Single utility port approach in robot-assisted sleeve segmentectomy for bronchial carcinoid tumor

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INTRODUCTION

Sleeve segmentectomy is mainly performed in patients with low-grade malignant tumors or some early lung cancer invaded segmental bronchus, or elderly patients with decreased pulmonary function. Several cases of robot-assisted sleeve resection at the segmental level with a four- or five-ports approach have been reported in previous studies. Surgical techniques with fewer incisions, especially the uniportal technique, are associated with less chest pain. Here, we describe an aged patient with decreased pulmonary function whose carcinoid tumor invaded the bronchus originating of the right superior segment (S6), who underwent robot-assisted right S6 sleeve segmentectomy via the single utility port approach with three robotic arms.

CASE REPORT

The patient was a 78-year-old woman who presented with 2 months of cough. This patient had no history of smoking. Chest computer tomography (CT) scan showed a mass in the right S6 bronchus (B6) of the right lower lobe and distal atelectasis. The bronchoscopy revealed a nodular lesion at the origin of right B6 (Figure 1). Bronchoscopic biopsy specimens were confirmed as carcinoid tumor under the microscope, which was a low-grade malignant tumor. The patient was diagnosed with mild restrictive ventilation functional disturbance by the pulmonary function test. Other routine physical examination and laboratory tests were normal. Thus, clinical T1aN0M0 disease was diagnosed according to the eighth edition of the TNM classification for lung cancer. After comprehensive consideration, especially considering the advanced age of the patient and her decreased ventilatory function, we performed a single utility port robot-assisted right S6 sleeve segmentectomy and lymph node dissection using the three-arms da Vinci Surgical System (Intuitive Surgical).

The patient was in a left lateral position with double lumen endotracheal intubation. The three-arms da Vinci Surgical System was docked on the head side of the patient and slightly turned to the dorsal side. A 1.5-cm incision was performed in the eighth intercostal space of the midaxillary line and another 4-cm incision was made in the fifth intercostal space of the anterior axillary line. Postoperative recovery of the patient was smooth without postoperative complications.

KEYWORDS
carcinoid tumor, lung cancer, robot-assisted thoracoscopic surgery, sleeve segmentectomy

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FIGURE 1  Preoperative physical examination evaluation. (a) Preoperative computed tomographic imaging. (b) Preoperative bronchoscopy showed a nodular lesion at the origin of right B6 (arrow). B6, superior segmental bronchus; B7-10, basal segmental bronchus.

FIGURE 2  View of robotic instruments. (a) Position of the incisions. (b) The layout of arms in the 4-cm incision.

FIGURE 3  Intraoperative view. (a) Group 7 lymph nodes were dissected. (b) The stumps of the right lower bronchus and basal segmental bronchus (yellow circle). (c) The anastomosis was performed by the half-continuous suturing method. (d) The anastomosis was completed and the knot tied.
used to insert a robotic endoscope and right robotic arm. It is
should be noted that the 12-mm endoscopic trocar was
inserted into the upper end of the 4-cm incision and outside
the silicon rubber wound protector, and the trocar of right
robotic arm was inserted into the lower end of the 4-cm inci-
sion (Figure 2). The assistant inserted into the approximately
2 cm gap between the endoscopic trocar and right arm trocar
using curved suction apparatus and other conventional long
instruments to assist surgery.

We first dissected the hilar and pulmonary ligament. Then, the mediastinal, hilar, interlobar and segmental lymph
nodes were dissected. The superior segmental vein (V6), the
superior segmental artery (A6), and the segmental plane of
the right S6 were dissected, which is similar to the procedure
for conventional S6 segmentectomy. The staplers were
mainly inserted via the assistant gap. During the operation,
the right robotic arm can be withdrawn to facilitate the safe
and stable operations of the staplers. If the angle of the sta-
pplers is not satisfactory in the assistant gap, the 1.5-cm inci-
sion can be used as an alternative operation approach for
the staplers. Bronchus invaded by the tumor, including the
right B6 and the partial right lower lobe bronchus, was
resected with the robotic scissors to achieve macroscopically
sufficient margins. The right middle lobe was preserved.
Radical resection (R0) was confirmed by intraoperative fro-
zen section. End-to-end anastomosis was performed
between the right lower bronchus and the basal segmental
bronchus by the half-continuous suturing method
(Figure 3). No air leakage at the bronchial anastomosis was
confirmed by a sealing test under 25 cm H2O ventilation
positive end-expiratory pressure.

Postoperative recovery of the patient was smooth without
postoperative complications. The chest X-ray on the first post-
operative day showed the lung was well ventilated (Figure 4).
Bronchial anastomosis was confirmed by fibrotic bronchosco-
py before discharge. The chest CT scan of the patient 1
month after the operation showed no abnormality. The follow-
up showed that the patient had survived for 8 months without
recurrence.

DISCUSSION

Bronchial carcinoids are rare neuroendocrine tumors that
are recognized as low-grade malignant tumors. Sleeve
segmentectomy can avoid lobectomy or pneumonectomy to
preserve more pulmonary function for aged patients with
low-grade malignant tumors and decreased pulmonary
function, thus it is safe and useful as a lung-saving opera-
tion. Furthermore, surgical techniques with fewer inci-
sions, especially the uniportal technique, are associated with
less chest pain. We therefore performed a single utility port
robot-assisted right S6 sleeve segmentectomy with three
robotic arms, which can further reduce the excess surgical
trauma caused by another port or more ports, and simulta-
neously preserve more functional lung tissues. To the best of
our knowledge, this is the first report on robot-assisted sleeve
segmentectomy with the single utility port approach.

Because the endoscope cannot be withdrawn during the
operation, we placed the endoscopic arm at the upper end of
the 4-cm incision and outside the silicon rubber wound pro-
tector to make the best use of space and minimize the dis-
turbance of the endoscopic arm during the operation
process. On the contrary, the robotic instrument arm was
inserted into the incisions which were placed by the silicon
rubber wound protectors. In this way, we were able to with-
draw any robotic instrument arm at any time to insert the
staplers or ensure the safe operation of the staplers, and pro-
tect the incision from tumor invasion. Interference between
the endoscopic arm and the right robotic arm was inevitable
because these two arms were insert into the same incision.

After determining the appropriate position and angle of
the robotic arms, the surgical operation via single utility port
approach with three arms was feasible based on our experi-
ence. The movement range of the right arm should not be
larger to avoid additional trauma.

In conclusion, we consider that robot-assisted sleeve
segmentectomy via the single utility port approach is feasible
and safe for carefully selected patients.

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REFERENCES
1. Tsutani Y, Okada M. Bronchoplasties at the segmental level. Thorac
Surg Clin. 2018;28(3):299–304.
2. Anile M, Diso D, Rendina EA, Venuta F. Bronchoplastic procedures
for carcinoid tumors. Thorac Surg Clin. 2014;24(3):299–303.
3. Pan X, Gu C, Wang R, Zhao H, Shi J, Chen H. Initial experience of robotic sleeve resection for lung cancer patients. Ann Thorac Surg. 2016;102(6):1892–7.
4. Gu C, Pan X, Chen Y, Yang J, Zhao H, Shi J. Short-term and mid-term survival in bronchial sleeve resection by robotic system versus thoracotomy for centrally located lung cancer. Eur J Cardiothorac Surg. 2018;53(3):648–55.
5. Li C, Zhou B, Han Y, Jin R, Xiang J, Li H. Robotic sleeve resection for pulmonary disease. World J Surg Oncol. 2018;16(1):74.
6. Magouliotis DE, Fergadi MP, Spiliopoulos K, Athanassiadi K. Uniportal versus multiportal video-assisted thoracoscopic lobectomy for lung cancer: an updated meta-analysis. Lung. 2021;199(1):43–53.
7. Sano Y, Okazaki M, Shigematsu H, Yamashita N, Sugimoto R, Sakao N, et al. Quality of life after partial lung resection with uniportal versus 3-port video-assisted thoracoscopic surgery: a prospective randomized controlled study. Surg Today. 2021;51:1755–63.
8. Ueda K, Umehara T, Maeda K, Suzuki S, Yokomakura N, Kariatsumari K, et al. Three-incision robotic major lung resection for cancer. Transl Cancer Res. 2021;10(11):4617–23.
9. Goldstraw P, Chansky K, Crowley J, Rami-Porta R, Asamura H, Eberhardt WEE, et al. The IASLC lung cancer staging project: proposals for revision of the TNM stage groupings in the forthcoming (eighth) edition of the TNM classification for lung cancer. J Thorac Oncol. 2016;11(1):39–51.
10. Jiao W, Zhao Y, Qiu T, Xuan Y, Sun X, Qin Y, et al. Robotic bronchial sleeve lobectomy for central lung tumors: technique and outcome. Ann Thorac Surg. 2019;108(1):211–8.
11. Travis WD, Brambilla E, Nicholson AG, Yatabe Y, Austin JHM, Beasley MB, et al. The 2015 World Health Organization classification of lung tumors: impact of genetic, clinical and radiologic advances since the 2004 classification. J Thoracic Oncol. 2015;10(9):1243–60.

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