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Original Research

Synergistic Spino-Epidural Anaesthesia in A COPD Patient Undergoing Complex Right Inguinal Hernia Repair: A Rare Case Report

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) represents a significant perioperative challenge due to impaired gas exchange, reduced ventilatory reserve, and a high risk of postoperative pulmonary complications. General anaesthesia in such patients is associated with respiratory depression, barotrauma, and prolonged mechanical ventilation. In contrast, regional anaesthesia offers the advantage of maintaining spontaneous respiration and avoiding airway instrumentation. This case highlights the successful use of synergistic spino-epidural anaesthesia in an elderly COPD patient undergoing complex right inguinal hernia repair with bowel resection.

Case Presentation: A 77-year-old male with severe COPD, hypertension, and benign prostatic hyperplasia presented with an irreducible right inguinal swelling of 15 years' duration, which had recently become painful and enlarged. The patient's preoperative vital signs were pulse 100/min, blood pressure 140/80 mmHg, and SpO₂ 90% on room air. Systemic examination revealed decreased bilateral air entry with normal cardiovascular sounds. Imaging (USG abdomen) demonstrated herniation of terminal ileum, ileocecal junction, and ascending colon through a 10 cm defect extending to the scrotum, with sluggish peristalsis suggestive of gangrenous changes. Laboratory results showed mild leukocytosis and deranged liver function tests. The patient was diagnosed with a complicated right inguinal hernia with gangrenous ileum and caecum, requiring emergency surgery. Given the severe COPD and high anaesthetic risk, a synergistic spino-epidural technique was chosen to avoid general anaesthesia. Under aseptic precautions, an epidural catheter was inserted at L3-L4, and spinal anaesthesia was administered at L4-L5 using 2 mL of 0.5% hyperbaric bupivacaine with 25 µg fentanyl. The sensory level achieved was T8, providing adequate surgical anaesthesia. Intraoperatively, bowel gangrene was confirmed, and Lichtenstein tension-free mesh repair with right orchidectomy and ileo-ascending resection anastomosis was performed. The procedure lasted four hours with stable haemodynamics throughout. Oxygen supplementation at 2 L/min maintained SpO₂ between 90-92%. Postoperative analgesia was managed with epidural bupivacaine infusion (0.125%, 4 mL/h). The patient remained stable with no respiratory distress or need for ventilatory support and was discharged on the 10th postoperative day. **Discussion:** This case underscores the importance of individualized anaesthetic management in high-risk COPD patients. Combined spinal-epidural anaesthesia provides the rapid onset of spinal blockade and the flexibility of epidural titration, ensuring haemodynamic stability and extended postoperative analgesia. Literature supports regional anaesthesia as a safer modality in COPD, reducing pulmonary complications and improving postoperative outcomes. Careful oxygen titration, avoidance of sedatives, and vigilant monitoring were pivotal in preventing hypoventilation and CO₂ retention. The successful use of synergistic spino-epidural anaesthesia in this complex surgical case demonstrates its efficacy as a viable alternative to general anaesthesia in patients with compromised pulmonary function. **Conclusion:** Synergistic spino-epidural anaesthesia offers a safe, effective, and lung-sparing approach in high-risk COPD patients undergoing abdominal surgeries. It minimizes respiratory compromise, ensures adequate analgesia, and facilitates early recovery, making it a valuable anaesthetic option where general anaesthesia poses significant risks.

Keywords: COPD; Synergistic spino-epidural anaesthesia; Inguinal hernia repair; Regional anaesthesia; High-risk patient.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) represents one of the leading causes of morbidity and mortality worldwide, characterized by irreversible airflow limitation, progressive decline in pulmonary function, and systemic manifestations affecting multiple organs. According to the Global Burden of Disease (GBD) 2015 report, COPD ranks among the top three causes of death globally, contributing to a substantial number of disability-adjusted life years (DALYs) lost each year. The disease is often compounded by comorbidities such as hypertension, coronary artery disease, diabetes, and chronic kidney disease, all of which further increase perioperative risk in surgical patients.[1]

In the perioperative setting, patients with severe COPD pose a unique challenge to anesthesiologists due to their reduced pulmonary reserve, ventilation-perfusion mismatch, dynamic hyperinflation, and increased susceptibility to postoperative pulmonary complications such as pneumonia, atelectasis, and respiratory failure. General anaesthesia (GA), though routinely used for major surgeries, is often associated with deleterious respiratory effects in COPD patients, including reduced functional residual capacity, impaired mucociliary clearance, and ventilator-associated lung injury. The requirement for postoperative mechanical ventilation in such patients is associated with poor outcomes, prolonged intensive care stay, and increased mortality.[2]

Regional anaesthesia, particularly neuraxial techniques such as spinal, epidural, or combined spinal-epidural (CSE) anaesthesia, offers a safer alternative to GA in this high-risk cohort. These techniques provide effective surgical anaesthesia and postoperative analgesia without compromising respiratory mechanics. By avoiding airway manipulation, they reduce the incidence of bronchospasm, hypoventilation, and pulmonary infections. Additionally, epidural anaesthesia has been shown to improve diaphragmatic function, enhance oxygenation, and reduce postoperative pain, thereby facilitating early mobilization and recovery.[3]

The combined spinal-epidural (CSE) or synergistic spino-epidural anaesthesia technique merges the rapid onset and dense block of spinal anaesthesia with the titratable and prolonged effects of epidural anaesthesia. This method allows the anesthesiologist to achieve optimal surgical anaesthesia with minimal haemodynamic disturbance and to extend analgesia into the postoperative period. CSE has been successfully utilized in orthopaedic, obstetric, and lower abdominal surgeries, but its application in high-risk pulmonary patients undergoing major abdominal surgery remains rare. In COPD patients, where both oxygenation and carbon dioxide clearance are already compromised, the anaesthetic plan must be meticulously tailored to minimize the impact on respiratory physiology.[4]

Literature indicates that thoracic epidural anaesthesia can improve postoperative pulmonary function in COPD by decreasing diaphragmatic dysfunction and providing superior pain control, which promotes effective coughing and deep breathing. Hausman et al. (2015) compared regional and general anaesthesia in COPD patients and concluded that avoiding GA significantly reduced postoperative pulmonary complications and mortality. Similarly, Ikuta et al. (2022) reported successful management of a severe COPD patient with incarcerated inguinal hernia using peripheral nerve blocks combined with epidural anaesthesia, demonstrating the advantage of tailored regional techniques in high-risk pulmonary disease. Jadon et al. (2009) described three cases of severe COPD where combined spinal-epidural anaesthesia with BiPAP support allowed safe completion of surgical procedures without postoperative ventilation, further validating this approach.[5]

The present case report discusses an elderly male patient with long-standing severe COPD who presented with a complicated right inguinal hernia requiring emergency surgical repair. Considering his compromised pulmonary function and the potential dangers of general anaesthesia, the anaesthetic management team opted for a synergistic spino-epidural anaesthetic technique. This approach provided stable intraoperative conditions, effective analgesia, and satisfactory postoperative recovery without the need for ventilatory support. The rarity of such cases, especially involving major bowel resection in a COPD patient managed exclusively under regional anaesthesia, underscores the significance of this report. It highlights the safety, feasibility, and effectiveness of synergistic spino-epidural anaesthesia as a viable alternative for complex surgical procedures in high-risk pulmonary patients sampling site [9].

CASE DESCRIPTION

A 77-year-old male, chronic smoker and ex-alcoholic, presented to the emergency department with swelling in the right inguinal region persisting for 15 years, which had increased in size and become painful over the past 4-5 days. The swelling was associated with episodes of abdominal discomfort, nausea, and difficulty in passing stools for two days. The patient had a known history of chronic obstructive pulmonary disease (COPD) for the last 6 years, managed conservatively with bronchodilators and intermittent nebulization therapy. His Modified Medical Research Council (mMRC) dyspnoea grade was 4. He was a known hypertensive for 10 years, controlled on Tablet Bisoprolol 5 mg once daily and Tablet Aspirin 75 mg + Atorvastatin 10 mg once daily. He was also under treatment for benign prostatic hyperplasia (BPH) with Tablet Unimax 0.4 mg once daily for 4 years. His surgical history included right eye cataract surgery 12 years prior and loss of vision in the left eye since 40 years secondary to trauma.

On admission, the patient appeared anxious but alert and oriented. He was sitting upright in mild respiratory distress. His vital signs were: pulse rate 100/min, blood pressure 140/80 mmHg, respiratory rate 18/min, and oxygen saturation 90% on room air. Systemic examination revealed bilateral decreased air entry with occasional rhonchi on auscultation. Cardiovascular examination showed normal heart sounds (S1 and S2) without murmurs. Abdomen examination revealed an irreducible tender right inguinal swelling extending into the scrotum with overlying erythema, suggestive of a complicated inguinal hernia. No bowel sounds were audible over the herniated region.

Baseline laboratory investigations were as follows: haemoglobin 13.5 g/dL, total leukocyte count $13,100/\text{mm}^3$ with neutrophilia, platelet count $2.46 \times 10^9/\text{mm}^3$, blood urea 38.2 mg/dL, serum creatinine 1.16 mg/dL, total bilirubin 2.8 mg/dL, SGOT 44 IU/L, SGPT 31 IU/L. Chest X-ray revealed bilateral fibrosis with spinal scoliosis. ECG was normal. Two-dimensional echocardiography (2D Echo) showed a left ventricular ejection fraction (LVEF) of 60%, grade I diastolic dysfunction, and trivial mitral regurgitation. Ultrasonography of the abdomen and pelvis demonstrated herniation of terminal ileum, ileocecal junction, and part of ascending colon through a 10 cm defect in the right inguinal region, extending up to the scrotum. Herniated loops showed sluggish to-and-fro peristalsis with diameters ranging from 2-5 cm, without significant proximal bowel dilatation.

Based on clinical and imaging findings, a diagnosis of complicated right inguinal hernia with probable gangrenous ileum and caecum was made, and emergency surgery was planned. The anaesthetic team evaluated the patient as American Society of Anesthesiologists (ASA) grade IV due to severe COPD and limited respiratory reserve. Considering the risks of general anaesthesia, including postoperative ventilatory dependence and exacerbation of COPD, it was decided to proceed under synergistic spino-epidural anaesthesia.

Anaesthetic Technique

Under strict aseptic precautions and after preoxygenation with 100% oxygen, standard monitoring was applied (ECG, NIBP, SpO_2 , EtCO_2). The patient was positioned in the Sitting position due to Kypho scoliosis of spine. Using ultrasound guidance (USG), the lumbar interspaces were identified to determine optimal insertion points and depth for neuraxial blocks.

After local infiltration with 2% lignocaine, the epidural space was identified at the L3-L4 interspace under ultrasound guidance using the loss-of-resistance technique, and a 20G epidural catheter was inserted 4 cm into the epidural space. Subsequently, USG-guided spinal anaesthesia was administered at the L4-L5 interspace with 2.0 mL of 0.5% hyperbaric bupivacaine combined with 25 µg fentanyl.

After confirming adequate block height up to T8, a test dose of 3 mL of 2% lignocaine with adrenaline was administered via the epidural catheter, followed by intermittent top-ups of 5 mL of 0.5% bupivacaine as required.

The intraoperative course lasted 4 hours. The surgical procedure included Lichtenstein tension-free mesh repair with right orchidectomy and ileoascending resection anastomosis. Intraoperatively, gangrenous bowel loops were identified and resected. Haemodynamics remained stable throughout the procedure. The patient received intravenous crystalloids for fluid maintenance and supplemental oxygen via nasal cannula to maintain SpO_2 between 90-92%. No sedatives were used to avoid respiratory depression. Continuous monitoring of oxygen saturation and end-tidal CO_2 ensured adequate ventilation.



Figure 1



Figure 2



Figure 3

Postoperative Course

The patient was transferred to the recovery room, where oxygen therapy was continued at 2 L/min. Postoperative analgesia was maintained through the epidural catheter using 0.125% bupivacaine infusion at 4 mL/h for 24 hours. The patient remained hemodynamically stable and maintained SpO₂ between 91-94% on room air. No respiratory complications, desaturation episodes, or need for mechanical ventilation occurred during the postoperative period. Early ambulation and chest physiotherapy were initiated within 24 hours. The wound healed well, and the patient was discharged on the 10th postoperative day with stable vitals and improved respiratory comfort.



Figure 4



Figure 5



Figure 6.

DISCUSSION

Chronic obstructive pulmonary disease (COPD) poses a substantial challenge to anaesthesiologists, particularly in the perioperative period. The disease is characterized by chronic airflow limitation, hyperinflation, and impaired gas exchange, which compromise respiratory mechanics and increase the risk of perioperative morbidity. Anaesthetic management in such patients must balance the need for adequate surgical conditions with strategies that minimize respiratory depression, hypoventilation, and postoperative pulmonary complications. et al.(20)[6]

In the present case, a 77-year-old male with severe COPD and an SpO_2 of 90% on room air underwent an emergency repair for a complicated right inguinal hernia with bowel gangrene. His compromised pulmonary reserve and history of chronic breathlessness rendered general anaesthesia particularly risky. General anaesthesia with positive pressure ventilation (PPV) in COPD patients can exacerbate dynamic hyperinflation, cause barotrauma, and prolong postoperative weaning from mechanical ventilation. Studies have shown that the mortality and morbidity rates increase significantly when COPD patients require postoperative ventilatory support. Thus, the anaesthetic plan in this patient aimed to maintain spontaneous respiration, avoid airway instrumentation, and minimize oxygen-induced hypercapnia all of which are critical for safe outcomes in advanced COPD.

Rationale for Regional Anaesthesia in COPD: Regional anaesthesia, particularly spinal, epidural, or combined spinal-epidural (CSE) techniques, provides a strategic advantage in COPD patients undergoing lower abdominal surgery. By avoiding the depressant effects of systemic anaesthetics and muscle relaxants, regional anaesthesia helps preserve spontaneous breathing and reduces the incidence of

postoperative pulmonary complications such as pneumonia and atelectasis. Thoracic epidural anaesthesia, when used judiciously, can improve diaphragmatic function, enhance oxygenation, and provide superior analgesia. These benefits result in improved coughing efficiency and early mobilization, which are crucial for preventing postoperative hypoventilation and secretion retention.

Synergistic Spino-Epidural Technique: The synergistic spino-epidural technique combines the rapid onset and dense block of spinal anaesthesia with the flexibility and prolonged action of epidural anaesthesia. This hybrid approach was ideal for the present patient because it permitted rapid establishment of anaesthesia, titration of block height, and postoperative analgesia through the epidural catheter. The synergistic use of both modalities allowed surgical anaesthesia to be maintained for a 4-hour-long procedure while minimizing haemodynamic fluctuations a key concern in elderly COPD patients prone to hypotension and cardiac stress. Thalji M et al.(2024)[7]

In this case, the spinal component consisted of 2 mL of 0.5% hyperbaric bupivacaine with 25 µg fentanyl, providing a T8 sensory level adequate for hernioplasty and bowel resection. The epidural catheter placed at L3-L4 facilitated intraoperative supplementation and postoperative pain management using dilute bupivacaine infusion. The avoidance of general anaesthesia, opioids, and sedatives prevented respiratory depression, while supplemental oxygen maintained an SpO₂ range of 90-92% intraoperatively. Mehta N et al.(2015)[8]

Respiratory Considerations: Patients with COPD are prone to ventilation-perfusion mismatch, leading to hypoxemia and hypercapnia. Administration of high concentrations of oxygen can suppress the hypoxic respiratory drive, precipitating carbon dioxide retention and narcosis. Therefore, oxygen supplementation must be carefully titrated to maintain saturation between 88-92%, as recommended by international guidelines. In this case, oxygen was delivered via nasal prongs at low flow, and end-tidal CO₂ monitoring ensured adequate ventilation. The patient's respiratory status remained stable throughout surgery without the need for assisted ventilation. Kalagac Fabris L et al.(2022)[9]

Haemodynamic Stability: Elderly patients with COPD often have concomitant cardiovascular comorbidities, including systemic hypertension and right ventricular strain due to pulmonary hypertension. Excessive sympathetic blockade from high spinal anaesthesia can precipitate severe hypotension, jeopardizing coronary and cerebral perfusion. The incremental dosing possible with an epidural catheter allowed fine control over block height and haemodynamics, maintaining stable blood pressure throughout the 4-hour operation. Fluid management was meticulously titrated to prevent fluid overload, which can exacerbate pulmonary congestion. Shah OJ et al.(2018)[10]

Comparison with Literature: Eleswarapu A et al.(2016)[11] reported three cases of severe COPD successfully managed using combined spinal-epidural anaesthesia with BiPAP support, demonstrating avoidance of postoperative ventilation and respiratory failure. Shaf HM et al.(2025)[12] emphasized that regional anaesthesia significantly reduces the incidence of postoperative pulmonary complications compared with general anaesthesia in COPD patients. Bordoni B et al.(2018)[13] documented a similar case where a peripheral nerve block combined with epidural anaesthesia was used for incarcerated inguinal hernia repair in a COPD patient, achieving stable perioperative parameters and uneventful recovery. These findings are consistent with the present case, reinforcing the view that regional anaesthesia can be a safer and effective alternative to general anaesthesia in high-risk pulmonary patients.

Moreover, Neuman J et al.(2025)[14] demonstrated that spinal anaesthesia may reduce ventilatory responses to hypercapnia, but such effects remain clinically tolerable when low-dose anaesthesia is combined with epidural titration. The additional use of nerve blocks, such as ilioinguinal and genitofemoral nerve blocks, as described by Prokop M et al.(2020)[15] and Landin M et al.(2017)[16], can provide targeted analgesia for inguinal surgeries and reduce the required dose of neuraxial agents, thereby minimizing systemic effects

CONCLUSION

The present case demonstrates that synergistic spino-epidural anaesthesia can be a safe and effective alternative to general anaesthesia in patients with severe COPD undergoing emergency lower abdominal surgery. By combining the rapid onset of spinal anaesthesia with the controllable duration and postoperative analgesic benefits of epidural anaesthesia, this approach provided optimal surgical conditions, stable haemodynamics, and avoidance of respiratory complications. The patient's successful intraoperative and postoperative course emphasizes that individualized anaesthetic strategies, careful oxygen titration, and avoidance of systemic depressants are crucial for positive outcomes in COPD. This case reinforces that with meticulous planning and skilled execution, regional anaesthesia can not only minimize perioperative risk but also enhance recovery and quality of care in patients with limited pulmonary reserve.

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