CRITICAL CARE

COMMENTARY

The feasibility and safety of fiberoptic bronchoscopy during noninvasive ventilation in patients with established acute lung injury: another small brick in the wall

Massimo Antonelli*

See related research by Baumann *et al.*, http://ccforum.com/content/15/4/R179

Abstract

In hypoxemic patients needing fiberoptic bronchoscopy (FOB), noninvasive ventilation (NIV) has been used to prevent gas-exchange deterioration associated with FOB and to compensate for the increase in work of breathing occurring during FOB, thus avoiding endotracheal intubation and its related complications. The application of NIV to allow FOB has been found of particular interest in the diagnosis of pneumonia in patients spontaneously breathing and in those who started NIV to assist FOB. There is less information for patients who were already receiving NIV for acute respiratory failure and who were scheduled to undergo FOB. In the previous issue of *Critical Care*, the study by Baumann and colleagues adds new information to this specific issue, addressing the feasibility and safety of FOB during NIV in patients with established hypoxemic respiratory failure.

In the previous issue of *Critical Care*, Dr Baumann and colleagues conducted a prospective study to assess the feasibility of fiberoptic bronchoscopy (FOB) with bronchoalveolar lavage in critically ill patients who were on noninvasive ventilation (NIV) prior to the bronchoscopy procedure, to treat their acute hypoxemic respiratory failure [1]. Prospectively studying 40 consecutive severe acute lung injury patients (Simplified Acute Physiology Score II 47 ± 10, 21 (53%) immunocompromised) who were receiving NIV for several hours, the authors evaluated the feasibility and safety of diagnostic FOB. The authors delivered NIV via a facial mask, and introduced the bronchoscope into the airways through a T-adapter, with the classical seal connection [2-5], attached to the mask and connected to the respiratory circuit.

A low intubation rate (10%) was reported immediately after the procedure with high diagnostic performance, yielding useful information in almost 70% of the cases. Only two patients had oxygen desaturation (oxygen saturation <84%). At the end of the procedure and during the following 30 minutes there occurred in many cases a transient $PaCO_2$ increase and a pH decrease. Contrary to previous reports in which patients received only topical anesthesia [2-7], in this investigation all patients received a form of sedation – a combination of 10 to 20 mg propofol and 1 to 2 mg midazolam every 2 to 3 minutes, or propofol alone. The cumulative doses of 2 mg benzodiazepine with 69 ± 41 mg propofol might explain the attenuation of the deepness of breath and the consequent, transitory hypercarbia. Even though no patients were intubated as a consequence of the sedative drugs received, this might be a matter for concern for more severe and at-risk patients. The conclusion, however, was that patients with established hypoxemic respiratory failure who are on NIV can well tolerate the bronchoscopic procedure, with a low complication rate.

But why perform FOB during NIV?

In critically ill patients, even standard FOB is associated with transient alterations in pulmonary mechanics and gas exchange [8,9]. The PaO_2 may fall significantly below its baseline value during the procedure and remains decreased for between a few minutes and several hours after removing the bronchoscope [8,9]. In a group of 107 mechanically ventilated patients undergoing FOB, an average decline in the PaO_2 of 26% was observed at the end of the procedure [10]. Hypoxemia may be more

*Correspondence: m.antonelli@rm.unicatt.it
Department of Intensive Care and Anesthesiology, Policlinico Universitario A. Gemelli, Università Cattolica del Sacro Cuore, Largo A. Gemelli 8, 00168 Rome, Italy

marked when bronchoalveolar lavage is performed because of ventilation and perfusion abnormalities induced by the saline solution instillation [11].

In a nonintubated adult male, a 5.7 mm outside diameter flexible bronchoscope occupies about 10% of the tracheal cross-sectional area and about 15% of the cross-sectional area at the cricoid ring [8]. Positioning the bronchoscope in the major airway decreases the area available for airway flow, and consequently increases airway resistance [8]. The high exhalation resistance rapidly results in an increase in functional residual capacity, and therefore in the development of an intrinsic positive end-expiratory pressure mechanism [9]. This finally leads to increased work of breathing and risk of barotrauma. Besides the physical presence of the bronchoscope in the airway, a frequent suction through the working channel of the instrument may be another cause of the alterations in pulmonary mechanics and gas exchange. Removal of tracheobronchial gas by excessive use of suction evacuates respiratory gas from the airway, decreasing the functional residual capacity or causing de-recruitment under positive-pressure ventilation, with consequent hypoxemia [8,12].

By improving oxygenation and reducing the work of breathing [13], NIV has been indicated as a useful method to avoid endotracheal intubation in hypoxemic and hypercapnic patients [3,4,14]. The application of NIV during FOB has until now been described in at-risk patients who were initially breathing spontaneously and started NIV to assist FOB [2,5-7], and has been described sporadically in small subgroups of patients who were already receiving NIV and were scheduled to undergo FOB during NIV [3,4,15]. The study by Baumann and colleagues represents the first systematic investigation focused on severely ill patients with established acute lung injury receiving NIV [1]. Although not a randomized trial, this study's conclusions can reassure the clinician on the feasibility and safety of FOB with bronchoalveolar lavage in these difficult patients.

Abbreviations

FOB, fiberoptic bronchoscopy; NIV, noninvasive ventilation; $PaCO_2$, arterial pressure of carbon dioxide; PaO_2, arterial pressure of oxygen.

Competing interests

The author declares that he has no competing interests.

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