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Comparison of video-assisted thoracoscopic talcage for recurrent primary *versus* persistent secondary spontaneous pneumothorax

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ABSTRACT: Thoracoscopic talcage (TT) is a safe and effective prophylactic treatment for patients suffering from recurrent primary spontaneous pneumothorax (PSP). Empirically, TT is considered equally effective in the treatment of persistent secondary spontaneous pneumothorax (SSP), although this has not yet been proved.

In this study, the efficacy and safety of TT was prospectively evaluated in 28 patients (17 males and 11 females, mean age 27±8 yrs), with 31 episodes of recurrent PSP, and in 20 patients (13 males and 7 females, mean age 43±21 yrs) with persistent SSP.

TT proved to be equally effective in achieving pleurodesis in both groups: there were 6.5% recurrences in the PSP group and 8.7% in the SSP group during a mean follow-up period of 18 months (p>0.05). In the SSP group, there were significantly more prolonged postoperative air leaks (26 *vs* 0%; p=0.004) and a longer postoperative chest tube drainage time (35.5±18 *vs* 24.9±3.2 hrs; p=0.002) was necessary. All air leaks, however, ceased spontaneously during drainage. Duration of hospitalization was significantly longer in the SSP group (4.7±2 *vs* 3.2±0.5 days; p<0.0001). Postoperative pain (90 *vs* 43%; p<0.0001) and fever (65 *vs* 17%; p= 0.001) were more frequent in the PSP group than in the SSP group.

There were no major peri- or postoperative complications in either group. We conclude that thoracoscopic talcage is as efficient and safe in achieving pleurodesis in persistent spontaneous pnuemothorax as in recurrent primary spontaneous pneumothorax.

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Primary spontaneous pneumothorax (PSP) is defined as a pneumothorax occurring spontaneously in a person without (known) underlying lung disease; whereas, a secondary spontaneous pneumothorax (SSP) is defined as a spontaneous pneumothorax occurring in a patient with known underlying lung disease [1]. Although it is now widely recognized that the majority of PSP patients do have underlying abnormalities of their lungs (*i.e.* subpleural blebs or bullae, most often located at the apices of the lung) [2, 3], their typical history and the absence of associated pulmonary disease allows the categorization of PSP as a distinct clinical entity [4, 5].

Numerous therapeutic options are available for the treatment of spontaneous pneumothorax, including: simple observation (with oxygen supplementation); simple manual aspiration; chest tube thoracostomy with or without instillation of various sclerozing agents; thoracoscopy with talc poudrage; pleural scarification; parietal pleurectomy; neodimium yytrium aluminium garnet (NdYAG) laser bleb ablation; bleb or bulla oversewing or stapling; and open thoracotomy with a variety of possible interventions [1]. The procedure of choice in any given patient with a spontaneous pneumothorax will depend upon: the extent and severity of the pneumothorax; the expected rate of recurrence (taking into account whether it is a first or a recurrent episode); the absence or presence of a persistent air leak; the presence or absence of underlying lung disease; and the availability of and personal experience with specific therapeutic techniques (*e.g.* thoracoscopy, NdYAG laser *etc.*).

Since PSP is usually well-tolerated, and notwithstanding a recurrence rate of 30–50% during the 5 years after a first episode of PSP [1, 5], it is recommended (though not universally accepted [5]) that thoracoscopic treatment should be reserved for patients with recurrent PSP [6, 7]. However, to our knowledge, no prospective, controlled study is available to refute or confirm this strategy. Nevertheless, clinical evidence supports the use of thoracoscopy for prevention of the recurrence of PSP [5, 6–9]. Of the various thoracoscopic pleurodesis techniques available, talc insufflation seems as effective as other more invasive methods (mechanical or thermal abrasion, thoracoscopic pleurectomy, *etc.*), but is easier to perform, although, again, no controlled studies are available.

In contrast with PSP, SSP is often serious and sometimes life-threatening because of the underlying lung disease; the recurrence rates are probably higher in SSP [10, 11]. It is, therefore, recommended that all patients with SSP be treated with chest tube thoracotomy and be considered for pleurodesis [1]. In these patients also, however, no controlled studies on which sclerozing agent or technique to use are available. Furthermore, one may have to consider the effects of the sclerozing agent on a future lung transplant, which may be compromised or even refused due to increased technical difficulties [1].

Little information has been published about the thoracoscopic management of patients with SSP, and although, empirically, thoracoscopic talcage is thought to be equally effective in SSP as in PSP [5], no controlled studies on this subject are available. In this study, therefore, we prospectively evaluated and compared the efficacy of thoracoscopic talcage for achieving pleurodesis in recurrent primary *versus* persistent secondary spontaneous pneumothorax.

Materials and methods

Patients

From January 1993 until December 1995, 48 patients with spontaneous pneumothorax (SP), primary and secondary, were included in the study.

PSP was defined as a SP in a patient with no known or apparent underlying lung disease. Indications for thoracoscopy were: a second (or more) episode of PSP, which was symptomatic (dyspnoea, chest pain or chest tightness, *etc*.), and with an estimated size of ≥30% according to the formula of LIGHT [1]. Twenty eight patients (17 males and 11 females, mean age 27±8 yrs, range 16–56 yrs) with 31 episodes of PSP were treated (two recurrences, one contralateral episode). During the study period, 36 other patients with a first episode of PSP were treated with small-catheter aspiration or a small-sized chest tube thoracostomy (12 or 16 F diameter) without injection of a sclerozing agent; five of these patients were seen with a recurrence, and were then included in the present study.

SSP was defined as a SP in a patient with known or apparent underlying lung disease. Twenty patients (13 males and 7 females, mean age 43±21 yrs, range 17–74 yrs) with 23 episodes of SP were studied. Thoracoscopy was indicated when an air leak persisted after five or more days of chest tube suctioning. The causes of underlying lung disease are listed in table 1. All patients were given detailed information on the procedures.

Table 1. – Underlying diseases in the SPP group (n=20)

	n	%
COPD	6	30
CF	5	25
ILD	3	15
AIDS	2	10
Pneumonia	1	5
Aspergillosis	1	5
Hodgkin's disease	1	5
Bronchial carcinoma	1	5

SPP: secondary spontaneous pneumothorax; COPD: chronic obstructive pulmonary disease; CF: cystic fibrosis; ILD: interstitial lung disease (including lymphangioleiomyomatosis, idiopathic pulmonary fibrosis, and dermatomyositis); AIDS: acquired immune deficiency syndrome.

Methods

Thoracoscopy

All procedures were performed in the operating room, under strict aseptic conditions, and using total intravenous anaesthesia (TIVA). Patients were intubated with a Hi-Lo single lumen endotracheal tube (Mallincrodt®, Northampton, UK). At the onset of the thoracoscopy, ventilation with oxygen enriched air (fraction of inspired oxygen (F_{I,O_2}) =0.5) was switched from conventional volume-control mode (Siemens Elema 900C®; Siemens Elema AB, Solna, Sweden) to high-frequency jet ventilation (HFJV) mode (Acutronic®; Acutronic Medical Systems AG, Jona, Switzerland). At the time of intubation and the use of volume-controlled ventilation, all patients had a chest tube to avoid tension pneumothorax. End-tidal carbon dioxide tension (P_{ET,CO_2}) and arterial oxygen saturation (S_{a,O_2}) were monitored continuously.

Patients were positioned in lateral decubitus with the healthy side down, and the upper arm placed at a right angle to the body's long axis, and attached to a horizontal bar. The patients were grounded by taping a metal paddle, connected to the coagulation source, to a buttock. The site of the operation field was generously disinfected with Isobetadine®. After a new incision of the skin and blunt dissection through subcutis, intercostal muscle and parietal pleural, a 7 mm diameter trocar with cannula was inserted into the pleural cavity. A rigid telescope (Richard Wolf, Knittlingen, Germany) was then introduced through the trocar. The telescope was coupled to a light source, with automatic modulation of light power, and to a videocamera with TV monitor and S-VHS videorecorder. The point of entry was usually located in the third or fourth intercostal space, on the midaxillary line. After a first inspection, supplemental air was pumped into the pleural cavity when necessary. A second point of entry was chosen depending on the local situation (*e.g*. pleural adhesions *etc*.) and the exact location of visualized abnormalities (*e.g*. apical bulla *etc*). The second trocar (5.5 mm diameter) was always introduced under thoracoscopic vision. The original chest tube was removed.

Talc poudrage

When no or only minimal abnormalities (VANDERSCHUEREN [2] types I, II and some type III cases) were identified, after thorough inspection of the entire lung surface and pleural cavity, talc poudrage was immediately performed *via* the second point of entry, under thoracoscopic vision: 2 g of sterile, asbestos-free Pharmacopea talc was insufflated on the visceral and parietal pleura.

In five interventions in four cystic fibrosis patients with persistent SSP, talcage was limited to the lung apex in order to avoid the development of extensive adhesions,

which would compromise possible future lung transplantation, according to a technique described previously [12].

Bleb ablation by electrocoagulation

In 12 patients (11 with type IV PSP, one with SSP secondary to bullous emphysema) blebs and bullae with a diameter ranging 2–5 cm were thoracoscopically visualized. In six of these patients, one or more blebs clearly appeared ruptured. After thorough inspection and mapping of all the blebs, a thermocoagulation forceps was introduced through the second (insulated) trocar. The tip of the forceps was held at the base of each bleb, and short bursts of coagulation (power 40–60 W) were applied. After 10–50 bursts circumferentially around their base, shrinkage (and even complete ablation in 10 patients) of the blebs was obtained (figs. 1 and 2). Thereafter, talc poudrage was performed as described above.

At the end of the procedure, the telescope was switched to the second entry point. Thereafter, the first cannula was removed, and a 24 French chest tube was inserted through the same incision under videoscopic control, and directed at the lung apex. After removal of the thoracoscope and skin closure of the second entry point, the chest tube was connected to a 4-chamber aspiration system at a suction pressure of -20 cmH_2O. The following data were recorded: macroscopic thoracoscopic findings (allowing for classification of the PSP); duration of the procedure; perioperative complications (bleeding, rupture of a bulla, oxygen desaturation *etc.*), postoperative pain and fever; duration of chest tube drainage; hospital stay; and recurrence rate.

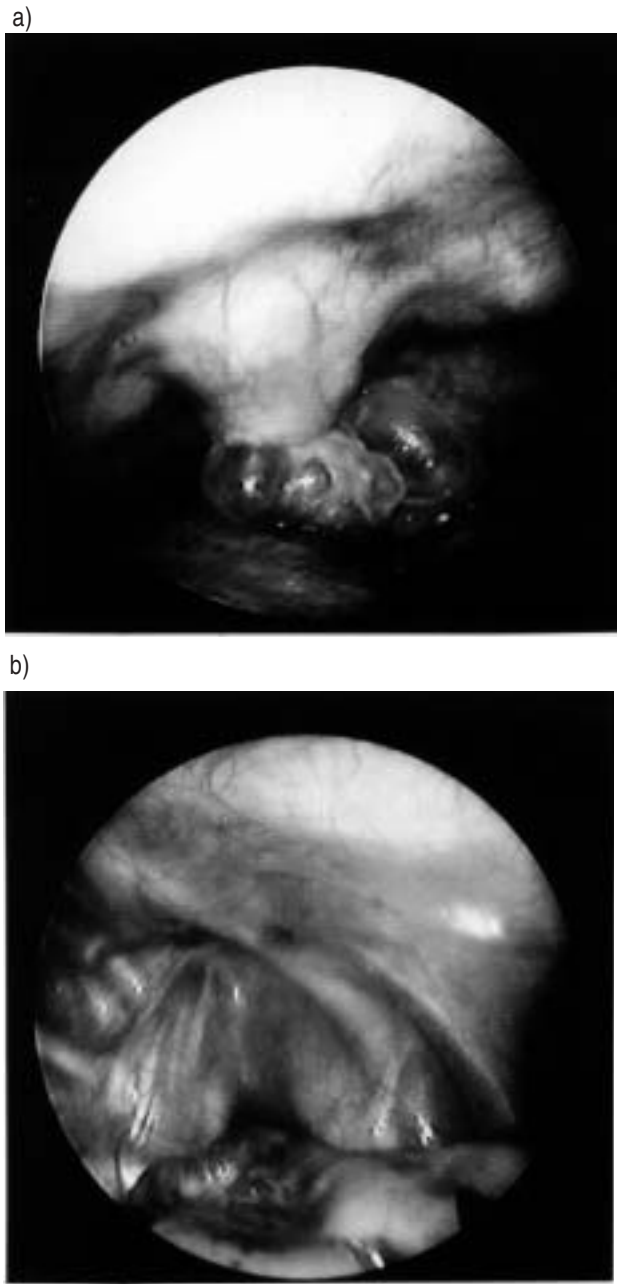

Fig. 1. – Apical bullae: a) before; and b) after thermocoagulation.

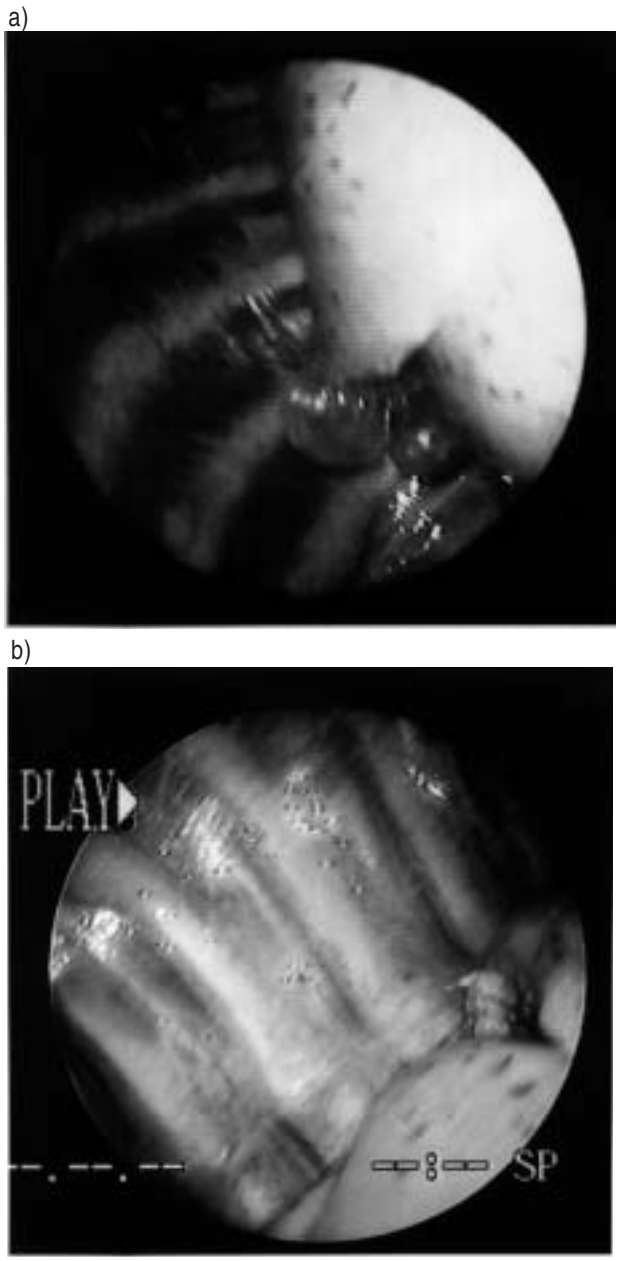

Fig. 2. – Small bullae located at the fissure of the right upper lobe: a) before; and b) after thermocoagulation.

Statistical analysis

Data are expressed as mean±SD. Baseline patient characteristics were compared using the unpaired two-tailed Student's t-test and the Chi-squared or Fisher exact test. Study endpoints were compared between the two patient groups using the two-tailed Student's t-test and the Chi-squared or Fisher exact test. Significance was accepted at p-values less than 0.05.

Results

Duration of the procedure

Mean±SD duration of the thoracoscopic procedure tended to be shorter in the PSP group (29±9 min) as compared to the SSP group (35±14 min), but the difference was not significant (p=0.06) (table 2).

Thoracoscopic findings

Macroscopic findings in the PSP group, according to the classification of VANDERSCHUEREN [2], are summarized in table 3. There were 10 (34%) type I cases (normal findings); two (7%) type II cases (pleuropulmonary adhesions); six (21%) type III cases (bullae/blebs less than 2 cm diameter); and 11 (38%) type IV cases (bullae >2 cm diameter). In the SSP group, one patient with chronic obstructive pulmonary disease (COPD) had bullous apical malformation, and in the cystic fibrosis patients important deformations of the lung were observed. In one patient with lymphangioleiomyomatosis, numerous blebs were seen on the lung surface. No other lesions were observed.

Perioperative complications

All procedures were uneventful. There were no episodes of bleeding or lung laceration. There were no episodes of severe ventilatory (P_{ET,CO_2} >6 kPa (45 mmHg)) or oxygenation (S_{a,O_2} <90%) problems.

Table 2. – Results and complications of thoracoscopic talcage in PSP and SSP episodes

	PSP (n=31)	SSP (n=23)	p-value
Duration of the procedure min	29±9	35±14	0.06
Immediate closure of air leaks n	29 (94)	17 (74)	0.06
Prolonged air leaks n	0 (0)	6 (26)	0.004
Duration of chest tube drainage	24.9±3.2	35.5±18	0.002
Pain n	28 (90)	10 (43)	<0.0001
Fever ≤38.5°C n	20 (65)	4 (17)	0.001
i.v. propacetamol n	28 (90)	10 (43)	<0.0001
Duration of hospitalization days	3.2±0.5	4.7±2	<0.0001
Follow-up months	18.3±12	17.6±11.9	NS
Recurrence rate n	2 (6.5)	2 (8.7)	NS

Values are presented as mean±SD, or as absolute number, and percentage in parenthesis, as appropriate. PSP: primary spontaneous pneumothorax; SSP: secondary spontaneous pneumothorax; NS: not significant.

Table 3. – Classification of PSP at thoracoscopy (n=29)* according to VANDERSCHUEREN [2]

PSP	n	%
Type I	10	34
Type II	2	7
Type III	6	21
Type IV	11	38

*: one patients had a contralateral episode of primary spontaneous pneumothorax (PSP).

Postoperative period

In most PSP patients (29 of the 31 episodes, 94%), air bubbling through the water seal stopped within a few seconds of postoperative aspiration (table 2). In two PSP patients, bubbling persisted for a few hours and then ceased spontaneously. In 17 out of 23 episodes (74%) of SSP, postoperative bubbling stopped immediately. In six patients air leakage persisted for 24 h or more but ceased with continuous drainage. The chest tube was removed after 24.9±32 h (range 24–36 h) in the PSP patients, and after 35.5±18 h (range 24–120 h) in the SSP patients (p=0.002) (table 2). Twenty eight of the 31 PSP patients (90%) experienced postoperative chest pain, and in 20 out of 31 (65%) cases there was low grade fever (≤38.5°C) (table 2). Pain and fever responded well to intravenous propacetamol, which was given for 24 or 48 h. In the SSP patients, pain (10 out of 23 episodes; 43%) and fever (4 out of 23 episodes; 17%) were significantly less pronounced, and propacetamol was necessary in only 10 of the 23 (43%) cases (table 2).

Mean hospital stay was 3.2±0.5 days (range 3–5 days) for the PSP patients and 4.7±2 days (range 3–12 days) for the SSP group (p<0.0001) (table 2).

Follow-up and recurrence rate

Mean follow-up was 18.3±11.6 months (range 2–36 months) in the PSP group, and 17.6±11.9 (range 2–36 months) in the SSP group (NS) (table 2).

In two patients (a 20 year old male after 20 months, and a 25 year old female after 21 months), ipsilateral recurrence of PSP occurred (2 out of 31 episodes; 6.5%). At the second thoracoscopy, pleuropulmonary adhesions were present, preventing complete collapse of the lung (table 2). In two SSP episodes (8.7%) in one patient with lymphangioleiomyomatosis, early bilateral recurrences were seen after talcage.

Discussion

This prospective study compared the efficacy of thoracoscopic talc poudrage in patients with recurrent PSP and persistent SSP: talc poudrage, with electrocautery bleb coagulation when indicated, was equally efficient in achieving pleurodeses in both groups of patients.

The mean overall recurrence rate in PSP after thoracoscopic talc poudrage is reported to be 7–9% [5, 8].

In some large series, recurrence rates even approach the results obtained by thoracotomy (2–5%) [5]. However, in most series, patients with PSP and SSP were included. In the (few) studies in which PSP patients only were included, no recurrences occurred after talc poudrage [8]. Nevertheless, the recurrence rate of 6.5% in the present study in a purely PSP patient group can be considered equal to the data in the literature, taking into account the fact that these PSP patients probably had "more severe" disease, since only patients with recurrent SP were included. This is reflected in the macroscopic classification according to VANDERSCHUEREN [2]: although type I disease was equally present in the present group as compared to other series, we observed more type IV disease (38 *versus* 17–29%) [13]. In contrast with VANDERSCHUEREN [2], the type IV PSP patients in the present study were not older than the patients with PSP of other types.

Thoracoscopic talcage for the treatment of persistent SSP has been studied less than for PSP: in a few case reports and small retrospective series of "pure" SSP patients, thoracoscopic talcage appeared to be equally effective as in "pure" PSP series (recurrence rates 0 and 12%) [8]. Although no comparative studies are available, theoretically and empirically, thoracoscopic talc poudrage is considered to be safer as compared to more complicated (and time-consuming) thoracoscopic methods or thoracotomy for older patients with underlying lung disease and/or respiratory distress [5]. SSP, indeed, carries a significantly higher complication and mortality rate in patients suffering from underlying diseases, such as COPD and emphysema [14–16], tuberculosis [15, 17], cystic fibrosis [18], *etc*. as compared to PSP. Any pleurodesis technique, including thoracoscopic talcage should, therefore, be simple, effective, and free of major complications and side-effects.

The duration of the procedure was slightly, though not significantly, longer in the SSP group. The higher incidence of prolonged air leakage (26 *vs* 0%) and the longer postoperative chest tube drainage (and, therefore, hospital stay) can be explained by the more severe underlying pulmonary abnormalities in SSP patients. It is unclear, however, why SSP patients presented significantly less pain (43 *vs* 90%) and fever (17 *vs* 65%) requiring propacetamol as compared to PSP patients. Perhaps the longer presence of air and/or a chest tube in the pleural cavity in the SSP patients (at least 5 days, as compared to 1–2 days in the PSP group) may have reduced the sensitivity to pain of the parietal pleura, somewhat comparable to the lower incidence of pain that is observed after talcage for chronic pleural effusion [8].

The exact place of thoracoscopic talcage in the management of primary and secondary spontaneous pneumothorax remains to be determined by comparative, large scale, prospective studies in well-defined study populations. Efficacy, safety, cost, short-term and long-term complications, including the impact of talcage on subsequent thoracic surgery, are elements that should be included in such studies. However, when one considers pleurodesis in patients with persistent secondary spontaneous pneumothorax, this study provides ample evidence that thoracoscopic talcage is as effective and safe in secondary as in primary spontaneous pneumothorax patients.

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References

1. Light RW. Management of spontaneous pneumothorax. *Am Rev Respir Dis* 1993; 148: 245–248.
2. Vanderschueren RG. Le talcage pleural dans le pneumothorax spontané. *Poumon Coeur* 1981; 37: 273–276.
3. Lesur O, Delorme N, Fromaget JM, Bernadac JM, Bernadac P, Polu JM. Computed tomography in the etiologic assessment of idiopathic spontaneous pneumothorax. *Chest* 1990; 98: 341–347.
4. Light RW. Pneumothorax. *In*: Murray JF, Nadel JA, eds. Textbook of Respiratory Medicine. Philadelphia, W.B. Saunders, 1988; pp. 1745–1759.
5. Boutin C, Loddenkemper R, Astoul P. Diagnostic and therapeutic thoracoscopy: techniques and indications in pulmonary medicine. *Tubercle Lung Dis* 1993; 74: 225–239.
6. Berger R. Pleurodesis for spontaneous pneumothorax: will the procedure of choice please stand up? *Chest* 1994; 106: 992–994.
7. Van de Brekel JA, Duurkens VAM, Vanderschueren RGJRA. Pneumothorax: results of thoracoscopy and pleurodesis with talc poudrage and thoracotomy. *Chest* 1993; 103: 345–347.
8. Kennedy L, Sahn SA. Talc pleurodesis for the treatment of pneumothorax and pleural effusion. *Chest* 1994; 106: 1215–1222.
9. Milanez JR, Vargas FS, Filomeno LTB, Fernandez A, Jatene A, Light RW. Intrapleural talc for the prevention of recurrent pneumothorax. *Chest* 1994; 106: 1162–1165.
10. Light RW, O'Hara VS, Moritz TE, *et al*. Intrapleural tetracycline for the prevention of recurrent spontaneous pneumothorax. *JAMA* 1990; 264: 2224–2230.
11. Archer GJ, Hamilton AAD, Upadhyay R, Finley M, Grace PM. Results of simple aspiration of pneumothoraces. *Br J Dis Chest* 1985; 79: 177–182.
12. Noppen M, Dhondt E, Malfroot A, Mahler T, Dab I, Vincken W. Successful management of recurrent pneumothorax in cystic fibrosis by localised apical thoracoscopic talcage. *Chest* 1994; 106: 262–265.
13. Boutin C, Astoul P, Rey F, Mathur PN. Thoracoscopy in the diagnosis and treatment of spontaneous pneumothorax. *Clin Chest Med* 1995; 16: 497–503.
14. Videm V, Pillgram-Larsen J, Ellingsen O, Andersen G, Ovrum E. Spontaneous pneumothorax in chronic obstructive pulmonary disease: complications, treatment and recurrences. *Eur J Respir Dis* 1987; 71: 365–371.
15. Shields TW, Olschlager GA. Spontaneous pneumothorax in patients 40 years of age and older. *Ann Thorac Surg* 1966; 2: 377–383.
16. George RB, Herbert J, Shames JM, Ellithorpe DB, Weill H, Ziskind MM. Pneumothorax complicating pulmonary emphysema. *JAMA* 1975; 234: 389–393.
17. Wilder RJ, Beacham EG, Ravitch MM. Spontaneous pneumothorax complicating cavitary tuberculosis. *J Thorac Cardiovasc Surg* 1962; 43: 561–573.
18. Spector ML, Stern RC. Pneumothorax in cystic fibrosis: a 26 yr experience. *Ann Thorac Surg* 1989; 47: 204–207.