

## Video-assisted Thoracoscopic Surgery Versus Axillary Thoracotomy in Primary Spontaneous Pneumothorax

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### ABSTRACT

**Introduction:** Video-assisted thoracic surgery (VATS) is now commonly used for primary spontaneous pneumothorax. In the present study we compared the outcomes of this technique with those obtained by conventional thoracotomy.

**Material and Methods:** In this cross-sectional study, forty patients were enrolled into two groups: VATS (n=20) and thoracotomy (n=20). In both groups the blebs were resected and pleural abrasion was performed with putting a mesh on the apical surface of the parietal pleura, finalized by patchy pleurectomy and mechanical abrasion with gas. Two groups were appropriately matched for age, gender, side of bleb, indication for surgery, and the smoking habits. As outcome measures, the conversion from VATS to thoracotomy and the early complications including wound infection, air leakage and intraoperative bleeding were assessed. After discharge, follow up schedule included visits at one, three, six months and one year post-operation to evaluate the recurrence rate.

**Results:** Mean age of these forty patients (34 males and 6 females) was 28.4±8.74 years. There was no conversion from VATS to thoracotomy group. The complications, including prolonged air leakage and wound infection, were seen in three patients of each group (totally 6 patients) (P=0.712). One patient in VATS group experienced the recurrence (P=0.235). Average admission time was 5±0.79 days in the VATS and 5.65±0.81 days in the thoracotomy group (P=0.043), duration of surgery in the open thoracotomy and VATS groups were 76±5.52 and 48.35±4.35 min, respectively (P<0.001) and intra-operative bleeding in the open thoracotomy and VATS groups were 127.5±10.69 and 112.5±8.5 mL, respectively (P<0.001) these three factors were significantly less in the VATS group.

**Conclusion:** VATS seems to be superior to thoracotomy, when it is indicated due to the recurrence or other reasons, because in spite of the similar therapeutic efficacy and recurrence rate, VATS is associated with less tissue damage and shorter hospital stay.

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## Introduction

Primary spontaneous pneumothorax (PSP) is accumulation of air in the pleural cavity due to rupture of subpleural blebs in patients without any underlying disease; while this condition might lead to the secondary lung collapse. Male gender, tallness and slenderness are associated with higher risk of occurrence (1, 2). The conservative first-line treatments include rest, needle aspiration and tube drainage (thoracostomy). They are safe but the high recurrence reports (up to 60%) lead to the subsequent need for thoracotomy (3, 4). Although thoracotomy, as the first introduced technique, has been modified and now is performed using less invasive incisions such as axillary (5) or auscultatory triangle minithoracotomy (6), the prolonged recovery period is still a main problem of this method.

Video-assisted thoracoscopic surgery (VATS) has shown its effectiveness in the treatment of PSP. It has developed recently and now is the routine procedure in the treatment of PSP due to its efficacy and low morbidity and mortality (7-9). The indications for VATS are the same as those used for thoracotomy. VATS is mostly used for the treatment of persistent air leakage, recurrent PSP, failure of lung expansion after pleural drainage, appearance of blebs in the roentegenogram and in the patients with specific occupations (10-12).

Although VATS has been shown to be an effective and safe treatment, it still needs more evidence regarding its advantages over open thoracotomy in the PSP patients. In the present study, we aimed to study the efficacy and safety of VATS in the treatment of PSP in those patients with identified blebs or blebs on computed tomography scan and compare the results with those obtained by the open thoracotomy.

## Materials and Methods

The patients with PSP, who were candidate for surgical intervention between 2012 and 2014 in Qaem hospital of mashhad university of medical sciences, were enrolled in this cross-sectional study. The inclusion criteria were: no underlying pulmonary disease, no previous thoracic surgery, and under 45 years of age. The exclusion criteria were: traumatic or iatrogenic pneumothorax, reluctance to participate in the study, and chronic use of steroids or analgesics. The patients were divided into two groups: VATS and thoracotomy. The groups were appropriately

matched for age, gender, side of bleb, indication for surgery, and smoking habits. The smokers were considered those who at least smoked one cigarette per day in the last year. eight patients obligatory allocated to surgery group, due to their occupation: four pilots, three flight attendants and one diver

In both groups the lesions were resected and pleural abrasion was done with putting a mesh on the apical surface of the parietal pleura. Then, patchy pleurectomy and mechanical abrasion with gas were performed.

In the VATS group, videothoracoscopy was performed using three ports, one in the 8th intercostals space and two others in the 5th intercostal space on the anterior and posterior axillary lines, while the patient was in the lateral decubitus position. Besides, the resection was performed by an endostapling device. The axillary thoracotomy was performed through a classic axillary incision.

Afterwards, the conversion rate from VATS to thoracotomy and early complications including wound infection, air leakage and intraoperative bleeding were evaluated. After discharge, follow ups included visits at 1, 3, 6 months and 1 year after the operation to evaluate the recurrence rate. Furthermore, 30-day mortality was evaluated in these patients.

Data analysis was performed using SPSS version 16.0 (SPSS Inc, Chicago, IL). The statistical methods used in this study were independent t-test and Mann-Whitney test. P-value less than 0.05 was considered statistically significant. Written consent was obtained from all patients. (Ethical code: 900909).

## Results

Forty patients (34 males, and 6 females) were enrolled in this study with an average age of  $28.4 \pm 8.74$  years (ranged from 16 to 45 years) with equal number of patients in each group. The patient characteristics are described in Table 1. No patient in VATS group was converted to open thoracotomy.

The average operation time in the open thoracotomy and VATS groups were  $76 \pm 5.52$  and  $48.35 \pm 4.35$  min, respectively ( $P < 0.001$ ). The average amount of intraoperative bleeding in the open thoracotomy and VATS groups were  $127.5 \pm 10.69$  and  $112.5 \pm 8.5$  mL, respectively ( $P < 0.001$ ). The average admission time was  $5 \pm 0.79$

**Table 1.** Patient characteristics of VATS and thoracotomy groups

	VATS	Thoracotomy	P-value
Age (years)	$28.55 \pm 8.43$	$28.25 \pm 9.26$	0.90
Gender (male, female)	16 (80%), 4 (20%)	18 (90%), 2 (10%)	0.37
Smoker	17 (85%)	18 (90%)	0.63
Side of lesion (right, left)	12 (60%), 8 (40%)	11 (55%), 9 (45%)	0.75
Indication for surgery (recurrence, prolonged air leakage, certain job)	13 (65%), 4 (20%), 3 (15%)	10 (50%), 5 (25%), 5 (25%)	0.60

**Table 2.** Post operative complications in VATS and thoracotomy groups

Complications	All patients (n=40)	VATS (n=20)	Thoracotomy (n=20)	P-value
Prolonged air leakage	3 (7.5%)	2 (10%)	1 (5%)	>0.999 Fisher's exact test
Wound infection	3 (7.5%)	1 (5%)	2 (10%)	>0.999 Fisher's exact test
Total	6 (15%)	3 (15%)	3 (15%)	>0.999 Fisher's exact test

days in the VATS and  $5.65 \pm 0.81$  days in the thoracotomy group ( $P=0.043$ ). No mortality reported in the patients, so the 30-day survival rate was one hundred percent, while totally six patients (15%) faced complications in both groups (3 patients in each group)(Table 2). Hence, there was no significant difference between two groups regarding the complications ( $P=0.712$ ).

The blebs were not found in three patients, two in the VATS and one in the thoracotomy group ( $P=0.55$ ). In these patients the apical resection and pleural abrasion were performed. Totally among all patients, one patient experienced recurrence in the VATS group, but no patients in the other group ( $P=0.235$ ). This patient was one of those three patients, whose blebs were not found during the operation. For the appropriate management, this patient underwent open surgery and during the surgery, the bleb was observed in the middle lobe and resected.

## Discussion

The VATS technique as a treatment option for PSP was introduced in 1990s for the first time (13). Studies have evaluated the therapeutic efficacy and safety of this technique and demonstrated favorable results. Subsequently, with emergence of the minimally invasive procedures, the VATS method gradually was accepted as the choice treatment of PSP (14-17). Thoracotomy, was first introduced by Gaesner in 1956 (18), and have yielded a good therapeutic outcome and low recurrence rate. However, the prolonged recovery period and patients' uncomfortable feelings did not improved, even by using less invasive incisions (19).

In the present study, we compared the different variables including the intraoperative bleeding, length of hospital stay, duration of surgery, mortality and postoperative complications between two groups who underwent either open thoracotomy or VATS.

Besides, a major indication for VATS is considered to be the recurrent PSP (20) consisting 57.5% of our cases. Other cases underwent VATS due to having particular occupations. As PSP is less frequent in the patients older than 45 years old, we excluded the patients of this age group. Although in the recent studies the effectiveness of VATS in the treatment of first episode of PSP is showed (3, 21), we did not perform VATS after first episode, as it is still controversial and requires further large-sample

randomized clinical trials to be confirmed. There was no conversion from VATS to open thoracotomy and the recurrence rate was not different between two groups in this study ( $P=0.235$ ).

One out of twenty patients of the VATS group (5%) experienced recurrence in our study. A similar rate (5%) was reported in a Janssen's study for the patients undergone VATS for PSP (7). The admission time was also significantly lower in the VATS group in the present study ( $P=0.043$ ). Similarly, in two different studies by Passlic and Joshi, VATS resulted in a significant shorter admission time compared to thoracotomy (4.1 and 3 Vs 11.5 and 5.5 days, respectively). This is while the recurrence rate was not statistically different between two groups (12, 22). Our findings revealed that VATS was equal to thoracotomy in terms of recurrence rate and post operative complications (these factors are considered to determine the efficacy of the surgical approach) in Milner's (23) and our study.

However, unlike Milner's findings, duration of surgery ( $P<0.001$ ) and admission time was significantly lower in the VATS group compared to open surgery, in the present study. Also, in the comparative study of Olavarrieta et al., these factors were found to be significantly shorter in the VATS group compared to the other group (19).

The post-operative complications were rare in both groups. There were two cases of prolonged air leakage and one case of wound infection in the VATS group and two cases of wound infection and one prolonged air leakage in the other group ( $P=0.712$ ). However, the average intraoperative bleeding ( $P<0.001$ ), the operation time and hospital stay were significantly lower compared to the thoracotomy group. Also, other studies have shown the lower required dose of analgesics in the patients undergone VATS (19, 24). These findings indicated the less tissue traumatic nature of VATS and better toleration of the patients which can be due to no need to rib spreading.

Another issue to be addressed is cosmetics issues. In a study by Ben-Nun et al., in addition to significantly less administration of the analgesics in the VATS group compared to the thoracotomy group, the patients in this group were more satisfied with the aesthetic outcome of their surgical scars (24). Also, long term follow up of the patients demonstrated that relatively high percentage of the patients underwent thoracotomy were still

consuming analgesics. However, significant more VATS patients were satisfied with the outcome of surgery (24, 25). So, this is not an ideal outcome as pain can adversely affect the patients' occupation and cause more socio-economic issues.

## Conclusion

Based on our findings it can be concluded that VATS is superior to thoracotomy when it is indicated due to recurrence or other relevant reasons, because in spite of similar therapeutic efficacy and recurrence rate, VATS is associated with lesser injury of tissues and lower hospital stay.

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## Conflict of Interest

The authors declare no conflict of interest.

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