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Transaxillary mini thoracotomy as an alternative to thoracoscopy in the treatment of primary spontaneous pneumothorax: A prospective cohort study

Primer spontan pnömotoraks tedavisinde torakoskopinin alternatifi olarak transaksiller mini torakotomi: Prospektif kohort çalışma

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Abstract

Aim: Arguments comparing the outcomes of traditional open surgery and endoscopic approach performed for the treatment of primary spontaneous pneumothorax persist. This study aims to reveal the efficiency of transaxillary mini thoracotomy which is considered an alternative to thoracoscopy.

Methods: This study was conducted with 40 patients who underwent 3-port thoracoscopy and 40 patients who were treated with transaxillary mini thoracotomy for pneumothorax between 2012 and 2018. Two different types of surgery were compared in terms of age, gender, side of operation, duration of hospital stay, complications, recurrence and total cost.

Results: The whole group included 68 (85%) males and 12 (15%) females. Mean age was 25 (3.96) (range 18-35) years. Pneumothorax was right sided in 42 (52.5%) patients. Mean hospital stay was 2.86 (0.56) (range 2-4) days. Average cost was 3263.75 (563.71) TL per patient. Complications occurred in 11 (13.75%) patients whereas 4 (5%) cases developed recurrence. Groups of different surgeries had no statistically significant difference in terms of age, gender, side of operation, duration of hospital stay, rates of complication and recurrence while the average of cost was significantly lower for thoracotomy group.

Conclusion: Regarding the identical surgical outcomes and lower cost, transaxillary mini thoracotomy can be safely preferred as an alternative to thoracoscopy for the treatment of spontaneous pneumothorax.

Keywords: Video-assisted thoracic surgery, Transaxillary mini thoracotomy, Spontaneous pneumothorax, Cost

Öz

Amaç: Primer spontan pnömotoraks tedavisinde uygulanan geleneksel açık cerrahi ve endoskopik yaklaşımların sonuçları karşılaştırılmaya devam etmektedir. Bu çalışma torakoskopinin alternatifi olarak kabul edilen transaksiller mini torakotominin etkinliğini belirlemeyi hedeflemektedir.

Yöntemler: 2012 ile 2018 tarihleri arasında pnömotoraks nedeniyle 3-port torakoskopi ve transaksiller mini torakotomi uygulanmış olan 40'ar hastayı içeren bir çalışma yürütüldü. İki farklı cerrahi tipi yaş, cinsiyet, ameliyat tarafı, hastanede kalış süresi, komplikasyonlar, nüks ve toplam maliyet açısından karşılaştırıldı.

Bulgular: Tüm grupta 68 (%85) erkek ve 12 (%15) kadın hasta vardı. Ortalama yaş 25 (3,96) (aralık 18-35) yıl idi. Pnömotoraks 42 (%52.5) hastada sağ tarafta saptandı. Ortalama hastanede kalış süresi 2,86 (0,56) (aralık 2-4) gün olarak hesaplandı. Hasta başına ortalama 3263,75 (563,71) TL masraf yapıldı. Toplam 11 (%13,75) hastada komplikasyon gelişirken 4 (%5) hastada nüks saptandı. Farklı cerrahi yapılan grupları arasında yaş, cinsiyet, ameliyat tarafı, hastanede kalış süresi ile komplikasyon ve nüks oranları açısından istatistiksel olarak anlamlı fark yokken maliyet torakotomi grubunda belirgin olarak düşüktü.

Sonuç: Spontan pnömotoraks tedavisinde benzer cerrahi sonuçları ve daha düşük maliyeti göz önüne alındığında transaksiller mini torakotomi torakoskopiye alternatif olarak güvenle tercih edilebilir.

Anahtar kelimeler: Video yardımlı göğüs cerrahisi, Transaksiller mini torakotomi, Spontan pnömotoraks, Maliyet

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Introduction

Primary spontaneous pneumothorax (PSP) occurs in patients without any underlying pulmonary diseases and is frequently induced by the rupture of subpleural blebs and bullae. Conservative treatment or tube thoracostomy is usually adequate in the first episode of pneumothorax whereas recurrent pneumothorax, persistent air leakage or expansion defect of the lung parenchyma following chest tube insertion and bilateral pneumothorax are considered as principal indications for surgery [1].

Surgical approaches are represented by conventional thoracotomy and video-assisted

thoracoscopic surgery (VATS) where both techniques depend on the idea of removing the deformed tissue and preventing deflation of the lungs [2].

Current literature consists of numerous studies comparing these two approaches with regards to surgical outcomes. Aim of this study was to compare VATS and transaxillary mini thoracotomy (TMT) in terms of complications, recurrence, and cost effectiveness.

Materials and methods

Following the approval of Namik Kemal University's Ethics Committee (form number: 2019.20.02.04 on 28 March 2019), the patients with second-episode PSP who had undergone VATS and TMT in Thoracic Surgery Departments of Istanbul and Namik Kemal University between 2012 and 2018 were analyzed. Exclusion criteria included diagnosis of secondary spontaneous pneumothorax, recurrent pneumothorax, and incompatibility with the scheduled postoperative follow-ups whereas patients who had chest tubes at the first or second episodes were included in the study.

The same two surgeons performed operations regardless of who performed VATS or TMT. The patients were surgically treated via wedge resections and bullectomy in addition to partial parietal pleurectomy through a 3-port thoracoscopy or a transaxillary thoracotomy. TMT was performed through a standardized 10 cm incision also sparing the serratus anterior muscle. Pleurodesis was not performed in any of the cases. At the end of the operations, a single 24-French chest tube was placed into the thoracic cavity. Radiological screening was conducted beginning at postoperative day one and ending the day after the chest tube was pulled out. Patients were invited to follow-up examinations during the first and third weeks after being discharged. Recurrence was considered when it was confirmed radiologically during the follow-ups in the first three weeks on the same side of initial operation.

Forty patients included in each of VATS and TMT groups were comparatively examined in terms of age, gender, side of the affected hemithorax, duration of hospital stay, complications, status of recurrence and cost. Total cost was calculated by reviewing records for each patient including the expenditures of hospital stay and surgical instruments.

Statistical analysis

SPSS (IBM SPSS for Windows, ver.24) statistical package program was used for calculations. Descriptive statistics for continuous variables in the study were expressed as mean, standard deviation, minimum and maximum; categorical variables were expressed as number (n) and percentage (%). The data were confirmed to be normally distributed via Shapiro-Wilk and Skewness-Kurtosis tests. Independent T-test was used to compare the average of measurements for patient groups and Chi-square test was employed to reveal the relation between categorical variables. *P*-value <0.05 was considered statistically significant.

In the power analysis based on recent studies and the prevalence of recurrent pneumothorax, the minimum number of patients required for the study was calculated as 70 with 80% power (1-β err prob=0.80) and 5% error margin (α err prob=0.05). Therefore, a total of 80 cases, 40 for each of two groups, were included in the workup.

Results

A total of 80 patients included 68 (85%) males and 12 (15%) females. Mean age was 25 (3.96) (range 18-35) years. Pneumothorax was right-sided in 42 (52.5%) and left-sided in 38 (47.5%) patients. Average of hospital stay was 2.86(0.56) (range 2-4) days. Mean cost was 3263.75(563.71) TL. Complications occurred in 11 (13.75%) patients whereas a total of 4 (5%) cases developed recurrence. Related data are summarized in Tables 1 and 2.

Table 1: Demographic and clinical features of the patients

Parameters		n	%
Gender	Male	68	85
	Female	12	15
Side of surgery	Right	42	52.50
	Left	38	47.50
Complication	Present	11	13.75
	Absent	69	86.25
Recurrence	Present	4	5
	Absent	76	95
Total		80	100

Table 2: Evaluation of the general data

Parameters	Mean	SD	Min.	Max.
Age (years)	25	3.96	18	35
Length of hospital stay (days)	2.86	0.56	2	4
Cost (TL)	3263.75	563.71	2310	4340

SD: Standard deviation

Thirty-three (82.5%) males were included in VATS group while TMT group had 35 (87.5%) males. Mean age was calculated as 25.3 years for VATS and 24.7 years for TMT. Right-sided operations were performed for VATS and TMT in 24 (60%) and 18 (45%) patients, respectively. Mean hospital stay was 2.87 days for VATS and 2.85 days for TMT. An average of 3780 and 2747.5 TL were spent for VATS and TMT, respectively. Six (15%) patients who had undergone VATS developed complications whereas recurrence occurred in 2 (5%) patients included in both groups. The difference between cohorts of patients in terms of age, gender, side of pneumothorax, length of hospital stay and rates of complications or recurrence were not statistically significant while cost of hospital stay was demonstrably higher for cases who had undergone VATS (Table 3 and 4).

None of the surgical interventions resulted in mortality. Complications were similar, 3 wound discharges and 2 atelectasis for both groups except arrhythmia in one additional patient who had undergone VATS. Two patients from both groups developed recurrence which necessitated re-operation.

Table 3: Comparison of VATS and TMT groups

Parameters		VATS		TMT		*P*-value
		n	%	n	%	
Gender	Male	33	82.5	35	87.5	0.531
	Female	7	17.5	5	12.5	
Side of surgery	Right	24	60	18	45	0.369
	Left	16	40	22	55	
Complication	Present	6	15	5	12.5	0.745
	Absent	34	85	25	87.5	
Recurrence	Present	2	5	2	5	1
	Absent	38	95	38	95	
Total		40	100	40	100	----

Chi-square test, VATS: Video-assisted thoracic surgery, TMT: Transaxillary mini thoracotomy

Table 4: Assessment of quantitative variables

Parameters	VATS				TMT				*P*- value
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	
Age (years)	25.30	3.88	18	34	24.70	4.01	18	35	0.475
Length of hospital stay (days)	2.87	0.55	2	4	3.85	0.57	2	4	0.840
Cost (TL)	3780	249.9	2660	4340	2747.5	200.3	2310	3290	0.0007

Independent T-test, SD: Standard deviation, VATS: Video-assisted thoracic surgery, TMT: Transaxillary mini thoracotomy

Discussion

The findings of this study clearly indicate that mini axillary thoracotomy is a dependable alternative to thoracoscopy in the surgical treatment of pneumothorax regarding its similar outcomes at lower costs.

Since 1937 when thoracoscopy was first used to identify a bulla, technological advances in medical devices have contributed to the development of VATS which is currently considered the most convenient approach for the treatment of pneumothorax by most thoracic surgeons [3]. On the other hand, disadvantages of a thoracotomy have been commonly emphasized as deterioration of pulmonary function, evident postoperative pain, and longer hospitalization [4].

Regarding the outcomes of pneumothorax surgeries, current studies report the rate of recurrence ranging between 2% and 14% for VATS and up to 5% for thoracotomy [5,6]. Joshi et al. announced that recurrence rate did not significantly differ between patients who had undergone VATS and thoracotomy [7]. Compatible with this statement, both groups in this study developed recurrence at the same rate of 5%. Patients undergoing thoracoscopy suffer peroperative complications including bleeding or conversion to thoracotomy at rates between 3% and %8 whereas less threatening events such as wound infections or prolonged air leakage may occur for VATS and open surgery at identical frequencies [8,9]. The patients in this series developed no peroperative complications whereas 6 (15%) cases in VATS and 5 (12%) in TMT group encountered postoperative problems that resolved successfully. Mean hospital stay has been reported as between 2.8 and 6.9 days for VATS and 4.3 and 9.4 days for thoracotomy denoting a significant difference for two procedures [10-12]. Our patients who had undergone VATS and thoracotomy were discharged after an average of 2.87 and 3.85 days, respectively. Recent studies revealed no cost advantage of VATS considering the use of mostly disposable and more expensive instruments for surgery [13-15]. In our experience, the costs were significantly lower in the thoracotomy group.

Thoracotomy is the basic surgical intervention to approach the pleural cavity and the first stage of education in thoracic surgery whereas thoracoscopy indicates a learning curve of experience numbered between 30 and 100 cases reported by previous studies [16-18]. Therefore, thoracotomy, which is an easily applicable procedure not requiring an advanced level of experience and elaborative surgical equipment appears to hold its place as the first choice of surgical treatment for pneumothorax as well as some other thoracic pathologies.

Limitations

The principal limitation of this study was the design in two centers focusing on a limited number of cases. To obtain more heterogeneous cohorts, future studies may contain secondary pneumothorax patients and data obtained from a larger group of surgeons.

Conclusion

Considering the cost effectiveness in addition to identical surgical outcomes and recurrence rates of thoracoscopy, transaxillary mini thoracotomy may be confidently preferred as the treatment choice of pneumothorax.

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