Best evidence topic - Thoracic general

Does video-assisted thoracoscopic pleurectomy result in better outcomes than open pleurectomy for primary spontaneous pneumothorax?

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Summary

The question addressed by a best evidence topic approach using a structured protocol was whether pleurectomy using video-assisted thoracoscopic surgery (VATs) resulted in better outcomes than open pleurectomy for primary spontaneous pneumothorax. Altogether 45 relevant papers were identified of which nine papers represented the best evidence to answer the question. The author, journal, date and country of publication, patient group studied, study type, relevant outcomes, results and study weaknesses were tabulated. We conclude that VATs pleurectomy has been shown to be comparable to open pleurectomy in the treatment of spontaneous pneumothorax, with a meta-analysis and several RCTs showing reductions in length of hospital stay and analgesic requirements. Postoperative pulmonary dysfunction has also been shown to be reduced after VATs pleurectomy in two RCTs, although a third study found no significant difference. A concern may be a four-fold increase in the recurrence of pneumothorax following VATs pleurectomy as compared to open pleurectomy reported in a recent meta-analysis of four randomised and 25 non-randomised studies performed in 2007 and published in the Lancet, although a second meta-analysis of only the randomised trials did not show this difference.

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Keywords: VATs; Thoracic surgery; Pneumothorax; Evidence based medicine

1. Introduction

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

2. Clinical scenario

A 22-year-old male is referred to the thoracic surgical outpatient clinic by the respiratory physicians for consideration for pleurectomy. He has a history of recurrent right-sided primary spontaneous pneumothorax. This has happened twice in the last three months and required intercostal chest drain insertion on both occasions. The patient has searched the ‘internet’ on this subject where he found that surgery can be performed by ‘key-hole’ or by a ‘bigger cut’. The idea of ‘key-hole surgery’ is very appealing to him but he is not sure whether this is the best option for long-term cure of his problem. You want to advise him on the basis of current best evidence and therefore resort to check the literature.

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3. Three-part question

In [patients with primary spontaneous pneumothorax] is [VATS pleurectomy] better than [open pleurectomy] in [improving outcome post operatively]?

4. Search strategy


5. Search outcome

A total of 45 relevant papers were found. Nine of these were selected as representing the best evidence on this topic (Table 1).

6. Comments

Barker et al. [2] performed a meta-analysis of four randomised and 25 non-randomised studies to compare recurrence rates between VATS and open procedures for the treatment of recurrent pneumothorax. They found a four-fold increase in recurrence of pneumothoraces when a
## Table 1
### Best evidence papers

<table>
<thead>
<tr>
<th>Author</th>
<th>Patient group</th>
<th>Outcome</th>
<th>Key results</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Barker et al., (2007), Lancet, UK [2]</td>
<td>29 studies (four randomised and 25 non-randomised) on pneumothorax surgery were identified and recurrence rates in patients undergoing VATS were compared with those undergoing open surgery</td>
<td>Recurrence of pneumothorax</td>
<td>Relative risk of recurrences in VATS compared to open surgery was 4.731 (2.699–8.291; ( P&lt;0.0001 )) overall</td>
<td>RR of recurrence was similar between randomised and non-randomised studies</td>
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<td>Meta-analysis (level 1a)</td>
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<td>Sedrakyan et al., (2004), Br Med J, UK [4]</td>
<td>12 trials were identified that randomised 670 patients undergoing VATS or thoracotomy for treatment of pneumothorax and lung resections</td>
<td>Length of hospital stay</td>
<td>VATS associated with shorter length of stay (1.0–4.2 days)</td>
<td>Authors conclude that VATS is associated with better outcomes</td>
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<tr>
<td>Meta-analysis (level 1a)</td>
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<tr>
<td>Waller et al., (1994), Ann Thorac Surg, UK [5]</td>
<td>Two groups (( n=30 )) of 60 patients suffering from complicated spontaneous pneumothorax</td>
<td>Operating time</td>
<td>Significantly longer in group V than group T (45 vs. 37.5 min ( P&lt;0.05 ))</td>
<td>Within the study group, 30 consecutive patients presented with primary spontaneous pneumothorax. Within this subgroup there was no significant difference in operating time between VATS and thoracotomy but post-operative pain, hospital stay and pulmonary dysfunction were all less for those undergoing VATS</td>
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<td>PRCT (level 2b)</td>
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<td>Freixinet et al., (2004), Ann Thorac Surg, Spain [6]</td>
<td>Two groups of 90 patients with primary spontaneous pneumothorax</td>
<td>Postoperative blood loss</td>
<td>No significant difference between the two groups</td>
<td>The authors conclude that VATS and axillary thoracotomy offer similar results in the surgical treatment of primary spontaneous pneumothorax</td>
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<td>PRCT (level 2b)</td>
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<td>Sekine et al., (1999), Eur J Cardiothorac Surg, Japan [7]</td>
<td>38 patients with spontaneous pneumothorax randomised into two groups</td>
<td>Gas exchange</td>
<td>Alveolar-arterial oxygen tension gradient in VATS patients significantly less than patients with axillary thoracotomy from the 6th hour to the 4th day postoperatively ($P &lt; 0.01$)</td>
<td>This study showed that bullectomy via VATS less deleterious to pulmonary gas exchange. Axillary thoracotomy caused worsening of gas exchange postoperatively due to incisional pain, chest wall deformity and peripheral atelectasis.</td>
</tr>
<tr>
<td>Sawada et al., (2005), Chest, Japan [8]</td>
<td>281 patients with primary spontaneous pneumothorax</td>
<td>Recurrence of pneumothorax</td>
<td>First episode recurrence in 54.7% of conservative treatment patients, 7.7% for open thoracotomy and 10.3% for VATS. Recurrence rates after the second episode 60.3% for conservative treatment, 0% for open thoracotomy and 18.6% for VATS.</td>
<td>There was no statistical significance for recurrence of pneumothorax between the open thoracotomy and VATS groups ($P = 0.15$). Authors conclude that in terms of low morbidity, low invasiveness and cosmetic issues, VATS is superior to open thoracotomy.</td>
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<tr>
<td>Horio et al., (1998), Surg Endosc, Japan [9]</td>
<td>Two groups of 95 patients with spontaneous pneumothorax undergoing resection of pulmonary bullae</td>
<td>Operating duration</td>
<td>Significantly shorter in VATS than LAT cases</td>
<td>Authors note that although not statistically significant the higher recurrence rate in VATS cases could be as a result of overlooking bullae at operation; they recommend additional pleurodesis in VATS for spontaneous pneumothorax to prevent recurrence.</td>
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similar pleurodesis procedure is done with a VATS approach compared to an open approach, with randomised and non-randomised trials showing similar recurrence rates. They showed that the high relative risk of recurrence for VATS remained robust to a random effects model [4.051 (1.996–7.465); \( P < 0.0001 \)], by including all comparative studies [3.991 (2.584–6.164); \( P < 0.0001 \)], with only high-quality studies used [4.016 (1.846–8.736); \( P < 0.0001 \)], and on a simulation biased in favour of VATS when there were no events in either group [3.559 (2.165–5.852); \( P < 0.0001 \)]. They argued that by including non-randomised studies they found consistency between the randomised and non-randomised populations, and concluded that the difference in event rates is real [3]. A weakness is that 15 of the 29 studies included in this analysis were reported prior to 1997. In the last ten years VATS has been increasingly used for the treatment of pneumothorax and earlier outcomes may not reflect present results [3].

Sedrakayan et al. [4] performed a meta-analysis of randomised controlled trials only, comparing clinical outcomes in VATS against thoracotomy for pneumothorax surgery, minor lung resections and lobectomy. In the treatment of pneumothorax, they concluded that VATS procedures are associated with shorter length of hospital stay and less use of analgesics than thoracotomy, with a complication rate similar to that for thoracotomy.

In a prospective randomised controlled trial (PRCT), Waller et al. [5] studied two groups of 30 patients undergoing surgery for pneumothorax by VATS and open pleurectomy. They reported that the operating time was significantly longer for the VATS group but that the postoperative analgesic requirement, hospital stay and lung dysfunction (as measured by reductions in FEV\(_1\)/FVC) were reduced for this group compared to the thoracotomy group. All treatment failures (three patients in the VATS group and one in the thoracotomy group) were in the subgroup having treatment for secondary spontaneous pneumothorax, leading the authors to conclude that VATS pleurectomy is superior to open pleurectomy in the treatment of primary spontaneous pneumothorax. A PRCT investigating complication rates for patients undergoing VATS or transaxillary thoracotomy for primary spontaneous pneumothorax was carried out by Freixinet et al. [6]. There was no significant difference between the two groups in terms of peri-oper-
ative blood loss, respiratory function, postoperative pain, analgesic requirements, postoperative complications, hospital stay or resumption of normal activity. In another PRCT, Sekine et al. [7] investigated the influence of VATS and transaxillary pleurectomy on postoperative pulmonary gas exchange and concluded that bullectomy via VATS was less deleterious to gas exchange than axillary thoracotomy. They attributed this to reductions in chest wall pain, chest wall deformity and peripheral atelectasis.

Sawada et al. [8] investigated recurrence rates and length of hospital stay in a retrospective non-randomised study for patients with primary spontaneous pneumothorax comparing conservative treatment to VATS or thoracotomy procedures. They found no statistically significant difference between VATS or thoracotomy procedures in terms of recurrence rates, with both being superior to conservative treatment and concluded that VATS procedures were superior in terms of low morbidity, invasiveness and cosmetic issues. Horio et al. [9] compared surgical results for VATS procedures and limited axillary thoracotomy in a retrospective study of patients with spontaneous pneumothorax. They report that duration of surgery, postoperative chest tube drainage and hospital stay were significantly shorter with VATS procedures than with open procedures. Recurrent pneumothoraces were more frequent with VATS procedures, which they felt were due to the lower numbers of resected bullae during VATS procedures. In a similar study, Jiménez-Merchán et al. [10] compared complication rates for VATS and thoracotomy procedures for spontaneous pneumothorax. They found higher rates of complications with VATS procedures, but attributed this to lack of surgical experience with their early cases, as the most recent 60 VATS procedures had much lower complication rates. They conclude that VATS procedures resulted in less pain, better recovery and shorter hospital stay. Crisci and Coloni [11] studied 60 patients having VATS or thoracotomy procedures for pneumothorax and reported shorter hospital stay, shorter duration of chest drainage, fewer prolonged air leaks and lower total economic cost with VATS procedures. However, there were two recurrent pneumothoraces following VATS procedures compared to none with the thoracotomy procedures.

7. Clinical bottom line

We conclude that VATS pleurectomy has been shown to be comparable to open pleurectomy in the treatment of spontaneous pneumothorax, with a meta-analysis and several RCTs showing reductions in length of hospital stay and analgesic requirements. Postoperative pulmonary dysfunction has also been shown to be reduced after VATS pleurectomy in two RCTs, although a third study found no significant difference. A concern may be a four-fold increase in the recurrence of pneumothorax following VATS pleurectomy as compared to open pleurectomy reported in a recent meta-analysis of four randomised and 25 non-randomised studies performed in 2007 and published in the Lancet although a second meta-analysis of only the randomised trials did not show this difference.

References