

## Surgical Treatment of Recurrent Spontaneous Pneumothorax: What Is the Optimal Timing?

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**OBJECTIVES:** To analyze the impact on the outcome of video-assisted thoracoscopic surgery (VATS) of delaying surgery in patients with previous episodes of pneumothorax.

**MATERIAL AND METHODS:** We studied 57 surgical procedures for recurrent primary spontaneous pneumothorax. The cases were grouped according to the medical history. One group comprised patients treated surgically at the first episode of contralateral pneumothorax or the second episode of ipsilateral pneumothorax. The second group comprised patients treated surgically at the third or successive episode. We compared the 2 groups as to number of thoracotomies, number of conversions from VATS to thoracotomy, presence of adhesions, and length of postoperative hospital stay.

**RESULTS:** Of the total number of procedures, 13.9% were performed during the third or successive episode. In this group the number of pleuropulmonary adhesions and the percentage of thoracotomies (whether initially indicated or conversions from VATS) was significantly higher ( $P < .05$ ). However, there was no difference between the 2 groups in length of postoperative stay.

**CONCLUSIONS:** VATS is the technique of choice for the surgical treatment of recurrent primary spontaneous pneumothorax. Such treatment should be performed at the first episode of contralateral pneumothorax or the second episode of ipsilateral pneumothorax since delayed surgery gives rise to a higher incidence of technical difficulties that entail thoracotomies.

**Key words:** Spontaneous pneumothorax: recurrent, persistent. Surgical indications. Video-assisted thoracoscopic surgery (VATS).

Cirugía del neumotórax espontáneo de repetición: ¿cuándo indicarla?

**OBJETIVOS:** Analizar la influencia del retraso en la indicación de cirugía, en términos de episodios de recidiva de neumotórax previos a la intervención, sobre los resultados de la cirugía videotoracoscópica (CVT).

**MATERIAL Y MÉTODOS:** Se analizaron 57 procedimientos quirúrgicos llevados a cabo por neumotórax espontáneo primario de repetición. Estos procedimientos se dividieron en función de sus antecedentes. En un grupo se reunieron los intervenidos durante el primero (en el caso de neumotórax contralateral) o segundo episodios sobre el mismo hemitórax, y en otro los operados en el tercero o sucesivos. Entre ambos grupos se comparó el número de toracotomías, las conversiones de CVT a toracotomía, la presencia de adherencias y la estancia postoperatoria.

**RESULTADOS:** El 13,9% de los procedimientos se practicaron en el tercer episodio o siguientes. En este grupo de enfermos la frecuencia de adherencias pleuropulmonares y el porcentaje de toracotomías practicadas (ya fuera por indicación inicial o tras conversión de CVT) fue significativamente mayor ( $p < 0,05$ ). Sin embargo, no se aprecian diferencias en cuanto a las estancias postoperatorias generadas por estos pacientes.

**CONCLUSIONES:** La CVT es la técnica de elección en el tratamiento quirúrgico del neumotórax espontáneo primario de repetición. La indicación quirúrgica en estos casos debe establecerse en el primero (neumotórax contralateral) o segundo episodios de neumotórax, dado que el retraso de la cirugía condiciona una mayor incidencia de dificultades técnicas que motiva un aumento del índice de toracotomías.

**Palabras clave:** Neumotórax espontáneo recidivante. Indicación quirúrgica. Cirugía videotoracoscópica (CVT).

### Introduction

Spontaneous pneumothorax, both primary and secondary, accounts for a large number of patients treated in thoracic surgery units.<sup>1</sup> Moreover, primary

spontaneous pneumothorax (PSP) constitutes a weighty socioeconomic problem since it affects a large sector of the population ranging in age from 20 to 40 years.<sup>2</sup> However, approaches to the management of PSP differ from one medical or surgical service to another. Diverse clinical management guidelines (Table 1) coincide in indicating surgery, among other approaches, in cases of recurrent spontaneous pneumothorax, contralateral pneumothorax, simultaneous bilateral pneumothorax, and persistent air leak<sup>1,3</sup> (defined by the Spanish Society of Pulmonology and Thoracic Surgery —SEPAR— as

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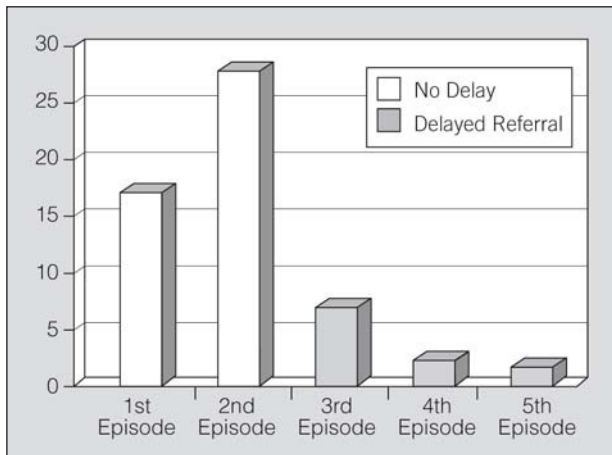


Figure. Distribution of surgical procedures by number of preintervention episodes in the same side. First episode indicates the first in that side (for cases of contralateral hemothorax).

air leak that lasts longer than 5 days<sup>1</sup>). Although indications for surgical treatment of a second ipsilateral or first contralateral pneumothorax<sup>3,4</sup> are debated,<sup>4,5</sup> they are based on statistical analysis of the risk of recurrence relative to the number of previous episodes.

Although video-assisted thoracoscopic surgery (VATS) is also controversial,<sup>6</sup> it is considered the treatment of choice for PSP.<sup>1-3,7,8</sup> According to a Spanish multicenter VATS study, spontaneous pneumothorax is at present the indication for almost half of the VATS treatments performed in Spain.<sup>9</sup>

The objective of the present study was to analyze the effects on the outcome of VATS of delayed referral for surgery in terms of the number of episodes of recurrent pneumothorax prior to intervention.

## Material and Methods

From January 2001 through December 2002, 82 patients with spontaneous pneumothorax underwent surgery in the thoracic surgery unit of the Hospital Universitario Xeral-Cies in Vigo, Spain. Of these cases, 62 (75.61%) were primary and 20 (24.39%) were secondary. The inclusion criteria for our study were indication for surgery due to recurrence of pneumothorax (ipsilateral or contralateral) and no prior

TABLE 1  
Indications for Surgery in Spontaneous Pneumothorax\*

Second ipsilateral pneumothorax
First contralateral pneumothorax
Air leak longer than 5 days
Incomplete reexpansion of the lung
Severe bleeding into the pleural space (hemopneumothorax)
Simultaneous bilateral spontaneous pneumothorax
Spontaneous tension pneumothorax
Bullae visible radiographically and/or thoracoscopically
High-risk professions

\*Adapted from the guidelines of the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR)<sup>1</sup> and the British Thoracic Society.<sup>3</sup>

interventions other than pleural drainage on the same side. Of the 62 patients undergoing surgery for PSP, 47 (75.81%) met these criteria. The study population included 38 men (80.85%) and 9 women (19.15%) ranging in age from 15.11 to 42.75 years (mean [SD]: 24.69 [6.45] years).

In accordance with the presentation of the episodes in the 47 patients, 37 (78.72%) procedures were unilateral and 10 (21.28%) were bilateral, with 6 (12.77%) of the bilateral procedures occurring during the same surgical event and 4 (8.51%) in successive interventions. The total number of surgical procedures was 57.

Regardless of the type of procedure (thoracotomy or VATS), the surgical technique used in all cases was bullectomy by endocutter and mechanical pleurodesis (pleural abrasion).

The variables evaluated were the initial procedure indicated (thoracotomy or VATS), the number and description of complications during surgery, the number of conversions from VATS to thoracotomy, the number of VATS procedures and thoracotomies counting conversions, and the length of postoperative hospital stay.

The number of previous episodes of ipsilateral pneumothorax was recorded for each surgical procedure. Adhering to our inclusion criteria, procedures were classified as either "no delay" (interventions performed at the first contralateral or second ipsilateral episode of pneumothorax) and "delayed referral" (those performed at subsequent episodes). Both groups were compared regarding the variables specified in the preceding paragraph.

The program used for statistical analysis was SPSS version 9.0.0 for Windows (SPSS Inc, 1998). We compared the variables between the no-delay group and the one with delayed referral using  $\chi^2$  tests and exact Fisher tests for qualitative variables and Student *t* tests for quantitative ones. The statistical significance level was fixed at  $P < .05$ . We performed a multivariate analysis with VATS/thoracotomy dichotomy (conversions included) as the dependent variable.

## Results

Of the 57 surgical procedures analyzed, 18 (31.6%) were performed after the first episode of pneumothorax on that side of the thorax (the previous episode having been on the other side); 28 (49.1%) after the second episode; 8 (14.0%) after the third; 2 (3.5%) after the fourth; and 1 (1.8%) after the fifth. Thus, there were a total of 46 cases (80.7%) in the no-delay group (surgery after the first or second episode) and 11 (19.3%) in the delayed-referral group (Figure). No significant differences regarding age or sex were found between the groups.

VATS was indicated for all 46 (100%) cases in the no-delay group whereas thoracotomy was initially indicated in 1 case in the delayed-referral group (9.1%) and VATS in 10 (90.9%) ( $P = .193$ ). In total, thoracotomy was indicated in 1 case (1.8%) and VATS (98.2%) in 56.

Of the 56 VATS procedures (46 after no delay and 10 after delayed referral), technical difficulties were encountered in 9 procedures (16.1%), 5 of which were in the no-delay group and 4 in the delayed-referral group. In other words, difficulties arose in 10.9% (5/46) of the no-delay cases and in 40.0% (4/10) of the

delayed-referral cases, the difference being statistically significant ( $P=.04$ ) (Table 2). In all 9 cases the difficulties were caused by pleural adhesions. It was necessary to convert to thoracotomy in 3 (5.4%) of the 56 VATS procedures. One of the 3 patients was a no-delay case and 2 were in the delayed-referral group. Expressed in percentages, conversions were performed in 2.2% of the no-delay group and in 20% of delayed-referral group ( $P=.079$ ).

In all 57 procedures, including conversions to thoracotomy, a total of 53 VATS procedures (93.0%) and 4 thoracotomies (7.0%) were performed. Analyzed by type of surgery, the no-delay patients underwent 45 of the 46 VATS procedures (97.8%) and 1 thoracotomy (2.2%), whereas 8 of the 11 delayed-referral procedures (72.7%) were VATS and 3 (27.3%) were thoracotomies. The differences were statistically significant ( $P=.02$ ).

The mean (SD) length of hospital stay was 5.63 (2.98) days for the no-delay group and 6.10 (3.00) days for the delayed-referral group ( $P=.654$ ).

Multivariate analysis revealed colinearity between technical difficulties (due to adhesions) and conversion to thoracotomy ( $P<.001$ ).

## Discussion

The recent literature agrees for the most part that VATS is the technique of choice for treating PSP.<sup>1-4,7-9</sup> However there is a lack of consensus regarding the ideal moment for performing the procedure. In our hospital we propose VATS for all patients at the second ipsilateral or first contralateral episode.<sup>3</sup> Some services, however, propose VATS as early as the first episode,<sup>4,10,11</sup> while others delay intervention until the third.<sup>5</sup> This lack of consensus results in heterogeneity of practice from one service to another.<sup>11,12</sup> In our series, the time of surgery was decided by the delayed referral of patients from some medical and surgical services for which ours is the referral hospital, such that 19.3% of the patients underwent surgery after the third or later episode (the delayed-referral group).

VATS was indicated in 98.2% of cases in the present series. The only indication for thoracotomy was radiologic evidence of adhesions that would impede VATS. Nevertheless in 3 (5.4%) of the 56 procedures that started as VATS, conversion to thoracotomy was necessary due to technical difficulties. The conversion rates published by other authors range from 1% to 10%.<sup>4,8,13,14</sup> Overall, our conversion figures fell within this range; but the rate of 20% for the delayed-referral patients was much higher. The conversion rate (2.2%) in the no-delay group, on the other hand, approached the lower limit. Technical difficulties in the form of pleuropulmonary adhesions were encountered during 16.1% of the VATS procedures over all, and once again the rate was higher in the delayed-referral group (40%) than in the no-delay group (19.9%)—a difference that was statistically significant ( $P=.04$ ). The hypothesis that patients with more prior episodes of pneumothorax

TABLE 2  
Technical Difficulties in Video-Assisted Thoracoscopic Surgery Related to Delayed Referral for Surgery\*

	No Delay	Delayed Referral
Adhesions	5 (10.9%)	4 (40%)
No adhesions	41 (89.1%)	6 (60%)
	46 (100%)	10 (100%)

\* $P=.04$ .

TABLE 3  
Distribution of Surgical Procedures by Timing of Refer\*

	No Delay	Delayed Referral
Thoracotomy	1 (2.2%)†	3 (27.3%)‡
VATS	45 (97.8%)	8 (72.7%)
	46 (100%)	11 (100%)

\* $P=.02$ . VATS indicates video-assisted thoracoscopic surgery.

†Conversion from VATS.

‡One was an initially-indicated thoracotomy; the others were conversions from VATS.

develop more adhesions (which normally make conversion to thoracotomy necessary) was also supported by multivariate analysis, which revealed colinearity between the presence of adhesions and conversion. Galbis et al<sup>8</sup> also identified adhesions as the most frequent cause for conversion in their series.

Waller et al<sup>11</sup> described delayed referral—defined by prolonged and/or repeated pleural intubation—as a factor that negatively affects VATS outcome. Delay impeded 24% of the patients in their study from benefiting from the minimal invasiveness of VATS due to adhesions or pleural empyema. In our study we defined delayed referral in terms of the number of previous recurrences of pneumothorax, whether or not pleural drainage had been performed, and excluding patients with pleural infection. Nevertheless, 7% of our 57 procedures involved thoracotomy—although that technique was used in 27.3% of patients undergoing surgery at the third or successive episode (the delayed-referral group) and only 2.2% of patients undergoing surgery at the first or second episode. In our judgment this constitutes a difference between the 2 groups that was clinically important as well as statistically significant ( $P=.02$ ). It definitely seems that repeated ipsilateral episodes of pneumothorax give rise to the formation of pleural adhesions, technically impede VATS, and increase the percentage of patients who are unable to benefit from VATS.

In summary, we conclude that a) VATS is the technique of choice for surgical treatment of recurrent PSP; b) referral for surgery in such cases should be established at the first contralateral or second ipsilateral episode of pneumothorax, and c) delaying referral gives rise to a higher incidence of technical difficulties that, in turn, increase the rate of thoracotomies performed.

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REFERENCES

1. Grupo de Trabajo SEPAR. Normativa sobre diagnóstico y tratamiento del neumotórax. Arch Bronconeumol 2002;38:589-95.
2. Baumann MH, Strange C, Heffner JE, Light R, Kirby TJ, Klein J, et al, AACP Pneumothorax Consensus Group. Management of spontaneous pneumothorax: an American College of Chest Physicians Delphi consensus statement. Chest 2001;119:590-602.
3. Henry M, Arnold T, Harvey J: Pleural Diseases Group, Standards of Care Committee, British Thoracic Society. BTS guidelines for the management of spontaneous pneumothorax. Thorax 2003; 58(Suppl 2):39-52.
4. Sahn SA, Heffner JE. Spontaneous pneumothorax. N Engl J Med 2000;342:868-74.
5. Weissberg D, Refaely Y. Pneumothorax: experience with 1199 patients. Chest 2000;117:1279-85.
6. Kim KH, Kim HK, Han JY, Kim JT, Won YS, Choi SS. Transaxillary minithoracotomy versus video-assisted thoracic surgery for spontaneous pneumothorax. Ann Thorac Surg 1996;61:1510-2.
7. Waller DA, Forty J, Morrill GN. Video-assisted thoracoscopic surgery versus thoracotomy for spontaneous pneumothorax. Ann Thorac Surg 1994;58:372-7.
8. Galbis Caravajal JM, Mafé Madueño JJ, Benlloch Carrión S, Baschwitz Gómez B, Rodríguez Paniagua JM. Cirugía videotoroscópica en el tratamiento de los neumotórax: consideraciones sobre 107 procedimientos consecutivos. Arch Bronconeumol 2003; 39:310-3.
9. Rivas de Andrés JJ, Freixinet Gilart J, Rodríguez de Castro F. Estudio multicéntrico español de cirugía videotoroscópica. Arch Bronconeumol 2002;38:60-3.
10. Rivas de Andrés JJ, Torres Lanzas J. Thoracoscopy and spontaneous pneumothorax. Ann Thorac Surg 1993;55:811.
11. Waller DA, McConnell SA, Rajesh PB. Delayed referral reduces the success of video-assisted thoracoscopic surgery for spontaneous pneumothorax. Respir Med 1998;92:246-9.
12. Butland RJA, Spickett GP, Seaton D. A survey of the management of primary spontaneous pneumothorax in the UK. Thorax 1987;42: 226-7.
13. Freixinet J, Canalis E, Rivas JJ, Rodríguez de Castro F, Torres J, Gimferrer JM, et al. Surgical treatment of primary spontaneous pneumothorax with video-assisted thoracic surgery. Eur Respir J 1997;10:409-11.
14. Elfeldt RJ, Thies J, Schroder DW. Thoracoscopic resection of parenchymal blebs in spontaneous pneumothorax. Indications, operative management and results. Scand J Thorac Cardiovasc Surg 1995;29:75-8.