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Original Article / Оригинални рад

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The advantages of video-assisted thoracoscopic surgery compared to thoracic drainage in the treatment of primary spontaneous pneumothorax

Предности видео асистиране торакоскопске хирургије у поређењу са торакалном дренажом у лечењу примарног спонтаног пнеумоторакса

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SUMMARY

Introduction/Objective The aim of the study is to analyze the treatment of spontaneous pneumothorax (PSP) through our ten-year experience.

Methods The study included 67 patients with PSP treated with video assisted thoracoscopic surgery (VATS) or with thoracic drainage (TD) in the Clinic for Chest Surgery at the Military Medical Academy in Belgrade in the period 2008-2017.

Results PSP patients with VATS were younger (33.2 ± 16.4 *vs.* 45.5 ± 21.5 years, p = 0.010), and both groups consisted mainly of males (69.2% *vs.* 78%). VATS treated patients were shorter hospitalised and wore drains (p <0.001, p <0.002). Recurrence after treatment was more common after TD (61% *vs.* 3.8%) and in most cases it was treated with VATS (92%). The incidence of intraoperative complications is similar between groups (p = 0.599, p = 0.636, p = 0.311, p = 0.388, p = 0.388). Pain was more common in TD (p<0.001). The early complications in the group of patients treated with TD occurred more often (p <0.001, p <0.001), without significant difference in the incidence of pleura infections and intercostal blockade between groups (p = 0.388, p = 0.388, respectively). Patients treated for PSP with VATS method came to control later compared to patients treated with TD (p<0.001).

Conclusion VATS proved to be efficient, which was reflected in the optimal duration of surgery, length of hospitalization, tolerable postoperative pain and satisfactory cosmetic effect and the postsurgical relapse only in one case.

Keywords: pneumothorax; bullous lung disease; video-assisted thoracoscopy; thoracic drainage

САЖЕТАК

Увод/Циљ: Циљ ове студије је анализа лечења примарног спонтаног пнеумоторакса (СПП) кроз наше десетогодишње искуство.

Метод: Студија је укључила 67 пацијената са СПП-ом лечених видеоасистираном торакоскопском хирургијом (ВАТХ) или торакалном дренажом (ТД) у Клиници за грудну и кардиохирургију у Војномедицинској академији у периоду 2008–2017.

Резултати: Пацијенти са ПСП-ом лечени ВАТХ-ом су били млађи (33.2 ± 16.4 наспрам 45.5 ± 21.5 година, *p* = 0.010), а у обе групе су већину чинили мушкарци (69.2% наспрам 78%). Такође, оболели третирани ВАТХ-ом су брже завршавали хоспитално лечење и краће носили дрен (*p* <0.001, *p* <0.002). Рецидив након лечења се чешће јављао у лечених ТД-ом (61% наспрам 3.8%) и у највећем броју случаја третиран је ВАТХ-ом (92%). Учесталост интраоперативних компликација је била слична између група (*p* = 0.599, *p* = 0.636, *p* = 0.311, *p* = 0.388, *p* = 0.388). Бол као компликација се чешће јављао у лечених ТД-ом (*p*<0.001), као и ране компликације (*p* <0.001, *p* <0.001). Није било разлике у учесталости инфекције плеуре и примене интеркосталне блокаде између група (*p* = 0.388, односно *p* = 0.388). Пацијенти лечени ВАТХ-ом су касније долазили на контролу у поређењу са пацијентима леченим ТД-ом (*p*<0.001).

Закључак: ВАТХ се као хируршка метода показао ефикаснијим у односу на ТД, што се огледа у оптималном трајању операције, дужини хоспитализације, толерабилном постоперативном болу и задовољавајућем козметском ефекту, као и рецидиву у само једном случају.

Кључне речи: пнеумоторакс; булозно плуће; видеоасистирана торакоскопија; торакална дренажа

INTRODUCTION

Pneumothorax is the presence of air in the pleural space, between the lung and the chest wall. It can be classified as spontaneous and non-spontaneous. Non-spontaneous pneumothorax can have iatrogenic or traumatic cause. Spontaneous pneumothorax occurs without apparent underlying lung

disease due to a rupture of subpleural bullae and then we are talking about primary spontaneous pneumothorax. Secondary spontaneous pneumothorax occurs as a complication of underlying lung disease of pre-existing clinically manifested lung disease, such as chronic obstructive pulmonary disease, cystic fibrosis, or infection. According to the data, the incidence rate among men is about 23 per 100,000 inhabitants, and in women 3.6 per 100,000 per year. Primary spontaneous pneumothorax is also related to physical constitution. These are usually younger, thin and tall individuals. Smoking increases the risk of this condition. There is also high percentage of second episodes, i.e. recurrence, and it goes up to 67% [1, 2, 3].

Recurrent pneumothorax is a common complication and is seen in about 30% of cases. It usually occurs within 6 months to 2 years after the first episode. The main goal of the treatment is evacuation of air from the pleural space and prevention of recurrence. The treatment depends on size, symptoms, whether it is open or closed, primary, secondary, or recurrent. Treatment can be conservative, with needle aspiration, catheter drainage, drainage of the pleural space, sclerosing agent installation, VATS or thoracotomic blebectomy, bullectomy, pleural abrasion, pleuractomy and sclerosation [2, 3, 4].

The purpose of this study was to present experiences in a ten-year period in the treatment of spontaneous pneumothorax with a minimally invasive thoracic surgery technique.

METHODS

The retrospective cohort study included 67 patients treated for PSP at the Clinic for Thoracic and Cardiac Surgery of the Military Medical Academy in Belgrade in the period from 2007 until now, divided into two groups. One group consisted of 41 patients who had previously been treated using drainage after recurrent episodes of spontaneous pneumothorax. The second group of 26 patients was treated by VATS immediately after the first episode. All patients who were treated with the VATS method were informed about the method, technique of performance, potential risks and complications, and they also signed a standardised consent for patients undergoing surgical procedures at the Military Medical Academy. The monitoring period includes regular clinical and radiographic controls carried out after a month, three months, and one year after hospitalization. Parameters to be monitored in assessing efficiency of the techniques are as follows: duration of surgery, number of hospital days, drain-wearing time and percentage of recurrence. Parameters to be monitored in assessing safety of the techniques are as follows: intraoperative complications, early postoperative complications (pain, bleeding, emphysema, wound infection) and late postoperative complications (pleural infection).

Complete statistical data analysis will be made using the commercial statistical software SPSS Statistics 18. Statistically significant difference was assessed at the minimum level $p < 0.05$.

RESULTS

Primary spontaneous pneumothorax (PSP) patients treated with VATS were of average age 33.2 ± 16.4, while PSP patients treated with TD were 45.5 ± 21.5 years old, from which it follows that patients treated with VATS were significantly younger in comparison with patients treated with TD ($p = 0.010$), and both groups consisted mainly of male patients (69.2% *vs.* 78.0%). Duration of surgery, number of hospital days and drain wearing time were compared in the group of patients with primary spontaneous pneumothorax who underwent TD or VATS and the results are shown in Table 1.

Duration of surgery using VATS was almost twice longer compared to TD and it was statistically significant (69.8 minutes *vs.* 29.3 minutes, $p < 0.001$). Patients treated with VATS after PSP were hospitalised and wore drains shorter than the patients who underwent thoracic drainage after PSP ($p < 0.001$, $p < 0.002$).

The PSP recurrence rate as a complication after using VATS and TD methods for the treatment of PSP are shown in Table 2. Recurrence after treatment for PSP is more common after thoracic drainage (25 patients or 61%) compared to VATS (1 patient or 3.8%), and in most cases it is treated with VATS (23 patients or 92% of patients treated with TD). The results show that the incidence of inadequate drainage position, re-drainage, reposition, addition and removal of drains is similar between groups, there is no statistically significant difference ($p = 0.599$, $p = 0.636$, $p = 0.311$, $p = 0.388$, $p = 0.388$). Incidence of intraoperative complications: the use of analgesics, atypical localisation of pain, adhesions and the application of open surgery were very similar between the groups in which PSP was treated with VATS or TD ($p = 0.518$, $p = 0.147$, $p = 0.158$).

Pain as an early complication was more common in thoracic drainage, which was statistically significant ($p < 0.001$). Each group had only one patient with bleeding as a complication, so there was no significant difference between the groups (1 patient or 2.4% *vs.* 1 patient or 3.8%, $p = 1.000$) (Table 3).

Early complications were grouped according to their low incidence as follows: wound infection, pain, bleeding, emphysema, reduction in pulmonary function, FEV 1 (Table 4).

One and two and more early complications in the group of patients treated with TD were significantly more common (68.3% *vs.* 26.9%, 17.1% *vs.* 7.7% respectively; $p < 0.001$, $p < 0.001$). There was no statistically significant difference in the incidence of pleura infections and intercostal

blockade between groups (p = 0.388, p = 0.388 respectively). Patients treated for PSP with VATS method came to the follow-up control later compared to patients treated with TD (5.8 months *vs.* 3.7 months, p <0.001) (Table 5).

DISCUSSION

Our two study groups were composed mostly of younger men, which is in line with the existing epidemiological data on the distribution of primary spontaneous pneumothorax with respect to age and sex [4]. Regarding the duration of the intervention itself, it is optimal and in line with the already published results of prospective studies, with a significantly shorter drain wearing time and duration of hospitalization compared to TD [5].

According to some authors, VATS is described as the treatment of choice of PSP with very low recurrence rate, the possibility of bullectomy or apical pleurectomy using mechanical abrasion and the option to switch to open surgery, if needed [6–8].

In a large European study, the PSP recurrence rate was compared between patients treated with thoracic drainage and VATS with talc pleurodesis. The obtained values are 34% compared to 5% in patients treated with VATS [9]. Ten-year monitoring of PSP patients in one center confirmed the long-term safety and efficiency of VATS with talc pleurodesis, with a 5% recurrence rate in patients with bullae.

Recurrences after the treatment of our patients by VATS were practically negligible, and early and late complications were at approximately the same level as TD, which leads us to the conclusion that the VATS method is at least as safe as the TD method but more effective than it. All the above mentioned leads also to an explanation of the late first follow-up controls among patients treated with VATS in relation to thoracic drainage, since VATS as a definitive treatment model did not require prior appointment with the surgeon.

Treatment of relapse is unclearly defined, taking into account that thoracic drainage in the first act is 15-62% unsuccessful [10]. Chemical pleurodesis is superior to simple drainage in the prevention of recurrence (recurrence rate of 8-13% and 36% respectively) [10, 11]. In patients with Vanderschueren's stage II or IV PSP, some authors advocate the advantage of VATS in relation to thoracoscopy, because of possibility to apply bullectomy or apical pleurectomy. There is no evidence of a preventive effect of bullectomy on the occurrence of relapse, but pleurodesis has proven to be effective. VATS pleurodesis is as efficient as apical pleurectomy, but with less side effects [12].

In patients with previous medical thoracoscopy, there are controversies regarding the repetition of thoracoscopy ipsilaterally due to the fear that the adhesions will interfere with visualization or because of the increased risk of complications. Studies that included a few series of patients treated with repeated thoracoscopy, as well as a group that had previous talk pleurodesis, proved its practicability and safety [11]. In most of them it was possible to apply talk pleurodesis as part of repeated thoracoscopy. On the other hand, during the analysis of the course of treatment within a small series of 39 patients who were treated with VATS after previous talk pleurodesis, repeated pleurodesis was successful in almost 70% of patients [11, 13].

Furthermore, patients treated with VATS benefit from better cosmetic effects and painless procedures. In relation to the earlier method of treating spontaneous pneumothorax with thoracic drainage, the VATS method of solving is a more efficient and significantly safer method of treatment, which is also economically more cost-effective [14].

CONCLUSION

The advantage of VATS in relation to TD is in less number of days of hospital treatment, less postoperative pain, less morbidity, better postoperative gas exchange, faster return to normal physical activity, better cosmetic effect, and therefore VATS has become the gold-standard treatment for pneumothorax.

REFERENCES

1. Shields MD, Thomas W, LoCicero J, Reed CE, Feins RH. General Thoracic Surgery.5th ed. Philadelphia: Lippincot Williams & Wilkins, 2009; 7(1):740-761.
2. Sakurai H. Videothoracoscopic surgical approach for spontaneous pneumothorax: reviewof the pertinent literature. World J EmergSurg 2008: 3-23.
3. Ng C S H, Lee T W, Wan S, APC Yim. Video assisted thoracic surgery in the management of spontaneous pneumothorax: the current status. Postgrad Med J. 2006 Mar; 82(965):179–185.
4. Joshi V, Kirmani B,Zacharias J. Thoracotomy versus VATS: is there an optimal approach to treating pneumothorax?RCS annals. 2013; 95(1):61–4. https://doi.org/10.1308/003588413X13511609956138
5. GalbisCaravajala JM, MaféMadueñoaJJ, BenllochCarriónb S, Baschwitz Gómez B, Rodríguez PaniaguaaJM.Video-assisted thoracoscopic surgery in the treatment of pneumothorax: 107 consecutive procedures. Arch Bronconeumol. 2003; 39(7):310–3.
6. Blanc FX, Atassi K, Bignon J, Housset B. Diagnostic value of medical thoracoscopy in pleural disease: A 6-year retrospective study. Chest. 2002; 121(5):1677–83.
7. Cardillo G, Facciolo F, Giunti R, Gasparri R, Lopergolo M, Orsetti R, et al. Videothoracoscopic treatment of primary spontaneous pneumothorax: a 6-year experience. Ann Thorac Surg. 2000; 69(2):357–61; PMID: 10735663
8. Tschopp JM, Boutin C, Astoul P, Janssen JP, Grandin S, Bolliger CT, et al. Talcage by medical thoracoscopy for primary spontaneous pneumothorax is more cost-effective than drainage: a randomised study. EurRespir J. 2002; 20(4):1003–9; PMID: 12412696
9. Györik S, Erni S, Studler U, Hodek-Wuerz R, Tamm M, ChhajedPN. Long-term follow-up of thoracoscopic talc pleurodesis for primary spontaneous pneumothorax. Eur Respir J. 2007; 29(4):757–60. PMID:17182650 DOI: 10.1183/09031936.00122106
10. Chen JS, Hsu HH, Tsai KT, Yuan A, Chen WJ, Lee YC. Salvage for unsuccessful aspiration of primary pneumothorax: thoracoscopic surgery or chest tube drainage? Ann Thorac Surg. 2008; 85(6):1908–13.; PMID:18498793 DOI:10.1016/j.athoracsur.2008.02.038
11. Parrish S, Browning RF, Turner FJ, Zarogoulidis K, Kougioumtz I, Dryllis G, et al. The role for medical thoracoscopy in pneumothorax. J Thorac Dis. 2014; 6(S4):S383–S391; PMID: 25337393, PMCID: PMC4203991 DOI:10.3978/j.issn.2072-1439.2014.08.06
12. Rena O, Massera F, Papalia E, Della Pona C, Robustellini M, Casadio C. Surgical pleurodesis for Vanderschueren's stage III primary spontaneous pneumothorax. EurRespir J 2008; 31(4):837–41. PMID:18057049 DOI:10.1183/09031936.00140806
13. Doddoli C, Barlési F, Fraticelli A, Thomas P, Astoul P, Giudicelli R, et al. Video-assisted thoracoscopic management of recurrent primary spontaneous pneumothorax after prior talc pleurodesis: a feasible, safe and efficient treatment option. Eur J Cardiothorac Surg. 2004; 265(5):889–92. PMID: 15519177 DOI:10.1016/j.ejcts.2004.05.033
14. Sawada S, Watanabe Y, MoriyamaS. Video-Assisted Thoracoscopic surgery for primary spontaneous pneumothorax, Evaluation of indications and long-term outcome compared with conservative treatment and open thoracotomy. Chest 2005; 127(6):2226–30.

Table 1. Duration of surgery, number of hospital days and drain-wearing time

Characteristics of the surgical approaches		Group					p
		Arithmetic average	SD	Median value	Percentile 25	Percentile 75	
Duration of surgery (minutes)	TD	29.3	44	15	15	15	< 0.001
	VATS	68.1	20	60	60	60	
Number of hospital days	TD	12	4.7	12	8	16	0.001
	VATS	8.4	5.8	7	5	9	
Drain wearing time (days)	TD	8.9	4.7	8	6	11	0.002
	VATS	6	4.6	4	3	7	

Mann–Whitney test
TD – thoracic drainage; VATS – video-assisted thoracoscopic surgery

Table 2. Recurrence distribution according to the method of treatment

Complications of the surgical approaches		group				p
		TD		VATS		
		N	%	N	%	
Recurrence as complication	no	16	39	25	96.2	< 0.001
	yes	25	61	1	3.8	

χ^2 test
TD- thoracic drainage; VATS – video-assisted thoracoscopic surgery

Table 3. Early complications after surgery

Complications		Group				p
		TD		VATS		
		N	%	N	%	
wound infection	no	41	100	26	100	-
	yes	0	0	0	0	
pain	no	6	14.6	17	65.4	< 0.001
	yes	35	85.4	9	34.6	
bleeding	no	40	97.6	25	96.2	1.000§
	yes	1	2.4	1	3.8	

χ^2 test; §Fisher test
TD – thoracic drainage; VATS – video-assisted thoracoscopic surgery

Table 4. Total early complications after treatment

Complications		Group				p
		TD		VATS		
		N	%	N	%	
Early complications total	No complications	6	14.6%	17	65.4%	< 0.001
	1.	28	68.3%	7	26.9%	
	≥2	7	17.1%	2	7.7%	

χ^2 test
TD – thoracic drainage; VATS – video-assisted thoracoscopic surgery

Table 5. Follow-up control time after intervention

Control time after surgery		group					p
		arithmetic average	Sd	median value	percentile 25	percentile 75	
late control (months)	TD	3.7.	2.0.	3.0.	3.0.	6.0.	<0.001
	VATS	5.8.	1.0.	6.0.	6.0.	6.0.	

Mann–Whitney test
TD – thoracic drainage; VATS – video-assisted thoracoscopic surgery

