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**\*Key Words:**

Strangulated abdominal hernia ;  
Insufflation ; Laparoscopic procedure  
; Incarcerated hernia ; Ventral hernia

**\*List of Abbreviation**

ERCP: Endoscopic retrograde chol-  
angiopancreatography CT: Comput-  
erized tomography mm Hg: millime-  
ters mercury  
NSAIDs: non-steroidal anti-inflam-  
matory drugs  
BMI: Body Mass Index  
ASA: American Society of Anesthesi-  
ologists  
IAP: Intraabdominal pressure

**Ventral Hernia Strangulation After Insufflation for  
Laparoscopic Procedure: A Case Report**

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**Abstract**

**Introduction:** Although hernia strangulation is an uncommon complication, it is a surgical emergency. One known risk factor associated with strangulated abdominal hernias is increasing intra-abdominal pressure. Increasing intra-abdominal pressure secondary to insufflation during laparoscopy could be a risk factor that has yet to be explored. In this report, we describe an unusual case of hernia strangulation that presented after abdominal insufflation for a laparoscopic procedure.

**Methods:** The patient is a 41-year-old female with a history of obesity and ventral incisional hernia who presented for laparoscopic cholecystectomy due to cholelithiasis. The patient had a known incarcerated, incisional hernia for 12 years that has been increasing in size. There was significant loss of domain with a large portion of the large intestine within the hernia. She was not a candidate for hernia repair due to her obesity and continuation of smoking. She initially presented with choledocholithiasis and had the common duct cleared by Endoscopic retrograde cholangiopancreatography (ERCP). Subsequent cholecystectomy was performed. On postoperative day two, the patient developed abdominal pain, tenderness, and inflammatory skin changes over the ventral hernia.

**Results:** Computerized tomography was obtained that showed fecalization of the bowel within the hernia and possible pneumatosis with perforation. Given the acuity of these symptoms and imaging findings, she was taken urgently to the operating room for exploratory laparotomy. Hernia repair with partial colectomy and ileocolonic anastomosis was performed for a necrotic ileum, ascending and transverse colon. A densely fibrotic hernia sac was noted. The final diagnosis was ischemic bowel secondary to an incarcerated hernia. She was discharged uneventfully on post-op day five.

**Conclusions:** Prompt recognition of hernia strangulation is critical for general surgeons, especially in the setting of an enlarging, incarcerated, incisional hernia at baseline. The authors emphasize that laparoscopic surgery in patients with a known hernia may increase the risk of secondary hernia complications including strangulation requiring surgical intervention.

**Introduction**

Although the lifetime risk of strangulated hernia is low, 1-3%, hernia strangulation accounts for approximately 10% of surgical procedures for acute ischemic bowel [3, 20]. Emergency abdominal hernia repairs have worse outcomes including elevated mortality, and increased need for reoperation or readmission rates when compared to patients who underwent an elective repair [18]. Hernia defects of 3-4 cm, hernias located periumbilical, and multiple adhesive bands within the hernia sac all increase the risk for emergency repair of hernias [18, 19, 20]. Other risk factors correlated with increased risk of emergent repair include increased age, female sex, diabetes mellitus, and higher American Society of Anesthesiologists (ASA) classification [18, 19]. Strangulation of a hernia requires emergency surgery and is associated with

higher mortality, increased likelihood of bowel resection, increased rate of post-operative infection, and is 15 times more likely to require a readmission, when compared to elective repairs [18]. Known risk factors associated with strangulated abdominal hernias include size, location, and factors that increase intra-abdominal pressure (IAP) such as pregnancy, obesity, and activities such as strenuous exertion, chronic coughing, or straining during bowel movements [2]. Normal

IAP in a patient with non-obese or normal BMI is 7mm Hg, while an obese patients' IAP averages from 9-14mmHg. In comparison, insufflation commonly used for most laparoscopic procedures recommends around 15mm Hg of carbon dioxide for adequate exposure for visualization and instrument use [6, 9, 21]. The consideration that increasing intra-abdominal pressure secondary to insufflation during laparoscopy could be a risk factor for strangulation of hernias, has yet to be explored in current medical literature. In this report, we describe an unusual case of hernia strangulation that presented after abdominal insufflation for a laparoscopic procedure.

### Case Presentation

This patient is a 41-year-old female with a history of obesity, current smoker, and ventral incisional hernia who presented for laparoscopic cholecystectomy due to cholelithiasis. At this time, the patient had a known incisional hernia from a Caesarean-section 12 years prior that had been increasing in size. A computerized tomography scan from one year prior demonstrated two large infraumbilical ventral wall hernias containing mesentery and multiple loops of small and large bowel without obstruction. Another CT scan four months prior showed a single large infraumbilical hernia containing distal loops of ileum, cecum, appendix, and parts of the transverse colon along with inflammatory fat planes stranding from the root of the mesentery without signs of obstruction. There was significant loss of domain with a portion of the intestine within the hernia including the ileum, cecum, ascending colon, and transverse colon. She was not felt to be a candidate for hernia repair at this time due to her obesity and continuation of smoking. One month prior to the cholecystectomy, she presented with choledocholithiasis and had the common duct cleared by ERCP with sphincterotomy. During the cholecystectomy the abdomen was insufflated to 14 mm Hg with carbon dioxide without any hemodynamic consequences.

After the cholecystectomy, postoperatively day one, the patient was tolerating a clear liquid diet with no nausea or vomiting, surgical incisions were clean, dry and intact, and all labs were within normal limits. On physical exam, her abdomen was soft, non-tender, and non-distended.

Pain was managed with acetaminophen and NSAIDs.

In the morning on postoperative day two, the patient was tolerating a normal diet without nausea or vomiting, passing flatus but had not had a bowel movement. Physical exam demonstrated her incisional sites to be clean, dry, and intact. The patient was in no acute distress, had normoactive bowel sounds, soft, non-tender, and non-distended abdomen. Lab values were unremarkable. Over the course of the day, the patient developed pain over the hernia. She was started on a bowel regimen with no resolution of her constipation and was given a mineral oil enema that produced minimal stool. By that evening, the pain and tenderness over the hernia was increasing, but the remainder of her abdomen was non-tender. She also was no longer passing flatus. The incisional sites were still clean, dry and intact, but the skin overlying the ventral hernia was inflammatory and erythematous. Abdominal radiograph at that time showed a nonspecific bowel gas pattern.

Computerized tomography was obtained that showed omental infarction with fecalization of the bowel within the hernia and possible pneumatosis with perforation. During this study, the fascial defect was measured to be 5 x 6.5 centimeters, shown below in Figure 1.

Given the acuity of these symptoms and imaging findings, it was determined that the patient's hernia had likely become strangulated. She underwent exploratory laparotomy. Primary hernia repair with partial colectomy and ileocolonic anastomosis was performed for necrotic ileum, cecum, ascending colon, and transverse colon. A densely fibrotic hernia sac was noted shown after lysis of



**Figure 1:** CT demonstrated strangulated hernia with fecalization of the bowel and pneumatosis.



**Figure 2:** Intraoperative picture demonstrating contents of hernia sac after lysis of adhesions.

adhesion in Figure 2. The final diagnosis was ischemic bowel secondary to strangulation of her chronic incarcerated hernia. She was discharged uneventfully on post-op day five.

## Discussion

Hernias develop from fascial or muscle weakness in the abdominal wall from increased intraabdominal pressure or can be acquired congenitally [1]. The majority of hernias are reducible, where the contents within the hernia can be manually pushed back into the abdominal cavity; however, some can become incarcerated, where their contents are no longer able to be manually placed back inside the abdominal cavity, as seen in our patient whose hernia was chronically incarcerated [1]. Incarcerated hernias, if not causing pain or bowel obstruction are not surgical emergencies, but do have a risk of progressing to strangulation, in which the blood supply to intestines becomes compromised, resulting in ischemic bowel, that necessitates emergency surgical intervention [1, 18]. Once the hernia becomes strangulated and has created a closed loop of ischemic bowel, emergency surgery is required.

For patients undergoing laparoscopic procedures, insufflation or pneumoperitoneum is created using trocars and a gas, generally carbon dioxide [7]. There are different levels of pressure that can be utilized during laparoscopic procedures including low, medium, and high pressure measuring 5-7 mm Hg, 12-15 mm Hg, and >20 mm Hg respectively, although the majority of laparoscopic procedures require at around 15mmHg [8, 9, 12, 21]. When insufflating the peritoneum, the hernia sac may also increase in size [13, 14, 15]. In fact, this is utilized in

preoperative progressive pneumoperitoneum which is used for patients with complex hernias with significant loss of domain, an intervention that our patient may have benefited from when undergoing herniorrhaphy in a non-acute setting [14,15]. This allows for closure of the abdominal wall to be tension-free despite the large loss of domain [13]. Many incarcerated and strangulated hernias are still managed with an open procedure [17]. One complication of insufflation includes changes in hemodynamic stability including bradycardia, decreased cardiac output, and increased preload and afterload [4]. There is evidence these effects can be decreased when using low pressures and titrating the increase in pressure more slowly [10, 11]. Other complications of pneumoperitoneum include carbon dioxide embolism, increased airway pressures, pneumothorax, hypercarbia, hypoxemia, subcutaneous emphysema, and a decrease in pulmonary compliance [4].

Although there are no absolute contraindications to laparoscopic insufflation, current guidelines by the International Endohernia Society for relative contraindications to laparoscopic procedure include patient age and hernia size [5]. This study by Bittner et al. outlines that patients with an increased age are at a higher risk for complications due to laparoscopic insufflation and that hernias greater than 10 centimeters are more likely to recur when fixed with a laparoscopic approach when compared to an open approach [5]. Another study by Srivastava and Niranjana recommends guidelines for determining if a patient should or should not undergo laparoscopic insufflation [7]. These guidelines detail safe practices to reduce complications during laparoscopic procedures and recommend that patients with cardiopulmonary compromise should not undergo these procedures without high-risk informed consent [7].

Currently, there are no guidelines or contraindications to performing laparoscopic procedures in patients with known hernias and little data exists in current literature on acute incarceration and strangulation of hernias [5]. Similarly, there has yet to be a universally accepted mechanism to describe hernias as small, medium, or large; although, Muyusoms et al. proposes a classification system for abdominal wall hernias by the European Hernia Society [16]. Each of these makes studying the effect of insufflation on known hernias difficult. However, due to the severity of a strangulated hernias and the measures that must be taken to minimize mortality and complications in such cases, there should be more exploration into risk factors that causes hernias to become strangulated including the use of insufflation. In the setting of known abdominal hernia prior to laparoscopic procedures, consideration should be given to the potential increased rate of hernia complications post-operatively including incarceration and strangulation.

## Conclusion

As insufflation in an otherwise healthy patient is not a benign procedure, for those who have a known incarcerated abdominal hernia, special consideration should be given as to the potential outcomes if not undergoing concurrent herniorrhaphy. Increasing intra-abdominal pressure is a known risk factor for hernia strangulation. Insufflation is known to increase pressure in the abdominal cavity and hernia sac. The authors of this paper believe that patients with known hernias should be given special pre-operative consideration and planning prior to undergoing any procedure that requires insufflation without concurrent herniorrhaphy due to a potential increased risk for postoperative hernia complications including strangulation. There should be further study to establish if there is a statistically significant correlation in patients developing hernia complications after laparoscopic procedure.

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