

Thoracoscopic Partial Pneumonectomy with and without Postoperative Thoracic Drainage Tube

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ABSTRACT

Objective: To compare thoracic drainage tube placement on clinical outcomes and serum CRP, IL-6, cortisol in patients undergoing thoracoscopic partial pneumonectomy.

Study Design: Analytical study.

Place and Duration of Study: Yulin Second Hospital, China, between January 2017 and January 2022.

Methodology: Eighty-four patients with lung cancer who underwent thoracoscopic partial pneumonectomy were studied. A thoracic drainage tube was placed postoperatively (Group A, n=41). Otherwise, a thoracic drainage tube was not placed if an air leak was not detected in the suction-induced leak test postoperatively (Group B, n=43). Difference effect was compared.

Results: Postoperative hospitalisation time and incidence of postoperative subcutaneous emphysema in Group A were lower than those in Group B ($p<0.001$ and $p=0.038$ respectively). On the 1st day before surgery, the differences in serum CRP, IL-6, and cortisol were not significant between the two groups ($p=0.443$, 0.644 , and 0.738 respectively); on the 1st day after surgery, levels of serum CRP, IL-6, and cortisol in Group A were lower than those in Group B ($p<0.001$, $p<0.001$, and $p=0.001$ respectively).

Conclusion: Postoperative hospitalisation time and the frequency of postoperative subcutaneous emphysema were lower in patients of thoracoscopic partial pneumonectomy without placing thoracic drainage tubes. The degree of surgery-induced stress was also lower. The decision not to leave the thoracic drainage tube may be considered reasonable and safe if the criteria are carefully selected.

Key Words: Thoracoscopy, Thoracic tube drainage, Partial pneumonectomy, Cortisol, IL-6, CRP level.

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INTRODUCTION

The traditional thoracic surgery to treat lung cancer with lobectomy of the lungs and clearance of hilar and mediastinal lymph nodes has the disadvantages of large surgical incisions, long recovery time, awful pain, and many other complications.¹ As the field of thoracoscopic surgery matures, thoracoscopic partial pneumonectomy has become one of the research hotspots in thoracic surgery.²

After thoracoscopic partial pneumonectomy, thoracic drainage tubes may be used to drain gas and fluid from the chest cavity.³ In response to the adoption of fast-track surgery in clinical practice, the management strategy of placing thoracic drainage tubes after thoracoscopic partial pneumonectomy has changed. Thoracic drainage tubes have no longer been suggested to be necessary after thoracoscopic partial pneumonectomy.⁴

The absence of thoracic drainage tubes after partial pneumonectomy, according to some studies, does not increase the incidence of postoperative complications or the length of hospital stay after surgery.⁵ However, it has also been suggested that placement of a thoracic drainage tube after partial pneumonectomy may reduce the length of hospital stay, but increase postoperative complications such as pneumothorax or hemopneumothorax, thereby requiring increased vigilance.⁶ Therefore, controversy exists regarding whether the pleural cavity should be left with a thoracic drainage tube after partial pneumonectomy.

Surgical trauma can cause varying degrees of stress.⁷ Affected by it, patients with lung cancer are prone to increase surgical stress reactions and thus delay recovery. Level of C reactive protein (CRP) is considered to be a direct indicator of surgical stress.⁸ Interleukin-6 (IL-6) is one of the key inflammatory mediators of the surgical stress response, and its elevated levels can trigger activated neutrophils to assemble rapidly at the trauma site and induce the production of lysosomal enzymes, leading to inflammatory responses.⁹ IL-6 also activates the hypothalamic-pituitary-adrenal axis to increase the level of cortisol,¹⁰ which is considered as a landmark indicator of the strength of the body's stress response.¹¹ Currently, reports on the effects of

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placing thoracic drainage tubes postoperatively on surgical stress indicators like CRP, IL-6 and cortisol in patients undergoing thoracoscopic partial pneumonectomy are still relatively rare.

The aim of this study was to compare the effects of thoracic drainage tube placement on the clinical outcomes and serum stress indicators CRP, IL-6, and cortisol levels in patients undergoing thoracoscopic partial pneumonectomy.

METHODOLOGY

This retrospective study was carried out in Yulin Second Hospital, China, from January 2017 to January 2022. Eighty-four patients with lung cancer who underwent thoracoscopic partial pneumonectomy were chosen as research subjects. Inclusion criteria based on their clinical symptoms and signs, patients were given chest X-ray, spiral CT scan, and MRI examination of the lung to clarify the lung lesions; patients with feasible thoracoscopic partial pneumonectomy due to thoracic surgery disease; without limited or diffuse emphysema; no prolonged pleural effusion requiring thoracic drainage preoperatively; no perioperative death or conversion to thoracotomy.

Exclusion criteria were patients with lesions affecting multiple lung lobes, patients who were intolerant to surgery according to cardiopulmonary function assessment, coexistent malignant tumours of other tissues, mental diseases such as dementia, emphysema, coagulation abnormalities, history of ipsilateral thoracic lung surgery, patients with acute cardiovascular accidents, history of radiotherapy, bleeding tendency, or moderate to severe adhesions in the thoracic cavity.

Air leak tests were performed in 84 patients undergoing thoracoscopic partial pneumonectomy (thoracoscopic wedge resection) in this study. If no air leak was detected in the suction-induced leak test, no thoracic drainage tube was placed postoperatively (Group A, n=41). If the patient did not meet this criterion, a thoracic drainage tube was placed postoperatively (Group B, n=43).

Operation time and postoperative hospital stay were compared. Incidence of complications such as postoperative pneumothorax and postoperative subcutaneous emphysema were observed.

Levels of stress indicators CRP, IL-6, cortisol in serum were measured by drawing 3-5 mL venous blood from all patients on the first day before and after surgery in the early morning on an empty stomach. Serum CRP was measured by latex-enhanced immunoturbidimetry, serum IL-6 by ELISA, and serum cortisol by radioimmunoassay. The levels of serum CRP, IL-6, and cortisol were contrasted on the first day before and after surgery.

Statistical analyses were performed with SPSS 25. Shapiro-Wilk test was used for normality test of numerical data. Numerical data that fit normal distribution were expressed as

mean±SD. Categorical data were expressed as n (%). The difference between numerical data was analysed with an independent sample t-test. Categorical data were compared with a chi-squared test. The p-values lower than 0.05 were interpreted as significant.

RESULTS

Differences in gender (male, female), age, pathological type (adenocarcinoma, squamous cell carcinoma, small cell carcinoma), and TNM stage (I+II, III) between the two groups were not significant (p=0.801, 0.811, 0.741, and 0.705), (Table I).

Table I: Comparison of demographic data.

| Parameter | Group A (n=41) | Group B (n=43) | P |
|--------------------------------|-------------------|-------------------|--------|
| Male [n(%)] | 24 (58.54) | 24 (55.81) | 0.801* |
| Female [n(%)] | 17 (41.46) | 19 (44.19) | |
| Age (years old) | 65.88±4.33 | 65.65±4.34 | 0.811^ |
| Adenocarcinoma [n(%)] | 24 (58.54) | 26 (60.47) | 0.741* |
| Squamous cell carcinoma [n(%)] | 11 (26.83) | 13 (30.23) | |
| Small cell carcinoma [n(%)] | 6 (14.63) | 4 (9.30) | |
| TNM stage I+II [n(%)] | 31 (75.61) | 34 (79.07) | 0.705* |
| TNM stage III [n(%)] | 10 (24.39) | 9 (20.93) | |

* Chi-squared test was used; ^ Independent sample t-test was used; TNM: tumour-node-metastasis.

Both operation time and incidence of postoperative pneumothorax in patients of the two groups were not different (p=0.192 and 0.355) (Table II). Postoperative hospitalisation time and the incidence of postoperative subcutaneous emphysema in group A were lower than in group B (p<0.001 and p=0.038) (Table II).

On the 1st day before surgery, the differences in serum CRP, IL-6, and cortisol were not statistically significant in the two groups (p= 0.443, 0.644 and 0.738, on the 1st day after surgery, the levels of serum CRP, IL-6 and cortisol in group A were lower than those in group B (p<0.001, p<0.001, and p=0.001), (Table II).

DISCUSSION

There is no definitive answer on whether to place thoracic drainage tubes after thoracoscopic partial pneumonectomy, as well as its advantages and disadvantages. Some studies suggest that thoracic drainage tubes may be routinely left in place in patients after partial thoracoscopic pneumonectomy in order to allow negative pressure and drain fluid in, as well as remove gas from the chest cavity. The patient's condition after surgery should be continuously monitored.¹² Some studies suggest that late removal of thoracic drainage tubes in patients after partial thoracoscopic pneumonectomy may exacerbate pain and delay recovery of lung function postoperatively.¹³ In some post-thoracoscopic partial pneumonectomy cases, the thoracic drainage tube may be omitted for drainage.¹⁴

In this study, no difference was found in operation time between patients in Group A, suggesting that there was no significant difference in operation time between placing a thoracic drainage tube or not following thoracoscopic partial pneumonectomy. This finding is generally consistent with results reported in the previous study.¹⁵ Postoperative hospital stay in Group A was found to be shorter than that in Group B.

Table II: Comparison of relevant indices and surgical stress indicators between the two groups.

| Parameter | Group A (n=41) | Group B (n=43) | p |
|---|----------------|----------------|---------------------|
| Operation time (min) | 52.38± 3.92 | 53.66±4.90 | 0.192 [^] |
| Postoperative hospitalization time (d) | 4.62±0.35 | 5.31±0.45 | <0.001 [^] |
| Postoperative pneumothorax [n (%)] | 10 (24.39) | 7 (16.28) | 0.355 [*] |
| Postoperative subcutaneous emphysema [n (%)] | 11 (26.83) | 21 (48.84) | 0.038 [*] |
| Serum CRP on the 1 st day before surgery (mg /L) | 8.19±0.57 | 8.08±0.70 | 0.443 [^] |
| Serum CRP on the 1 st day after surgery (mg /L) | 10.20±0.72 | 11.50±0.95 | <0.001 [^] |
| Serum IL-6 on the 1 st day before surgery (ng /L) | 30.53±6.14 | 30.78±5.97 | 0.644 [^] |
| Serum IL-6 on the 1 st day after surgery (ng /L) | 39.76±3.62 | 42.94±3.55 | <0.001 [^] |
| Serum cortisol on the 1 st day before surgery (ng /mL) | 65.33±5.95 | 65.75±5.40 | 0.738 [^] |
| Serum cortisol on the 1 st day after surgery (ng /mL) | 92.21±8.45 | 98.19±8.06 | 0.001 [^] |

* Chi-squared test was used; ^ Independent sample t-test was used; CRP: C-reactive protein; IL-6: interleukin-6.

It has been noted that improper selection of patients can lead to postoperative complications.⁶ Watanabe *et al.* determined whether a chest tube should be placed using the criteria of no air leakage in the intraoperative seal test, no large alveolar or emphysematous changes in lung, no dense pleural adhesions, and no prolonged pleural effusion requiring thoracic drainage tubes before surgery. For cases that met these criteria, no chest tube was placed. They found that thoroscopic wedge resection did not increase the incidence of postoperative complications.⁵

The authors found there was no difference in the incidence of postoperative pneumothorax in patients of group A, and the incidence of postoperative subcutaneous emphysema in group A was lower than in group B, suggesting that there is no significant difference in postoperative pneumothorax between placing thoracic drainage tubes postoperatively or not following thoroscopic partial pneumonectomy; however, the incidence of postoperative subcutaneous emphysema was higher in the former. Subcutaneous emphysema around the drainage tube is commonly observed after surgery. It can be caused by the blockage of the drainage tube, the decrease in the venting capacity of the small-aperture drainage tube, the way the drainage tube incision is sutured, and the patient's frequent cough after surgery.¹⁶ For this reason, it can be hypothesized that some patients with pulmonary lesions meeting specific criteria in thoracic surgery do not require the placement of a thoracic drainage tube after surgery. However, from the perspective of surgical stress, cytokines such as CRP and IL-6 are important in the induction of stress response *etc.*¹⁷

Glucocorticoid cortisol is significantly increased after surgical stress, which adversely affects the metabolism of related nutrients.¹⁸ In this study, it was found that the serum CRP, IL-6 and cortisol levels in group A were lower than in group B on the postoperative first day, suggesting that the degree of surgical stress was less in those who were not placed a thoracic drainage tubes. It is presumed that no placement of a thoracic drainage tube after surgery can reduce the damage.

Although the authors have made serious research, there are some limitations, such as the sample size of clinical research is small, and the curative effect needs to be further verified.

It is urgent to strengthen multicentre and large sample prospective research.

CONCLUSION

There is no significant difference in operation time and incidence of postoperative pneumothorax between thoroscopic partial pneumonectomy with and without placing thoracic drainage tubes, but postoperative hospitalisation time, degree of surgical stress and the incidence of postoperative subcutaneous emphysema were lower in patients of the latter group than those of the former. The decision not to leave the thoracic drainage tube may be considered reasonable and safe if the criteria are carefully selected.

ETHICAL APPROVAL:

This study was approved by the ethics committee of the hospital.

PATIENTS' CONSENT:

Written informed consents were obtained from all patients.

COMPETING INTEREST:

The authors declared no competing interest.

AUTHORS' CONTRIBUTION:

JD: Data acquisition and drafting of the manuscript.

XZ: Critical revision and final approval of the manuscript.

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