Laparoscopic Surgery for Patients with Severe Chronic Obstructive Lung Disease

Victor Saxena*, Talal Alzahrani*, Alexander Cho, Guillermo Gutierrez
The George Washington University, Department of Medicine
Washington, DC

Learning Objectives

- Describe the treatment of post-laparoscopic hypercapnia in patients with stage IV chronic obstructive lung disease.
- Explain alternative operative modalities for patients with stage IV chronic obstructive lung disease who require intra-abdominal repair.

Case Presentation:
A 56 year old African American man with a past medical history of HIV, TB (treated), and severe stage IV COPD (FEV1 25%) with thirty pack year smoking history presents for an outpatient bilateral hernia repair.

Past Medical and Social History:
- Active smoker for 40 years
- At the time of presentation patient is well controlled on aclidinium bromide inhalation powder daily and albuterol inhaler as needed
- Baseline hypercapnia with ABG of PH 7.34, PCO2 49, PO2 67, and a normal bicarbonate of 26.

Hospital Course:

Intraoperative Course:
- The patient underwent bilateral laparoscopic hernia repair with mesh placement.
- He was induced by propofol, rocuronium, and succinylcholine. The peritoneal space was insufflated with 12 mmHg CO2 pressure.
- Bilateral inguinal hernias as well as a right femoral hernia were found intraoperatively
- Patient was sedated with general anesthesia for two hours and eighteen minutes. Surgery was without complication.

Postoperative Course:
- In the PACU Patient was noted to be excessively somnolent, without receiving pain medications.
- An ABG was completed and showed an acute respiratory acidosis with a pH of 7.25, PCO2 of 80 mmHg.
- The patient was subsequently started on BiPAP given a rescue Albuterol 2.5 mg nebulizer once. Overnight and to the next day the patient was continued on BiPAP and treated with intravenous-albuterol nebulizers.
- The following day patient noted to be increasingly oriented, and a repeat ABG showed his acidosis was resolving with a pH of 7.36 and PCO2 of 60 mmHg.
- He was discharged home on budesonide and formotero nebulizers.

Two approaches may be used to combat the accumulation of excess CO2 in patients with severe COPD:
- Treatment: As discussed, postoperative treatment of hypercapnic respiratory failure via BiPAP can be utilized to stabilize the patient.
- Prevention: The use of alternative surgical and anesthetic techniques such as open procedures with nerve blocks which do not involve the creation of a pneumoperitoneum and, therefore, do not produce hypercapnia.

Of note, patients with mild (stage I) to moderate (stage II) COPD develop a significant hypercapnia during laparoscopic procedures. However, this hypercapnia has not been shown to prolong the length of stay or increase the rate of complications in these patients.

While such data holds true for stage I and II COPD patients, it should not be extrapolated to patients with severe to very severe (stage III/IV) COPD. As of yet, no similar studies have included patients with stage III/IV COPD. Therefore, the surgical management of such patients should weigh the risks and benefits of laparoscopy until more definitive data can clearly guide management.

We recommend the use of alternative techniques to optimally manage patients with severe pulmonary pathology.

Radiological Studies

Fig 1: His chest X-ray showing bi-apical scarring/fibrosis that appears to have progressed since prior examination. Marked hyperinflation of the lungs and flattening of the diaphragms consistent with chronic obstructive pulmonary disease.

Pulmonary Function Test

Fig 2: PFT showing severe airway obstruction and air trapping with decreased diffusing capacity. This pulmonary test pattern is most consistent with COPD, Gold Stage IV.

Discussion

- Laparoscopy is a commonly used minimally invasive surgical technique, which utilizes CO2 to create a pneumoperitoneum that allows the surgeon to easily visualize structures and perform surgery.
- Compared to open procedures, laparoscopic procedures have improved outcomes and decreased the length of stay for most patients. However, it may not be ideal for all patients.
- Carbon dioxide diffuses into the circulation very quickly during the process of creating a pneumoperitoneum. In addition, this process limits diaphragmatic movement, which may lead to hypercapnia.
- For most patients, the rapid absorption of CO2 can be offset by adjustments in ventilator settings. However, this is not always possible for patients with severe COPD, which in turn causes the patient to develop hypercapnic respiratory failure.
- Surgical techniques other than laparoscopy that avoid the use of CO2 to create a pneumoperitoneum may be beneficial in patients with severe COPD.

References


*Contributed equally