Case report

Short-term noninvasive ventilation in the postanesthesia care unit: a case series

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Abstract Eight patients suffering various causes of transient postoperative respiratory failure in the postanesthesia care unit were treated with short-term noninvasive pressure-support ventilation administered through a tight-fitting face mask. Intubation was avoided in all of them, and no complications were observed, as assessed by the treating anesthesiologist and from review of their charts. Indications and advantages of noninvasive ventilation in the early postoperative period are discussed.

1. Introduction

Acute respiratory failure occurs relatively frequently in the early postoperative period, especially in patients with preexisting compromised respiratory function and/or undergoing major thoracoabdominal procedures. For example, after intra-abdominal surgery, need for mechanical ventilation or reintubation represents 30% of the postoperative pulmonary complications, which occur in 9.6% of patients undergoing this type of surgery according to Lawrence et al. [1]. Many of these episodes of postoperative respiratory failure may be short-lasting, as in the case of residual neuromuscular blockade or respiratory depression by various drugs, combined with postoperative dysfunction of the patient’s respiratory muscles. In the current standard of care, if supplemental oxygen and other measures, such as reversal of neuromuscular blocking agents, bronchodilators, deep-breathing exercises and chest physiotherapy are not successful, patients with acute postoperative respiratory failure are intubated so that mechanical ventilation can be started. Here, we report the successful use of noninvasive positive-pressure ventilation (NPPV) in a variety of rapidly reversible causes of postoperative respiratory failure in the postanesthesia care unit (PACU), thus avoiding intubation with its associated risks.

2. Case series

After approval from the institutional review board of our hospital, the medical records of 8 patients, who had been placed on NPPV in the PACU of a large tertiary hospital by a single anesthesiologist (coauthor of this report) in the course of 2 years, were reviewed, and relevant clinical
<table>
<thead>
<tr>
<th>Case</th>
<th>Sex, age (y)</th>
<th>Underlying diseases</th>
<th>Operation</th>
<th>Anesthesia</th>
<th>Respiratory problems on emergence</th>
<th>Respiratory problems in PACU</th>
<th>Suspected cause of respiratory failure</th>
<th>Max PS level (cm H₂O)/duration (h)</th>
<th>Respiratory response to NPPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F, 70</td>
<td>CAD, S/P CABG,Lt phrenic nerve paralysis</td>
<td>Rt shoulder arthroplasty</td>
<td>GA + Rt interscalene block</td>
<td>Low SaO₂ (92%) on face mask</td>
<td>↑ Tachypnea</td>
<td>Rt phrenic nerve paralysis</td>
<td>18/4</td>
<td>↓ RR</td>
</tr>
<tr>
<td>2</td>
<td>F, 70</td>
<td>Severe COPD</td>
<td>Thoracoscopic resection of Lt upper lobe mass</td>
<td>GA + thoracic epidural</td>
<td>Mild dyspnea</td>
<td>Worsening dyspnea</td>
<td>Postoperative exacerbation of COPD</td>
<td>14/4</td>
<td>No dyspnea</td>
</tr>
<tr>
<td>3</td>
<td>M, 94</td>
<td>CAD, hx of CHF, HTN, AF, CRF, dementia, lung cancer, “do not intubate” order</td>
<td>Lt hip replacement</td>
<td>Continuous spinal</td>
<td>Dyspnea ↓ SaO₂</td>
<td>Worsening dyspnea ↓ SaO₂</td>
<td>Exacerbation of pulmonary edema</td>
<td>12/1.5</td>
<td>Decreasing dyspnea ↑ SaO₂</td>
</tr>
<tr>
<td>4</td>
<td>F, 72</td>
<td>COPD, S/P thoracoscopic resection of Lt lung nodule</td>
<td>Thoracoscopic resection of Lt Lung nodule</td>
<td>GA</td>
<td>Mild dyspnea</td>
<td>↑ Drowsiness (Paco₂ = 87 mm Hg)</td>
<td>Postoperative respiratory failure in COPD with CO₂ retention, possible residual NMB</td>
<td>17/0.5</td>
<td>↑ alertness ↓ Paco₂ (to 69 mm Hg)</td>
</tr>
<tr>
<td>5</td>
<td>M, 73</td>
<td>Sleep apnea, hx of difficult intubation</td>
<td>Rt Hip arthroplasty</td>
<td>GA</td>
<td>Generalized weakness after extubation</td>
<td>Worsening dyspnea with upper airway obstruction</td>
<td>Residual NMB</td>
<td>12/1.5</td>
<td>Immediate decrease of dyspnea and obstruction</td>
</tr>
<tr>
<td>6</td>
<td>F, 29</td>
<td>S/P lung transplant, poor baseline respiratory function (SaO₂ of 88% on 4 l/min O₂ by nasal cannula)</td>
<td>Bronchoscopy with BAL</td>
<td>GA</td>
<td>Dyspnea ↓ SaO₂</td>
<td>Acute decompensation of chronic respiratory failure due to BAL</td>
<td></td>
<td>14/2.5</td>
<td>Immediate decrease of dyspnea and ↑ SaO₂</td>
</tr>
<tr>
<td>7</td>
<td>M, 62</td>
<td>Morbid obesity (400 lb), COPD, CAD, hx of CHF, HTN, NIDDM, AF</td>
<td>Debridement and irrigation of penis</td>
<td>GA</td>
<td>↓ SaO₂ after extubation</td>
<td>↑ RR; ↓ SaO₂</td>
<td>Postoperative respiratory failure in obese pt</td>
<td>18/2.5</td>
<td>Immediate ↓ RR and ↑ SaO₂</td>
</tr>
<tr>
<td>8</td>
<td>F, 86</td>
<td>S/P esophagectomy, Lt vocal cord paralysis, Lt pleural effusion, HTN, hx of DVT</td>
<td>Lower back debridement in prone position</td>
<td>GA</td>
<td>↓ SaO₂ after extubation</td>
<td>↓ SaO₂ (90%) and tachypnea (30-34 bpm)</td>
<td>Atelectasis (shown in Lt lung on chest x-ray)</td>
<td>14/3</td>
<td>↑ SaO₂</td>
</tr>
</tbody>
</table>

†, increase in; ↓, decrease in; AF, atrial fibrillation; CAD, coronary artery disease; CHF, congestive heart failure; CRF, chronic renal failure; DVT, deep venous thrombosis; GA, general anesthesia; HTN, hypertension; hx, history; Lt, left; NIDDM, non–insulin-dependent diabetes mellitus; Rt, right; S/P, status/post.

* Not known before present operation.
information is summarized in Table 1. All of these patients had exhibited respiratory distress and/or hypoxia immediately after extubation in the operating room or upon arrival at the PACU; respiratory distress was defined by the treating anesthesiologist as a respiratory rate (RR) greater than 30 breaths per minute (bpm) and/or dyspnea (ie, use of accessory muscles of respiration and/or the patient complaining of uncomfortable breathing), whereas hypoxia was defined as an oxygen saturation (SaO₂) of less than 90% on supplemental oxygen. As documented in the nurses’ notes, pain appeared to be well controlled before institution of NPPV, and anxiety did not appear to have caused respiratory distress. Because supplemental oxygen and other maneuvers such as reversal of neuromuscular blocking agents and/or deep-breathing exercises were not successful, and the treating anesthesiologist thought that their respiratory problems might be short-lasting. These patients were placed on NPPV rather than being intubated. Ventilation with pressure support mode was provided by a Puritan Bennett 7200 ventilator (Puritan Bennett, Pleasanton, Calif) through a clear, tightly strapped face mask, using a simple clinical decision process developed by the treating anesthesiologist: initially, a PS of 5 cm H₂O, a positive end-expiratory pressure (PEEP) of 5 cm H₂O, and FiO₂ of 1.0 were used in all the patients; then, PS was increased in steps (3-4 cm H₂O at a time) until a PS level, compatible with comfortable breathing and with a RR of less than 30 bpm, had been reached; then, the FiO₂ was gradually decreased down to 0.4, whereas arterial SaO₂, monitored by pulse oximetry, was maintained above 90%. In most patients, no arterial blood gases were ordered, as it was thought that their results would have not led to changes in patients’ treatment. No sedation was required by any of the patients during NPPV.

Thirty minutes after the maximum PS level had been reached (ie, level at which patient was breathing comfortably with an RR less than 30 bpm), PS was gradually decreased, by 3 to 4 cm H₂O at a time toward 5 cm H₂O, as guided by the patient’s RR and respiratory comfort: if RR did not increase and respiration remained comfortable after about 10 minutes, PS was again decreased in a stepwise manner. In 1 patient (case 4), PS could be decreased even more rapidly as the patient quickly regained her strength. Once a PS of 5 cm H₂O was reached, with the patient breathing comfortably and SaO₂ above 90% with an FiO₂ of 0.4), NPPV was stopped and the patient was given supplemental oxygen (FiO₂ of 0.4) through a clear mask. Details of these cases are summarized in Table 1. With regard to patient 5 who had a history of difficult intubation, the treating anesthesiologist elected to briefly try NPPV; if no quick improvement in respiratory pattern had been seen, intubation would have been performed with a fiberoptic technique. No complications associated with aspiration, gastric distension, or discontinuation of mechanical ventilation were observed. At the 24-hour follow-up, only 1 patient (case 3) had required further noninvasive ventilation.

3. Discussion

In NPPV, ventilatory support is delivered through a nasal or face mask; this technique has been successfully used in patients with acute or chronic respiratory failure [2]. Its main advantage, compared with traditional forms of mechanical ventilation, is that it may eliminate the need for endotracheal intubation with its associated risks, such as injury to vocal cords and respiratory tract infections, as well as the need for sedation. Furthermore, once a patient is intubated, mechanical ventilation may last longer than NPPV, as clinicians may feel more comfortable with early removal of a face mask than of an endotracheal tube. Admission to an intensive care unit from the PACU may also be more likely if a patient gets intubated rather than having been on NPPV for a few hours.

The use of noninvasive ventilation with Bilevel Positive Airway Pressure in the PACU was described by Tobias [3] in 2000; however, only 1 of his 3 patients presented with a short-lasting form of respiratory failure (due to residual neuromuscular blockade, similar to our case 5), whereas his other 2 patients were on NPPV for 2 to 4 days. Prolonged use of NPPV in the postoperative period had also been described in patients with chronic respiratory failure by 2 German studies [4,5]. On the other hand, our report describes truly transient NPPV in the PACU (for no longer than 4 hours) in a variety of reversible causes of postoperative respiratory failure, including conditions never reported before, such as a complication of regional anesthesia (case 1), “do not intubate order” and exacerbation of pulmonary edema in a terminal patient (case 3), major postoperative carbon dioxide retention in patient with chronic obstructive pulmonary disease (COPD; case 4, probably related to intraoperative carbon dioxide retention during one-lung ventilation), acute decompensation of chronic respiratory failure due to bronchoalveolar lavage (BAL) (case 6), and postoperative respiratory failure in an obese patient (case 7). Postoperative dysfunction of respiratory muscles and atelectasis (documented radiologically in case 8) were probably contributing factors in our cases of short-lasting respiratory failure in the PACU. The very rapid termination of NPPV in case 4 (about 30 minutes) may have been possible because of resolving neuromuscular blockade (NMB).

Noninvasive pressure support and PEEP delivered by face mask was well tolerated by all the patients reported here, without any complications and without the need for intubation; this may have been because of careful selection and instruction of patients (for inclusion criteria and relative contraindications, see Hillberg and Johnson [2]) and early institution of NPPV before dyspnea had become severe. Rapid PS titration, based on patient’s respiratory response, allowed termination of NPPV within hours after its initiation. To our knowledge, this is the first case series of the successful use of transient NPPV in treating short-lasting respiratory failure in the PACU from a variety of rapidly reversible causes, thus avoiding intubation.
4. Summary

Short-lasting respiratory failure (that is, failure lasting hours rather than days) occurs relatively frequently in the early postoperative period. Here, we report the successful use of NPPV to treat 8 patients in the PACU. Pressure support and PEEP were applied noninvasively through a face mask for a short period (0.5-4 hours) to support patients recovering from a variety of reversible causes of respiratory failure. Intubation was avoided in all of these patients, and no complications were observed.

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References