



## Case report

## Double epidural catheter technique in a patient with severe COPD undergoing major abdominal surgery: A case report

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## ABSTRACT

**Introduction and importance:** Chronic Obstructive Pulmonary Disease (COPD) leads to the development of postoperative pulmonary complications (PPC), such as atelectasis, pneumonia and respiratory failure.

The use of epidural anesthesia, alone or combined with general anesthesia, is known to reduce the incidence of PPC and shorten tracheal intubation time. In major procedures involving both the lower and upper abdomen, central neuraxial block at a single level may be inadequate to provide sufficient metameric extension of anesthesia. This limitation could be overcome with the use of double epidural catheter (DEC), has proved effective in diverse surgical scenarios.

**Case presentation and clinical discussion:** We present the case of a woman affected by moderate-severe COPD scheduled for major abdominal cytoreductive surgery due to ovarian malignancy with planned xypho-pubic laparotomy. We developed and implemented a DEC-based strategy for perioperative pain management based on the extent of surgical incision and the high risk of difficult weaning from ventilation and PPC.

We used intraoperative monitoring to guarantee adequate antinociception throughout the entire 350 min long demolitive surgical procedure. No additional top-ups of intravenous analgesia or neuromuscular blocking agent (NMBA) was needed during surgery; at the end of the procedure, the patient was extubated in the operating theatre, maintaining adequate respiratory function during the whole postoperative period.

**Conclusions:** The DEC technique could be beneficial for patients undergoing cytoreductive surgery. In our case, this technique granted optimal analgesic coverage and was instrumental in achieving fast weaning from mechanical ventilation and early tracheal extubation. Systematic studies on this subject are warranted.

### 1. Introduction

Patients with Chronic Obstructive Pulmonary Disease (COPD) are more prone to develop postoperative pulmonary complications (PPC), such as atelectasis, pneumonia and respiratory failure [1]. Epidural anesthesia, alone or combined with general anesthesia, is known to reduce the incidence of PPCs [2], especially pneumonia [3], this being even more significant in patients with COPD [1].

This finding could be ascribed to a shorter duration of postoperative tracheal intubation, enhanced chest expansion, better breathing pattern, increased cough and decreased sputum retention in the postoperative period. These effects lead to a faster recovery of effective spontaneous

respiratory function, thus to lower incidence of PPCs [4].

The epidural blockade has been associated with a NMBA sparing effect [5]. Lowering intraoperative NMBA doses could result in postoperative benefits in terms of PPCs. Furthermore, postoperative residual curarization (PORC) leads to an increased incidence of PPCs [6].

The double epidural catheter (DEC) technique was first implemented and described for pain management during labor, especially in high-risk patients [7,8], and for anesthesia for cesarean section in a patient with severe pulmonary hypertension [9]. Outside of obstetric anesthesia and analgesia, effective implementation of the DEC technique has been described as a valid postoperative pain management strategy after Ivor-Lewis esophagectomy [10], spine surgeries [11] and general abdominal

**Abbreviations:** COPD, Chronic Obstructive Pulmonary Disease; PPC, Postoperative Pulmonary Complication; DEC, Double Epidural Catheter; NMBA, Neuro-muscular Blocking Agent; PORC, Postoperative Residual Curarization.

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surgeries [12].

The rationale for using multiple epidural catheters resides primarily in broadening the metameric extension of the neuraxial blockade, which - in the case we are presenting - allowed a significant reduction of the dose of intravenous opioids and NMBA and early weaning from mechanical ventilation.

This case has been reported following the SCARE Criteria [13].

## 2. Case presentation

After having obtained written informed consent, we present the case of a 67-year-old woman scheduled for major abdominal cytoreductive surgery due to ovarian malignancy. The planned surgical access was via xypho-pubic incision, including placement of a chest tube as part of the procedure.

Past medical history of the patient was relevant for arterial hypertension, chronic heart failure with mildly reduced left ventricle ejection fraction secondary to viral myocarditis (LVEF 45 % on last pre-operative control) [14], active smoking with COPD (GOLD Class B) needing continuous oxygen therapy and complicated by frequent exacerbations - the most recent one having occurred one month prior to the scheduled date of surgery. Pre-operative pulmonary function test (PFT) revealed moderately severe obstructive disorder with parenchymal hypertension. ARISCAT score for postoperative pulmonary complications prediction was 66 points, indicating high risk of PPCs [15].

We developed a DEC-based perioperative pain control strategy based on these findings and submitted it to the patient. Written informed consent was then obtained prior to the date of surgery.

The patient was conducted in the operating theatre, where basic monitoring was applied; a senior anesthetist placed the epidural catheters before the induction of general anesthesia: the cranial one at T10–11 level, the caudal one at L3–4 level. Correct positioning of the devices was tested and confirmed by negative aspiration test and injection of 2 mL of 0.2 % Ropivacaine; catheters' placement procedure was conducted under local anesthesia and according to the local protocol for prevention of infections. Metameric anesthesia distribution was tested using the pinprick test; hypoesthesia extension ranging from T7 to S1 levels was documented after 15 min before the general anesthesia induction.

General anesthesia was induced with intravenous Sufentanil 0.3 µg/kg, Propofol 2 mg/kg and Rocuronium 0.6 mg/kg. After orotracheal intubation, Sevoflurane (0.8–1.2%Et) was used to maintain anesthesia; adjustments were made based on Bispectral Index (BIS) monitoring. After induction of anesthesia, the right internal jugular vein and the right radial artery were cannulated for advanced haemodynamic monitoring using the FloTrac-Hemisphere system (Edwards Lifesciences, Irvine, CA). The patient received protective ventilation in volume-controlled mode with FiO<sub>2</sub> 0.4 throughout the procedure.

A total of 4 boluses (10 mL each) at a 1.5 h time interval were administered through each epidural catheter. It was used Ropivacaine (5 mL of 0.15 % solution in the thoracic epidural catheter, 5 mL of 0.3 % solution through the lumbar one) and Sufentanil (5 µg/5 mL through both devices).

According to intraoperative monitoring, adequate antinociception was maintained throughout the entire 350 min long demolitive surgical procedure; no additional top-ups of intravenous analgesia or NMBA was needed during surgery.

At the end of the procedure, emergence from anesthesia was assisted with supported ventilation, and the patient was extubated in the operating theatre before being transferred to the postoperative intensive care unit. In the ICU the patient received low flow oxygen therapy with nasal prongs, maintaining adequate respiratory function until discharge.

The patient has been interviewed at the end of hospital stay, she did not report any periprocedural discomfort and was satisfied with the postoperative epidural analgesia she received.

## 3. Discussion

Medical history of the patient (COPD and impaired cardiac function) and the demolition extent of planned surgery raised concerns about ensuring a painless surgical course without hindering the patient's respiratory and cardiocirculatory functions.

Epidural analgesia is a cornerstone of perioperative pain management. It has been shown to reduce time to extubation [16] and PPCs [2] in laparotomic abdominal surgeries - possibly by reducing intraoperative use of intravenous opioids and NMBAs [5] - leading us to base our intraoperative strategy on this technique.

Several scientific societies advocate and suggest its implementation for pain control in gynaecologic cytoreductive surgery and focus on its beneficial effects in the postoperative period [17,18]. At the same time, it is particularly relevant in this case its intraoperative positive effects that lead to shorter mechanical ventilation time and early extubation.

Given the sizeable splanchnic involvement of the surgery and the comparatively limited extension of neuraxial block achievable with a single epidural catheter, we opted for a double epidural catheter strategy.

In addition to improving metameric analgesic coverage, the DEC technique made it possible to administer smaller amounts of less concentrated local anesthetic, granting optimal analgesia without significant hemodynamic consequences.

## 4. Conclusions

Scientific evidence analyzing the DEC technique's advantages in optimizing intraoperative nociception control and preventing PPCs in major demolitive abdominal surgery is lacking; systematic studies on this subject are warranted.

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## Ethical approval

This study is exempted from ethical approval in our institution.

## Consent

We obtained verbal and written informed consent from the patient for this case report. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

## Author contribution

AC and CC: Investigation and Resources;  
AC and MT: Writing - Original Draft;  
CC, VB and EB: Review & Editing and Supervision.

## Research registration

Not applicable.

## Guarantor

Prof. Elena Giovanna Bignami.

## Declaration of competing interest

The authors declare no conflicts of interest.

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