

Comparison of two surgical approaches for the treatment of primary spontaneous pneumothorax*

N.P. ARDÒ¹, D. LOIZZI¹, A. DE PALMA², M. LOIZZI², D. CAPORALE¹, R. DE BELLIS², F. CIALDELLA², S. TANGO², V. SIMONE², F. SOLLITTO¹

SUMMARY: Comparison of two surgical approaches for the treatment of primary spontaneous pneumothorax.

N.P. ARDÒ, D. LOIZZI, A. DE PALMA, M. LOIZZI, D. CAPORALE, R. DE BELLIS, F. CIALDELLA, S. TANGO, V. SIMONE, F. SOLLITTO

Aim. The authors report a retrospective study on surgical treatment of primary spontaneous pneumothorax (PSP). Surgical approaches by Videoassisted axillary mini-thoracotomy (VAMT) and three-port VATS (t-VATS) are compared. Mean post-operative stay (MPS) and ipsilateral recurrence rate (IRR) are assessed. Secondary endpoints were about complications, early post-operative pain and long term neurologic symptoms.

Patients and Methods. From January 2009 to December 2011 we consecutively observed 85 cases of PSP. Treatment was represented by surgery in 52 patients: the approach was by VAMT in 39 instances and t-VATS in 13. Median follow up was 30 months.

Results. Patients submitted to surgery had a MPS of 6.62 ± 1.5 days for VAMT and 6.69 ± 3.4 days for t-VATS ($p=0.94$). The IRR was 0% in both surgical approaches, comparing to 7.2% for the group of patients treated by simple drainage. Complications were observed in VAMT group: 2 conversions to thoracotomy for technical difficulties (extensive pleural adhesences) and one case of re-thoracotomy for hemothorax. Mean Visual Analogic Scale (VAS) score for early post-operative pain was: 2.10 ± 0.71 for VAMT and 1.92 ± 0.64 for t-VATS, $p=0.42$ at t-student test. Paresthesia complain rate was 33.3% (VAMT) vs 30.7% (t-VATS) for moderate symptoms ($p=0.72$ at chi square test). The remaining patients complained only slight symptoms or no symptoms at all.

Conclusions. Our experience suggested that both surgical approaches to PSP are safe and effective. No differences were found for early post-operative pain and long term paresthesia rate, between the two approaches. No recurrence occurred during follow up.

KEY WORDS: Primary spontaneous pneumothorax - Videoassisted thoracic surgery - Pneumothorax recurrence - Pneumothorax treatment.

Introduction

Primary spontaneous pneumothorax (PSP) is a relatively common event in healthy people.

Nevertheless, the practice management of this condition is extremely variable among different countries and centers and the existing guidelines are not univocal (1).

Target of treatment is complete re-expansion of the lung and prevention of recurrent pneumothorax (2). Actually, indications for surgery include: ipsilateral or contralateral first recurrent episode; persistent air leaks from chest tube (>5-7 days) or radiological persistence of pneu-

mothorax after the same period; bilateral pneumothorax; concurrent hemothorax; risk occupation; pregnancy (3).

In the British Thoracic Society (BTS) pleural disease guidelines (2010) and Belgian Society of Pneumology Guidelines on the management of spontaneous pneumothorax, open thoracotomy and pleurectomy remain the procedure with the lowest recurrence rate (approximately 1%) for difficult or recurrent pneumothoraces. Nevertheless, the minimally invasive approach should be preferred to the open procedure since it is able to reduce the postoperative pain and it is associated with a faster recovery of the physical and working activity (3).

Thus, video-assisted thoracoscopic surgery (VATS) by pleurectomy or pleural abrasion is better tolerated, but has a higher recurrence rate (approximately 5%) (3, 4).

The Spanish Society of Pulmonology and Thoracic Surgery (SEPAR) Guidelines for the Diagnosis and Treatment of Spontaneous Pneumothorax (5) as well states that the gold standard of surgical treatment is video-as-

¹ Thoracic Surgery Unit, University of Foggia, Foggia, Italy

² Thoracic Surgery Unit, "A. Moro" University of Bari, Bari, Italy

Corresponding author: Ardò Nicoletta Pia, e-mail: nicoletta.ardo@gmail.com

*Accepted and presented among the best SPIGC communications at the XVII National Congress of the "Società Italiana di Endoscopia Toracica (SIET)"

© Copyright 2014, CIC Edizioni Internazionali, Roma

sisted thoracoscopic bullectomy associated with pleural abrasion.

Furthermore, uniportal VATS has been proposed for innovative minimally invasive approach for surgical management in PSP (6).

Herein two videoassisted approaches for PSP, Videoassisted axillary mini-thoracotomy (VAMT) and three-port VATS (t-VATS), are compared in a retrospective study regarding mean post-operative stay (MPS) and ipsilateral recurrence rate (IRR). Secondary endpoints were complications, early post-operative pain and long term neurologic symptoms.

Patients and methods

We report on the cases of PSP consecutively observed at a single institution from January 2009 to December 2011. Inclusion criteria were: episode of spontaneous pneumothorax in patients without clinically apparent underlying lung disease; age >18 and <35; both females and males.

According to the current guidelines, first episodes were treated by pleural drainage. Immediate surgery was performed in patients with: ipsilateral or contralateral first recurrent episode; bilateral pneumothorax; concurrent hemothorax; risk occupation; pregnancy. Surgical treatment followed chest drainage in patients with persistent air leaks from chest tube (>5 days) or radiological persistence of pneumothorax after the same period.

Surgical treatment was performed by the same surgical team. It consisted in resection of blebs or bullae, frequently localized at the apex of the upper (apicectomy) or lower lobe, followed by surgical pleurodesis obtained through mechanical pleural abrasion. As for the type of approach, no specific criteria were established for assignation to VAMT or t-VATS. Each patient was allocated to one of the two possible surgical approaches according to the surgeons' options. The resulting two groups of patients were comparable for age ($p=0.46$ at t-student test) and sex ($p=0.37$ at chi square test) (Table 1).

VAMT was performed, as firstly described in 1976 by Becker and Munro (7, 8), by a 5cm-incision through the 2nd or 3rd intercostal space, in the axillar region. This incision involves only serratus anterior muscle, sparing pectoralis major that lies medially; furthermore, it does

not need rib divarication. One, or rarely two, ancillary accesses are performed through the 6th intercostal space on the anterior and/or posterior axillary line. The main incision allows the surgeon to lift up and resect the affected parenchyma, while the camera is positioned through the ancillary access. The position of camera and instruments can be modified during the procedure, if needed. T-VATS was performed by three ports, that form a triangle, respectively through the 2nd or 3rd intercostal space and the 6th intercostal space. Position of camera and instruments vary depending upon the position of blebs or bullae. Both surgical approaches allow the surgeon to explore the pleural cavity and the lung parenchyma, identify blebs or bullae and resect them by mechanical stapler, and finally perform mechanical pleural abrasion. At the end of the procedure a 28 Ch chest tube was positioned using the inferior thoracic access.

MPS and IRR have been assessed for each group. Early post-operative pain was measured by a visual analogic scale (VAS) score ranging from 0 to 4 (9). Median follow up was 30 months; this included annual clinical and radiological checks and telephonic interviews in-between. Data gained from follow up were referred to eventual relapse and/or long term neurologic symptoms. Long term paresthesia complain rate (LTPCR) was estimated in percentage for VAMT and t-VATS groups. Results comparison between the two groups of patients has been respectively determined by t-student and chi square test.

There were 85 consecutive cases of PSP. They involved 78 patients, 7 of whom treated for recurrence (2 ipsilaterally after drainage, 5 contralaterally). Median age was 25 years (range 18-33), male:female rate was 5,5:1.

Treatment included: simple chest tube in 33 patients with a first episode; immediate surgery in 10 patients, 7 with recurrent pneumothorax, 2 with concurrent hemothorax, 1 with risk occupation; chest tube followed by surgery (the latter performed for prolonged air leaks or radiological persistence of pnx) in 42.

Surgical approach was by VAMT in 39 instances and t-VATS in 13 (Table 1).

Results

Patients submitted to surgery had a MPS of 6.62 ± 1.5 days for VAMT and 6.69 ± 3.4 days for t-VATS

TABLE 1 - CHARACTERISTICS OF PATIENTS IN THE VAMT AND T-VATS GROUPS.

	VAMT (n=39)	t-VATS (n=13)	p-value
Mean age (years) \pm SD	24,4 \pm 7,2	26,3 \pm 13,9	0,46*
M/F (n. patients)	32/7	12/1	0,37**

* t student test; ** chi square test

TABLE 2 - MEAN POST-OPERATIVE STAY (MPS), IPSILATERAL RECURRENCE RATE (IRR), VISUAL ANALOG SCALE (VAS) SCORES FOR EARLY POST-OPERATIVE DAY AND LONG TERM PARESTHESIA COMPLAIN RATE (LTPCR) FOR VAMT AND T-VATS PATIENTS.

	VAMT (n=39)	t-VATS (n=13)	p-value
MPS (days) \pm SD	6.62 \pm 1.5	6.69 \pm 3.4	0,94*
IRR (%)	0	0	
VAS score (mean \pm SD)	2.10 \pm 0.71	1.92 \pm 0.64	0,42*
LTPCR (%)	33,3	30,7	0,72**

* *t* student test; ** *chi square test*

($p=0,94$). The IRR was 0% in both surgical approaches, comparing to 7,2% for the group of patients treated by simple drainage. Complications were observed in VAMT group: 2 conversions to thoracotomy for technical difficulties (extensive pleural adhesences) and one case of re-thoracotomy for hemothorax. No prolonged air leaks were recorded in the post-operative period. VAS score for early post-operative pain was (mean \pm sd): 2.10 \pm 0.71 for VAMT and 1.92 \pm 0.64 for t-VATS, $p=0.42$ at *t*-student test. Paresthesia complain rate was 33.3% (VAMT) vs 30.7% (t-VATS) for moderate symptoms ($p=0.72$ at *chi square test*). The remaining patients complained only slight symptoms or no symptoms at all (Table 2).

Discussion and conclusions

Primary pneumothorax remains a significant global problem (3). The goal of treatment is obtaining the lung re-expansion, preventing recurrences and controlling symptoms.

The current guidelines on PSP recommend immediate surgical treatment after recurrent ipsilateral, first contralateral, bilateral pneumothorax or haemopneumothorax. Besides, risk occupation and pregnancy are indications for invasive procedures. Surgery following chest drainage is indicated for patients with prolonged air leaks.

Although there is some consensus on indications of surgery, the best surgical approach is not yet codified.

It was stated that the minimally invasive approach is preferred to the open procedure since it is associated to reduced postoperative pain and a faster recover (3). At present there are several minimally invasive approaches to be considered and there are no conclusive evidences about which would be the best one. The current effort in thoracoscopic surgery is to use fewer ports in order to decrease post-operative pain, chest wall paresthesia and duration of hospital stay (10). Nevertheless, studies about uniportal VATS reported isolated experiences, only on

exiguous numbers of patients (9-12). Uniportal VATS needs small bore, articulating instruments and probably for this reason it has not reached a large diffusion yet. In this landscape, VAMT could be considered as a large uniportal approach that can be gradually 'shortened' when more comfortable instruments become available. The great advantage of the approach studied in this paper, described as VAMT, resides in a higher incision. Indeed, a 2nd- 3rd intercostal space surgical access means a direct access to the lung apex and the mechanical irritation of the highest region of the pleural cavity, with a more effective pleurodesis.

It could be supposed that the approach here described as VAMT encloses technical advantages both from uniportal and triportal VATS: instruments lie in the same sagittal plane like uniportal VATS, while an ancillary port is usually utilized for the camera, similarly to triportal VATS. It is particularly useful to maintain instruments in the same sagittal plane, especially when resecting parenchymal blebs or bullae: indeed VAMT, like uniportal VATS, could offer the option to perform lung sutures, by linear staplers, always on the same line direction. Avoiding suture-lines intersections can be tactical in order to prevent post-operative prolonged air leaks. These observations should be scientifically supported and proved in a specific study. Howbeit, herein no prolonged air leaks have been observed in both groups of patients.

The experience reported, although on exiguous numbers and for a short time follow up, suggested that both surgical approaches to PSP are safe and effective. No significant differences between VAMT and t-VATS were observed in regards to MPS, IRR, early post-operative pain and long term paresthesia.

Although VAMT is commonly thought as an approach more similar to open surgery, no significant differences have been recorded between VAMT and t-VATS in regards to post-operative stay and sudden/long term neurologic symptoms. No ipsilateral recurrences were observed in the follow up period in patients of both groups. Hereof some authors have stated that the IRR after the first episode would tend to increase with minimally in-

vasive procedures. This seems to be related to a poor pleurodesis in thoroscopic surgery. Thus, effective pleurodesis is essential for ipsilateral recurrence prevention, primarily in case of minimally invasive procedures. Last-

ly, the outcome of patients affected by 'surgical' PSP probably depends on a large number of factors, including surgical technique and surgical approach, but also pre and post-operative management and surgeon's experience.

References

1. Baumann MH, Strange C, Heffner JE, et al. Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi consensus statement. *Chest*. 2001;119:590-602.
2. O'Rourke JP, Yee ES. Civilian spontaneous pneumothorax. Treatment options and long-term results. *Chest*. 1989;96:1302-6.
3. MacDuff A, Arnold A, Harvey J, et al. Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax*. 2010;65 Suppl 2:ii18-31.
4. De Leyn P, Lismonde M, Ninane V, Noppen M, Slabbynck H, Van Meerhaeghe A, Van Schil P, Vermassen F. Belgian Society of Pneumology. Guidelines on the management of spontaneous Pneumothorax, (2005).
5. Rivas de Andrés JJ, Jiménez López MF, Molins López-Rodó L, Pérez Trullén A, Torres Lanzas J. Recommendations of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR). Guidelines for the Diagnosis and Treatment of Spontaneous Pneumothorax. *Arch Bronconeumol*. 2008;44(8):437-48.
6. Salati M, Brunelli A. Uniportal VATS for pneumothorax and interstitial lung disease. *J Thorac Dis*. 2013;5(S3):S217-S220.
7. Becker RM, Munro DD. Transaxillary minithoracotomy: the optimal approach for certain pulmonary and mediastinal lesions. *Ann Thorac Surg*. 1976;22:254-9.
8. Massard G, Thomas P, Wihlm JM. Minimally invasive management for first and recurrent pneumothorax. *Ann Thorac Surg*. 1998;66:592-9.
9. Jutley RS, Khalil MW, Rocco G. Uniportal vs standard three-port VATS technique for spontaneous pneumothorax: comparison of post-operative pain and residual paraesthesia. *Eur J Cardiothorac Surg*. 2005;28:43-6.
10. Tamura M, Shimizu Y, Hashizume Y. Pain following thoracoscopic surgery: retrospective analysis between single-incision and three-port video-assisted thoracoscopic surgery. *J Cardiothorac Surg*. 2013;8:153.
11. Chen PR, Chen CK, Lin YS, et al. Single-incision thoracoscopic surgery for primary spontaneous pneumothorax. *J Cardiothorac Surg*. 2011;6:58.
12. Salati M, Brunelli A, Xiumè F, et al. Uniportal video-assisted thoracic surgery for primary spontaneous pneumothorax: clinical and economic analysis in comparison to the traditional approach. *Interact Cardiovasc Thorac Surg*. 2008;7:63-6.