Treatment of complicated spontaneous pneumothorax by simple talc pleurodesis under thoracoscopy and local anaesthesia

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Abstract

Background – Complicated (recurring or persistent) spontaneous pneumothorax requires treatment either by talc pleurodesis with bullae electrocoagulation or, more aggressively, by thoracotomy or video-assisted thoracoscopic surgery. However, the relative merits of bullectomy, pleurectomy, and pleurodesis have not yet been established in the treatment of spontaneous pneumothorax.

Methods – The complications, duration of drainage, length of hospital stay, and immediate and long term success rate of treating complicated spontaneous pneumothorax with talc pleurodesis under local anaesthesia supplemented with nitrous oxide were studied.

Results – Talc pleurodesis was performed in 93 patients without serious complication (two benign arrhythmias, two subcutaneous emphysema, two pneumonia, one bronchospasm). The procedure was immediately successful in 90 patients (97%) with a median duration of drainage of five days (range 2–40) and a median length of hospital stay of 5.2 days (range 3–40). After a mean follow up duration of 5.1 (range 1–9.4) years in 84 cases the long term success rate was 95%, although six cases developed a small localised recurrence of spontaneous pneumothorax which did not require further surgery. Macroscopic staging at thoracoscopy was only carried out in the last 59 cases of whom 10 (17%) had bullae with a diameter of >2 cm. In this group of patients the risk of definitive failure requiring surgery was significantly higher than in those patients without such bullae (odds ratio 7; confidence interval 3.7 to 13.3; p = 0.03), although eight of these patients did not require thoracotomy. Total lung capacity was reduced immediately after talc pleurodesis (mean (SD) 75 (23)% predicted at 10 days) but had improved to 95 (14)% predicted at 12 months.

Conclusions – This study shows that simple thoracoscopic talc pleurodesis under local anaesthesia is a safe and effective treatment for complicated spontaneous pneumothorax. However, patients with bullae of >2 cm in diameter have a greater risk of treatment failure.

Spontaneous pneumothorax is a significant problem1 with an estimated recurrence rate of 23–50% after the first episode and higher after the first recurrence.2 There is little consensus about the treatment of spontaneous pneumothorax, with some authors recommending treatment by thoracotomy whereas others only recommend thoracoscopic surgery for recurrent or complicated cases. Thoracotomy with pleurectomy and bullectomy is the definitive treatment for spontaneous pneumothorax and is associated with a very low recurrence rate but significant morbidity and mortality.3 There is also debate about whether the presence of bullae should alter the initial management. In patients with bullae of >2 cm in diameter many authors recommend bullectomy either by thoracotomy4 or, more recently, by video-assisted thoracoscopic surgery and pleurectomy.5 However, both techniques require general anaesthesia and intubation with a double lumen tube. To avoid such invasive procedures it is generally accepted that, in the absence of bullae of >2 cm diameter, chemical pleurodesis with talc by “medical” thoracoscopy – that is, with local anaesthesia – could be performed accompanied, if necessary, by electrocoagulation of bullous lesions. As others have observed,6,7 however, we are not aware of any controlled study showing that procedures such as pleurectomy, bullectomy, or leak sealing significantly decrease the incidence of recurrent spontaneous pneumothorax beyond the reduction that would result from performing pleurodesis by minimally invasive medical thoracoscopy.

In our hospital “medical” thoracoscopy has been carried out only for recurrent or persistent spontaneous pneumothorax, or for rare cases of a first episode of secondary spontaneous pneumothorax in patients with severe underlying lung disease, irrespective of the presence or absence of bullae. We now report the results of a study of the efficacy, complications, duration of drainage, and late recurrence rates of spontaneous pneumothorax treated only by talc pleurodesis under thoracoscopy and local anaesthesia. We have also investigated whether the presence of bullae with a diameter of >2 cm is a risk factor for recurrence after talc pleurodesis by medical thoracoscopy.

Methods

THORACOSCOPY AND TALC PLEURODESIS

Patients were premedicated with atropine 0.5 mg and during the procedure received...
titrated midazolam (3–10 mg) and pethidine (25–100 mg) under careful supervision and continuous monitoring of blood pressure, ECG, oxygen saturation, and end tidal carbon dioxide pressure (Ohmeda, Louisville, USA).

Thoracoscopy was carried out in the lateral decubitus position under local anaesthesia with lignocaine 1%. A 7 mm diameter trocar (Wolf, Knittlingen, Germany) was inserted in the fifth axillary intercostal space in the mid axillary line. A 0° optical telescope (Panoview; Wolf) was inserted and connected to a video camera and monitor (Sony). The pleurae were inspected and any fluid was removed. By examining the chest radiographs and under direct vision we then selected the best site for the second point of entry. Two trocars and two chest tubes were used so that we could choose the best intercostal space to manipulate the lung with blunt forceps and inspect the visceral pleura in the apical and interlobar regions, cut any pleural adhesions by diathermy to expose all the visceral pleura to talc spraying, optimise talc spraying at the apex where lung lesions were generally found, and so that at the end of thoracoscopy we could leave one tube at the apex or adjacent to any bullae or pulmonary tears and one in the lower and posterior part of the pleural space to drain any pleural fluid. No electrocaucoleation, stapling or ligation of any parenchymal lesions was carried out, even when a leak was visualised. At the end of the procedure the patient inhaled a mixture of 50% oxygen/50% nitrous oxide and 3–5 ml of pure talc was insufflated into the pleural space. The two drains (16 French gauge) were connected to underwater seal suction with a negative pressure of 30 cm H2O for at least two days or until air leakage stopped. When an air leak persisted for more than seven days of chest tube drainage a second procedure (details in table 2) with surgery in <7 days because of poor health.

DATA ANALYSIS
Immediate success was defined as the proportion of cases with talc pleurodesis who had a complete re-expansion of their lung during the hospital stay, and long term success was defined as the number of cases with talc pleurodesis who did not require any surgical treatment at any time (first thoracoscopy or follow up). Results are expressed as mean (SD) with medians and ranges where relevant.

Results
MACROSCOPIC LESIONS
In the last 59 cases thoracoscopy showed a normal visceral pleura in 20 cases (stage I, 34%) and some pleural adhesions in 11 cases (stage II, 19%). One patient was in severe respiratory failure secondary to emphysema and talc was insufflated immediately without cutting any adhesions. Blebs or bullae with a diameter of <2 cm were found in 18 cases (stage III, 30%) and in 10 cases bullae with a diameter of ≥2 cm (stage IV, 17%) were found.

IMMEDIATE SUCCESS RATE
The median duration of drainage was five days (range 2–40) and the median length of hospital stay was 5.2 days (range 3–40). There were no serious complications such as empyema or re-expansion oedema and no deaths (table 1).

LONG TERM FOLLOW UP
Outpatient follow up information was obtained in 90% of cases for a mean of 5.1 (3.4) years. There were six late recurrences of spontaneous pneumothorax, two of which required no spe-
Table 2  Thoracoscopic talc pleurodesis: details of second procedures and outcome of patients with spontaneous pneumothorax and drainage duration of >7 days

<table>
<thead>
<tr>
<th>Patient no./sex</th>
<th>Age (years)</th>
<th>Indication for talc pleurodesis</th>
<th>Second procedure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/M 58</td>
<td>Primary recurring SP</td>
<td>No lung re-expansion; thoracotomy at day 10</td>
<td>Failure (surgery)</td>
<td></td>
</tr>
<tr>
<td>2/M 73</td>
<td>Secondary recurring SP with severe COPD</td>
<td>Persistent localised pneumothorax; 3rd drain</td>
<td>Success</td>
<td></td>
</tr>
<tr>
<td>3/M 26</td>
<td>Primary recurring SP</td>
<td>No lung re-expansion; tetracycline instillation</td>
<td>Success</td>
<td></td>
</tr>
<tr>
<td>4/M 20</td>
<td>Primary recurring SP</td>
<td>3rd drain</td>
<td>Success</td>
<td></td>
</tr>
<tr>
<td>5/F 20</td>
<td>Primary recurring SP</td>
<td>Persistent localised pneumothorax; tetracycline instillation</td>
<td>Success</td>
<td></td>
</tr>
<tr>
<td>6/M 17</td>
<td>Primary recurring SP</td>
<td>Bubbling; tetracycline instillation</td>
<td>Success</td>
<td></td>
</tr>
<tr>
<td>7/F 30</td>
<td>Primary recurring SP</td>
<td>Relapse after 3 days; new thoracoscopic TP</td>
<td>Success</td>
<td></td>
</tr>
<tr>
<td>8/F 26</td>
<td>Secondary bilateral SP with AIDS, PCP and ARDS</td>
<td>Bubbling + +; new thoracoscopic TP Up to 5 drains on each side</td>
<td>Success</td>
<td></td>
</tr>
<tr>
<td>9/M 36</td>
<td>Primary recurring SP</td>
<td>No lung re-expansion; VATS at day 5</td>
<td>Failure (surgery)</td>
<td></td>
</tr>
</tbody>
</table>

SP = spontaneous pneumothorax; TP = talc pleurodesis; COPD = chronic obstructive pulmonary disease; VATS = video-assisted thoracoscopic surgery; PCP = Pneumocystis carinii pneumonia; ARDS = adult respiratory distress syndrome.

Discussion

The aim of treatment in patients with spontaneous pneumothorax is to achieve rapid re-expansion of the lung and permanent pleurodesis. We believe that we have obtained good results overall using simple talc pleurodesis by thorascopy with two drains, without resection or electrocoagulation. Our results support our hypothesis that successful treatment of complicated spontaneous pneumothorax requires adequate pleurodesis but that direct treatment of specific lesions such as ruptured bullae is not usually necessary. This makes the management of complicated spontaneous pneumothorax much simpler.

This study showed that patients with complicated spontaneous pneumothorax, and especially those with secondary pneumothorax complicated by respiratory insufficiency, can safely tolerate thoracoscopy with talc pleurodesis under local anaesthesia. This minimally invasive technique can be undertaken quickly (in approximately 15 minutes) by a well trained pulmonologist. The duration of drainage and length of hospital stay are comparable with other recent studies of the treatment of spontaneous pneumothorax either by "medical" talc pleurodesis, or video-assisted thoracoscopic surgery.

We used talc as a sclerosing agent because it is inexpensive and has been shown experimentally to be more effective than tetracycline, laser coagulation, or electrocoagulation and is comparable in efficacy to surgical abrasion. Many clinical studies have confirmed its efficacy in comparison with tetracycline. We used talc pleurodesis rather than slurry because of the higher incidence of side effects with the latter formulation.

At the beginning of the study, and because of the potential reported risks of talc slurry, we instilled tetracycline rather than repeating talc pleurodesis as a secondary procedure in the rare cases with localised persistent pneumothorax or partial re-expansion of the lung and permanent pleurodesis after a previous talc pleurodesis, although we would not recommend thoracoscopic talc pleurodesis in young patients who are potential candidates for lung transplantation. Pain related to talc pleurodesis was controlled by the combination of pethidine and midazolam, reinforced by inhalation of nitrous oxide which was safe, easy to use, and quickly reversible. We are not aware that other investigators have used nitrous oxide for thoracoscopic analgesia in spite of reports of its use without any complications in outpatient patients in the USA, and in the UK in conjunction with pethidine (Entonox) in many patients during labour.

Gillet-Juvin et al recently published results of the treatment of 71 cases of stage IV spontaneous pneumothorax with thoracoscopic talc pleurodesis and found a similar proportion (5%) of patients requiring subsequent surgery. In our study two of 10 patients with stage IV pneumothorax required surgery before leaving hospital and two had a partial relapse at follow up that did not require any specific treatment. This suggests that patients with stage IV pneumothoraces are more at risk of definitive failure or partial relapse. It may therefore be that simple talc pleurodesis is not adequate in these patients. A recent study claimed to obtain...
good results after tetracycline pleurodesis. However, these authors excluded eight cases with persistent air leak from the analysis.

Overall, our findings support the use of thoracoscopic talc pleurodesis under local anaesthesia in the treatment of spontaneous pneumothorax. It provides a safe, cheap, and simple method of treatment for complicated pneumothoraces.