Transareolar pulmonary bullectomy for primary spontaneous pneumothorax

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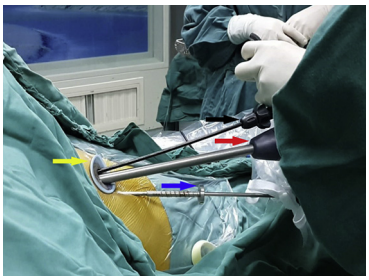
ABSTRACT

Background: Conventional 3-port video-assisted thoracoscopic surgery is the classic approach for the diagnosis and treatment of primary spontaneous pneumothorax. Transareolar pulmonary bullectomy rarely has been attempted. This study aimed to evaluate the feasibility and safety of this novel minimally invasive technique in managing primary spontaneous pneumothorax.

Methods: From January 2013 to December 2014, a total of 112 male patients with primary spontaneous pneumothorax underwent transareolar pulmonary bullectomy by use of a 5-mm thoracoscope.

Results: All procedures were performed successfully, with a mean operating time of 26.5 minutes. The mean length of transareolar incision for the main operation was 2.0 ± 0.2 cm, the mean length of incision for the camera port was 0.6 ± 0.1 cm, and the mean postoperative cosmetic score was 3.0 ± 0.8. All patients regained consciousness rapidly after surgery. One hundred seven patients (95.5%) were discharged on postoperative day 2 or 3, with the remainder discharged on postoperative day 4 or 5. Postoperative complications were minor. At 6 months postoperatively, there was no obvious surgical scar on the chest wall, and no patient complained of postoperative pain. No recurrent symptoms were observed. One-year follow-up revealed an excellent cosmetic result and degree of satisfaction.

Conclusions: Transareolar pulmonary bullectomy is a safe and effective therapeutic procedure for primary spontaneous pneumothorax caused by pulmonary bullae. The incision is hidden in the areola with excellent cosmetic effects. This novel procedure shows promise as a treatment of primary spontaneous pneumothorax. (J Thorac Cardiovasc Surg 2016;152:999-1005)



Transareolar pulmonary bullectomy procedure. The *colored arrows* indicate the following: *black*, flexible endograsper; *red*, endoscopic linear stapling device; *yellow*, wound protector; *blue*, 5-mm 30° thoracoscope and trocar.

Central Message

Transareolar pulmonary bullectomy for primary spontaneous pneumothorax provided excellent cosmetic and clinical outcomes in 112 patients.

Perspective

The procedure resulted in a short hospital stay, minimal postoperative pain, no major complications, an excellent cosmetic outcome, and no recurrence in a minimum 1-year follow-up duration. Transareolar pulmonary bullectomy provides several advantages compared with traditional PSP treatment techniques.

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In most institutions, the diagnosis and treatment of primary spontaneous pneumothorax (PSP) usually is performed through conventional 3-port video-assisted thoracoscopic surgery (cVATS). cVATS leaves 3 obviously visible scars on the chest wall, resulting in a permanent cosmetic defect. Furthermore, in cVATS the second operation hole is placed through the seventh intercostal space at the posterior axillary line where the chest wall muscles are thick and the intercostal space is narrow; this often induces intercostal nerve injury, which results in numbness or paresthesia,

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Scanning this QR code will take you to a procedural video.

Abbreviations and Acronyms

CT = computed tomography
cVATS = conventional 3-port video-assisted thoracoscopic surgery
PSP = primary spontaneous pneumothorax
SITS = single-incision thoracoscopic surgery
VAS = visual analog scale
CXR = chest x-ray

and postoperative wound-related pain. Single-incision thoracoscopic surgery (SITS) has been reported, but it is not used widely because of its poor maneuverability and the requirement for expensive special or disposable devices.[1] Considering the disadvantages of these pneumothorax treatment procedures, we designed a transareolar pulmonary bullectomy for pneumothorax (Video 1) at our hospital in January 2013. In this article, we report our initial experience with transareolar pulmonary bullectomy for pneumothorax.

METHODS

Patient Selection

From January 2013 to December 2014, a total of 127 male patients with PSP underwent pulmonary bullectomy at our institution. Among them, 112 cases (88.2%) underwent transareolar pulmonary bullectomy by use of a 5-mm thoracoscope. Patient characteristics are listed in Table 1. This study was approved by the Institutional Review Board and Ethics Committee of the First Affiliated Hospital of Fujian Medical University (No. 2013-01, January, 2013). All patients received a preoperative routine blood examination, cardiological consultation, and computed tomography (CT) scan of the chest. A detailed medical history, the degree of symptoms, and the distribution of pulmonary bulla also were documented. All patients signed their informed consent at least 1 day before surgery after careful explanation of the procedure and goals of the study.

Inclusion criteria were age >16 years and <50 years; male patients with PSP; no history of thoracic surgery or severe chest wall deformity. Exclusion criteria were age <16 years and >50 years; female patients; history of thoracic surgery or severe chest wall deformity; upper airway and maxillofacial injury or deformity; lung, pleural, or heart diseases.

VIDEO 1. Transareolar pulmonary bullectomy procedure. Video available at http://www.jtcvsonline.org/article/S0022-5223(16)30653-5/addons.

TABLE 1. Patient characteristics

Characteristics	Value
No. of patients	112
Mean age/range, y	24 (16-49)
Mean BMI/range, kg/m^2	20.6 (18.2-23.4)
Positive family history, yes/no	6/106
Distribution of pulmonary bulla, n (%)	
Left upper lobe of lung only	57/50.9
Plus left lower lobe of lung	3/2.7
Right upper lobe of lung only	48/42.9
Plus right middle lobe of lung	2/1.8
Plus right middle and lower lobe of lung	2/1.8

BMI, Body mass index.

Surgical Procedure

All patients were positioned on the operating table in a semi-sitting position with arms in abduction and underwent healthy side 1-lung ventilation (Figure 1, *A*). A 5-mm incision for the camera port was made through the fourth intercostal space at the lower edge of the areola (Figure 1, *B*). We used a 5-mm 30° thoracoscope (Karl Storz GmbH & Co. KG, Tuttlingen, Germany) to observe the thoracic cavity, especially the area surrounding the bulla identified on computed tomography. When the lesions were identified and adhesions were minimal, a second 2.0-cm port was introduced through the third intercostal space at the upper edge of the areola as the main operational incision, and a wound protector (ENDO KEEPER; NELIS, Bucheon, Korea) was fixed on the incision window. Next, the endograsper (Covidien, Mansfield, Mass) and the endoscopic linear stapling device (ENDO-GIA, Johnson & Johnson, Mansfield, Mass) were inserted into the window for wedge-shaped excision of the lung (Figure 1, *B*).

After resection, warm saline water was poured into the thorax to test for air leakage; fibrin glue was sprayed to the lung surface and the lung resection area. Then, a piece of gauze with iodopovidone was used to perform both mechanical abrasion and chemical pleurodesis on the chest wall. A 2-mm subclavian vein tube was placed through the second intercostal space at the mid-clavicular line (Figure 1, *A* and *C*), whose lower end was later connected to a thoracic drainage bottle with negative pressure (Figure 2, *D*). A second 2-mm subclavian vein tube was placed through the seventh intercostal space at the middle axillary line, whose lower end was later connected to a drainage bag (Figure 2, *B* and *D*). All procedures were completed by insertion of a 14F chest tube through the incision window, and the lung was reinflated under visual control. The chest tube was aspirated while the anesthesiologist ventilated the patient manually, exerting continuous positive pressure for a few seconds before the drain subsequently was removed. Compont Medical Adhesive (Compont Medical Devices Co., LTD, Beijing, China) was used to dress wounds after the muscle and subcutaneous tissue were sutured (Figure 3, *A*). The subclavian vein tube was removed[2] when: (1) the lung was expanded fully without pleural effusion on chest radiography; (2) there was no air leakage through the chest tube; and (3) the amount of drainage was less than 100 mL per day.

Data Collection and Follow-up

The operating time, resuscitation time, hospital stay, incision length, pain score, and complications were recorded. The patients were followed up for 12-26 months by hospital visits (53 cases, 47.3%), telephone (38 cases, 33.9%), or e-mail (21 cases, 18.8%). The mean duration of follow-up was 15.6 ± 3.2 months. Patients were required to fill out a