Best evidence topic - Transplantation

Does thoracic epidural analgesia improve outcome after lung transplantation?

Julien Pottecher, Pierre-Emmanuel Falcoz, Gilbert Massard, Jean-Pierre Dupeyron

1. Introduction

A best evidence topic was constructed according to a structured protocol. The question addressed was whether the use of preoperative or early postoperative thoracic epidural analgesia (TEA) is effective in improving outcomes – reducing duration of mechanical ventilation, intensive care unit (ICU) length of stay and respiratory complications – in patients undergoing lung transplantation (LTx). Of the 42 papers found using a report search, five presented the best evidence to answer the clinical question. The authors, journal, date and country of publication, study type, group studied, relevant outcomes and results of these papers are given. We conclude that, on the whole, four out of the five retrieved studies clearly supported the use of TEA as the cornerstone of a multi-faceted strategy for improving outcomes after LTx. Indeed, the interest and benefit was shown not only in terms of duration of mechanical ventilation, but also in reducing the ICU length of stay and the number of respiratory complications. Hence, current evidence suggests TEA to be safe and effective in alleviating postoperative pain and in improving patient recovery, thus enhancing the choice of available medical care and bettering outcome after LTx. However, given the low level of evidence of published studies, prospective trials are warranted to confirm those encouraging results. © 2011 Published by European Association for Cardio-Thoracic Surgery. All rights reserved.

Keywords: Thoracic surgery; Lung transplantation; Intensive care unit; Epidural analgesia; Postoperative period; Mechanical ventilation

2. Three-part question

In patients undergoing lung transplantation is epidural analgesia effective in reducing duration of mechanical ventilation, ICU length of stay and preventing respiratory complications]

3. Clinical scenario

A 61-year-old man underwent double lung transplantation (LTx) for lung fibrosis through a bilateral thoraco-sternotomy. The patient was transferred under mechanical ventilation in the intensive care unit (ICU). On postoperative day (POD) 1, the patient was painless (under patient-controlled intravenous morphine analgesia), ventilated in pressure support mode with excellent arterial blood gas. Extubation was well tolerated in the first hours, after which dyspnea and large thoraco-abdominal swings were encountered. The patient had to be re-intubated due to extreme exhaustion. On POD6, the patient was deemed fit for extubation; sedation was discontinued. However, under continuous intravenous analgesia, the patient described a left-sided parietal pain and shortness of breath. Uneven respiratory movements with large thoraco-abdominal swings re-appeared. A thoracic epidural analgesia (TEA) was performed (sitting position). It immediately brought pain to an end. Extubation was then well tolerated in a patient with large, even respiratory movements. TEA was discontinued on POD9 without residual pain. We wonder whether preoperative or early postoperative TEA would have allowed successful extubation at the first attempt. We therefore decide to look up the evidence in the literature.

4. Search strategy

Table 1. Overview of the studies

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments/weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard et al. (2004), Ann Thorac Surg, Canada, [2]</td>
<td>Study group: 83 lung transplant patients over a four-year period</td>
<td>Quality of postoperative analgesia</td>
<td>Lung transplant recipients have a lower incidence of adequate pain relief ($P&lt;0.05$) and a higher failure rate of transition from epidural to oral analgesia ($P&lt;0.01$)</td>
<td>Inter-individual variability in the management of pain score; small number of patients</td>
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<tr>
<td>Westerlind et al. (1999), J Cardiothorac Vasc Anesth, Sweden, [3]</td>
<td>Assessment of the use of CPAP and TEA after lung transplantation</td>
<td>LOMV</td>
<td>Median: 4.3 h (1.0–312.0)</td>
<td>Lack of data from a control group not receiving TEA or CPAP</td>
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<tr>
<td>Rocca et al. (2003), J Cardiothorac Vasc Anesth, Italy, [4]</td>
<td>Use of short acting anesthetic drugs, TEA, pre-defined extubation criteria and NIV</td>
<td>Physiological and intraoperative parameters</td>
<td>In early extubated patients ($n=12$): less transfusion, higher PaO$_2$/FiO$_2$, lower PAP, lower EVLW, less norepinephrine, five patients required NIV without subsequent re-intubation</td>
<td>Small sample size and no randomization group</td>
</tr>
<tr>
<td>Hansen et al. (2003), J Cardiothorac Vasc Anesth, Denmark, [5]</td>
<td>New anesthetic approach including TEA, active warming and short-acting anesthetic drugs</td>
<td>Extubation</td>
<td>53 patients (50%) exubated in the OR</td>
<td>Need more studies for definitive conclusions</td>
</tr>
<tr>
<td>Augoustides et al. (2008), Interact CardioVasc Thorac Surg, USA, [6]</td>
<td>Adults with COPD who underwent SLTx ($n=57$) over a five-year period</td>
<td>Perioperative outcomes</td>
<td>No significant differences between groups in length of ICU and hospital stay, prolonged LOMV, primary graft dysfunction, pneumonia and renal dysfunction</td>
<td>Selection bias since the timing of tracheal extubation was at the discretion of the physicians</td>
</tr>
</tbody>
</table>

BLT, bilateral lung transplantation; CPAP, continuous positive airway pressure; EVLW, extra vascular lung water index; HLT, heart-lung transplantation; ICU, intensive care unit; LOMV, length of mechanical ventilation; NIV, non-invasive ventilation; OR, operating room; COPD, chronic obstructive pulmonary disease; PAP, pulmonary artery pressure; SLT, single lung transplantation; TEA, thoracic epidural analgesia.
5. Search outcome

A total of 42 abstracts were found, from which five papers were selected for providing the best evidence on the topic. These papers are documented in Table 1.

6. Results

Richard et al. [2] have retrospectively analyzed the quality of postoperative pain control and transition from epidural to oral analgesia in 83 lung transplant recipients. Compared to 30 randomly selected patients that received TEA for other thoracic procedures, lung transplant recipients had a lower incidence of adequate pain relief (73% vs. 87%; \( P < 0.05 \)) and a higher incidence of transition from epidural from oral analgesia failure (47% vs. 20%; \( P < 0.01 \)). They concluded that the difference could be attributed to a longer duration of rib retraction during lung transplant surgery, to the clamshell incision in bilateral LTx and also to the lower use of co-analgesics.

Westerveldt et al. [3] performed a retrospective analysis of their lung transplant recipients. Over a six-year period, an epidural catheter was inserted in all patients (either preoperatively or postoperatively). Extubation was performed when predefined criteria were met and continuous positive airway pressure (CPAP) was administered for 1 h, four to six times daily after extubation. The median length of ventilation was 4.3 h and the median ICU length of stay was four days. Ten patients (10%) were re-intubated. They concluded that the use of CPAP and TEA is associated with an early and safe extubation after LTx.

Rocca et al. [4] prospectively assessed the feasibility of an early extubation protocol after LTx in 43 patients. TEA was the cornerstone of a multi-faceted approach associating short-acting anesthetic drugs, powerful analgesia, pre-defined extubation criteria and postoperative non-invasive ventilation (NIV). Despite similar operating, graft ischemia and anesthesia times, early-extubated patients \((n = 12)\) had lower extravascular lung water, lower mean pulmonary arterial pressure, lower norepinephrine infusion rate and higher PaO\(_2\)/FiO\(_2\) ratio than non-early extubated patients \((n = 31)\) \((P < 0.05)\). Among the 12 early-extubated recipients, five required NIV with subsequent improvement in dyspnea scores and oxygenation. They concluded that the multi-faceted approach makes early extubation after LTx possible and effective.

Hansen et al. [5] conducted a retrospective survey of 106 patients receiving single LTx (SLTx) for whom a new anesthetic protocol was implemented including TEA, active warming and short-acting anesthetic drugs. Fifty-three patients (50%) were extubated in the operating room (OR) and most of them had received TEA and propofol-remifentanil anesthesia regimen. None of the eight patients without TEA were extubated in the OR. Eleven patients extubated in the OR had to be reintubated within 24 h postoperatively and experienced a non-significant increase ICU length of stay and no significant difference in FEV\(_1\) at six months. This study demonstrates the feasibility of early extubation (in the OR) after SLTx.

Augoustides et al. [6] reported their five-year experience with early tracheal extubation in SLTx for chronic obstructive pulmonary disease (COPD) \((n = 57)\). They retrospectively assessed factors associated with early (in the OR) compared to delayed tracheal extubation (in the ICU) and compared the outcomes. The timing of extubation was left to the discretion of the attending physician. Compared to delayed extubation \((n = 36)\), early-extubated patients \((n = 21)\) received less anesthetic drugs and had a higher exposure to TEA. Although early-extubated patients had a trend to higher incidence of repeated tracheal intubation within 72 h \((P = 0.09)\), perioperative outcomes were safe and equivalent to those experiencing delayed extubation.

7. Clinical bottom line

On the whole, four of the five studies presented were clearly in favor of the use of TEA in a multi-faceted strategy for improving outcomes after LTx. Indeed, the interest and benefit was shown not only in terms of duration of mechanical ventilation, but also in reducing the ICU length of stay and the number of respiratory complications. However, it has been shown in the literature that the risk of epidural haematoma was rare even when cardiopulmonary bypass was used [7]. Hence, current evidence shows TEA to be safe and effective in alleviating postoperative pain and in improving patient recovery, thus increasing the choice of available medical care and enhancing the outcome after LTx. However, retrieved studies were retrospective analysis of single-center series with small sample sizes and provided low level of evidence. Large prospective controlled trials are thus warranted to confirm those encouraging results.

Acknowledgements

The authors thank Marc Fischler for his invaluable comments, Jean-Gustave Hentz for his technical assistance and the Strasbourg Lung Transplant Group.

References