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Subcutaneous emphysema during eTEP inguinal hernia repair: A case report

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Abstract

Introduction: Laparoscopic inguinal hernia repair is increasingly performed because of reduced postoperative pain and faster recovery compared with open surgery. However, carbon dioxide insufflation may lead to specific complications, including subcutaneous emphysema.

Case presentation: A 65-year-old man underwent elective totally extraperitoneal extended view (eTEP) repair for right inguinal hernia. Fifty minutes after carbon dioxide insufflation, a progressive rise in end-tidal carbon dioxide reaching 60 mmHg was observed, accompanied by mild oxygen desaturation. Physical examination revealed subcutaneous crepitus extending to the patient's neck. Ventilatory adjustments were performed, and the insufflation pressure was reduced. Subcutaneous catheters were inserted into the supraclavicular region. The procedure was successfully completed. Postoperative chest radiography confirmed extensive subcutaneous emphysema without pneumothorax or pneumomediastinum. The patient remained clinically stable and was conservatively managed. Complete resolution was confirmed radiologically, and the patient was discharged on the third postoperative day.

Conclusion: Subcutaneous emphysema is an uncommon but increasingly recognized complication of extraperitoneal laparoscopic hernia repair. Vigilant intraoperative monitoring allows for early detection and appropriate management, preventing unnecessary morbidity.

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Keywords: Laparoscopic surgery; Totally extraperitoneal; Subcutaneous emphysema; Inguinal hernia repair; End-tidal carbon dioxide.

Abbreviations: SE: Subcutaneous Emphysema; EtCO2: End-Tidal Carbon Dioxide; eTEP: Enhanced Totally Extraperitoneal; ASA: American Society of Anesthesiologists.

Introduction

Subcutaneous Emphysema (SE) is defined as the presence of gas in the subcutaneous tissues. It most commonly involves the chest wall and the neck. During laparoscopic surgery, SE results from Carbon dioxide (CO_2) extravasation into the subcutaneous plane.

Clinically, SE is often suspected when there is a sudden rise in End-Tidal Carbon Dioxide ($EtCO_2$) and is confirmed by the detection of crepitus on physical examination or by imaging studies [1,2]. Although frequently benign and self-limited, severe cases may lead to hypercapnia and respiratory compromise.

This report describes a case of extensive subcutaneous emphysema occurring during eTEP inguinal hernia repair and discusses its risk factors, pathophysiology, and management.

Case presentation

A 65-year-old man presented with a right inguinal hernia for elective laparoscopic repair. He was classified as ASA II, with a body mass index of 19.5 kg/m². His medical history was significant for smoking and a prior median laparotomy performed 15 years earlier for perforated duodenal ulcer and peritonitis.

The eTEP approach was selected to avoid intraperitoneal adhesiolysis. General anesthesia was then administered.

Standard intraoperative monitoring included electrocardiography, noninvasive blood pressure, oxygen saturation, heart rate, respiratory rate, and continuous EtCO2 monitoring.

A 10 mm optical trocar was placed 3 cm above and lateral to the left umbilicus. Carbon dioxide insufflation was initiated at 8 L/min with a maximum pressure of 12 mmHg. After blunt telescopic dissection of the retromuscular space, two additional 5 mm trocars were inserted. Dissection of the preperitoneal space revealed an indirect right inguinal defect.

Fifty minutes after insufflation, a gradual increase in $EtCO_2$ was observed, which reached 60 mmHg. The oxygen saturation decreased from 100% to 96%. Ventilatory adjustments were performed by increasing the respiratory rate to 25 breaths per minute, increasing the flow to 15 L/min, and setting the fraction of inspired oxygen to 100%. The intra-abdominal pressure was reduced to 10 mmHg. However, $EtCO_2$ remained elevated despite these measures.

Physical examination revealed subcutaneous crepitus extending to the patient's neck. Subcutaneous 24G catheters were inserted into the supraclavicular area to facilitate the release of gas.

Approximately 30 min later, the hernia was reduced, and a 15×12 cm mesh was placed. The procedure was completed without any complications. The patient was extubated after the respiratory parameters were normalized.

Postoperative chest radiography revealed bilateral subcutaneous emphysema involving the chest wall, neck, and upper abdominal wall without evidence of pneumothorax or pneumomediastinum (Figure 1).

The patient remained hemodynamically stable, with oxygen saturation between 94% and 97% on room air. Conservative management with oxygen therapy, analgesia, and respiratory physiotherapy was instituted. Follow-up chest radiography confirmed the complete resolution of the effusion. The patient was discharged on the third postoperative day.

Figure 1: Postoperative chest radiography.

Discussion

The increasing adoption of laparoscopic surgery has improved postoperative recovery and reduced pain compared with open techniques. However, insufflation-related complications are frequently encountered.

Subcutaneous emphysema occurs when insufflated CO_2 escapes into the subcutaneous tissue planes. The reported incidence varies widely, with rates of up to 23% in laparoscopic and robotic abdominal procedures when systematically screened [3].

Several risk factors have been identified, including advanced age, low body mass index, prolonged operative duration, robotic approach, and elevated insufflation pressures exceeding 15 mmHg [2,4,5]. Technical factors such as trocar placement, multiple punctures, and high CO_2 flow rates also contribute [6].

Pathophysiologically, CO_2 diffuses along the fascial planes following extravasation through peritoneal or fascial defects. Clinically, a sudden increase in $EtCO_2$ is typically the earliest sign of PE [2]. Isolated SE generally does not cause significant hypoxemia or increased airway pressure, distinguishing it from pneumothorax [7]. Nevertheless, massive SE may be associated with severe hypercapnia and, rarely, tension pneumothorax [8].

The management of this condition is primarily supportive. The reduction of insufflation pressure and increased minute ventilation are usually sufficient [3-5]. If respiratory or hemodynamic compromise occurs, evaluation for pneumothorax is mandatory, and chest tube placement may be required [8].

Preventive strategies include minimizing operative duration, limiting insufflation pressure, avoiding multiple trocar attempts, and ensuring proper fascial sealing [2,9,10].

Conclusion

Subcutaneous emphysema is an uncommon but recognized complication of extraperitoneal laparoscopic hernia repair. Although typically benign, early identification through careful intraoperative monitoring of $EtCO_2$ and physical examination is essential to prevent serious complications and ensure safe treatment.

Declarations

Conflict of interest: The authors declare no conflicts of interest.

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