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Best evidence topic - Thoracic non-oncologic

Is prophylactic minitracheostomy beneficial in high-risk patients undergoing thoracotomy and lung resection?

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Summary

A best evidence topic in thoracic surgery was written according to a structured protocol. The question addressed was whether prophylactic minitracheostomy (PM) is beneficial in high-risk patients undergoing thoracotomy and lung resection. Altogether, 115 papers were found using the reported search, of which four represented the best evidence to answer the question. Three randomised controlled trials (RCT) compared a total of 161 patients who underwent thoracotomy and received either PM or standard postoperative treatment alone. Another non-RCT of 144 patients observed the reduction of toilet bronchoscopy with the increased use of PM. These are summarised in the Table. The studies assessed the benefit of PM inserted immediately after lung resection surgery in patients perceived as at high-risk of developing pulmonary complications. High-risk defined patients as those who smoked, have poor lung function, ischaemic heart disease, chronic obstructive pulmonary disease, absence/failure of regional analgesia, and/or cerebrovascular accident. In the largest randomised study (102 patients), Bonde et al. [Bonde P, Papachristos I, McCraith A, Kelly B, Wilson C, McGuigan JA, McManus K. Sputum retention after lung operation: prospective randomized trial shows superiority of prophylactic minitracheostomy in high-risk patients. Ann Thorac Surg 2002;74:196–202] concluded that the PM group had a significant reduction in sputum retention and postoperative atelectasis. The authors also reported a reduction in the incidence of pneumonia and toilet bronchoscopy but this did not achieve statistical significance. Issa et al. [Issa MM, Healy DM, Maghur HA, Luke DA. Prophylactic minitracheostomy in lung resection. A randomized controlled study. J Thorac Cardiovasc Surg 1991;101:895–900] were able to demonstrate a significant reduction in the rate of pneumonia in the PM group and Randell et al. [Randell TT, Tierala E, Lepantalo MJ, Lindgren L. Prophylactic minitracheostomy: a prospective, random control, clinical trial. Eur J Surg 1991;157:501–504] showed a significant reduction in postoperative atelectasis and toilet bronchoscopy in their PM group. Au et al. [Au J, Walker WS, Inglis D, Cameron EW. Percutaneous cricothyroidostomy (minitracheostomy) for bronchial toilet: results of therapeutic and prophylactic use. Ann Thorac Surg 1989;48:850–852] observed a reduction in toilet bronchoscopy from 9% to 4% in a four-year period; however, the authors could not directly relate this to the use of PM but believed it was likely. None of the studies demonstrated a statistical difference in mortality or intensive care unit or hospital length of stay. All the studies reported some complications associated with minitracheostomy (MT) insertion, the incidence of which ranged from 5.6% to 57%. One percent of 227 patients who received MT in the studies experienced a life-threatening complication, the rest were minor and easily controlled. None of the complications resulted in death.

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Keywords: Prophylactic minitracheostomy; Lung resection; Pulmonary resection

1. Introduction

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

2. Three-part question

In [high-risk patients undergoing thoracotomy and lung resection] is [prophylactic minitracheostomy] of benefit in reducing [rate of pulmonary complications, therapeutic bronchoscopy, length of stay, ITU admission and mortality]?

3. Clinical scenario

A 70-year-old patient with a history of chronic obstructive pulmonary disease (COPD) and current smoking requires lung resection for T1 N0 M0 lung cancer. He is considered borderline for resection with pulmonary function forced expiratory volume in one second (FEV1) of <40% predicted and excessive bronchial secretions. Minitracheostomy (MT) is a strategy designed to aid postoperative sputum clearance in those with secretion retention. We decided to investigate the literature and evaluate whether or not this strategy improves outcomes in lung resection patients.

4. Search strategy

MEDLINE was searched from 1950 to August 2010, and EMBASE was searched from 1980 to August 2010 using the OVID interface.

The search terms were: [minitracheostomy.mp OR minitrach.mp OR mini-trach.mp OR cricothyroidostomy.mp].

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Table 1. Relevant papers

<table>
<thead>
<tr>
<th>Author, date and country 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>Bonde et al., (2002), Ann Thorac Surg, UK, [2] PRCT (level 1b)</td>
<td>One hundred and two elective thoracotomy and lung resection patients. Comparison of PM n=50 vs. standard therapy n=52</td>
<td>Sputum retention</td>
<td>PM n=1 (2%) Control n=15 (28.8%)</td>
<td>Inclusion criteria: – Smoking within six weeks of operation – FEV1 ≤ 50% of predicted (&lt;70% for pneumonectomy) – IHD (current angina or previous MI) – CVA, TIA, or complete stroke – Absence of regional anaesthesia postoperatively – COPD (productive cough most days for three months in ≥ two years) – Sleeve pulmonary resection – Phrenic or recurrent nerve resection High rate of chest infection SR outcome subjective</td>
</tr>
<tr>
<td>Issa et al., (1991), J Thorac Cardiovasc Surg, Ireland, [3] PRCT (level 1b)</td>
<td>Thirty elective thoracotomy and lung resection patients. Comparison of prophylactic minitracheostomy n=15 vs. standard therapy n=15</td>
<td>Pneumonia; pyrexia &gt;38.5 °C, CXR infiltrate, and sputum with large numbers of granulocytes and single bacterial species on gram stain</td>
<td>PM n=2 (13%) Control n=9 (60%)</td>
<td>The study included high-risk patients: – 76% were smokers – 56% had abnormal pulmonary function tests and – 86% had lung cancer with some degree of obstruction and potentially infected distal lung segment Mean ITU LOS PM=three days Control=4.1 days No significant difference Mean number of physiotherapy sessions (mean time) PM=7 (92 min) Control=8 (112 min) No significant difference Complications of insertion n=12 out of 19 MT inserted (63%) 4: discomfort in the neck 2: surgical emphysema 1: stridor 1: infection at insertion site (control group) Total MT inserted PM: 15 Treatment MT: four In hospital mortality Non-reported</td>
</tr>
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</table>
The Cochrane Library was also searched using the same terms.

5. Search outcome

One hundred and fifteen papers were found using the reported search. Four papers were selected as giving the best evidence on the topic; these are presented in the table.

6. Results

Bonde et al. (2002) [2] conducted a randomised controlled trial (RCT) which included 102 patients undergoing elective thoracotomy and lung resection. They were randomised to receive either prophylactic minitracheostomy (PM) and standard respiratory therapy or standard respiratory therapy alone. Inclusion criteria reflected patients of higher perceived risk (Table 1). PM was associated with a reduction in sputum retention (SR) compared to the control group; however, there was no significant difference in the rate of pneumonia. Although the PM group had a higher rate of respiratory failure, the authors note that none of these cases were related to SR. Toilet bronchoscopy and severe atelectasis (lobar consolidation or lobar collapse with consolidation) were more frequent in the control group. There were three in-hospital deaths in each group; none of which were caused by SR in the PM group but SR was the main cause of all deaths in the control group. Five patients suffered minor complications of MT insertion of which all resolved (Table 1).

Issa et al. (1991) [3] conducted a RCT on 30 elective thoracotomy and lung resection patients who were considered to be at high risk of developing complications. The PM group received hourly suction during the first six post-operative hours and then on an ‘as required’ basis. A higher number of patients in the control group developed pneumonia. A total of 19 MT were inserted (15 as PM, and four as a treatment measure in the control group), 10 patients suffered minor complications related to insertion which resolved without sequelae, and one patient from the treatment group developed as infection at the site of insertion and required antibiotics. No mortality from either of the groups was demonstrated.

Randell et al. (1991) [4] investigated the efficacy of PM in reducing the incidence of atelectasis after thoracotomy. The participants in this study were all male, the authors do not explain nor justify the choice for all male participants and as a consequence of this the results may not be applied to the whole population. A larger number of control patients than might be expected (66%) required toilet bronchoscopy and the authors did not detail any standardised criteria for deciding when to undertake this intervention. The rate of atelectasis was significantly higher in the control group, whereas length of stay (LOS) was similar in both groups. There were three complications associated with MT insertion; one caused by venous bleeding which required ligature, and in two the procedure was prolonged due to anatomical reasons. There was no in-hospital mortality.
In an observational study, Au et al. (1989) [5] assessed the value of using a 20-F paediatric silver tracheostomy tube (instead of the Portex ‘Mini-Trach’ system) in reducing the number of toilet bronchoscopy procedures performed over a four-year period. One hundred and forty-four patients (62 receiving PM and 81 MT for established SR) underwent various thoracic and oesophageal surgery were studied. There was a significant reduction in the rate of toilet bronchoscopy during the four-year period. This reduction could not be directly linked to the use of PM, although the authors believed this is likely. There were five cases of bleeding caused by MT insertion out of which one required reverting to formal tracheostomy, and one sustained airway obstruction by a clot which resulted in cardiac arrest which was successfully resuscitated. There was no in-hospital mortality.

Bonde et al. (2002) [6] identified those at risk of SR after lung resection surgery on multivariate analysis. The authors concluded that SR is more likely to occur in patients who smoke within six weeks of surgery, have a history of ischaemic heart disease or postoperative absence of regional analgesia (COPD and cerebrovascular accident were only risk factors on univariate analysis). In their study, post-operative (not PM) MT was the primary treatment for most patients (92.6%) who developed SR.

MT is not free from complications, however, most of the complications reported in the literature are minor and easily managed such as; minor bleeding, voice change, surgical emphysema, and failure of insertion [2, 4, 7–9]. Major complications include severe haemorrhage requiring ligation or reverting to formal tracheostomy, distal migration of the MT tube into the bronchial tree and tube misplacement and perforation of the oesophagus [8–12]. There are no reports in the literature of any death caused by MT insertion or being in place. MT in general is considered to be a simple, safe, bedside procedure with low risk of complications [4, 7, 8, 13, 14].

7. Clinical bottom line

PM facilitates early and regular suctioning of the tracheobronchial tree during the critical postoperative period. For high-risk patients, PM may be beneficial in preventing retention of secretions and subsequent complications associated with SR. None of the studies were able to demonstrate a significant reduction in mortality, intensive care unit LOS, or hospital LOS.

Although serious and life-threatening complications have been reported in the literature, complications from MT insertion are mostly minor and self-limiting.

References


eComment: Multidisciplinary management of high-risk patients undergoing lung resection

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We read with great interest the article by Abdelaziz et al. [1] highlighting the role of prophylactic minitracheostomy (PMT) in high-risk patients undergoing thoracotomy and lung resection to aid postoperative sputum clearance. It is well-known that minitracheostomy facilitates early and regular suctioning of the tracheobronchial tree during the critical postoperative period. However, this procedure is not free from complications, some of the major complications include severe haemorrhage, distal migration of the minitracheostomy tube into the bronchial tree and perforation of the oesophagus [2–22]. For these reasons and because of evidence that postoperative pulmonary rehabilitation (PPR) significantly improves the sputum clearance, six minutes walk distance, haemoglobin saturation (SaO2), dyspnoea status and forced expiratory volume in the 1 s (FEV1) [3], and considering that PPR is becoming a crucial component of the overall treating strategy in high-risk surgical patients [4], we believe that the PMT could be an overtreatment.

In conclusion we suggest a multidisciplinary approach in the management of high-risk patients undergoing lung resection for non-small cell lung cancer, in which surgeons are a part of the unit care together with the rehabilitation team. Overall, our experience demonstrated that there is place for this cooperation, especially because PPR does not interfere with any oncological follow-up or adjuvant therapy planning.

References