Complete resection of left paratracheal nodes for stage IIIA disease can be achieved with robotics during left upper lobectomy after induction therapy

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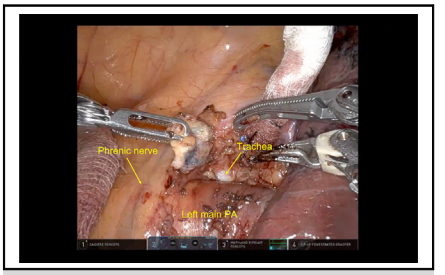


Complete resection of level 5 and 4L nodal stations.

CENTRAL MESSAGE

Robotic technology, including magnified visualization and small-wristed instruments, can be advantageous in complete lymphadenectomy, achieving R0 in stage IIIA disease after induction therapy.

See Discussion on page 290.

Video clip is available online.

To view the AATS Annual Meeting Webcast, see the URL next to the webcast thumbnail.

There is growing evidence to support the feasibility of robotic lung resection after induction therapy.[1,2] We present a case where robotic technology was advantageous in performing a complete left paratracheal lymph node dissection and highlight techniques that can be employed to improve the safety and efficacy of robotic-assisted lung resection after induction therapy.

CASE

The patient is a 63-year-old man who is a 40 pack-year smoker with chronic obstructive pulmonary disease and diabetes who was found to have a 1.4 cm left upper lobe nodule on computed tomography (CT) scan with associated left paratracheal lymphadenopathy. Both the nodule and left paratracheal nodes were F-fluorodeoxyglucose-avid on positron-emission tomography (PET) scan (Figure 1). PET/CT and brain magnetic resonance imaging revealed no distant metastases and an endobronchial ultrasound biopsy of the level-4L lymph node was consistent with squamous cell carcinoma (stage IIIA, pT1b N2 M0). Per institution guidelines, institutional review board approval and written informed consent were not required for publication.

The patient underwent neoadjuvant chemotherapy (carboplatin/taxol) and mediastinal radiation (50 Gray) rather than immunotherapy given his negative programmed cell death ligand 1 status and restaging PET/CT showed a treatment response. He then underwent robotic left upper lobectomy.

TECHNIQUE

A completely portal approach was used with 4 ports across the eighth intercostal place, 2 of which were 12-mm stapler ports to facilitate stapling from both the anterior and posterior aspects. An assistant port was placed in the 10th intercostal space (Figure E1).

The inferior pulmonary ligament was resected and level-8 and -9 nodes were removed. The lung was retracted

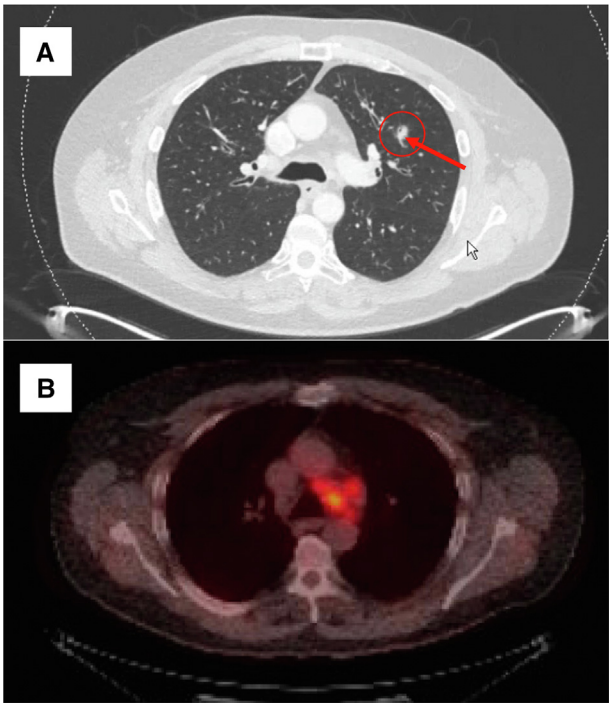
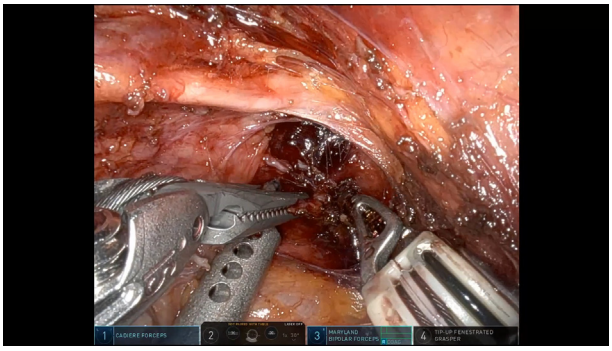
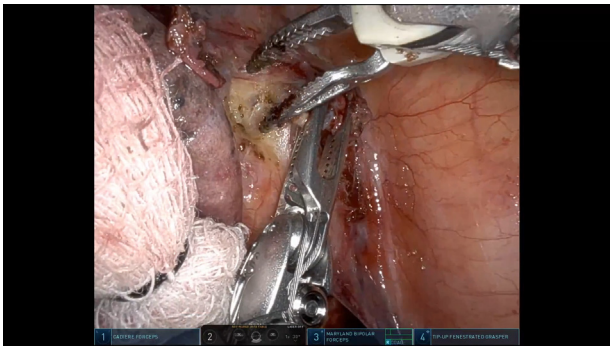


FIGURE 1. A, Computed tomography image of the patient's chest with left upper lobe nodule (*red arrow*). B, positron-emission tomography-computed tomography image with F-fluorodeoxyglucose-avid left paratracheal nodes.

anteriorly, and the level-7 lymph station was harvested (Video 1). The level-11 node on the pulmonary artery (PA) was removed and the plane between the PA and the aorta was developed. The PA was exposed in the fissure and the posterior major fissure was completed. (Video 2). After removal of the interlobar node at the junction of the upper and lobe bronchus, the lingular PA and the parenchyma of the anterior major fissure were transected. All structures were divided with the robotic SureForm stapler



VIDEO 1. Level 7 lymph node dissection. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00265-1/fulltext.



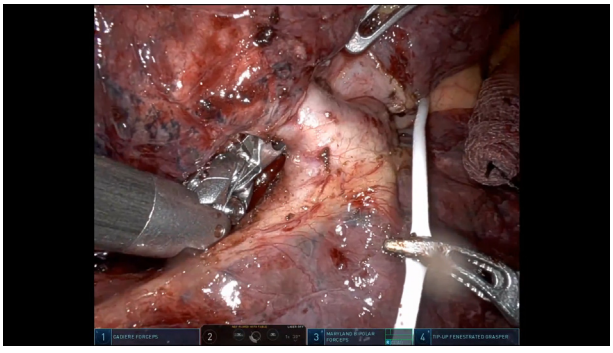
VIDEO 2. Posterior hilar dissection and dissection on the pulmonary artery in the major fissure. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00265-1/fulltext.

(Intuitive). The posterior ascending PA branch was then ligated (Video 3).

Significant posttreatment fibrosis was encountered with attempted dissection of the truncus PA branch. Further dissection in this area was deferred until better exposure and total vascular control was obtained. The left main PA was exposed after complete resection of the level-5 and level-4L nodes and great care was taken to preserve the recurrent laryngeal nerve in this area (Figure 2 and Video 4).

Total vascular control of the left main PA and left inferior pulmonary vein were obtained with vessel loops. The superior pulmonary vein and left upper lobe bronchus were divided before the truncus PA branch to increase exposure. The bedside assistant applied traction to the vessel loops while the truncus PA branch was ligated (Video 5).

An intercostal muscle flap was harvested and buttressed to the bronchial stump to prevent bronchopleural fistula (Video 6). The patient tolerated the procedure well and was free of vocal cord dysfunction. Final pathology showed 0% residual tumor with 7 lymph node stations examined



VIDEO 3. Division of the pulmonary artery branches to the left upper lobe. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00265-1/fulltext.

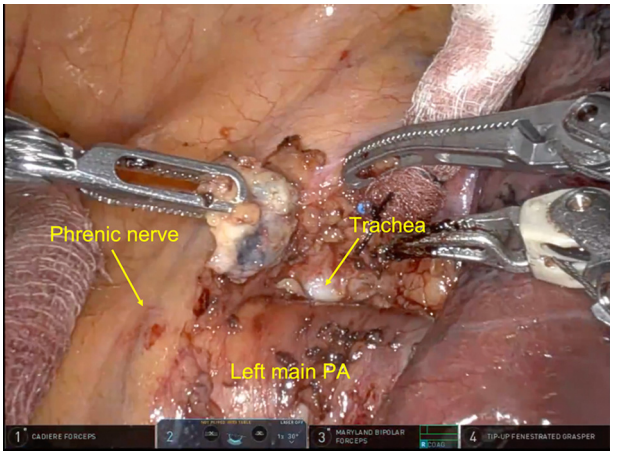
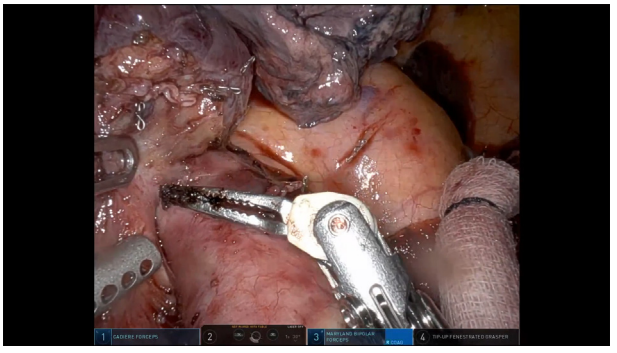


FIGURE 2. Complete resection of level 5 and 4L nodal stations. *PA*, Pulmonary artery.

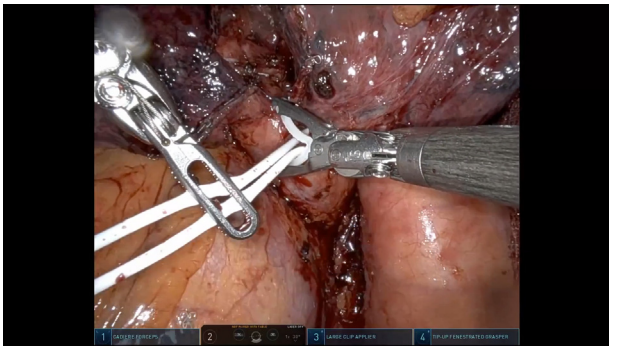
and 1 0.1-mm focus of squamous cell carcinoma was found in the resected 4L lymph node (ypT0p N2a1 M0).

COMMENT

This case highlights robotic techniques that can facilitate safe resection of stage IIIA disease after induction therapy. Magnified robotic visualization and small-wristed instruments facilitate dissection in tight spaces with difficult access. This technology was advantageous to achieve an R0 resection with complete removal of the left paratracheal nodes. Additionally, total vascular control can be obtained before division of friable PA branches and an intercostal muscle flap can be harvested without the need for thoracotomy. Conversion to thoracotomy for patient safety should not be considered an adverse event. However, avoiding detrimental effects of increased pain and changes in chest wall compliance on respiratory mechanics has been shown to improve outcomes.[3]



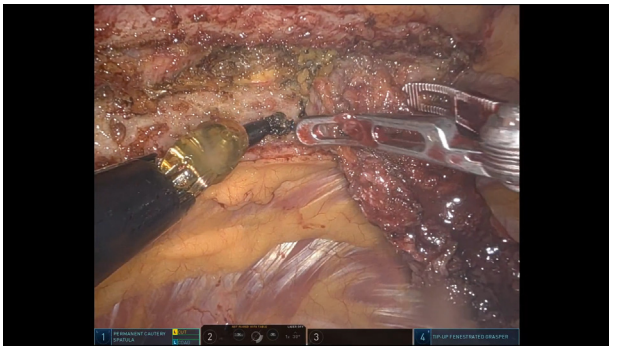
VIDEO 4. Dissection and removal of level 5 and 4L nodes. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00265-1/fulltext.



VIDEO 5. Obtaining total vascular control of the left main pulmonary artery and left inferior pulmonary vein. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00265-1/fulltext.

There are no randomized controlled trials comparing minimally invasive surgical approaches with thoracotomy after induction therapy. One retrospective study of 428 patients who underwent lobectomy after induction therapy (397 thoracotomy, 14 video-assisted thoracoscopic surgery, and 17 robotic) showed that outcomes were similar between minimally invasive approach and thoracotomy groups, respectively, including R0 resection rate (97% vs 94%; $P = .99$), postoperative morbidity (32% vs 33%; $P = .99$), and 3-year disease-free survival (49.0% vs 42.1%; $P = .19$).[1] In the CheckMate 816 trial, 30% of patients in the neoadjuvant nivolumab plus chemotherapy group underwent minimally invasive surgery with favorable surgical outcomes, including shorter duration of surgery and less need for pneumonectomy without increase in postoperative complications.[4]

Patients with locally advanced disease were excluded in the initial published experience of robotics. However, lymph node upstaging and number of harvested lymph nodes with robotics is similar to open and superior to video-assisted thoracoscopic surgery.[5,6] The advantages of



VIDEO 6. Intercostal muscle flap harvest and buttress to the bronchial stump. Video available at: https://www.jtcvs.org/article/S2666-2507(23)00265-1/fulltext.

robotics that facilitate a more complete lymphadenectomy must be harnessed to improve oncologic outcomes in this patient population as long as safety is ensured.

Webcast

You can watch a Webcast of this AATS meeting presentation by going to: https://www.aats.org/resources/complete-resection-of-left-paratracheal-nodes-for-stage-iiia-disease-can-be-achieved-with-robotics-during-left-upper-lobectomy-after-neoadjuvant-chemotherapy-and-radiation.

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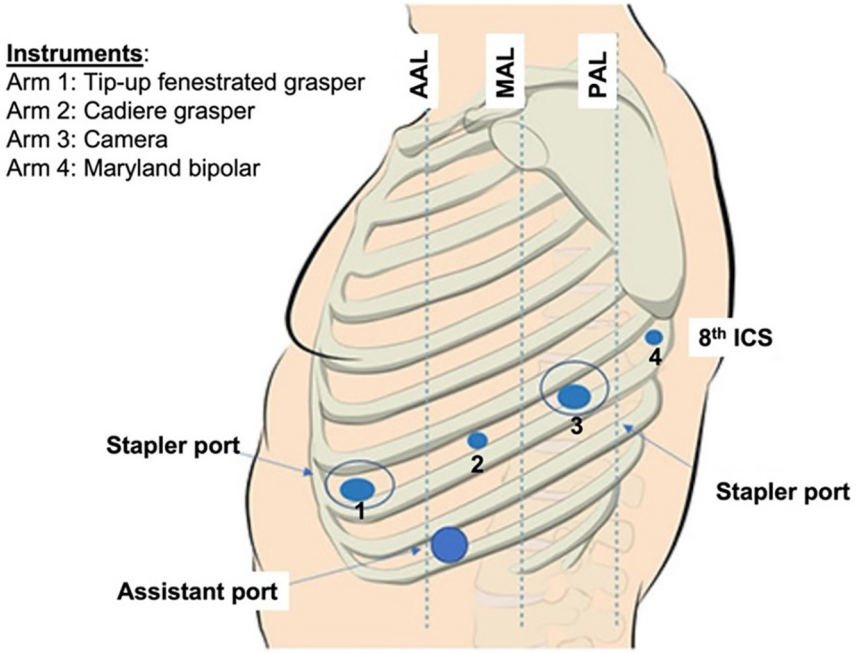

FIGURE E1. da Vinci Xi robotic port placement. *AAL*, Anterior axillary line; *MAL*, middle axillary line; *PAL*, posterior axillary line; *ICS*, intercostal space.