Does mechanical pleurodesis result in better outcomes than chemical pleurodesis for recurrent primary spontaneous pneumothorax?

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Abstract

A best-evidence topic was written according to a structured protocol. The question addressed was whether mechanical pleurodesis results in better outcomes in comparison with chemical pleurodesis in patients undergoing surgery for recurrent primary spontaneous pneumothorax. A total of 542 papers were found using the reported searches, of which 6 represented the best evidence to answer the clinical question. The authors, date, journal, study type, population, main outcome measures and results are tabulated. The studies found compared the outcomes of mechanical and chemical pleurodesis and also focused on the outcomes of the different methods of mechanical pleurodesis: pleural abrasion and pleurectomy. Reported measures were operative mortality, mean operation time, post-operative bleeding, persistent air leaks, chest drain duration, pain levels, pneumonia, respiratory failure, wound infection, pulmonary function, re-exploration for bleeding and air leak, hospital stay, recurrence and re-operation for recurrence. One large cohort study compared the outcomes of mechanical and chemical talc pleurodesis and reported a significant reduction in recurrence with talc pleurodesis in comparison with pleurectomy (1.79% vs. 9.15%, P = 0.00018). Another large cohort study, analysing pleural abrasion, pleurectomy and talc pleurodesis, both in isolation and in combination with apical bullectomy, reported the highest rate of recurrence in bullectomy plus abrasion patients (1.4%) followed by bullectomy plus talc pleurodesis patients (0.4%). No recurrence was seen with other techniques. The reported freedom from surgery at 10-year follow-up was 98.9% with talc pleurodesis, 97.5% with pleurectomy and 96.4% with pleural abrasion, however, with no statistical significance. A prospective randomized study, a retrospective case series review and two smaller cohort studies compared the outcomes of pleural abrasion and pleurectomy as different techniques of mechanical pleurodesis and reported statistically significant shorter operation times, lower rates of post-operative bleeding, re-exploration and pain observed with pleural abrasion and lower rates of recurrence with pleurectomy. Three studies reported the outcomes of apical bullectomy or wedge resection with recurrence rates ranging from 0.4% to 6.2%. We conclude that there is a very similar outcome profile in the comparison of mechanical and chemical pleurodesis, with modest evidence suggesting lower rates of recurrence with chemical talc pleurodesis.

Keywords: Mechanical pleurodesis • Chemical pleurodesis • Pleurectomy • Abraision • Talc • Primary spontaneous pneumothorax

INTRODUCTION

A best-evidence topic was constructed according to a structured protocol. This protocol is fully described in ICVTS [1].

Clinical scenario

A 24-year-old man is admitted under your care via the emergency services with an atrumatic spontaneous right-sided pneumothorax. He has no known underlying lung pathology and is a non-smoker; however, he has suffered a previous right-sided pneumothorax, treated with intercostal chest tube drainage. Currently, his right lung has failed to re-expand after 48 h of suction drainage and you begin to consider the surgical management options.

Three-part question

In [patients undergoing surgery for recurrent primary spontaneous pneumothorax] does [mechanical pleurodesis] rather than [chemical pleurodesis] result in [the best freedom from recurrence]?
Table 1: Best-evidence papers

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Study type (level of evidence)</th>
<th>Patient group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Rena et al. (2008)</td>
<td>Eur Respir, J, Italy [2]</td>
<td>220 VATS procedures performed on 208 consecutive patients for PSP over a 4-year period</td>
<td>Mean age 25 (12-39) 169 male patients 112 patients randomly assigned to pleural abrasion (Group A) 108 patients randomly assigned to apical pleurectomy (Group B) All patients underwent apical lung wedge resection using an endoscopic stapler Mean operation time Post-operative acute bleeding (&gt;200 mL/h for 3 h consecutively) Re-exploration for bleeding Mean chest drain duration Persistent air leak rate Re-exploration for large air leak Post-operative pain levels Mean duration of hospital stay Recurrence Re-operation for recurrence</td>
<td>Group A, 38 min Group B, 55 min (P = 0.0001) Group A, 1 patient (0.9%) Group B, 8 patients (7.4%) (P = 0.036) Group A, 1 patient (0.9%) Group B, 8 patients (7.4%) (P = 0.036) Group A, 2.53 days Group B, 2.92 days (P = 0.065) Group A, 6 patients (5.3%) Group B, 6 patients (5.5%) (P = 0.978) Group A, 1 patient (0.9%) Group B, 1 patient (0.9%) Group A patients reported significantly lower residual chest pain and discomfort than Group B patients on visual analogue scale (P = 0.001) Group A, 3.52 days Group B, 3.89 days (P = 0.08) Group A, 7 patients (6.2%) Group B, 5 patients (4.6%) (P = 0.821) Group A, 5 patients (4.5%); Group B, 4 patients (3.7%) Recurrences re-submitted to VATS and pleural abrasion</td>
<td>VATS mechanical pleural abrasion is safer than apical pleurectomy for the treatment of PSP; however, there are no differences in recurrence rates between the two procedures</td>
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<tr>
<td>Shalhrezai et al. (2011)</td>
<td>Eur J Cardiothorac Surg, UK [3]</td>
<td>550 VATS procedures performed on 480 patients for PSP over a 17-year period</td>
<td>Mean age, 28.4; 318 male patients; 70 bilateral VATS procedures Isolated bullectomy, 3 Isolated pleurodesis, 58 Isolated pleural abrasion, 2 Isolated pleurectomy, 2 Bullectomy + abrasion, 225 Bullectomy + pleurodesis, 189 Bullectomy + pleurectomy, 41 Conversion to thoracotomy, 4 Talc or kaolin used for pleurodesis Apical pleurectomy performed to the level of the 5th/6th IC space Bullectomy performed by wedge resection using an endoscopic stapler Major post-operative complications (mortality, re-exploration, pneumonia, respiratory failure, air leak requiring drain re-insertion, pulmonary emboli) Minor post-operative complications (atrial fibrillation, pain, wound infection, air leak resolving within 5 days) Recurrence Major post-operative complications (mortality, re-exploration, pneumonia, respiratory failure, air leak requiring drain re-insertion, pulmonary emboli) Minor post-operative complications (atrial fibrillation, 3 (0.5%) Pain, 40 (7.3%) Wound infection, 10 (1.8%) Air leak resolving within 5 days, 8 (1.5%) Recurrence Isolated bullectomy, 0 Isolated pleurodesis, 0 Isolated pleural abrasion, 0 Isolated pleurectomy, 0 Bullectomy + abrasion, 8 (1.4%) Bullectomy + pleurodesis, 2 (0.4%) Bullectomy + pleurectomy, 0 Freedom from further surgery: 98.1% at 5 years; 97.8% at 10 years Freedom from further surgery at 10 years: Abrasion, 96.4% Pleurodesis, 98.9% Pleurectomy, 97.5% (P = 0.22)</td>
<td>When combined with bullectomy, the results of pleural abrasion and chemical pleurodesis do not significantly differ from pleurectomy Pleural abrasion is recommended in young patients reserving chemical pleurodesis for the elderly Pleurectomy may not be necessary</td>
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<td>Chang et al. (2006)</td>
<td>Surg Endosc, Taiwan [4]</td>
<td>65 consecutive patients undergoing VATS procedures for PSP over a 3-year period</td>
<td>Mean age 25.5 (16-52) 60 male patients 24 smokers 30 patients treated with apical pleurectomy 35 patients treated with pleural abrasion Operative mortality Mean operation time Post-operative analgesia use (meperidine hydrochloride) Post-operative chest tube duration Post-operative hospital stay Post-operative air leaks (&gt;5 days)</td>
<td>Zero</td>
<td>Mechanical pleurodesis by means of VATS provides a feasible and safe procedure for treating PSP Apical pleurectomy is more effective in preventing ipsilateral recurrence than pleural abrasion</td>
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<td>Leo et al. (2005), Eur J Cardiothorac Surg, France [5]</td>
<td>10 consecutive patients undergoing VATS procedures for PSP over a 1-year period</td>
<td>Post-operative wound infection, Recurrence</td>
<td>Pleurectomy group, 0; Abrasion group, 1 patient ($P = 1.00$)</td>
<td>An ideal pleurodesis is more likely after pleurectomy rather than pleural abrasion. Areas of persistent pleural sliding on ultrasonographical analysis are probably at risk of recurrence.</td>
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<td>Mean age 36.89 male patients 5 patients submitted to VATS complete pleurectomy 5 patients submitted to VATS pleural abrasion Apical blebs or bullae resected by the use of endoscopic staplers Complete pleurectomy consisted of parietal pleural stripping from the 1st rib to the diaphragm</td>
<td>Post-operative lung function FVC FEV1</td>
<td>Pleurectomy group, 86.3%; Abrasion group—88.5% ($P = 0.574$) Pleurectomy group, 94.9%; Abrasion group, 99.0% ($P = 0.378$)</td>
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RESULTS

Rena et al. [2] conducted a prospective randomized study of 208 consecutive patients undergoing 220 video-assisted thoracoscopic surgery (VATS) procedures for primary spontaneous pneumothorax (PSP). All patients underwent apical lung wedge resection and were randomized to undergo either mechanical pleural abrasion (n = 112) or apical pleurectomy (n = 108). The mean operation time was significantly reduced in the abrasion group in comparison with that of the pleurectomy group (38 and 55 min, respectively, P = 0.0001). Significant post-operative bleeding (>200 ml/h for 3 h consecutively) was observed in 0.9% of the abrasion group vs. 7.4% of the pleurectomy group (P = 0.036), with all patients undergoing re-exploration. Pleural abrasion patients reported significantly lower chest pain levels than patients undergoing pleurectomy (P = 0.001). The observed rate of recurrence was 6.2% in the abrasion group and 4.6% in the pleurectomy group (P = 0.821), with 4.5 and 3.7% of patients requiring re-operation for recurrence in the respective groups. There were no significant differences observed in mean chest drain duration, persistent air leak rate, re-exploration for large air leak and mean hospital stay.

Shaikhrezai et al. [3] conducted a retrospective case series review of 480 patients undergoing 550 VATS procedures for PSP via a combination of different techniques including isolated bullectomy (n = 3), isolated chemical pleurodesis (n = 58), isolated abrasion (n = 2), isolated pleurectomy (n = 2), bullectomy+abrasion (n = 255), bullectomy+chemical pleurodesis (n = 189) and bullectomy+pleurectomy (n = 41). Across all groups they observed the following post-operative complications: mortality—0%, re-exploration for bleeding—0.4%, re-exploration for large air leak—0.2%, pneumonia—1.1%, respiratory failure—0.7%, air leak requiring drain re-insertion—2.2%, atrial fibrillation—0.5%, pain—7.3%, wound infection—1.8% and air leak resolving within 5 days—1.5%. Recurrence was observed in 1.4% of the bullectomy+abrasion group and 0.4% of the bullectomy+chemical pleurodesis group. Other groups were free from recurrence. Freedom from further surgery at 10 years was observed in 96.4% of the abrasion groups, 98.9% of the chemical pleurodesis groups and 97.5% of the pleurectomy groups (P = 0.22).

Chang et al. [4] conducted a retrospective case series review of 65 consecutive patients undergoing VATS apical pleurectomy (n = 30) and VATS pleural abrasion (n = 35) for treatment of PSP. They reported no operative mortality. The mean operation time was significantly reduced in the abrasion group in comparison with that in the pleurectomy group (78 and 103 min, respectively, P = 0.001); however, there were no significant differences observed in the rates of post-operative analgesia use, chest tube duration, air leak lasting >5 days, wound infection, pulmonary function and length of hospital stay. Recurrence was observed in 8.6% in the abrasion group while no recurrence was reported in the pleurectomy group (P = 0.243).

Leo et al. [5] conducted a cohort study of 10 consecutive patients undergoing VATS complete pleurectomy (n = 5) and VATS pleural abrasion (n = 5) for treatment of PSP, analysing the ultrasonographical absence of pleural sliding as a marker of successful pleurodesis. Nine pre-defined positions on the thorax were subjected to ultrasonography. ‘Excellent’ pleurodesis was achieved in all five pleurectomy patients and only one abrasion patient. Pleurodesis in the remaining four abrasion patients was defined as ‘effective’. Recurrence was observed in one abrasion patient, at the level of a persistent pleural sliding zone.

Cardillo et al. [6] conducted a cohort study of 432 consecutive patients undergoing VATS subtotal parietal pleurectomy (n = 153) and talc chemical pleurodesis (n = 279) for treatment of PSP. They reported no operative mortality. The following post-operative complications were observed: subcutaneous emphysema—0.9%, localized pleural effusion—1.2%, prolonged air leak of >5 days—1.4%, minimal pleural detachment—0.2%, apical haematoma—0.2% and transient Bernard–Horner syndrome—0.2%. Recurrence was observed in 9.15% of the pleurectomy cohort and 1.79% of the talc chemical pleurodesis cohort (P = 0.00018).

Ayed et al. [7] conducted a cohort study of 72 consecutive patients undergoing VATS pleural abrasion (n = 39) and VATS apical pleurectomy (n = 33) for the treatment of PSP. They reported no operative mortality and a significant reduction in mean operation time in the abrasion cohort (50.7 vs. 61.8 min, P = 0.0001); however, there were no differences observed in post-operative pleural drainage, analgesia use, chest tube duration, prolonged air leak and hospital stay. Recurrence was observed in four patients in the abrasion cohort and none in the pleurectomy cohort (P = 0.05).

Clinical bottom line

The evidence presented reveals a very similar outcome profile in the comparison of mechanical and chemical pleurodesis. The two largest best-evidence studies directly comparing these techniques reveal a lower rate of recurrence in patients undergoing talc chemical pleurodesis than in those subjected to mechanical pleurodesis (parietal pleurectomy or pleural abrasion) for the treatment of PSP, with statistical significance in one study. However, the larger and most recent of these studies reports no statistical significance between the techniques in freedom from surgery after 10-year follow-up. This observed benefit from talc chemical pleurodesis is strengthened by reports of the safety of its application in young patients [8]. A sub-group analysis of the different techniques of mechanical pleurodesis reveals statistically significant shorter operation times, lower rates of post-operative bleeding, re-exploration and pain observed with pleural abrasion and lower rates of recurrence with pleurectomy.

Conflict of interest: none declared.

REFERENCES


