

## A Case of Adolescent Lung Cancer Resectable by the Microthoracoscopic One-port Method

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**An abnormal shadow was detected in a 15-year-old male adolescent by routine chest radiography during a school medical examination. Further detailed examination demonstrated stage IA primary lung adenocarcinoma in the right inferior lobe. The patient then underwent surgery. The right inferior lobe was resected, and the mediastinal lymph node was dissected by the microthoracoscopic one-port method. Thoracoscopic surgery for stage IA primary adult lung cancer has been established. However, no report has been published on thoracoscopic surgery, particularly the one-port method, for rare primary lung cancer in an adolescent, as demonstrated in this case.**

**Key words:** Lung cancer, Child, Adolescent, Video-assisted thoracic surgery, Thoracoscopy

### INTRODUCTION

Currently, thoracoscopic surgery is recognized as a standard treatment for lung cancer in the field of general thoracic surgery. For thoracoscopic surgery, we employ a two-port method, which allows a reduction in the skin incisional wound compared with posterolateral thoracotomy [1].

Recently, a less invasive microthoracoscopic one-port method has been introduced in many hospitals [2]. We herein employed the microthoracoscopic one-port method for surgery through a single incisional wound of about 2 cm diameter to resect the right inferior lobe under thoracoscopic guidance and to dissect the mediastinal lymph node for primary lung adenocarcinoma in an adolescent. More than 2 years have passed since the surgery. Currently, the patient is making satisfactory progress.

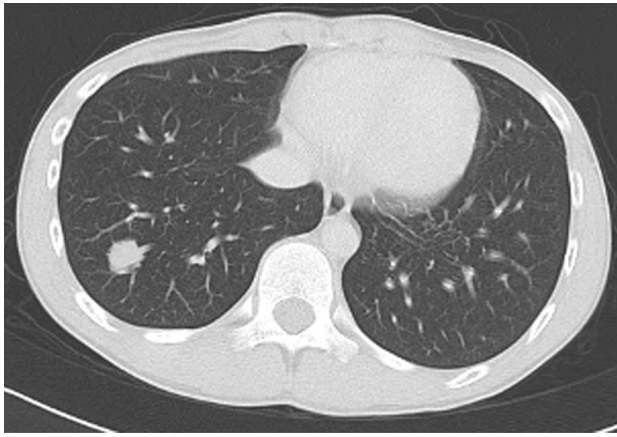
### CASE

The patient was a 15-year-old male adolescent. An abnormal shadow was detected by routine chest radiography during a school medical examination. The patient visited our hospital for a more detailed examination and treatment. The patient was 167 cm tall and weighed 50 kg. No abnormalities were found in the general examination and blood biochemistry tests (including tumor markers) on admission. Additionally, pulmonary function tests were within the normal limits. A lung tumor was detected in the right inferior lobe by chest computed tomography (CT) (Fig. 1). No increased <sup>18</sup>F-fluorodeoxyglucose accumulation was detected by chest positron emission tomography-CT. A benign tumor was suspected in light of the patient's age. However, adenocarcinoma was diagnosed by

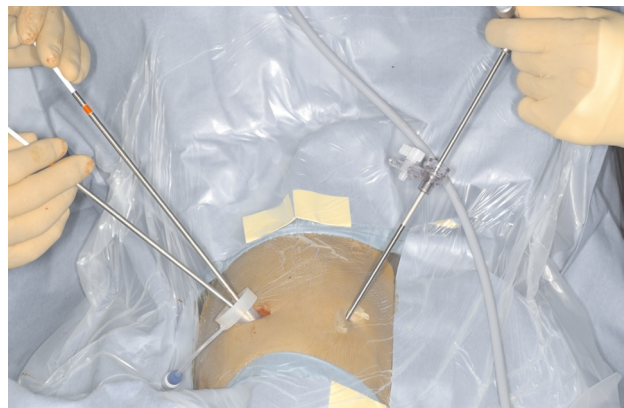
bronchoscopy with a transbronchial lung biopsy of the right S10b. The patient then underwent surgery.

After obtaining appropriate informed consent, the microthoracoscopic operation was performed under general anesthesia during one-lung ventilation with Univent (Fuji Systems Corp., Tokyo, Japan) [3]. The patient was placed in the left lateral decubitus position during the procedure, which enabled to revert to standard thoracotomy (posterolateral thoracotomy) at any time. First, an approximately 2-cm working port was created on the anterior axillary line on the fifth intercostal space, and a Thoraco Holder (Fuji Systems Corp.) was inserted [4] (Fig. 2). The pleural cavity was examined with a 3-mm, 30° microscope (Karl-Storz, Tuttlingen, Germany) to determine adhesion status. An access needle (Ethicon Endosurgery, Cincinnati, OH, USA) was then inserted near the auscultatory triangle in the fifth intercostal space. An automatic stapler (ENDO GIA multifire30-2.5; Covidien, Norwalk, CT) was used for anastomosis of the blood vessels, and an endbag (Covidien) was used to remove the right lower lobe from the pleural cavity. Mediastinal lymph node dissection was performed immediately after the lobectomy. After confirmation of no air leaks, a chest tube was inserted through the surgical wound on the surgeon's side before closing the chest wound, and the operation was concluded.

During surgery, the patient was diagnosed to have stage IA lung cancer. The surgery lasted 107 minutes, and blood loss was 7 g. Histopathologically, the tumor was diagnosed as adenocarcinoma, mixed subtype (mucinous type bronchioloalveolar carcinoma and papillary adenocarcinoma), well-differentiated type (G1) (pT1aN0M0 stage IA) (Fig. 3). The patient made satisfactory progress. The drain was removed on day



**Fig. 1** Chest computed tomography. A tumor shadow was detected with  $12 \times 16$ -mm vascular convergence in the peripheral right S9-10. No significant finding was observed in the hilar area and mediastinal lymph node.



**Fig. 2** Thoracoscopic one-port and puncture method.

4 after surgery. The patient was discharged from the hospital on day 5. More than 2 years have passed since the surgery. Currently, the patient is leading a normal healthy adolescent life without relapse.

### DISCUSSION

Pulmonary lobectomy for lung cancer was performed by video-assisted thoracoscopic surgery for the first time in 1993 [5-7]. Thoracoscopic surgery, designed to reduce invasion of the thoracic wall, was a revolutionary method [5-7] and Lewis [6] particularly emphasized the low invasiveness of the thoracic wall. In Japan, thoracoscopic lobectomy for lung cancer was introduced at various institutions in 1993. Except for our institution, all the operations at other institutions were performed with three or more skin incisions for access to the pleural space. Many surgeons soon supported a thoracoscopic approach for lobectomy, but even now, there is controversy regarding the performance of thoracoscopy for mediastinal lymph node dissection.

The first systematic mediastinal lymph node dissection was performed thoracoscopically in 1994 [8]. At that time, we developed the two-port method and performed mediastinal lymph node dissection with the conventional surgical instruments that we used during standard thoracotomy. We showed that dissection equivalent to that performed during standard thoracotomy was possible [9].

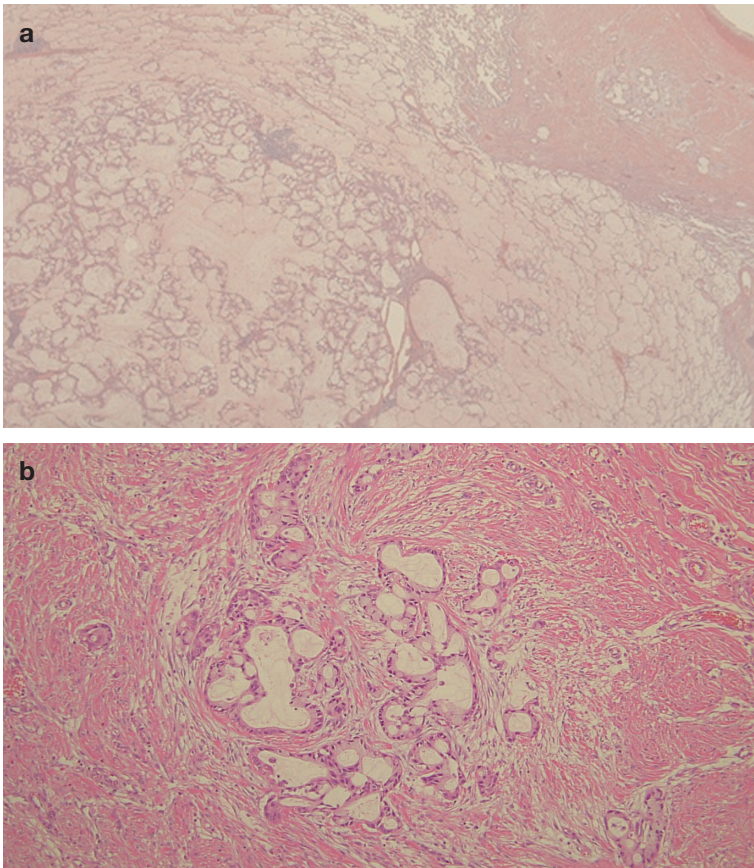
As of year 2000, the two-port method that we developed resulted in the least surgical invasion among the operations available for lung cancer. Because

postoperative pain has a major effect on the speed of the patient's return to normal life in society and on the degree of limitation of activities of daily living, performing a thoracoscopic operation adequately, while minimizing the thoracotomy procedure is the goal in lung cancer surgery.

We initially made a skin incision just large enough to insert a single hand into the pleural cavity and performed operations with thoracoscopic insertion ports at two other sites. In the beginning we performed the operation by making a 6-cm incision on the surgeon's side and 3-cm incision on the assistant's side. We then reduced the size of both incisions even further, and as we acquired proficiency in performing the operation, we devised a method in which two Thoraco Holders were used in the fourth intercostal space centered on the subscapular angle, that is, the two-port method [1, 3]. With the two-port method, not only are there just two small surgical scars visible on the skin and little invasion of the respiratory muscles, but it is possible to perform mediastinal lymph node dissection equivalent to that performed during the standard thoracotomy operation [9].

Because the two-port method enables identification of the tracheal bifurcation directly, it is easy to observe the status of the dissection, and the procedure is safe, with little risk of bleeding. It is also superior in every respect to the standard thoracotomy methods as an operation for stage IA lung cancer in terms of blood loss, operative time, postoperative pain, and length of hospital stay. It is also more economical [4, 5].

The one-port technique is an even better method.



**Fig. 3** (a)Microscopic feature of the resected pulmonary tumor. Mainly, the tumor consisted of mucin containing columnar cells and showed growth along the alveoli, so called 'lepidic growth', (b)and a part of the tumor showed invasive growth with fibrosis (right upper part in the figure). However, the tumor was localized in the lung, and no pleural invasion was observed. Neither vascular nor lymphatic infiltration was observed. No metastasis was observed in the dissected lymph node.

There are no differences from the two-port method in terms of operative time, blood loss, and number of staplers used, but the results obtained have shown that the one-port method is superior from the standpoint of postoperative pain and pulmonary function. The skin incision is approximately 2 cm long, and the operation can be performed through the single port only. However, because of the need to remove the resected lung from the body and the need to use automatic anastomosis devices, it is impossible to make the skin incision any smaller at the present time.

For patients with poor pulmonary function, elderly patients, and patients with complications, and even in patients in whom surgery for stage IA lung cancer is impossible by the conventional method, the thoracoscopic one-port method is less invasive, and we think the indications can be extended [2].

We believe that the microthoracoscopic one-port method should be more effective in growing adolescents than in adults. The microthoracoscopic one-port method should be indicated for surgeries in adolescents as well as adults. However, all the surgical instruments currently used for thoracoscopic surgery are manufactured for adults. Thus, instruments for thoracoscopic surgery and tubes for one-lung intubation should be developed for adolescents to extend

the indications of thoracoscopic surgery to narrow the operative wound and to shorten surgery time.

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