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## CLINICAL INFORMATION

# Non-invasive mechanical ventilation and epidural anesthesia for an emergency open cholecystectomy



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**Abstract** Non-invasive ventilation is an accepted treatment modality in both acute exacerbations of respiratory diseases and chronic obstructive lung disease. It is commonly utilized in the intensive care units, or for postoperative respiratory support in post-anesthesia care units. This report describes intraoperative support in non-invasive ventilation to neuroaxial anesthesia for an emergency upper abdominal surgery.

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### Ventilação mecânica não invasiva e anestesia peridural em colecistectomia aberta de emergência

**Resumo** Ventilação não invasiva é uma modalidade de tratamento aceita tanto em exacerbações agudas de doenças respiratórias quanto em doença pulmonar obstrutiva crônica. É comumente usada em unidades de terapia intensiva ou para suporte respiratório pós-cirúrgico em salas de recuperação pós-anestesia. Este relato descreve o suporte intraoperatório em ventilação não invasiva para bloqueio do neuroeixo em cirurgia abdominal alta de emergência. © 2014 Sociedade Brasileira de Anestesiologia. Publicado por Elsevier Editora Ltda. Este é um artigo Open Access sob uma licença CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

The Global Initiative for Chronic Obstructive Lung Disease defines chronic obstructive pulmonary disease (COPD) as “a common preventable and treatable disease characterized

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by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases".<sup>1</sup> COPD affects millions of people all over the world and its rate over the age of 40 years is almost 10%.<sup>2</sup> Therapy of COPD patients is mainly pharmacological; non-invasive ventilation (NIV) is an additional tool to increase the survival and improve the quality of life in severe COPD patients.<sup>3</sup> The role of NIV in the postoperative course is well described; however knowledge on its intraoperative use is limited, and majority of our current knowledge comes from occasional case reports.<sup>4-7</sup>

A recent systematic review of these case reports about NIV applications used perioperatively establishes that almost all of these reports are related to lower extremity or cesarean surgeries.<sup>7</sup> One of the main advantages expected of NIV application is to avoid intubation related, common pulmonary complications. Upper abdominal surgery poses a major risk factor for postoperative pulmonary complications.<sup>8</sup> The current report describes the use of NIV throughout the upper abdominal surgery and successful avoidance of further respiratory complications in a severely ill COPD patient.

## Case

A 46-year-old male patient was admitted to our hospital's emergency department with an upper abdominal quadrant pain. His physical examination and laboratory examination revealed the diagnosis of subacute cholecystitis and he was scheduled for an emergency cholecystectomy.

He had been diagnosed with COPD 8 years earlier and was on regular treatment with medications including furosemide, diltiazem, inhalational formoterol, budesonide and tiotropium bromide. The patient was having supplemental O<sub>2</sub> and using NIV device at home for the past one year. He had bilateral rales and rhonchi on chest examination. He was fully conscious, having supplemental 2 lt/min O<sub>2</sub> through nasal cannula, but his peripheral oxygen saturation (SpO<sub>2</sub>) was 74%. Arterial blood gas (ABG) analysis was drawn and pulmonary function tests were performed. Results of the pulmonary function tests were as follows: forced vital capacity 1.62 lt (40.7% predicted), and forced expiratory volume in 1 s 0.70 lt (21.3% predicted), forced expiratory volume in 1 s forced vital capacity ratio: 43.1%. Results of preoperative and consecutive ABG analysis are shown in Table 1. Rapid acting bronchodilator, salbutamol and 40 mg i.v. prednisolone were added to his treatment. Despite maximal therapy, his respiratory condition was unchanged and he was transferred to the operation theater. Monitoring included ECG, SpO<sub>2</sub> and non-invasive blood pressure

measurement. Heart rate was 115 beat/min, non-invasive blood pressure was 162/95 mmHg and SpO<sub>2</sub> was 70% during 2 lt/min O<sub>2</sub> administration with nasal cannula. The radial artery was catheterized for invasive blood pressure measurement and further sample drawing for arterial blood gas analysis. Epidural anesthesia was discussed with the surgeon and the patient gave consent to the technique. Epidural catheter was inserted through the T8-9 interspace with the patient in the sitting position. After negative aspiration of the catheter, anesthesia was initiated with 3 ml % 2 lidocaine and then established with fractionated administration of 9 ml bupivacaine plus 50 mcg fentanyl mixture. Serial examinations of the sensory block development were performed during epidural drug administration. When the upper level of the sensory block have reached T4 dermatome, the surgery was started. During the surgical procedure, the patient had ventilatory support with in biphasic intermittent positive airway pressure mode with his own NIV device. The set IPAP was 25 cm H<sub>2</sub>O, EPAP 6 cm H<sub>2</sub>O and FiO<sub>2</sub> were set to 35%. ABG analysis was made 30 min after NIV application, and the data are shown in Table 1. Surgical procedure was accomplished within an hour without any complication. The patient was transferred to intensive care unit (ICU) and received intermittent NIV. Result of ABG drawn 1 h after transportation to ICU is shown in the table. No respiratory or surgical complication was found on the follow-up at ICU. He was transferred to the ward on the 3rd postoperative day and discharged home two days thereafter with his regular respiratory therapy.

## Discussion

To the best of our knowledge, this is the first report that describes the successful use of NIV together with regional anesthesia for upper abdominal surgery. Additional respiratory support provided with NIV improved oxygenation and gas exchange during regional anesthesia in this patient.

Upper abdominal surgery is usually performed with general anesthesia and endotracheal intubation. However residual effects of both general anesthetic agents and pain related to surgery by itself interfere with the functions of the respiratory muscles, increasing the risk of postoperative atelectasia and other pulmonary complications.<sup>8</sup> Regional anesthesia may decrease the rate of postoperative respiratory complications in comparison with general anesthesia with endotracheal intubation.

In case of limited respiratory functional reserve, the incidence of potential pulmonary complications increases.<sup>9</sup> It is well known that invasive mechanical ventilation increases ICU stay and mortality rates in patients with acute exacerbations of COPD. An observational study comparing the effectiveness of invasive mechanical ventilation with NIV in the setting of acute exacerbation of respiratory failure in COPD patients indicates that it seems to be safer to use NIV in this set of patients.<sup>10</sup>

As the patient in this report had been already using an NIV device at home, we have allowed him to use his own device throughout the procedure. We are aware of the fact that thoracic epidural anesthesia may interfere with the function of the respiratory muscles.<sup>7</sup> In the present case, NIV seems to be useful in terms of opposing the effects of thoracic

**Table 1** Perioperative arterial blood gas values.

	pH	pO <sub>2</sub> (mmHg)	pCO <sub>2</sub> (mmHg)	SpO <sub>2</sub> (%)
Preoperative	7.37	41	49	74
Intraoperative	7.39	48	42	83
Postoperative	7.38	71	48	94

epidural anesthesia on respiratory muscles, if it had existed. However, the patient's willingness to regional anesthesia and his cooperation with the surgeon and anesthesia team provided an additional advantage to complete the procedure with success.

NIV is an accepted way of treatment in patients with acute respiratory failure.<sup>6,11</sup> Generally, NIV is not suitable for patients with fear of a tight-fitting mask on the face, who is not able to clear his secretions or who has altered/fluctuating level of consciousness. It is generally applied in the ICU, chest diseases wards or the emergency department. Anesthesiologists are a group of physicians who are very familiar with invasive mechanical ventilation in the operation theatres and ICUs. Although NIV application in the operation theatre is not a usual practise, its use in the operation theatre, as in this case, carries the advantage of continuous presence of an anesthesiologist, a person who is readily available to recognize any problem and provide further respiratory support. In parallel, the number of case reports describing the use of NIV together with regional anesthesia is increasing in recent years.<sup>5-7,9</sup>

In conclusion, NIV is applicable with thoracic epidural anesthesia for emergent upper abdominal surgery and its use has prevented a probable prolonged ICU stay due to invasive mechanical ventilation. There is a need for randomized prospective clinical trials in patients with high pulmonary complications risk to find out whether NIV together with regional anesthesia provides an advantage over general anesthesia with endotracheal intubation.

### Conflicts of interest

The authors declare no conflicts of interest.

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