

# Acute Postoperative Respiratory Failure after Retroperitoneal Robotic Surgery: A Case Series

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## Case Report

Volume 1 Issue 1

**Received Date:** May 27, 2016

**Published Date:** June 14, 2016

## Abstract

Postoperative respiratory failure has several possible causes, including narcotic overdose, inadequate reversal of paralytics and patient disease state. We present a case series of three patients who suffered acute postoperative respiratory failure after right-sided retroperitoneal robotic surgery. We propose that each of these patients' respiratory drive was depressed by a different mechanism; hypercarbia from CO<sub>2</sub> insufflations.

## Introduction

Laparoscopic and robotic surgeries use CO<sub>2</sub> (most commonly) to insufflate the peritoneal and/or retroperitoneal regions. If this CO<sub>2</sub> is sufficiently absorbed by the patient, a potential cause of postoperative respiratory failure after these surgeries is hypercarbia. Insufflations of the peritoneum and retro peritoneum leads to increases in arterial CO<sub>2</sub> content which can be followed using an end tidal CO<sub>2</sub> monitor or arterial blood gas monitoring. During these procedures, the formation of subcutaneous emphysema is possible, as is the theoretical accumulation of CO<sub>2</sub> between anatomical structures forming CO<sub>2</sub> pockets. CO<sub>2</sub> could then redistribute to other sites and therefore linger in the tissues and blood of these patients. Increased CO<sub>2</sub> levels can be treated with ventilator changes during surgery. Accurately monitoring patient arterial CO<sub>2</sub> levels is more difficult in the immediate postoperative period, requiring continued arterial blood gas monitoring or other specialized monitors. We present three cases of acute postoperative respiratory failure following robotic retroperitoneal surgery that could be explained by excess CO<sub>2</sub> absorption.

## Patient A

A 45 y.o. male, BMI 26, with a past medical history (PMH) of right lung pneumonia and right lung lobectomy secondary to abscess. He was diagnosed with a right atrophic kidney requiring a right robotic nephrectomy that was performed robotically over a period of two hours. There were no surgical or anesthetic complications. At the end of the case, the patient demonstrated sufficient recovery from paralysis with 4 out of 4 twitches on train of four (ToF) testing. His paralysis was reversed with neostigmine and glycopyrrolate. He was conscious and following commands prior to extubation. His last dose of fentanyl (50 mcg) had been 40 minutes prior to extubation and he received a total dose of 1,000 mcg. En route to the post anesthesia care unit (PACU), the patient was coherent and talkative. Upon transfer to the PACU he became unresponsive, and spontaneous respirations stopped, requiring bag mask ventilation for 10 minutes before regaining consciousness.

### Patient B

A 46 y.o. male patient, BMI 27, with a PMH of coronary artery disease, hypertension, MI, arrhythmia, diabetes mellitus, tobacco and alcohol use. He was diagnosed with a right ureteral stricture for which he required a robotic ureterostomy with buccal graft uretero plasty and omental wrapping. Surgery lasted 6 hours. During surgery he received a total dose 500 mcg of fentanyl; the last dose was 100 mcg and was given 70 minutes before extubation. He was reversed with neostigmine and glycopyrrolate after a ToF test showed 4 out of 4 twitches. The patient was extubated once he was spontaneously breathing, awake and appropriately responsive. Forty minutes after extubation, while in PACU, he developed respiratory failure and required resuscitation with reintubation. He was extubated 22 hours after the event.

### Patient C

A 62 y.o. female patient, BMI of 18, with a PMH of asthma, anxiety and depression who presented with a right ureteral obstruction that required a robotic pyeloplasty; the surgery lasted 4 hours. She received a total dose of fentanyl of 250 mcg and 2 mg of hydromorphone. The last dose of fentanyl 50 mcg was given 179 minutes and the last dose of hydromorphone 0.5 mg was given 144 minutes prior to extubation. The patient's paralysis was reversed with the maximum dose of neostigmine and glycopyrrolate when a ToF test showed 1 out of 4 twitches. The patient was extubated without complication. Initially, she was conscious and conversational while in PACU. Forty-two minutes after arrival in PACU, she became apneic and required bag mask ventilation until recovery of consciousness. She was placed on bipap for three hours and discharged from the PACU on two litres nasal cannula.

### Discussion

There are many reasons for postoperative respiratory failure, including narcotic overdose, residual weakness from incomplete reversal of paralysis and pulmonary disease of the patient, such as those with COPD. These patients can be susceptible to respiratory failure due to either decreased response to hypoxia or to hypercarbia sufficient to produce CO<sub>2</sub> narcosis [1]. In this case series we describe three patients, none of whom had COPD, who all developed postoperative respiratory failure after robotic retroperitoneal surgery (see Table 1 for summarized patient data). All patients were awake, strong, responsive, spontaneously breathing with end tidal CO<sub>2</sub> levels of 38-40 prior to extubation in the operating room. Narcotic overdose and incomplete reversal of paralysis are less likely explanations for their respiratory failure. We believe that all three patients experienced hypercarbia as a result of increased bodily CO<sub>2</sub> that occurred once spontaneous respirations began [2-4]. Streich et al [5] have shown that during laparoscopic retroperitoneal surgery, CO<sub>2</sub> absorption increases over time and persists after exsufflation [5]. In addition, CO<sub>2</sub> absorption is reported to be quicker and more efficient via the retro peritoneum than the peritoneal cavities because the retro peritoneum is a highly vascular area without an anatomic barrier [5-7]. Why only three patients developed postoperative respiratory failure due to suspected excessive absorption of CO<sub>2</sub> at our medical center where 30-40 such operations have occurred monthly for over 3 years is currently being investigated in a prospective study. Probable causes of CO<sub>2</sub> absorption in the three presented patients include the duration of insufflation, the insufflation pressures used, the development of subcutaneous emphysema, CO<sub>2</sub> redistribution, body habitus or other patient characteristics.

Case Summary	A	B	C
Age	45	46	62
Sex	M	M	F
BMI	26	27	18
Surgery duration (hrs)	2	6	4
Last narcotic dose prior to respiratory failure (minutes)	40	70	144
Total fentanyl dose (mcg) +*Hydromorphone	1,000	500	250+2mg*
Twitches prior to reversal	4/4	4/4	1/4
Dose of neostigmine/Glycopyrrolate (mg)	3/0.6	3/0.6	5/1
End tidal CO <sub>2</sub> value Prior to extubation	40	39	38

Table 1: Patient Case Data.

## Conclusion

Systemic CO<sub>2</sub> absorption during robotic and laparoscopic surgery is expected and common. Evidence of this absorption is seen intra operatively with increasing end tidal CO<sub>2</sub> levels. Changes in the patients' ventilator settings to increase minute ventilation most often corrects this CO<sub>2</sub> absorption and no patient morbidity due to CO<sub>2</sub> absorption has been reported to this point. We report on three patients with acute respiratory failure seen after robotic retroperitoneal surgery at an institution with a high volume of these types of procedures. We believe that while rare (incidence of 0.4% at our institution), excess systemic CO<sub>2</sub> absorption from inflation of the retroperitoneal cavity is the cause of these events.

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