Background: The J-RATSIG 01 multi-institutional prospective study demonstrated that robot-assisted thoracic surgery is inferior to video-assisted thoracic surgery (VATS) in terms of postoperative pain. As a reduction in the number of surgical ports was associated with a decrease in postoperative pain, a secondary analysis was performed to compare uniportal VATS (U-VATS) with multiportal VATS (M-VATS).

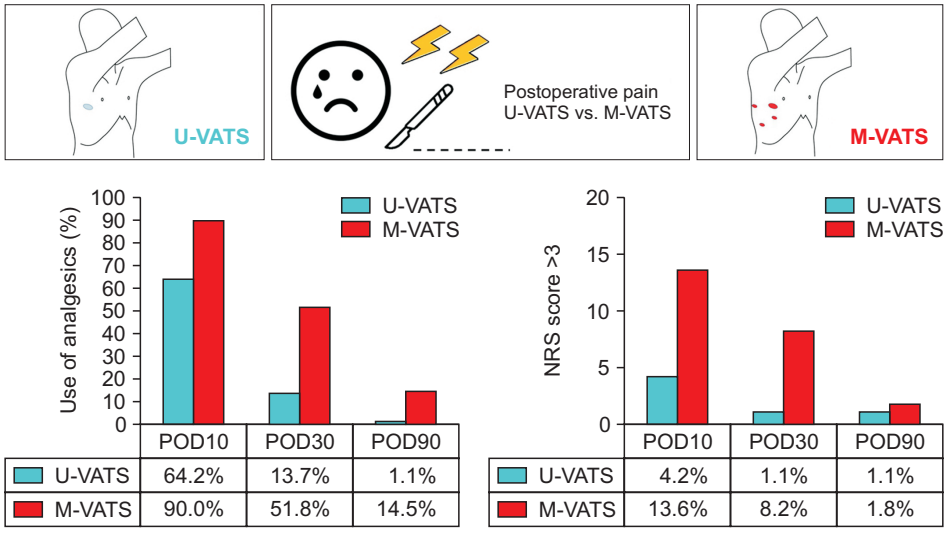
Methods: This secondary analysis included 205 patients who underwent anatomical lung resection via VATS at 12 institutions. Postoperative pain was assessed using the numerical rating scale (NRS) and the painDETECT questionnaire (PDQ) on postoperative days 10, 30, and 90.

Results: Among the study population, 95 patients underwent U-VATS, while 110 underwent M-VATS. The U-VATS group demonstrated significantly shorter operation times, chest tube duration, and lengths of hospital stay compared to the M-VATS group (146 min vs. 180 min, 2.1 days vs. 2.6 days, and 4.8 days vs. 6.4 days, respectively). The proportion of patients requiring analgesics was significantly lower in the U-VATS group at all postoperative phases (64% vs. 90%, 14% vs. 52%, and 1% vs. 15%; all $p<0.001$). NRS scores were significantly lower in the U-VATS group on postoperative days 10 (1.2 vs. 1.9, $p<0.001$) and 30 (0.7 vs. 1.5, $p<0.001$). Additionally, PDQ scores were consistently lower in the U-VATS group at all postoperative time points (all $p<0.001$). A multivariate analysis revealed that U-VATS significantly reduced the odds of an NRS score of >3 on postoperative days 10 and 30 (odds ratio, 0.26; 95% confidence interval [CI], 0.08–0.84; odds ratio, 0.09; 95% CI, 0.01–0.76).

Conclusion: U-VATS was associated with significantly reduced postoperative pain, as well as shorter operation times, chest tube duration, and hospital stays compared to M-VATS.

Keywords: Uniportal video-assisted thoracic surgery, Postoperative pain, Reduced-port surgery, Single port, Less invasive

Postoperative pain reduction and clinical value of uniportal video-assisted thoracic surgery: a secondary analysis of the J-RATSIG01 study



	POD10	POD30	POD90
U-VATS	64.2%	13.7%	1.1%
M-VATS	90.0%	51.8%	14.5%

	POD10	POD30	POD90
U-VATS	4.2%	1.1%	1.1%
M-VATS	13.6%	8.2%	1.8%

U-VATS significantly reduced postoperative pain and analgesic use compared to M-VATS. It is offering substantial benefits for lung cancer surgery.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0012
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S83

25S-0012

Consoler and Bedside Surgeon Fused Uniportal Robotic-Assisted Thoracoscopic Surgery

Shinya Tane, Ryosuke Izawa, Hiroyuki Ogawa, Daisuke Hokka, Yoshimasa Maniwa

Division of Thoracic Surgery, Kobe University Graduate School of Medicine, Kobe, Japan

Background: Uniportal thoracoscopic surgery for lung cancer has been rapidly increasing in Japan, and is now recognized as an option for minimally invasive surgery. Meanwhile, we have developed a "fused robotic-assisted thoracoscopic surgery (RATS)" approach, in which the bedside surgeon retracts the lung and performs stapling of the pulmonary vasculature and bronchus. To date, we have performed over 700 cases using this method. Therefore, by combining this fused technique with the uniportal approach, we introduce a console and bedside surgeon-coordinated uniportal RATS technique and elaborate on its operative outcomes.
Methods: The da Vinci Xi Surgical System was used, with specific configurations for right- and left-side operations. A working port measured 4 cm was placed in the sixth or seventh intercostal space along the middle axillary line. In the right-side configuration, Arm 1 was deactivated; Arm 2 was used for the camera, Arm 3 for the left-hand instrument (fenestrated bipolar forceps), and Arm 4 for the right-hand instrument (SynchroSeal). A table surgeon was positioned on each side of the patient to retract the lung and perform suction or coagulation using a suction coagulator, thereby maintaining a clear operative field. When stapling the pulmonary vasculature and bronchus, one robotic arm was lifted from the port, creating space for the easy insertion of a manual stapler through the working port.
Results: A total of 15 cases were performed using this approach. Lobectomy was performed in 13 patients and segmentectomy in 2. The average operation time was 153 minutes, and the postoperative course was uneventful in all cases.
Conclusion: By combining a console- and table-surgeon–coordinated fused RATS approach with the uniportal technique, we were able to perform uniportal RATS safely.

Keywords: Uniportal robotic-assisted thoracoscopic surgery, Fused robotic-assisted thoracoscopic surgery, Perioperative outcomes, Case reports

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0031
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S84

25S-0031

Low-Cost 3-Dimensional Modeling in Thoracic Surgery: Bridging the Technology Gap

Mouad Gourti, Elmehdi Maidi

Department of Surgery, HASSAN II Medical Center, Medical University of Agadir, Agadir, Morocco

Background: Thoracic surgery is complex in low-income countries due to limited imaging. Traditional 2-dimensional scans often yield unforeseen issues, impairing precision.
Methods: We introduced 3-dimensional modeling with open-source tools and remotely delivered training.
Results: Precision has greatly improved, but high costs and some training gaps remain.
Conclusion: Scalable, low-cost solutions can expand access worldwide.

Keywords: Three-dimensional imaging, Low-income countries, Lobectomy, Segmentectomy, Advances in surgery

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0028
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S85-S86

25S-0028

Novel Intraoperative Marking Using Indocyanine Green-Based Virtual-Assisted Lung Mapping with an Ultra-Thin Bronchoscope

Shota Nakamura[1], Takayasu Ito[2], Harushi Ueno[1], Keita Nakanishi[1], Yuka Kadomatsu[1], Taketo Kato[1], Tetsuya Mizuno[1], Toyofumi-Fengshi Chen-Yoshikawa[1]

[1]Department of Thoracic Surgery, Nagoya University Graduate School of Medicine; [2]Department of Respiratory Medicine, Nagoya University Graduate School of Medicine, Nagoya, Japan

Background: Virtual-assisted lung mapping (VAL-MAP) is a bronchoscopic technique used for preoperative marking of nonpalpable lung nodules, enabling visualization of intersegmental planes in anatomical segmentectomy and non-visible or non-palpable nodules. However, its effectiveness can be compromised by anthracosis or emphysematous changes, making dye marker difficult to identify intraoperatively. We have implemented indocyanine green (ICG)–VAL-MAP, incorporating ICG into the marking agents as an approach to overcome these limitations. Additionally, we have employed an ultra-thin bronchoscope and a fine-caliber catheter for dye injection, allowing precise marking even in the upper lobe, which has traditionally been difficult to access. This study evaluates the efficacy of ICG–VAL-MAP compared to conventional VAL-MAP.

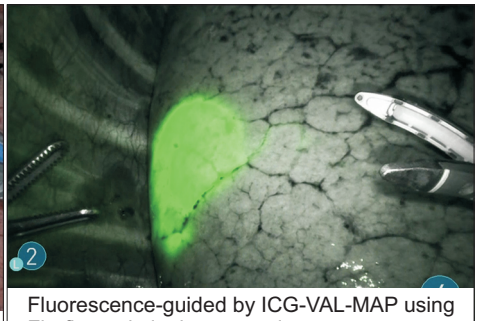
Methods: A retrospective analysis was conducted comparing ICG–VAL-MAP to conventional VAL-MAP. In ICG–VAL-MAP, ICG and a contrast agent were used instead of indigo carmine, and markings were visualized using near-infrared thoracoscopy. Marking visibility was assessed intraoperatively based on whether the marker was identifiable or not. We analyzed marking visibility in 2 cohorts: VAL-MAP (110 markings, 41 cases) and ICG–VAL-MAP (20 markings, 10 cases).

Results: ICG–VAL-MAP demonstrated significantly superior marking visibility compared to VAL-MAP. Intraoperative visibility was identifiable in 95.0% (19/20) of ICG–VAL-MAP, whereas 74.5% (82/110) for VAL-MAP (p=0.04). Furthermore, no major complications were observed in the ICG–VAL-MAP group, whereas VAL-MAP resulted in pneumomediastinum in 1 case.

Conclusion: ICG–VAL-MAP significantly improves intraoperative visualization of marker compared to conventional VAL-MAP. This technique enhances surgical precision in segmentectomy and wedge resection by ensuring clear localization of nonpalpable lesions. The incorporation of near-infrared fluorescence imaging into lung mapping may contribute to safer and more effective lung resections.

Keywords: Virtual-assisted lung mapping, Indocyanine green–virtual-assisted lung mapping, Preoperative marking, Ultra-thin bronchoscope, Indocyanine green-based virtual-assisted lung mapping

Thoracoscopic image in robot-assisted surgery



Fluorescence-guided by ICG-VAL-MAP using Firefly mode in the same view

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0059
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S87-S89

25S-0059

Initial Experience and Feasibility of Novel Asymmetric Linear Stapler in Pulmonary Resection: Single Center Experience

Yooyoung Chong, Min-Woong Kang

Department of Thoracic and Cardiovascular Surgery, Chungnam National University Hospital, Daejeon, Korea

Background: Accurate resection margin assessment is crucial for achieving optimal oncologic outcomes in lung cancer surgery. Conventional linear staplers introduce significant tissue deformation, limiting the ability to assess true resection margins intraoperatively. The novel asymmetric linear stapler (NALS) has been developed to address these limitations by minimizing tissue compression and preserving margin integrity. This study presents our initial experience with NALS, evaluating its feasibility in achieving accurate intraoperative margin assessment.

Methods: A retrospective study was conducted at Chungnam National University Hospital between July 2024 and February 2025. Patients who underwent pulmonary resection using NALS were included. Resection margins were evaluated intraoperatively using frozen section analysis and later confirmed via final pathological assessment. Margin positivity rates, tumor characteristics, and resection margin distances were analyzed.

Results: A total of 87 patients underwent pulmonary resection using NALS. The mean resection margin distance was 13.4±13.8 mm (interquartile range, 3.75–20 mm). Margin positivity was identified in 5.7% of cases (parenchymal: 5.5%, bronchial: 5.8%). Histopathologic examination confirmed that NALS preserved tissue integrity, allowing for reliable intraoperative assessment.

Conclusion: NALS enables precise intraoperative margin assessment by preserving resection margin integrity, reducing tissue distortion, and potentially minimizing unnecessary lung parenchymal resection. This technique may optimize the balance between oncologic safety and lung function preservation, particularly in sublobar resection. Further multicenter studies and long-term follow-up are warranted to assess the impact of NALS on recurrence rates and survival outcomes.

Keywords: Pulmonary resection, Resection margin, Lung cancer, Frozen section analysis, Novel asymmetric linear stapler

Table 1. Preoperative patient and tumor characteristics (n=87)

Characteristic	Subjects treated with NALS
Age (yr)	
Mean±SD	65.9±10.1
Median (IQR)	68.0 (61.0–72.5)
Sex	
Male	41 (47.1)
Female	45 (51.7)
Smoking status	
Never smoker	43 (49.4)
Ex-smoker	26 (29.9)
Current smoker	18 (20.7)
Comorbidity	
Diabetes	23 (26.4)
Hypertension	36 (41.4)
Chronic obstructive pulmonary disease	8 (9.2)
Pulmonary tuberculosis	5 (5.7)
Interstitial lung disease	3 (3.4)
Other malignancy	20 (22.9)
Preoperative pulmonary function test	
FEV1	2.3±0.5
FEV1%	106.4±19.1
DLCO/VA	17.7±4.8
DLCO/VA%	102.1±22.3
Tumor size (mm)	
≤5	35 (40.2)
6–10	17 (19.5)
11–20	22 (25.3)
21–30	6 (6.8)
>30	7 (8.0)
Tumor type	
Pure GGO	16 (18.4)
Part-solod GGO	32 (36.8)
Solid	39 (44.8)
Tumor location	
Right upper lobe	22 (25.2)
Right middle lobe	5 (5.7)
Right lower lobe	25 (28.7)
Left upper lobe	17 (19.5)
Left lower lobe	18 (20.6)
Type of resection	
Wedge resection	53 (60.9)
Segmentectomy	19 (21.8)
Lobectomy	15 (17.2)
Intersegmental plane identification with ICG among segmentectomy	16 of 19 (84.2)
ENB guided lung marking	32 (36.7)
NALS usage site	
Parenchymal margin	73 (83.9)
Bronchial margin	17 (19.5)

Values are presented as mean±SD, median (IQR), or number (%).
SD, standard deviation; IQR, interquartile range; NALS, non-anatomical lung segmentectomy; FEV1, forced expiratory volume in 1 second; DLCO/VA, diffusing capacity of the lung for carbon monoxide per alveolar volume; GGO, ground-glass opacity; ICG, indocyanine green; ENB, electromagnetic navigation bronchoscopy.

Table 2. Resection margin assessment and histopathologic evaluation (n=87)

Variable	Subject treated with NALS
Resection margin distance (mm)	13.4±13.8 (3.75–20)
Margin status	
Parenchymal resection margin (n=73)	
Negative	69 (94.5)
Positive	4 (5.5)
Bronchial resection margin (n=17)	
Negative	16 (94.2)
Positive	1 (5.8)
Histological results	
Benign disease	11 (12.6)
Atypical adenomatous hyperplasia	1 (1.1)
Adenocarcinoma	
Minimally invasive adenocarcinoma	8 (9.2)
Invasive adenocarcinoma	46 (52.8)
Squamous cell carcinoma	9 (10.3)
Small cell carcinoma	2 (2.3)
Secondary malignancy	10 (11.5)

Values are presented as mean±standard deviation (interquartile range) or number (%).
NALS, non-anatomical lung segmentectomy.

Table 3. Characteristics of margin-positive cases

Case	Age (yr)	Sex	Tumor size (mm)	location	Resection type	Frozen section for main mass	Margin status (parenchymal)	Margin status (bronchial)	Additional management
17	68	M	15	RLL superior segment	Segmentectomy	Adenocarcinoma	Focal atypical cells	Not done	Further wedge resection, adjuvant radiotherapy
19	68	M	17	LLL medial basal segment	Wedge r esection	Metastatic renal cell carcinoma	Focal atypical cells	Not done	None
30	54	F	26	LUL posterior segment	Lobectomy	Adenocarcinoma	Not done	Cluster of atypical epitheliums	Further bronchial resection
72	83	M	20	LUL lingular segment	Wedge resection	Chronic granulomatous inflammation	Chronic granulomatous inflammation	Not done	None
80	78	M	29	RLL posterobasal segment	Wedge resection	Small cell carcinoma	Focal involvement of tumor	Negative for malignancy	Further segmentectomy

M, male; F, female; RLL, right upper lobe; LLL, left lower lobe; LUL, left upper lobe; RLL, right lower lobe.

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0036
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S90-S91

25S-0036

Development of Apical-out Airway Organoids to Evaluate Respiratory Toxicity of Polystyrene Microplastics

Seon Young Choi, Soyoung Hwang, Hyun Joo Kim, Kuk Hui Son

Department of Thoracic and Cardiovascular Surgery, Gachon University Gil Medical Center, Gachon University College of Medicine, Incheon, Korea

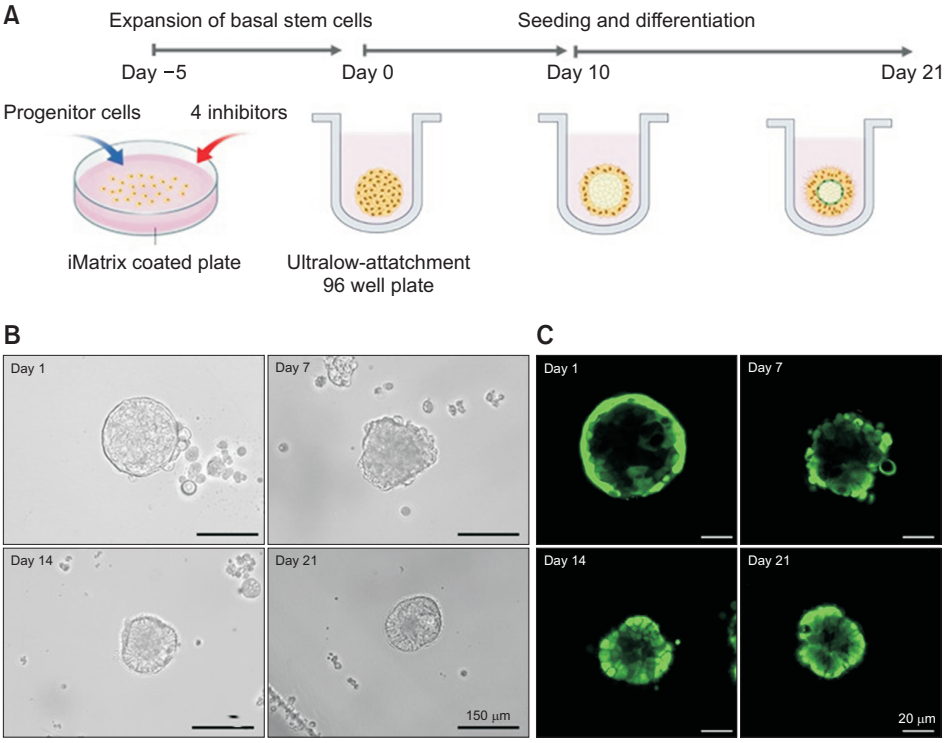
Background: Even though it has been reported that microplastic could infiltrate in the lung and induce inflammation, exact pathophysiology of microplastic indued-lung injuries has not been fully revealed. One of the main hurdles for evaluating respiratory exposure effect of microplastic on the airway is shortage of in vitro models which are relevant with human exposure of microplastic during inhalation. In this study, we generated apical out airway organoid (AOAO) which epithelial cell located in outer surface of organoid to evaluate the feasibility of AOAO for respiratory exposure models of microplastics.

Methods: Human airway basal stem cells (hABSCs, passage 2) were trypsinized and resuspended (10,000 cells/mL) in Pneuma Cult-ALI Medium (#05001; STEMCELL Technologies, Canada) supplement with Pneuma Cult-ALI supplements, hydrocortisone, and heparin. One hundred μL of resuspended hABSCs were placed per well in a low attachment 96-well microplate (Corning #7007, USA) and centrifuged at 1,500 RPM for 15 minutes. Fifty μL of medium were removed and refreshed every 2 days. The cultures were maintained at 37 °C with 5% CO2 for 21 days, and generation and movement of AOAOs were video recorded at 7-day intervals using an EVOS M7000 Imaging System (ThermoFisher Scientific, USA). After generating AOAO, polystyrene (PS) was treated and inflammation response were evaluated.

Results: To characterize AOAO in the resulting day 21, we performed immunofluorescence staining of key markers of airway epithelium and observed highly selective localization of acetylated-alpha-tubulin on the organoid outer surface. Besides ciliated cells, other cell types of airway epithelium such as basal cells and goblet cells were identified. Moreover, goblet cells and basal cells were localized on the inner layer of AOAOs. We then calculated the length of cilia on the organoid's outer surface. Similar to the human airway tissue, AOAOs have beating cilia. By treating PS, goblet cell hyperplasia was shown in the AOAO. Expression of inflammatory cytokine such as tumor necrosis factor-α and interleukin-1β were increased by PS.

Conclusion: Apical-out airway organoids mimic human upper airway epithelium and cilia function. Moreover, AOAOs represent an increase of mucin secretion and inflammation following microplastic exposure.

Keywords: Respiratory organoid, Respiratory toxicity, Microplastic, Inflammation



Establishment of apical-out airway organoids

JCS Journal of Chest Surgery
https://doi.org/10.5090/jcs.2025S1.25S-0029
pISSN: 2765-1606 eISSN: 2765-1614
J Chest Surg. 2025;58 Suppl 1:S92

25S-0029

Paradigm Shift in Management of Post-cardiopulmonary Resuscitation Flail Chest

Taeyeon Lee, Hyunmin Cho

Department of Trauma Surgery and Critical Care, Jeju Halla General Hospital, Jeju, Korea

Background: Chest compression during cardiopulmonary resuscitation (CPR) may be associated with iatrogenic chest wall injuries, flail chest (anterior type: sternal fracture with bilateral anterolateral multiple rib fractures) in particular. The extent to which these CPR-associated chest wall injuries contribute to a delay in the respiratory recovery of out-of-hospital cardiac arrest (OHCA) survivors has not been sufficiently explored. We aimed at the role of surgical treatment in patients with ventilator weaning failure due to post-CPR flail chest.

Methods: From January 2020 to December 2022, we reviewed 4 cases of OHCA underwent chest wall stabilization (CWS) surgery for post-CPR flail chest. All patients failed to wean the ventilator because of chest wall instability, flail motion of anterior chest wall, during spontaneous breathing. The variables are gender, age, cause of OHCA, cardiac intervention, ventilator care (days), extubation (postoperative days), need for tracheostomy, neurologic sequelae, and postoperative complications.

Results: The average duration of ventilator care before bilateral thoracic stabilization surgery was 7.5 days (range, 4–13 days) and interval to the extubation after CWS surgery was 2.5 days (range, 1–4 days). Tracheostomy was required in 2 of 4 cases (50.0%) due to failure of sputum expectoration and aggravation of pneumonia. None of the patients had perioperative neurologic sequelae. One empyema thoracis and 1 rib fixation failure (screw loosening) were noted postoperatively.

Conclusion: Surgical intervention after CPR-associated chest injuries could influence the clinical course and lead to an improvement in weaning from the ventilator. More research is urgently needed to reveal the effect of CWS surgery on the course of the weaning process. Future research should provide evidence of whether this surgical intervention will remain a rare treatment option, or if it has the potential to change clinical practice guidelines.

Keywords: Cardiopulmonary resuscitation, Flail chest, Chest wall stabilization

JOURNAL OF CHEST SURGERY