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

Hauck ES*, Balabanoff-Acosta C, Schiller R, Ferrari J and Gewirtz E
Lewis Katz School of Medicine, Temple University, USA

*Corresponding author: Hauck ES, Lewis Katz School of Medicine, Temple University, United States, Email: ellen.hauck@tuhs.temple.edu

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 CO₂ insufflations.

Introduction
Laparoscopic and robotic surgeries use CO₂ (most commonly) to insufflate the peritoneal and/or retroperitoneal regions. If this CO₂ 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 CO₂ content which can be followed using an end tidal CO₂ monitor or arterial blood gas monitoring. During these procedures, the formation of subcutaneous emphysema is possible, as is the theoretical accumulation of CO₂ between anatomical structures forming CO₂ pockets. CO₂ could then redistribute to other sites and therefore linger in the tissues and blood of these patients. Increased CO₂ levels can be treated with ventilator changes during surgery. Accurately monitoring patient arterial CO₂ 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 CO₂ 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.
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$_2$ 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$_2$ 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$_2$ that occurred once spontaneous respirations began [2-4]. Streich et al [5] have shown that during laparoscopic retroperitoneal surgery, CO$_2$ absorption increases over time and persists after exsufflation [5]. In addition, CO$_2$ 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$_2$ 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$_2$ absorption in the three presented patients include the duration of insufflation, the insufflation pressures used, the development of subcutaneous emphysema, CO$_2$ 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$_2$ value Prior to extubation | 40 | 39 | 38 |

Table 1: Patient Case Data.
Conclusion

Systemic CO₂ absorption during robotic and laparoscopic surgery is expected and common. Evidence of this absorption is seen intra operatively with increasing end tidal CO₂ levels. Changes in the patients’ ventilator settings to increase minute ventilation most often corrects this CO₂ absorption and no patient morbidity due to CO₂ 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 CO₂ absorption from inflation of the retro peritoneal cavity is the cause of these events.

References

1. Rudolf M, Banks RA, Semple SJ (1977) Hypercapnia during oxygen therapy and acute exacerbations of chronic respiratory failure. Hypothesis revisited. Lancet 2(8036): 483-486

2. Gutt CN, Oniu T, Mehrabi A, Schemmer P, Kashfi A, et al. (2004) Circulatory and respiratory complications of carbon dioxide insufflation. Dig Surg 21(2): 95-105.

3. Meininge D, Byhahn C, Wolfram M, Mierdl S, Kessler P, et al. (2004) Intraperitoneal Versus extraperitoneal insufflation of carbon dioxide in patients undergoing totally endoscopic Robot-assisted radical prostatectomy. Surg Endosc 18(5): 829-833.

4. Gill IS, Clayman RV, Albala DM, Aso Y, Chiu AW, et al. (1998) Retroperitoneal and pelvic extraperitoneal laparoscopy: an international perspective. Urology 52(4): 566-571.

5. Streich B, Decailliot F, Perney C, Duvaldestin P (2003) Increased carbon dioxide absorption during Retroperitoneal laparoscopy. Br J Anaesth 91(6): 793-796.

6. Critchley LA, Ho AM (2010) Surgical emphysema as a cause of severe hypercapnia during laparoscopic surgery. Anaesth Intensive Care 38(6): 1094-1100.

7. Wolf JS, Monk TG, Mdougall EM, McClennan BL, Clayman RV (1995) The extraperitoneal approach and subcutaneous emphysema are associated with greater absorption of carbon dioxide during laparoscopic renal surgery. J Urol 154(3): 959-963.