Renal Hilum Injury with Veress Needle

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ABSTRACT

Introduction: Since the advent of laparoscopy, the ideal first-port entry technique has not yet been determined. Use of the Veress needle at Palmer's point, although safe in practice under skilled physicians, is not without risk of complications.

Case Description: A female patient with prior abdominal surgeries underwent a laparoscopic surgery for a nonmalignant indication. Intraoperative complications included hemodynamic instability and gross hematuria. The patient was ultimately stabilized, and imaging after the case revealed a hematoma formation around the left kidney with evidence of renal hilar injury.

Discussion: The laparoscopic surgeon must be aware that blind Veress needle entry has inherent risk for injury of retroperitoneal structures including the renal system. Particularly if hemodynamic instability is noted after abdominal entry at any site, physicians should have a low threshold for investigation, including by laparotomy if necessary.

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INTRODUCTION

Minimally invasive surgery has quickly become the approach of choice for many practices. Injuries during abdominal entry are the most cited complications from laparoscopy. A variety of techniques for abdominal entry have been developed, each with their own unique advantages, disadvantages, and safety profiles.

Establishment of pneumoperitoneum is associated with risk for vascular and bowel injury.[1] A large systematic review by Azevedo, et al. reported the incidence of injuries related to insertion of the Veress needle is on average 1 in 442 laparoscopies with approximately 8% of injuries involving retroperitoneal vasculature and of those, 8% were to major pelvic vessels.[2]

The risks with use of the Veress needle change depending on site of insertion. Palmer's point, located in the left upper quadrant, 3 cm below the costal margin in the midclavicular line, is often regarded as a safe location of entry for very thin patients, obese patients, those with suspected periumbilical adhesions from previous surgeries, or after multiple unsuccessful umbilical entries.[3] Palmer's point contains substantially less subcutaneous fat and avoids major vessels, minimizing risk of major vascular injury.[4] While risk of injury to the liver, spleen, and stomach are well described, injury to retroperitoneal structures have fewer data, likely due to rarity of occurrence.[4] Namely the additional structures for consideration are the left kidney and associated renal vasculature.

In this case report we describe the use of a Veress needle for laparoscopic entry at Palmer's point, a retroperitoneal injury related to entry, and we discuss the safety profile and operative considerations for establishing insufflation with the Veress needle.

CASE REPORT

A 69-year-old female patient initially presented to her gynecologist with pelvic pain and known ovarian cysts

identified on prior imaging. She was counseled on management options and underwent a laparoscopic bilateral salpingo-oophorectomy. The patient was taken to the operating room where anesthesia was administered without difficulty. Surgical skin preparation and sterile draping was performed. A Foley catheter was placed prior to the beginning of the case. A Veress needle at Palmer's point was chosen for establishing pneumoperitoneum. On first attempt, abdominal placement could not be confirmed and the Veress needle was removed. On a second attempt, aspiration and a hanging drop test confirmed correct positioning of the Veress needle in the abdomen. The abdomen was then insufflated with CO_2 gas.

During insufflation, the patient developed hypotension with blood pressure in the 70's systolic and 30's diastolic. Concurrently, the patient began to have hematuria into her Foley catheter. A second laparoscopic port was placed in the right midabdomen during this time; however, there was inadequate visualization of the intra-abdominal anatomy due to significant pelvic adhesions from prior surgery. With ongoing hematuria and hemodynamic instability, it was decided intraoperatively to perform a laparotomy for assessment of possible bleeding from a major vessel injury. Meanwhile, an intraoperative urology consult was obtained. Due to the acute nature of the hemodynamic changes and with concern for active hemorrhage, a transfusion of 500 mL packed red blood cells was initiated and the patient received a total of 3 L of crystalloid resuscitation throughout the operation. Immediate evaluation by the anesthesia team did not report any derangements of respiratory parameters or mill-wheel murmur concerning for gas embolism.

Shortly after conversion to laparotomy, the hypotension resolved and hematuria decreased. Immediate evaluation of the abdomen did not identify any obvious source of bleeding from the bladder, colon, major pelvic vasculature, or adnexal structures. Upon further investigation, an area of hematoma was seen along the left ureter at the level of the renal hilum. The urologists performed a cystoscopy which revealed no bladder injury but did appreciate bleeding from the left ureteral orifice. The urologists suspected a subcapsular hematoma and a ureteral stent was placed as a precaution. Blood-tinged urine was seen draining from the stent after placement. As the hematoma was not expanding, the decision was made to observe without further intervention. Throughout the remainder of the surgery the patient's vital signs remained within normal limits and hematuria resolved. The case was completed via open laparotomy. The estimated blood loss was 500 cc, with 375 cc of gross hematuria. Pre-operative

and immediate postoperative hemoglobin values were 13.0 and 11.2 g/dL, respectively.

A computerized tomography (CT) scan of the abdomen/pelvis on postoperative day one demonstrated a small amount of fluid around the left kidney, renal edema, as well as a $4.0 \times 00.6 \times 6.8$ cm area of high attenuation in the anterior renal space compatible with a hematoma and needle injury of the renal hilum **(Figure 1).**

DISCUSSION

Vascular injury is a known complication of abdominal entry during laparoscopy. In attempting to mitigate this risk, surgeons often elect to enter at Palmer's point, as this has been understood to minimize risk of injury to the aorta, inferior vena cava, and iliac arteries at their bifurcation that are at risk with umbilical entry.[5] Our case provides an example of an injury at the left renal hilum with entry at Palmer's point using a Veress needle. This illustrates that while the risk of major vascular injury is low, retroperitoneal structures must be considered should intraoperative complication arise.

A study of abdominal magnetic resonance imaging demonstrated the average distance from Palmer's point to the left kidney was approximately 10 cm and 11.5 cm to the aorta.[6] The left kidney was the structure directly beneath the line of insertion in half of these participants. The authors proposed that a safe angle of entry at Palmer's point would be perpendicular to the skin in the axial plane and 45 degrees caudal in the sagittal plane.[6] This information may give clinical insight into avoidance of injury to retroperitoneal structures. It is paramount that laparoscopic surgeons are knowledgeable of the retroperitoneal anatomy, including the renal vasculature and collecting system.

Many surgeons have chosen to employ an open technique (Hasson) for abdominal entry, which consists of an incision of the abdominal wall followed by insertion of the first trocar and subsequent insufflation under direct visualization. The proposed benefits of the Hasson entry include prevention of vascular injury, but also extends to prevention of gas embolism, bowel injury, and preperitoneal insufflation.[7] Notably, despite expert use of the technique by Hasson, who reported only one bowel injury within the first 50 cases in his 29-year experience, subsequent studies have not shown significant benefit or risks over the closed methods.[8,9] A 2019 Cochrane Systematic Review of 57 randomized controlled trials further demonstrated that there was insufficient evidence to determine

Figure 1. Computed tomography abdomen/pelvis impression.

differences in rates of vascular injury, visceral injury, or failed entry between entry techniques.[10] A review of these methods, as well as their proposed advantages, disadvantages, and possible complications is listed in **Table 1**.

Other methods to optimize abdominal entry while avoiding injury have been posited, including, but are not limited to:

1. (Right upper quadrant) Insertion of the Veress needle at Latif's point, between the xiphoid process and the right costal margin with the needle directed towards the patient's right axilla.[11] Use of this new entry point was compared with use of Palmer's point, showing that both the mean pneumoperitoneum time and mean number of needle punctures was lower in the Latif's point group. The percentage of successful needle entry on a first attempt was greater in the Latif's point group and the number of overall complications was also lower.

2. (Modified umbilical entry) Caudal displacement of the umbilicus before insertion of the Veress needle to allow for a median displacement of 6 cm between the site of entry and underlying major vessels.[12]

3. (Modified umbilical entry) Angling the Veress needle at the umbilicus to 45 degrees in nonobese patients.[7]

4. Transuterine Veress CO_2 insufflation if Palmer's point and umbilical entry sites are not considered a safe option.[7]

5. A novel entry approach performed by surgeons in the author's practice involves a hybrid of open and closed entry. After incising skin and dissecting through subcutaneous fat layers to fascia, the fascia is grasped with Kocher clamps. After isolating this tissue, a Veress needle is placed through the fascia. Correct placement may be confirmed using standard methods (entry pressure, hanging drop test, etc.). During insufflation, Kocher clamps and Veress needle may be held together to ensure stability of the needle within the abdomen and prevent movement.

Overall, there is insufficient evidence to suggest a single superior method of initiating laparoscopy.

Lastly, this patient developed hemodynamic instability shortly after entry. Potential etiologies of hypotension in this patient include: hypovolemia from acute blood loss, gas embolism, vasovagal response from retroperitoneal injury, or response to peritoneal distension during insufflation. Hemodynamic instability noted during abdominal entry at any site during laparoscopy requires immediate attention. If major vessel injury is a concern intraoperatively; then airway, breathing, and circulation

Table 1.
Summary of Laparoscopic Abdominal Entry Techniques

Category	Technique	Description	Advantages	Disadvantages	Potential Complications
Open	Hasson	Incision from skin to peritoneum with insertion of a blunt trocar	Decreased Minor Complications, Avoidance of gas embolism or preperitoneal insufflation	Requires Tissue Dissection, Potential for pneumoperitoneum leak	Incisional hematoma,[13] Bowel Injury
	Single-Incision Laparoscopic Surgery/Laparo-endoscopic Single Site	20–30 mm Incision in or below the umbilicus, with or without use of a device with a silicone cap	Decreased Postoperative Pain, Improved Cosmesis	Decreased Range of motion due to proximity of multiple ports, specialized equipment	Incisional hematoma,[13] Bowel Injury
Closed	Veress Needle	Needle with a spring-loaded obturator is passed through layers of the abdominal wall to establish pneumoperitoneum	Provides Pneumoperitoneum Prior to primary trocar placement	Possible Pre-Peritoneal Insufflation, No Ability to visually confirm placement	Vascular or organ injury, gas embolism, rare reports of mortality.[10,13]
	Radially Expanding System	Needle with radially dilating sleeve is placed through layers of abdominal wall and expanded to create a trocar site after needle is removed	Single Sharp Instrument Introduced to abdomen, decreased trocar site bleeding[10]	Cost/Access to equipment	Vascular or organ injury
	Direct Entry	Insertion of a noncutting trocar into abdominal cavity prior to insufflation	Speed, Detection of bowel/vascular injuries or failed entry	Absence of pre-existing pneumoperitoneum to protect bowel/vasculature	Vascular or organ injury
	Optical Entry	Use of a clear plastic trocar that allows laparoscopic camera to be in place during port placement	Visualization of trocar path	Absence of pre-existing pneumoperitoneum to protect bowel/vasculature	Vascular or organ injury

must be controlled, and subsequently abdominal access via laparotomy may be required to identify and control bleeding.

CONCLUSION

In rare cases of complications from Veress needle placement at Palmer's point, the laparoscopic surgeon must maintain a broad consideration to underlying structures that may be at risk. Although this patient's retroperitoneal hematoma was able to be managed conservatively, awareness of complications and prompt intraoperative management is critical to mitigate morbidity. There are a wide variety of methods for initiating laparoscopic entry to the abdomen, each with advantages and disadvantages. Without data to suggest a superior approach, the laparoscopic surgeon must be considerate of the technique in use and the potential complications that are associated.

References:

1. Schafer M, Lauper M, Krahenbuhl L. Trocar and Veress needle injuries during laparoscopy. *Surg Endosc.* 2001;15(3):275–280.

2. Azevedo JL, Azevedo OC, Miyahira SA, et al. Injuries caused by Veress needle insertion for creation of pneumoperitoneum: a systematic literature review. *Surg Endosc.* 2009;23(7):1428–1432.

3. Thepsuwan J, Huang K-G, Wilamarta M, Adlan A-S, Manvelyan V, Lee C-L. Principles of safe abdominal entry in laparoscopic gynecologic surgery. *Gynecol Minim Invasive Ther.* 2013;2(4):105–109.

4. Tulikangas PK, Robinson DS, Falcone T. Left upper quadrant cannula insertion. *Fertil Steril.* 2003;79(2):411–412.

5. Asfour V, Smythe E, Attia R. Vascular injury at laparoscopy: a guide to management. *J Obstet Gynaecol.* 2018;38(5):598–606.

6. Giannios NM, Gulani V, Rohlck K, Flyckt RL, Weil SJ, Hurd WW. Left upper quadrant laparoscopic placement: effects of insertion angle and body mass index on distance to posterior peritoneum by magnetic resonance imaging. *Am J Obstet Gynecol.* 2009;201(5):e521–525.

7. Vilos GA, Ternamian A, Dempster J, et al. Laparoscopic entry: a review of techniques, technologies, and complications. *J Obstet Gynaecol Can.* 2007;29(5):433–447.

8. Hasson HM, Rotman C, Rana N, Kumari NA. Open laparoscopy: 29-year experience. *Obstet Gynecol.* 2000;96(5 Pt 1):763–766.

9. Deffieux X, Ballester M, Collinet P, Fauconnier A, Pierre F. Risks associated with laparoscopic entry: guidelines for clinical practice from the French College of Gynaecologists and Obstetricians. *Eur J Obstet Gynecol Reprod Biol.* 2011;158(2):159–166.

10. Ahmad G, Baker J, Finnerty J, Phillips K, Watson A. Laparoscopic entry techniques. *Cochrane Database Syst Rev.* 2019;1:CD006583.

11. Abd Ellatif ME, Ghnnam WM, Abbas A, Basheer M, Dawoud I, Ellaithy R. Latif's point: a new point for Veress needle insertion for pneumoperitoneum in difficult laparoscopy. *Asian J Endosc Surg.* 2018;11(2):133–137.

12. Vilos G, Vilos A, Jacob GP, Abu-Rafea B, Ternamian A. Safe Veress needle intraperitoneal placement and safer laparoscopic entry. *J Minim Invasive Gynecol.* 2018;25(7):1137–1137.

13. Merlin TL, Hiller JE, Maddern GJ, Jamieson GG, Brown AR, Kolbe A. Systematic review of the safety and effectiveness of methods used to establish pneumoperitoneum in laparoscopic surgery. *Br J Surg.* 2003;90(6):668–679.