

TECHNICAL NOTE

Subxyphoid single-incision thoracoscopic pulmonary metastasectomyChia-Chuan Liu^{1*}, Bing-Yen Wang^{1,2,3*}, Chih-Shiun Shih¹ & Wei-Cheng Lin⁴

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Introduction

The use of thoracoscopic surgery for pulmonary resection is widely accepted, and the number of incisions required has been reduced to a single port.^{1–3} Hand-assisted transxyphoid lung metastasectomy was first reported in 1999; and the feasibility and long-term results of this technique were well documented in 2007.⁴

Given the advances in minimally invasive surgery and techniques for the localization of lung nodules,⁵ the single-port technique can be applied through a single subxyphoid incision to perform bilateral pulmonary metastasectomy and right middle lobectomy.

Case 1

A 43-year-old female patient was admitted for resection of bilateral lung metastases for previous nasopharyngeal

Abstract

Single-incision thoracoscopic surgery has increasingly attracted public interest and been applied in numerous thoracic procedures. However, single-incision thoracoscopic surgery is associated with requiring subsequent procedures, such as intercostal neuralgia. Herein, we extend the single-port technique of pulmonary metastasectomy through a single subxyphoid approach, and report the first two cases of this procedure to date.

carcinoma, initially staged as cT4N2M0. A positron emission tomography-computed tomography (PET/CT) scan was performed before surgery in order to exclude metastases sites. There were two nodules in the right lower lung, two in the left upper lung, and one in the left lower lung near the diaphragm; tumor sizes ranged from 0.7 to 1.3 cm (Fig 1a–c). Three of the five lesions were subpleural. For the right lower lung lesion approximately 1 cm in size and 2 cm away from the pleura, we made a CT-guided tattoo on the lesion with an injection of 0.15 mL of methylene blue, just prior to surgery. The patient was placed in the supine position with her arm extended alongside her body. The patient was placed under general anesthesia and a 3.5-cm subxyphoid vertical incision was created using a double lumen tube. With finger blunt dissection toward the diaphragm, the bilateral pleural space was entered uneventfully. A wound protector and 10-mm articulate EndoEye Flex HD endoscope (Olympus, Tokyo, Japan) were used. We commenced the operation with the left-sided

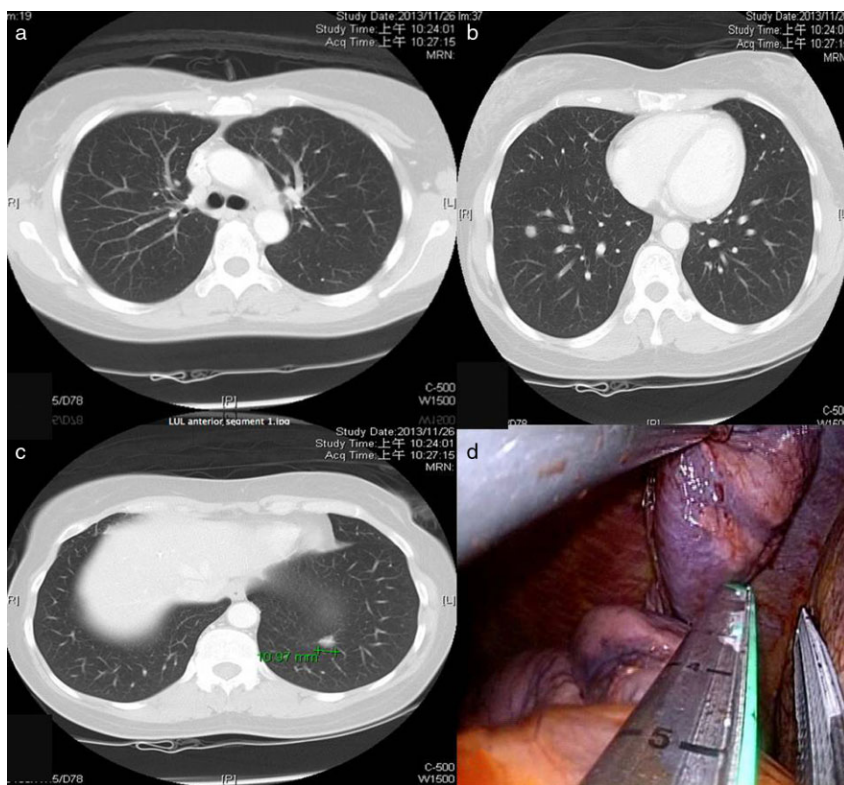


Figure 1 (a) Lingular lobe lesion. (b) Right lower lobe tumor, computed tomography-guided tattoo created preoperatively. (c) Right lower lobe lesion, near the diaphragm. (d) Subxyphoid single-port wedge resection of the right lower lobe tumor.

lesions, and then proceeded to the right. Three of the subpleural lesions located in the right lower lobe, left lower lobe, and left upper lobe were clearly observed and easily wedge resected using articulate staplers (Fig 1D). The lingular lesion was located by palpation with ring forceps, and resected without difficulty (Video S1). Resection of the relatively deep-seated lower lung lesion was more challenging, despite clear identification of the tattoo on the pleural surface. It was eventually removed using an endostapler. All resection margins of the removed lesions were free from cancer. Surgery took 105 minutes with 10 mL of blood loss. The bilateral chest tubes were implanted through the single subxyphoid wound. Both Fr 16 chest tubes to bilateral pleural cavities were removed on postoperative day three and the patient was discharged uneventfully on the same day.

Case 2

A 38-year-old female patient was admitted for salvage right middle lobectomy as a result of a residual tumor that persisted after intensive treatment for advanced left breast cancer with lung metastasis. A PET/CT scan was performed before surgery. After general anesthesia with selective lung ventilation, the patient was placed in the left semi-decubitus position at a 45° angle to the table. A 4 cm transverse

incision was made over the subxyphoid area. A subcostal tunnel was created and a wound protector with a sternal retractor applied. When we entered into the left pleural cavity, the patient's heartbeat often interfered with endoscopic instruments. Therefore, we used a retractor to lift the sternum to increase working space and decrease the influence of her heartbeat, and a 10-mm articulate Olympus EndoEye Flex HD endoscope was used (Fig 2). The mediastinal pleura, interlobar fissure, and vascular sheath were opened with hook electrocautery and double joint instruments (Scanlan International, St Paul, MN, USA). Two middle lobe arteries were identified; one was transected with a stapler, and the other was cut after applying Hemolock (Weck Surgical Instruments, Teleflex Medical, Durham, NC, USA) (Video S2). The middle lobe vein and bronchus were divided with an Endo GIA Curved Tip Reload curve-tip stapler (Covidien, New Haven, CT, USA). Finally, the incomplete fissure between the right upper lobe to the right middle lobe was transected uneventfully with multiple staplers (Video S2). The lung specimen was secured in a protective bag and the tumor was withdrawn easily through the subxyphoid incision. Surgical time was three hours, with a 20 mL blood loss. Chest drainage was discontinued on postoperative day three; however, the patient was only discharged late on postoperative day six.

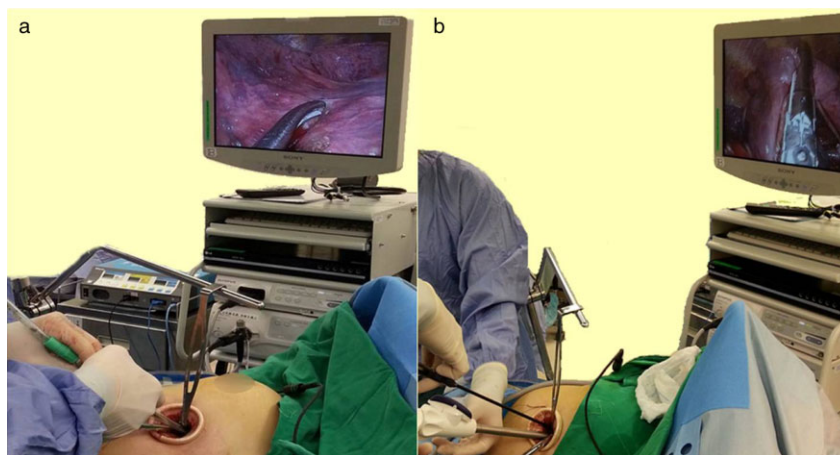


Figure 2 (a) Dissection of the minor fissure to approach the middle lobe pulmonary arteries. (b) The incomplete minor fissure was divided by using an endocutter to complete the right middle lobe lobectomy via the subxyphoid single-port approach.

Discussion

Thoracoscopic lung resection for lung cancer began in the early 1990s. It is usually performed with two or more incisions on the chest wall. Our team is experienced in single-incision thoracoscopic lobectomy/segmentectomy via the intercostal approach.³ We designed a novel single incision for thoracoscopic lung resection. The incision was designed at the subxyphoid area, thus there is no chest incision to avoid intercostal neuralgia. The instruments and dissection techniques of these two approaches, intercostal *versus* subxyphoid, are similar. Accordingly, we encountered no significant operative difficulties when we switched from the single intercostal incision to the single subxyphoid approach, as shown in these two case reports.

Intercostal neuralgia can occur as a result of damage or compression of the intercostal nerve. The intercostal incision in thoracoscopic surgery may inevitably cause some injury to the intercostal nerve. We made a single incision over the subxyphoid area and created a tunnel into the thorax. No intercostal incision was made. Postoperative pain was minimal in both patients, with no limitation to shoulder girdle movement. Both patients are scheduled for further management.

Suda *et al.* reported a case of single-incision bilateral wedge resection using the subxyphoid approach.⁶ We performed bilateral metastasectomy via the single-incision subxyphoid approach. Furthermore, we performed salvage right middle lobectomy. We believe that subxyphoid single-port pulmonary metastasectomy can decrease patient morbidity from multiple chest wounds, provide better cosmetic benefits without chest scarring, and reduce the operative time and recovery period in selected cases. Further study is needed to define the proper indications and confirm the benefits of this approach.

Disclosure

No authors report any conflict of interest.

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Supporting information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Video S1 The lingular lesion was located by palpation with ring forceps and resected without difficulty.

Video S2 Two middle lobe arteries were identified; one was transected with a stapler, and the other was cut after applying Hemolock. The middle lobe vein and bronchus were divided with a curve-tip stapler. Finally, the incomplete fissure between the right upper lobe to the right middle lobe was transected uneventfully with multiple staplers.