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Original Research

Immediate Video-Assisted Thoracoscopic Surgery Versus Chest Tube Drainage in the First Episode of Primary Spontaneous Pneumothorax: A Comparative Study

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Abstract

Objectives: To compare the outcomes of the patients with primary spontaneous pneumothorax (PSP) treated by immediate video-assisted thoracoscopic surgery (VATS) and chest tube placement in the first episode.

Methods: Fifty patients aged between 18 and 40 years with PSP were grouped regarding the treatment modalities as G1 (patients undergoing chest tube placement, n=25) and G2 (patients undergoing immediate VATS, n=25). VATS procedure consisted of apical blebectomy and partial pleurectomy. Early outcomes (chest tube and hospital duration, and in-hospital complications) and late outcomes (recurrence rate after 10 years) were compared.

Results: In G2, the mean duration of surgery was 40.3±14.5 min. No conversion to thoracotomy was required. The rate of complication was insignificantly higher in G1 (p>0.05). Prolonged air leak was significantly common in G1 (p=0.03). In G2, the duration of chest tube and hospital stay were significantly lower (p=0.03 and p=0.05, respectively). After a follow-up of 10 years, a significantly higher recurrence rate was recorded in G1 (p=0.02). Recurrence was insignificantly higher in smokers (p>0.05), and mostly detected in older patients (p=0.03).

Conclusion: Immediate VATS in the first episode of PSP is an effective treatment to prevent recurrence in patients with PSP. VATS is safe with a lower rate of morbidity, and lower durations of chest tube and hospital stay compared to chest tube treatment.

Keywords: Chest tube, outcomes, primary spontaneous pneumothorax, recurrence, video-assisted thoracoscopic surgery

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Primary spontaneous pneumothorax (PSP) is a significant global problem, commonly affecting young people without clinically apparent lung diseases. The annual incidence rates of PSP are 18-20/100000 in men and 1.2-6/100000 in women.[1] Nowadays, four general approaches are used for the initial management of PSP, including (a) observation only, (b) oxygen supplementation, (c) drainage through needle aspiration or tube thoracostomy, and (d) immediate operation under video-assisted thoracoscopic surgery (VATS) or thoracotomy.[2] PSP usually resolves when non-surgical treatment modalities (mostly chest tube placement) are used.[3] The main concern after the initial treatment is the high rate of recurrence (25-43%).[4] Thus preventive surgical intervention, meaning immediate operation, is offered as an alternative approach to diminish that high recurrence rate. Several systematic studies investigated the role of early surgical intervention in the first attack of PSP and reported lower recurrence rates.[2,5,6]

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In this study we compared the early (in-hospital) and late (10 years of follow-up) outcomes of the patients with PSP treated by immediate VATS and chest tube placement.

Methods

This study was conducted at a research and training hospital and the Ethics Committee of Sisli Hamidiye Etfal Training and Research Hospital endorsed the study protocol (approval date and number: 11.06.2024-4439). The written informed consent from the enrolled patients was waived, and this study was conducted in accordance with the Declaration of Helsinki. The data of all patients diagnosed to have PSP were collected. Among them, patients with previous pneumothorax and chest surgery were excluded. Patients older than 40 years old were excluded to avoid bias from underlying comorbidity. Patients with known contraindications for general anesthesia and lacking the ability to understand the information and the consequences were also excluded. Patients with a small and asymptomatic pneumothorax that was treated by either observation only or oxygen supplementation were omitted from the study. Pneumothorax was defined as small based on the guidelines after chest X-rays.[7,8] Patients presenting with severe dyspnea necessitating urgent chest tube placement were also not included in the study. Only patients without visible bullous lesions in their computed tomography of the chest were selected. A total of 50 patients (aged between 18 and 40 years) with PSP from January 2010 to January 2014 were enrolled into the study. The patients were grouped regarding the treatment modalities as G1 (patients undergoing chest tube placement) and G2 (patients undergoing immediate VATS). Each group consisted of 25 patients. Each patient was informed about the treatment options in detail and asked to choose among the treatment modalities.

In G2, VATS is done within the first 24 hours after hospital admission. The VATS procedure was done with a camera port incision (6th intercostal space at anterior axillary line) and an access incision of 5 cm over the 4th intercostal space) and included the resection of the apical blebs using endostaplers, and an apical pleurectomy extending from the 4th rib level up to the apex of the pleural cavity anteriorly, laterally, and posteriorly. No pleurodesis agents (such as talc poudrage) or staple line coverage after bleb resection were used. A chest tube was placed from the camera port. In G1, the chest tube was placed at the 4th intercostal space in the anterior axillary line. In both groups chest tubes were connected to continuous suction, and each patient received similar post-procedural chest physiotherapy. Chest tubes were removed when there was no visible air leak along with a totally expanded lung on chest X-ray, and fluid output was less than 150 ml/day.

Early outcomes included chest tube and hospital duration, and complications during the in-hospital stay. Follow-up was done at the outpatient clinic every 3 months for the first 2 years, then yearly via phone calls or WhatsApp messages to the patients for up to 10 years. Recurrences and their managements were noted. Statistical analysis was performed using the IBM SPSS version 26.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean±standard deviation (SD), median (min-max), or number and frequency, where applicable. The independent t-test was used to compare two groups. A p-value of <0.05 was considered statistically significant.

Results

Table 1 demonstrates the demographic data of the patients. There was no significant difference between both groups ($p>0.05$). All patients were symptomatic and presented with shortness in breath and chest pain. The diagnosis of PSP was confirmed by chest X-rays and computed tomography of the chest in each patient. The computed tomography of the chest demonstrated no visible bullous lesions in any lungs, either on the right or left side. For patients in G2, the mean duration of surgery was 40.3±14.5 min. No conversion to thoracotomy was required.

Table 2 shows the in-hospital outcomes. The rates of complication were 24% in G1 and 8% in G2 ($p>0.05$). Morbidi-

Table 1. Demographic data in both groups

	G1 (chest tube group)	G2 (immediate VATS group)	P
Total number	25	25	
Males (%)	23 (92)	24 (96)	NS
Females (%)	2 (8)	1 (4)	NS
Mean age (years±SD)	26.7±4.8	26.4±5.0	NS
Mean BMI (kg/m^2±SD)	18.8±3.9	19.1±4.2	NS
Smokers (n, %)	14 (56)	19 (76)	NS
Laterality of PSP (right/left) (%)	60/40	48/52	NS

VATS: video-assisted thoracoscopic surgery; SD: standard deviation; BMI: body mass index; PSP: primary spontaneous pneumothorax; NS: not significant.

Table 2. Post-intervention findings

	G1 (chest tube group)	G2 (immediate VATS group)	P
In-hospital morbidity (n, %)	6 (24)	2 (8)	0.12
Duration of chest tube (days±SD)	5.7±3.2	4.4±1.8	0.03
Hospital stay (days±SD)	6.0±3.7	4.6±2.3	0.05

VATS: Video-assisted thoracoscopic surgery; SD: Standard deviation.

ties in G1 included prolonged air leak lasting more than 5 days in 5 patients and wound infection in 1 patient, whereas those in G2 included wound infection in 2 patients. Prolonged air leak was significantly higher in G1 (p=0.03). Two patients with prolonged air leaks necessitated a second chest tube placement. In G2 the duration of chest tube and hospital stay were significantly lower (p=0.03 and p=0.05, respectively). No mortality was recorded in either groups.

After a follow-up of 10 years, a significantly higher recurrence rate was recorded in G1 (6 patients, 24%) compared with that in G2 (0%) (p=0.02). Recurrences developed at 4, 8, 12, 14, 20, and 28 months after the treatment with a chest tube. Overall recurrence rates for one, two and three years were 12%, 20%, and 24%, respectively, in patients undergoing tube thoracostomy as the initial treatment. These patients underwent VATS resection and no further recurrence developed during the follow-up in any of them. Recurrent PSP was insignificantly higher in smokers (4/6 patients, 67%) (p>0.05). Patients with recurrent PSP were significantly older than those without recurrence (30.7±4.9 years versus 25.4±4.1 years, p=0.03).

Discussion

According to the guidelines, non-surgical treatments are the first-line management for the first PSP episode, and VATS is used for recurrent pneumothorax, prolonged air leak, or for people with at-risk occupations during the first period.[9,10] However, the most major problem following non-surgical treatment in the first episode is the high rate of recurrence (25-43%).[4,9] It is traditionally known that when surgery (either thoracotomy or VATS) is performed in the treatment of PSP, the rate of recurrence is as low as 0-3.6%.[11] Thus, it was proposed that performing immediate VATS during the first period of PSP might reduce the rate of recurrence.[3,4,6,12]

In an early study dated 1996, Schramel et al.[13] used immediate VATS in the case of first PSP episode and compared their results with patients undergoing non-surgical treatment. The authors demonstrated that VATS was more effective in terms of recurrence in the treatment of the first PSP episode, and concluded that from 1991 they treated all their PSP patients using VATS at their first episode. Torresini et al.[14] demonstrated that chest tube treatment at first episode of PSP had a recurrence rate of 22.8% in the first year. Olesen et al.[4] also reported that VATS should be the standard of care in the first presentation of PSP.

Chou et al.[15] demonstrated no recurrence in patients undergoing VATS blebectomy in the first episode of PSP after a follow-up period of 38 months. In our study, each patient completed a longer follow-up period (10 years). We detected no recurrence in patients undergoing VATS, while a highly significant recurrence (24%) was recorded in patients undergoing tube thoracostomy. This rate was in accordance with other studies reporting a recurrence rate of 20 to 50% in non-surgically treated patients.[16,17] It was also reported that recurrence in non-surgically treated patients tends to occur in the first year, especially in females, and tall and thin males with a higher incidence in smokers.[16,18] In our study 3 out of 6 patients presented with recurrent PSP in within the first year after tube thoracostomy treatment. We detected that recurrence was common in active smokers insignificantly (p>0.05), and older patients significantly (p<0.05).

Although it was reported that the usage of several agents for chemical pleurodesis following blebectomy/bullectomy and partial pleurectomy lowered the recurrence of PSP,[19] several studies demonstrated that intraoperative chemical pleurodesis offers no additional advantage to surgery in deterring recurrence for patients with PSP.[20,21] Another intraoperative strategy to reduce the recurrence rate is to cover the staple line with absorbable cellulose mesh and fibrin glue.[22] In our study no chemical pleurodesis agents (such as talc poudrage) or staple line coverage after bleb resection was used.

In our study, the mean durations of the chest tube and hospital stay were significantly lower in G2 (p<0.05). Although insignificant, the morbidity rate was lower in G2 (8% versus 24%). It was reported that compared to conservative treatment, VATS had lower complication rates, and shorter durations of chest tube and hospital stay.[12,23,24,25] Olesen et al.[4] grouped their 181 patients in terms of chest tube treatment versus VATS in the first episode of PSP. They concluded that hospital stay was lower in the VATS group. Besides, 13% and 42% of the patients undergoing chest tube treatment necessitated either a second chest tube placement or suction to fully expand the lung, respectively.

Another important point to consider while comparing immediate VATS and chest tube placement in the treatment of the first episode of PSP is the economic burden. It was reported that conservative treatment of PSP in the first episode yielded a higher total cost compared to VATS.[13,25,26] We did not investigate the cost of both treatment groups in our study.

Conclusion

We concluded that immediate VATS in the first episode of PSP is an effective treatment to prevent recurrence. VATS is safe with a lower rate of morbidity, and lower durations of chest tube and hospital stay compared to chest tube treatment. However, more well-designed randomized controlled trials are needed to strengthen the current evidence.

Disclosures

Ethics Committee Approval: The study protocol was approved by the Sisli Hamidiye Etfal Training and Research Hospital Clinical Research Ethics Committee (date: 17.12.2024, number: 4668).

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