

## ORIGINAL ARTICLE

## Retrospective review of two-port thoracoscopic (VATS) wedge bullectomy and lung wedge biopsy

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**ABSTRACT:** *Background:* Video-assisted thoracoscopic surgery (VATS) involving wedge resection of bulla and lung biopsy can be done by two or three-port incisions. Controversy exists as to which approach is superior. We communicate our experience with two-port VATS for these procedures. *Methods:* We retrospectively analyzed the charts of all patients who underwent a VATS procedure by two-port incisions from July 2001 to July 2007 by two thoracic surgeons (S.C., S.C.) We included in the study all patients who underwent wedge resections for primary or secondary spontaneous pneumothorax and biopsies for pulmonary infiltrates and small nodules. *Results:* A total of 319 patients' charts were examined, and 217 of whom had undergone two-port incisions fitted in the inclusion criteria. There were 136 (65.7%) males and 81 (37.3%) females with a mean age of 47 years. Pneumothorax was the main diagnosis for 98 (45%) patients, followed by pulmonary infiltrates for 69 (32%) patients and lung nodules for 50 (23%) patients. The mean operative time and the number of post-op days for chest tube removal and to discharge home in each group have also been recorded. There were few post-operative complications, such as 11 (5%) cases of persistent air leak, 11 (5%) cases of transient fever of unknown origin, 3 (1.4%) cases of pneumonia, 3 (1.4%) cases of bleeding within, one reoperated, and 1 (0.46%) case of *C. difficile* colitis. The 30-day mortality was 0%. *Conclusion:* The thoracoscopic (VATS) wedge biopsy via two-port incisions is a safe operation for patients presenting with pneumothorax or requiring a lung biopsy. A two-port approach seems to be a reasonable alternative to three-port incision procedures for these types of diagnosis, regarding post-operative pain and cosmetic benefits particularly for young patients.

**KEYWORDS:** VATS, pneumothorax, bullectomy, thoracoscopy, pleurodesis, pulmonary nodule, pulmonary infiltrates, lung neoplasms.

### INTRODUCTION

Lung cancer incidence was 73,6/100,000 in 2004 in the United States (1), and spontaneous pneumothorax are more rare. Between 1991 and 1995, the rate of admissions to UK hospitals for both primary and secondary spontaneous pneumothorax was 16.7 per 100,000 men per year and 5.8 per 10,000 women per year (2). One diagnostic and therapeutic alternative to thoracotomy is video-assisted thoracoscopic surgery

(VATS), allowing wedge bullectomy and lung wedge biopsy while reducing pain by smaller incisions and leading to shorter hospital stay. VATS can be performed by three, two and even one-port incisions. Controversy exists as to which approach is superior (3,4). At our institution, three surgeons use either two-port or three-port procedure VATS but otherwise the same technic. They do not use one-port. We have reviewed our experience with two-port VATS over the last 6 years to determine whether this approach can be regarded as safe.

### PATIENTS AND METHODS

#### *Patients*

The charts of all patients who underwent a thoracoscopic procedure by two-port incisions from July 2001 to July 2007 by two thoracic surgeons were

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reviewed. We included in the study all patients who underwent wedge resections for spontaneous pneumothorax and wedge biopsies for pulmonary infiltrates and small nodules (<1.5 cm). The exclusion criteria were high pre-operative O<sub>2</sub> requirement (FiO<sub>2</sub>>0.5), large nodules (greater than 1.5 cm diameter), diffuse severe emphysema, giant bulla, and those who were converted to open surgery for any reason.

#### Data collection

Retrospective data collection includes comorbidities, surgical treatment received, duration of surgery, duration of chest tubes, hospital length of stay (LOS), post-operative complications and analgesia.

#### Surgical procedure

All patients were operated using the same technique. Under general anesthesia with double lumen intubation, the patient was placed on the lateral decubitus position to expose the left or right chest. A small 2cm transverse skin incision was performed on the lateral and lower aspect of the chest. A tunneled dissection was made superiorly for subsequent chest tubes. The 8th or 9th intercostal space was opened. The lung was deflated. A second thoracoscopic port incision was performed more superiorly and anteriorly or posteriorly.

Following that, a 10-mm, 0° thoracoscope (Karl Storz) with a working channel was introduced into the pleural cavity through the first incision. Careful inspection of the pleural space was performed.

For bullectomy and pleurectomy or pleurodesis, the apex of the upper lobe, having blebs, was grasped through the working port of the scope and an Endo GIA-45 stapler (3.5mm green cartridge Ethicon®) was used through the second port. The upper segment of the lower lobe was carefully inspected and blebs were resected using the same technic.

Diagnosis	N	%	♂	♀	Mean age (yr)	Range (yr)
Primary spontaneous pneumothorax	81	37.3	66	15	29.3	17-83
Secondary spontaneous pneumothorax	18	8.3	14	4	52.7	14-79
Pulmonary infiltrates	68	31.3	33	35	64.4	18-83
Pulmonary nodules	50	23	23	27	50.4	23-81

Table 1: Demographic data.

Regarding lung wedge biopsy for nodules or infiltrates, limited small wedge resections were performed using an endograsper and an endoGIA-45 4.8mm stapler. The wedge resections for biopsy were performed in different areas of the lung to obtain a good sampling.

Combined apical pleurectomy and mechanical pleural abrasion was performed for pleurodesis, on the anterior, lateral, and posterior aspects of the chest wall. For some elderly patients with chronic obstructive pulmonary disease, following the mechanical abrasion, talc poudrage was used to achieve optimal pleurodesis. Following irrigation and suction with normal saline, a 32 French chest tube was placed posteriorly to the lung up into the apex through the camera port. The lung was reinflated. All the incisions were closed using 0 Vicryl sutures stitched on the subcutaneous tissue and Monocryl 4-0 subcuticular on the skin. Intercostal block with bupivacaine 0.25 with epinephrine was done in the intercostal space where the trocar and the chest tube have been placed.

## RESULTS

We reviewed the charts of 319 patients and a total of 217 patients had undergone two-ports incisions and fit in the inclusion criteria; all remaining cases corresponded to any of the exclusion criteria. There were 136 (65.7%) males and 81 (37.3%) females with a mean age of 47 years (range 14-84).

General demographic data are shown in table 1.

The operative time, LOS, chest tube requirement time duration are summarized in table 2.

We noticed that 16% of primary spontaneous pneumothorax (PSP) cases showed postoperative complications, 19% for secondary spontaneous pneumothorax (SSP), 14% for pulmonary nodules and 12% for pulmonary infiltrate.

The most common postoperative complications were

Diagnosis	PSP	SSP	Pulmonary nodules	Pulmonary infiltrates
Operative time (min)	75 (35-135)	88 (51-145)	74 (50-115)	69 (35-130)
Chest tube requirement time duration (day)	3.85 (1-12)	3.67 (1-6)	2.34 (1-9)	3.22 (1-13)
LOS (day)	4.79 (2-40)	5.94 (2-17)	3.20 (1-9)	4.78 (2-20)

Table 2: Operative time, chest tubes duration and LOS.

11 (5%) cases of persistent air leak, 11 (5%) cases of transient fever peak of unknown origin, 3 (1.4%) cases of pneumonia, 3 cases (1.4%) of postoperative bleeding, and 1 (0.46%) case of *C. difficile* colitis which has resolved. There were no cases of wound/cellulitis, empyema, arrhythmia or cardio-vascular event. Only three cases of primary spontaneous pneumothorax needed a reoperation for bleeding, persistent air leak and a recurrence. The 30-day mortality was 0%.

Within the 98 patients operated for pneumothorax, 82 (83.7%) underwent pleurodesis by mechanical abrasion, 6 (6.1%) by talc poudrage, and 10 (10.2%) received no pleurodesis. Within the 69 patients operated for infiltrates, 1 (1.4%) underwent pleurodesis by mechanical abrasion, 3 (4.3%) by talc poudrage and 65 (94%) received no pleurodesis (figures 1 and 2).

## DISCUSSION

VATS is known for being both an effective diagnosis and therapeutic tool employing minimally invasive techniques. It became involved in the diagnosis of idiopathic interstitial lung disease (5), and the staging of lung nodules (6) while allowing a simultaneous assessment of the pleura. It also facilitates the treatment of pneumothorax by wedge bullectomy and pleurodesis. For primary spontaneous pneumothorax, it has even been demonstrated effective and safe for the first episode (7).

Our cohort data suggests that the average operative time is proportional to the number of postoperative days to remove chest tubes and discharge home if no postoperative adverse event occurs. This constation excludes the cases involving pulmonary infiltrates for which the longer length of stay is due to the pre-operative disease.

Compared to other VATS studies for spontaneous pneumothorax and indeterminate interstitial lung disease, our data shows good results regarding operative time, chest-tube drainage, and postoperative hospital stay.

For mean operative time, studies state values as  $57 \pm 19$  minutes (8),  $67.9 \pm 16.7$  minutes (5), and 129 minutes (9). For pleural drainage, studies show mean duration as 1.4 days (range 1-7) (10), 4.1 days (9),  $5.8 \pm 1.2$  days (2), and  $6.0 \pm 4.7$  days (5). For postoperative hospitalization, values were published for 2.4 days (10), 4 days (9,11), 5 days (12),  $7.7 \pm 1.6$  days (8),  $7.9 \pm 4.7$  days (5), and 9.5 days (9).

Compared with previous studies in terms of postoperative mortality and morbidity, our sample of patients who underwent two-ports surgery for VATS had very good results.

Regarding 30-day mortality, studies often depicts no cases (5,7-9,12-14) or rates as low as 0.5% (15), 0.8%

(16), 1.3% (17) and 3.6% (18). This last increased rate was seen for secondary spontaneous pneumothorax, due to diagnosed pulmonary pathologies as emphysema. Higher rates are present for postoperative complications, for which increasing factors include extreme age range and preoperative comorbidities. Studies depict morbidity of 9.6% for nodules (15), 1.7% (13), 25.4% (17), and 27.4% (8) for primary spontaneous pneumothorax, and 25% (13) and 76.9% (17) for secondary spontaneous pneumothorax. In previous reviews, persistent air leak was seen for 10% to 11.5% of procedures (9,17), pneumonia in up to 6.7% (17), bleeding in 1.6% (19). Those rates are equivalent or higher to ours. Moreover, others describe arrhythmia (17), empyema (17), and wound infection (13) that didn't occur in our cohort.

To minimize these complications, authors recommend a close monitoring in the post-operative care unit and on the ward. Vital signs, chest tubes drainage and incision wounds should be checked by the surgical team in morning rounds, and twice a day by nurses. Moreover, chest radiographs and complete blood count may be of particular interest if patients are symptomatic. Prevention of *C. difficile* infection is also important with a judicious use of antibiotics and isolation when necessary.

Interestingly, during the post-operative days, patients operated for lung infiltrates consumed more morphine (65.3 mg) than patients who underwent the surgery for lung nodules and pneumothorax (48.4 mg and 42.1 mg, respectively).

We noticed that the practice of pleurodesis did not significantly increase the use of narcotics, despite the earlier notion that pleurodesis increase pain in an important way. Post-operative morphine administration levels in pneumothorax cases whom surgery included mechanical abrasion illustrate an average difference of less than 10mg in post-operative day 1 and 2 (figure 1). This value spread is negligible. A study also suggested that additional mechanical pleurodesis has no disadvantages versus bullectomy alone in terms of worsening post-operative chest pain or pulmonary function (20).

Chemical talc pleurodesis appears to decrease the need for post-operative morphine. In our cohort, postoperative morphine administration levels in cases of pulmonary infiltrates were much greater for patients receiving no pleurodesis than for those receiving chemical talc pleurodesis. However, this included only 3 patients and is therefore highly susceptible to hazard (figures 1 and 2).

## CONCLUSION

We conclude that thoracoscopy (VATS) via two-port

incisions is a safe and efficient procedure for patients presenting a pneumothorax or requiring a lung biopsy. Our complication rate is similar or lower to the rates of three-port thoracoscopy. This technique is arguably superior to three-port incisions based on the finding that it may decrease the postoperative pain and neuralgia risks, and presents obvious cosmetic benefits particularly for young patients. A comparative study with three-port incisions is warranted to elucidate this controversy.

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