

WebM&M

Morbidity and Mortality Rounds on the Web

Spotlight

Fecal Contamination of the Peritoneum from Laparoscopic Trocar Injury: A Routine Operation Goes Wrong



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Source and Credits

- This presentation is based on the October 2022 AHRQ WebM&M Spotlight Case
 - See the full article at <https://psnet.ahrq.gov/webmm>
 - CME credit is available
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Objectives

At the conclusion of this educational activity, participants should be able to:

- Review techniques for laparoscopic abdominal access
- Identify factors that influence choice and technique of abdominal access
- Describe maneuvers to minimize injury during access into a complex abdomen
- Discuss complications of abdominal access and management if injury is seen during the index operation

FECAL CONTAMINATION OF THE PERITONEUM FROM LAPAROSCOPIC TROCAR INJURY: A ROUTINE OPERATION GOES WRONG

This case highlights the risk of vascular and bowel injury during peritoneal access for laparoscopy and the importance of patient history and abdominal anatomy when considering approaches to abdominal entry

Case Details (1)

- A 49-year-old woman presented to the Emergency Department (ED) with abdominal pain nine hours after discharge following outpatient laparoscopic left oophorectomy.
- The patient had a history of morbid obesity (body mass index [BMI] 49); chronic pelvic pain; urinary incontinence; breast cancer treated by mastectomy with subsequent reconstruction and abdominoplasty; and uterine fibroids treated by hysterectomy.
- The indication for the left oophorectomy was a mixed echogenic ovarian mass concerning for possible ovarian cancer.

Case Details (2)

- The left oophorectomy procedure involved an umbilical port placed using an Optiport visual trocar, a suprapubic port, and two additional ports laterally.
- The operative note mentioned no visible injury upon entry into the abdominal cavity, but there were extensive adhesions in the pelvis.
- After the left ovary was removed and the procedure concluded, the patient was discharged home the same day.
- The patient sought care at another hospital 9 hours after being discharged, due to increasing pain, nausea, and fever.

Case Details (3)

- Acute Care Surgery was consulted 7 hours after she was triaged in the ED, and the patient underwent laparotomy 2 hours after the consultation.
- At operation, there was obvious fecal contamination upon entry into the peritoneal cavity. The transverse colon was adherent to the peritoneum at the umbilicus, and the colon at this location had a full-thickness injury with fecal matter draining out.
- The surgeons concluded that the most plausible explanation was a trocar injury. There was significant contamination, but it was contained by adhesions, so inflammation around the colotomy site was minimal.
- Primary repair of the colotomy was performed, the abdominal fascia was closed, the skin was left open, and a negative pressure dressing was applied.

Case Details (4)

- The negative pressure dressing was changed on postoperative days 3 and 5, and was removed on postoperative day 6.
- The skin was closed over two penrose drains, which were pulled out 1 cm daily and removed on postoperative day 12. The patient was discharged home on postoperative day 15.
- She returned to clinic for follow-up one week later and a piece of penrose drain was found to have been retained in the wound.
 - Some providers reportedly cut the drain(s) as they were being advanced, and the drain(s) were not re-secured with a skin suture after each serial advancement.
 - It was removed without further complications.

FECAL CONTAMINATION OF THE PERITONEUM FROM LAPAROSCOPIC TROCAR INJURY: A ROUTINE OPERATION GOES WRONG

THE COMMENTARY

By Shushmita M Ahmed, MD, and Mohamed Ali, MD

BACKGROUND

Background (1)

- Laparoscopy has transformed the field of surgery, allowing for decreased morbidity and mortality in even the most complex operations. **However, it is not without risk.**
- This case illustrates not only the risk of injury during laparoscopic access, but also the possibility (and sequelae) of missing the injury at the time of the initial operation.

Background (2)

- Though laparoscopic vascular and bowel injury are rare, they represent the 2nd and 3rd leading causes of mortality in laparoscopic surgery.
 - Vascular injuries occur in 0.1-0.64% of laparoscopic cases, have a 15% mortality rate, and account for 81% of trocar injury-related deaths.
 - Bowel injuries occur in 0.03- 0.18% of cases, have a 2.5-5% mortality rate, and account for 19% of the deaths from trocar-related injury.
 - The majority of vascular and bowel injuries occur at the time of peritoneal access; in up to 50% of cases, the injury is not diagnosed at the time of surgery.

Background (3)

- As peritoneal access is the most vulnerable time for injury during laparoscopy, various techniques have been established for successful and safe entry.
- Three of the techniques used most frequently are as follows:
 1. Veress needle access
 2. Open (Hasson) access
 3. Direct/Optical entry

Background (4)

- A **Veress needle** is a long spring-loaded needle with a retractable obturator.
- For this technique, a skin incision is made, and the fascia is elevated. The needle is inserted; as the needle passes through fascia and peritoneum, the obturator recoils and clicks. Two clicks indicate entry into the peritoneal space. Once abdominal placement is confirmed, the abdomen is insufflated to 15mmHg. The initial trocar can then be inserted at the site of the needle, or at a different site on the abdomen. The camera is then inserted, and the abdomen is inspected.

Background (5)

- With the **Open (Hasson) technique**, an incision is made in the skin, the subcutaneous tissue is dissected, and the fascia is elevated and incised.
- The two fascial sides are then secured with stay sutures. The underlying peritoneum is then elevated and sharply incised. A finger is swept underneath the peritoneum to ensure no abdominal contents are adherent to the abdominal wall. A trocar is then inserted, and the abdomen is insufflated to 15mmHg. The camera is inserted, and the abdomen is inspected.

Background (6)

- **Optical entry** involves a specialized trocar with a transparent tip, which allows for insertion of the laparoscope and visualization of the abdominal wall layers during entry.
- While most Optical entries are performed after pneumoperitoneum is established with a Veress needle, some surgeons prefer to enter without pneumoperitoneum.
- The trocar/laparoscope complex is advanced with gentle pressure and twisting of the device to allow spreading of the tissue. Entry into the abdomen is typically indicated by a black space if insufflated versus visualization of fat or bowel if not insufflated. The insufflated abdomen is then inspected.

Background (7)

- There are risks associated with each of these techniques.
- In several randomized controlled trials evaluating Open vs Veress needle techniques, data were insufficient to show a difference in vascular and bowel injuries during peritoneal access because the studies were underpowered to evaluate these rare complications.
- Thus, there is no evidence to support the use of one technique over another.
- Surgeons are, therefore, encouraged to learn all entry methods, so that in case of difficult entry, a backup method can be employed.

APPROACHES TO IMPROVING PATIENT SAFETY: CONSIDERATION OF PATIENT HISTORY AND ANATOMY

Consideration of Patient History and Anatomy (1)

- The success and safety of laparoscopic access involves more than just the entry technique.
- Relevant factors include the patient's age, body habitus, scarring from prior surgery, and abdominal wall compliance.
- Therefore, the operating surgeon must be aware of the patient's medical history and anatomic variations to choose the safest entry technique and location.

Consideration of Patient History and Anatomy (2)

- Access is typically established in the periumbilical area of the abdomen.
- However, in patients with prior operations and adhesions, this may not be a safe approach.
- Access in the left upper quadrant (or, in select cases, the right upper quadrant) offer safe alternatives in these situations.
- The patient's abdomen in this case posed a special challenge given her obesity and history of abdominoplasty.

Consideration of Patient History and Anatomy (3)

- In patients with obesity, the thickness of the abdominal wall may pose a challenge to Veress needle access and trocar insertion.
- Longer Veress needles and trocars may be needed.
- Lifting the fascia may be challenging due to greater distance from the skin, necessitating a larger incision to allow dissection down to the fascia to clamp and elevate it. Insertion of the Veress needle and trocar entry at 90 degrees to the ground (as opposed to the traditional 45-degree angle) can facilitate cannulation of the peritoneal space.⁹

Consideration of Patient History and Anatomy (4)

- Patients with obesity may also have displacement of the umbilicus, with the more caudal umbilicus closer to the aortoiliac bifurcation.
- Challenges to periumbilical entry due to both abdominal wall thickness and umbilical positioning can be mitigated by entry in the left upper quadrant.
- With the Open technique, a larger incision may be necessary for successful dissection and lifting of the fascia and the underlying peritoneum.

Consideration of Patient History and Anatomy (5)

- Abdominoplasty not only distorts the position of the umbilicus and anterior midline but can also cause reduced abdominal wall compliance.
- Reduced compliance can result in difficulty achieving sufficient insufflation volume.
- Although data on patients with a history of abdominoplasty are limited, case reports show safe access with steep reverse Trendelenberg (head-up) positioning and access into the upper abdomen (rather than the periumbilical area). Other surgeons recommend Open access rather than Veress access to avoid injury from the Veress needle.

APPROACHES TO IMPROVING PATIENT SAFETY: SURGICAL MANEUVERS TO INCREASE SAFETY

Surgical Maneuvers to Increase Safety (1)

- For Veress needle access and trocar insertion, one important maneuver is to elevate the fascia.
- Some surgeons use towel clamps to elevate the skin; however, this approach may not always result in optimal fascial elevation, especially in patients with thicker abdominal walls.
- Another technique is to dissect the subcutaneous tissue down to fascia and use a clamp to grab and elevate the fascia itself.

Surgical Maneuvers to Increase Safety (2)

- With the Veress technique, confirmation of correct needle placement is an important step prior to insufflation.
 - One maneuver used to confirm needle placement is aspiration using a syringe attached to the Veress hub; the presence of blood or enteric contents indicates misplacement.
 - A second method is the saline drop test, in which saline is placed into the needle hub and the abdomen is then elevated; flow of saline into the needle tip indicates correct placement.
 - Finally, needle position can be assessed by attaching insufflation tubing to the Veress needle and measuring pressure. In patients without obesity, a pressure of 0-5 mmHg indicates correct position. However, opening pressure may be slightly higher (7-9 mmHg) in patients with obesity, such as the patient in this case.

Surgical Maneuvers to Increase Safety (3)

- With the Open technique, especially in patients with adhesions from prior operations, it is important to ensure adequate visualization and accurate incision of the peritoneum.
 - To achieve this goal, a longer incision may be needed. The peritoneum should be sharply incised with scalpel or scissors, then visualized and palpated prior to port placement; this process is necessary to ensure that the space has been opened without causing injury.
- With all techniques used for abdominal access for laparoscopy, following insufflation and camera incision, the abdomen should be thoroughly inspected to ensure that no injury was missed. Evaluation of the entry site alone is insufficient for this purpose as bowel and omentum may have shifted during the operation.

APPROACHES TO IMPROVING PATIENT SAFETY: RECOGNIZING INJURY

Recognizing Injury (1)

- Injury from the Veress needle technique may be recognized by using syringe aspiration (as described above).
- Presence of blood or enteric contents denotes injury. In cases of bowel or controlled vascular injury, the Veress needle should be kept in place and an alternative site of entry should be established, either via laparoscopic or open technique. Keeping the needle in place allows for visualization of the injury site once the abdomen is entered. If there is brisk bleeding from major vascular injury, then laparotomy should be undertaken immediately.

Recognizing Injury (2)

- The syringe technique is not always reliable and is not a substitute for careful evaluation of the abdomen upon entry. Even in the absence of obvious injury, insufflation of the omentum or mesentery should be accompanied by careful evaluation of the adjacent bowel.
 - Areas of clotted blood should be inspected to rule out ongoing minor vascular injury.
 - In patients with adhesions or difficult entry, thorough evaluation is especially important to ensure detection of even subtle injuries.
 - Laparoscopic surgery allows equal opportunity for all members of the operative team to visualize patient anatomy. Although the operating surgeon is generally the most experienced individual in performing the operation and detecting associated injuries, other members of the team should alert the surgeon should they see any aberrations.

Recognizing Injury (3)

- When an operation is completed without any known accompanying injuries, irregularities in the patient's postoperative course should raise suspicion for missed bowel or vascular injury.
- Subtle injuries take time to manifest in clinical signs and symptoms. Thus, new onset of fever, tachycardia, hypotension, excessive pain, peritonitis, and even uncontrolled nausea/vomiting all require further evaluation.
- Patients in the postoperative recovery unit exhibiting any of these symptoms should not be discharged.
- If patients present with these symptoms soon after discharge, the operating team should be notified immediately to ensure timely evaluation and management. Serial abdominal exams, laboratory tests, and imaging may be called for to provide additional information. In cases involving peritonitis or significant hemodynamic instability, immediate operative exploration may be warranted.

APPROACHES TO IMPROVING PATIENT SAFETY: FILLING THE TOOLBOX

Filling the Toolbox (1)

- No abdominal entry technique is foolproof.
- Therefore, while surgeons are encouraged to employ the technique with which they are most comfortable, they must be knowledgeable in alternative means of accessing the abdomen in order to mitigate potential injury.
- For example, retrospective studies show increased failure and complication rates when multiple access attempts using the Veress needle method are made (with up to an 80-100% complication rate after more than three attempts).
- Employing alternative access techniques may, therefore, allow safer entry into the challenging abdomen, while still avoiding laparotomy.

CONCLUSION

Conclusion (1)

- The patient in this case had a complicated medical history and anatomy. Given her surgical history, obesity, and abdominoplasty, an alternative entry site for the oophorectomy should have been considered.
- It is the preference of these authors to enter in the left upper quadrant. Syringe aspiration should have accompanied Veress needle insertion; given that the injury affected the full thickness of the colon, enteric contents may have been aspirated, which would have prompted immediate management.
- Following entry, careful exploration of the abdomen should have been performed. Given the caliber of the Veress needle, bowel injuries may be small and take time to leak. Therefore, inspection should have been performed at the beginning and end of the operation (as is our practice with complex cases like this one).

Conclusion (2)

- In this case, the missed injury resulted in spilled bowel contents, requiring laparotomy and delayed wound closure.
 - This complication not only added considerable morbidity to the patient's postoperative course, but also resulted in an additional iatrogenic complication: a retained piece of penrose drain in the wound.
 - This latter complication could have been avoided by keeping track of the total length of the drain inserted and the total length of the drain removed each day. Unintended retention of drain material in contaminated wounds is a known problem, but studies documenting this complication are limited.

Conclusion (3)

- Retained foam from negative pressure management has been described as a cause of postoperative sepsis; this understanding has prompted new wound care protocols requiring documentation of the number of foams removed and inserted during each dressing change (to ensure that the number of foams removed equals the number of foams inserted in the previous dressing change).
- Similarly, the number and length of adjustable drains should be documented to ensure that pieces are not left behind. Penrose drains are radiopaque.
- Thus, in cases of serial drain removal, a radiograph should be performed following removal of the last piece to ensure that no foreign material is retained.

TAKE HOME POINTS

Take-Home Points (1)

- Peritoneal access is the most vulnerable stage in laparoscopy and can result in vascular and bowel injury that may go undetected during the operation.
- Consideration of the patient's history and abdominal anatomy are crucial in determining the safest entry location and access technique to utilize.
- Following abdominal entry and insufflation, careful evaluation of the abdomen is necessary to ensure that no unintended injury is missed.

Take-Home Points (2)

- There is insufficient evidence to suggest that any laparoscopic entry technique is safer than any other; iatrogenic injuries may occur with any peritoneal access technique.
- Laparoscopic surgeons should be well versed in all methods of abdominal entry to ensure they can safely use backup options.
- Unintended access injuries that go undetected increase perioperative morbidity and mortality in patients undergoing laparoscopic operations and may result in reoperations and require additional procedures for management, which may, in turn, be associated with additional iatrogenic complications.

REFERENCES

References

1. Asfour V, Smythe E, Attia R. Vascular injury at laparoscopy: a guide to management. *J Obstet Gynaecol*. 2018;38(5):598-606. [[Available at](#)]
2. Ahmad G, Baker J, Finnerty J, Phillips K, Watson A. Laparoscopic entry techniques. *Cochrane Database Syst Rev*. 2019;1(1):CD006583. Published 2019 Jan 18. [[Free full text](#)]
3. Krishnakumar S, Tambe P. Entry complications in laparoscopic surgery. *J Gynecol Endosc Surg*. 2009;1(1):4-11. [[Free full text](#)]
4. Bhojrul S, Vierra MA, Nezhat CR, Krummel TM, Way LW. Trocar injuries in laparoscopic surgery. *J Am Coll Surg*. 2001;192(6):677-683. [[Available at](#)]
5. Vilos GA, Vilos AG, Abu-Rafea B, Hollett-Caines J, Nikkhah-Abyaneh Z, Edris F. Three simple steps during closed laparoscopic entry may minimize major injuries. *Surg Endosc*. 2009;23(4):758-764. [[Available at](#)]
6. Alkatout I. Complications of Laparoscopy in Connection with Entry Techniques. *J Gynecol Surg*. 2017;33(3):81-91. [[Free full text](#)]
7. Magrina JF. Complications of laparoscopic surgery. *Clin Obstet Gynecol*. 2002;45(2):469-480. [[Available at](#)]
8. Recknagel JD, Goodman LR. Clinical Perspective Concerning Abdominal Entry Techniques. *J Minim Invasive Gynecol*. 2021;28(3):467-474. [[Available at](#)]
9. Lamvu G, Zolnoun D, Boggess J, Steege JF. Obesity: physiologic changes and challenges during laparoscopy. *Am J Obstet Gynecol*. 2004;191(2):669-674. [[Available at](#)]
10. Ahmed S, Morrow E, Morton J. Perioperative considerations when operating on the very obese: tricks of the trade. *Minerva Chir*. 2010;65(6):667-675. [[Available at](#)]
11. Cassaro S, Leitman IM. A technique for laparoscopic peritoneal entry after abdominoplasty. *J Laparoendosc Adv Surg Tech A*. 2013;23(12):990-991. [[Available at](#)]
12. Karip B, Altun H, Işcan Y, et al. Difficulties of bariatric surgery after abdominoplasty. *Case Rep Surg*. 2014;2014:620175. [[Free full text](#)]
13. Philosophe R. Avoiding complications of laparoscopic surgery. *Fertil Steril*. 2003;80 Suppl 4:30-56. [[Available at](#)]

References

14. Karçaaltincaba M, Demirkazik FB, Imamoğlu T, Fırat A, Ariyürek M. Breast abscess mimicking malignant mass due to retained penrose drain: diagnosis by mammography and MRI. *Clin Imaging*. 2004;28(4):278-279. [[Available at](#)]
15. Leonovicz PF, Uehling DT. Removal of retained Penrose drain under fluoroscopic guidance. *Urology*. 1999;53(6):1221. [[Available at](#)]
16. Liu KS, Huang KC, Wong CH. A neglected retained penrose drain mimicking an amputation stump neuroma. *J Trauma*. 2007;62(4):1051-1052. [[Available at](#)]
17. Anagnostakos K, Thiery A, Sahan I. Retained Negative Pressure Wound Therapy Foams as a Cause of Infection Persistence. *Adv Wound Care (New Rochelle)*. 2021;10(12):699-710. [[Free full text](#)]
18. Pories WJ, McDonald DF, Hinshaw JR. A calibrated radiopaque Penrose drain. *J Urol*. 1961;85:405-407. [[Available at](#)]