Noninvasive ventilation before and after lobectomy reduces pulmonary dysfunction and length of hospital stay

Synopsis


**Question:** Does prophylactic use of noninvasive ventilation (NIV) before and after elective lobectomy affect postoperative oxygenation, pulmonary function, atelectasis, and length of stay in hospital? **Design:** Randomised, controlled trial with concealed allocation and blinded assessment of some outcomes. **Setting:** Surgical unit of a tertiary hospital in France. **Participants:** Adults with lung cancer and lung function <70% of the predicted value who were scheduled for elective lobectomy via posterolateral thoracotomy. Thirty-nine patients were randomised one week preoperatively to a NIV group (n = 22) or a control group (n = 19). **Interventions:** Both groups received standard postoperative care, including at least four days in the surgical intensive care unit and epidural analgesia. In addition, the NIV group used bilevel positive airway pressure for five one-hour periods daily from seven days prior to surgery until three days after surgery. During an initial one-hour acclimatisation period, the inspiratory positive airway pressure (IPAP) was titrated up from 8cmH2O to the maximum tolerated, and the expiratory positive airway pressure (EPAP) was set at 2 to 4cmH2O. **Outcome measures:** Arterial blood gases (pH, PaO2, PaCO2) and lung function (FEV1, FVC) were measured at enrolment, after the seven days of preoperative NIV, two hours postoperatively, and daily until the third day after surgery. Chest radiographs performed two hours postoperatively and daily until the third day after surgery were assessed by radiologists for the presence of lobar atelectasis. The duration of hospital stay, opioid use, and pain and dyspnoea scores were also recorded. **Results:** Thirty-two participants completed the study. One patient in the control group required invasive ventilation for total pneumothorax immediately postoperatively and was excluded from analysis. Six patients in the NIV group were excluded from the analysis because the surgical procedure was changed. Compared to the control group, arterial blood gases were significantly better in the NIV group after the seven days of pre-operative NIV and remained significantly better at all or most of the post-operative measurement points. Similarly, lung function was significantly better in the NIV group at most of the postoperative measurement points. Incidence of lobar atelectasis was not reduced significantly, with the number needed to treat to prevent one case of atelectasis estimated at 4 (95% CI –2 to 14). The duration of hospital admission was significantly reduced, by 7 (95% CI 5 to 9) days. Opioid use did not significantly differ between the groups, while pain and dyspnoea scores were not reported. **Conclusion:** Prophylactic use of NIV pre- and postoperatively significantly reduces pulmonary dysfunction and length of hospital stay after elective lobectomy.

[NNT, 95% CIs, and statistical power calculated by the CAP Co-ordinator]

Commentary

Despite lung cancer being the fourth leading cause of cancer death in Australia (AIHW 2007), little research is available investigating interventions to improve outcomes following lung resection. The current study highlights improvements in short-term physiological outcomes and hospital length of stay (LOS) in thoracic surgical patients receiving both pre- and postoperative NIV.

Whilst the reported reduction in the LOS is clinically important, the management outlined in this study is not representative of practice in Australian tertiary hospitals. Most patients return directly to the ward postoperatively rather than spend four days in a surgical ICU. In addition the LOS in the control group of 19 ± 3 and intervention group of 12 ± 1 is higher than mean data reported in similar populations: Spain < 10 days (Varela et al 2006); New Zealand unpublished audit of 50 patients 7 ± 3 days.

Atelectasis can be associated with development of several pathophysiological effects including impairment in oxygenation. The study did not identify a statistically significant effect of NIV on the incidence of atelectasis, but statistical power for this outcome was low (calculated retrospectively at 33%). The confidence interval includes effect sizes that would be considered clinically worthwhile, so the effect on atelectasis could be investigated further.

Pre-rehabilitation is an emerging concept although few have studied NIV for this purpose. However, in the current study the more significant responses to NIV occurred in the postoperative period and these changes are consistent with those found in previous research (Auriant et al 2001).

Using international classification systems to categorise FEV1 would allow assessment of the response to NIV in relation to the severity of airway obstruction. The timing of measurement of FEV1 and FVC in relation to pain scores post-operatively would have been useful inclusions in the paper, as spirometry is effort dependent.

Despite these clinical reservations, this study raises the issue of prophylactic use of NIV in surgical populations.

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References

