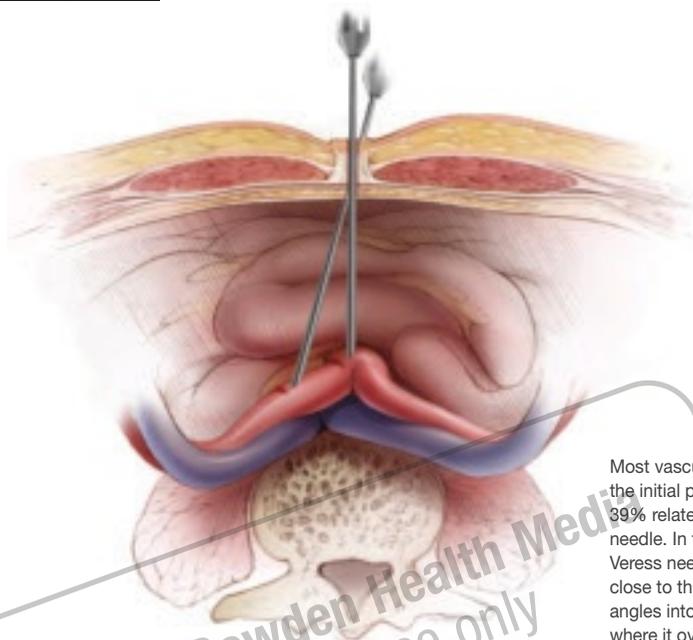


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Most vascular injuries occur during the initial phase of laparoscopy, with 39% related to placement of the Veress needle. In this composite view, one Veress needle approaches perilously close to the aortic bifurcation; the other angles into the right common iliac artery where it overlies its corresponding vein.

## Major vascular injury during laparoscopy: Pearls to cope

### IN THIS ARTICLE

**Are some trocars safer than others?**

Page 64

**Repairing an injury via laparoscope is risky. Reconsider!**

Page 67

**Meet your best friend, the vascular surgeon**

Page 68

- Strategies that may help you avoid MVI
- Tips on how to recognize it
- What to do when MVI occurs

### CASE Trocar insertion, then a bleed

Sophia, a 29-year-old nulliparous patient, undergoes diagnostic laparoscopy after unsuccessful medical therapy for chronic pelvic pain. After insufflation, a reusable 11-mm trocar with obturator is placed. A survey of the pelvis and abdomen reveals a 10-cm retroperitoneal hematoma in the midline just below the umbilicus.

What is the best way to manage this hemorrhage?

Contrary to widespread belief, gynecologic laparoscopy has a rate of major complication similar to, not higher

than, that of laparotomy—but it has a higher rate of major vascular injury (MVI), defined as laceration of the aorta, inferior vena cava, or common iliac or external iliac vessels.<sup>1</sup> In fact, MVI appears to be somewhat exclusive to laparoscopy.

In a large review of 29,966 gynecologic laparoscopies, investigators found the surgeon's level of experience to be an important variable in the overall complication rate but not in the incidence of MVI.<sup>2</sup> This means patients are at risk of MVI regardless of how many or how few laparoscopic procedures you perform.

What can a surgeon do to avert this

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type of injury? The most important strategy is to be conversant with variables that clearly increase the risk, as well as behaviors and protocols that can minimize it. This article offers five pearls—from prevention to postop management.

## 1. Pay attention to subtlety, starting at the preop visit

When a marriage counselor was asked which significant actions can improve a relationship, he responded: “The little things are the big things.”

To minimize the risk of vascular injury, a meticulous surgeon begins with the “little things” at the preoperative evaluation. Important considerations include the patient’s height, weight, and body mass index (BMI). Does she have a history of abdominal surgery or pelvic disease that could suggest intra-abdominal adhesions and anatomic distortion?

It is important to discuss the risk of bowel or vascular injury, as well as the need to convert to an open procedure, with all patients, but particularly with those who are thin or who have abnormal abdominal findings.

A recent randomized clinical trial found that routine mechanical bowel preparation did not facilitate surgery or decrease the incidence of complications, but may be helpful in select cases.<sup>3</sup>

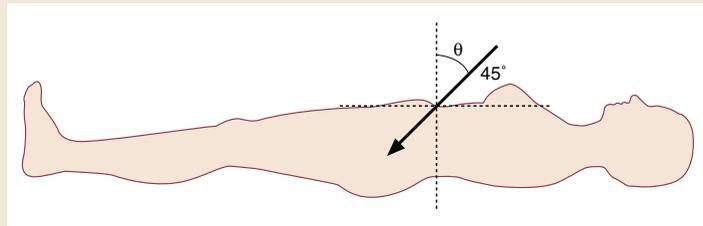
## 2. Don’t undervalue that ounce of prevention

A commuter commented to her friend that she thought the bus driver had exceptional driving skill. The friend couldn’t understand this remark. “The driver hasn’t been challenged yet,” the friend argued. “She hasn’t needed to demonstrate any action in the face of an emergency—so how do you know what level of skill she has?”

“That is precisely the point,” the commuter replied. “The driver has exercised extreme judgment and caution so as not to require using her superior skill in an emergency.”

FIGURE 1

### In thin women, insert the Veress needle toward the uterus



If the angle of insertion is 45° ( $\geq 34^\circ$ ) in the sagittal plane at the umbilicus, puncture safely avoids the aortic bifurcation.

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It is always better to avoid a potentially catastrophic complication than to manage it. The first requirement is vigilance in preparing for laparoscopy. It is important to ensure that the patient is in the supine position during initial entry and that her arms are comfortably tucked on both sides. In 85% of cases, the aorta can be palpated.<sup>4</sup>

### Select an entry technique wisely

Base this decision on experience, patient characteristics, the surgical procedure, and availability of equipment. No entry technique or device can be considered completely safe.

Most vascular injuries occur during the initial phase of laparoscopy:

- As many as 39% are related to placement of the Veress needle
- As many as 37.9% are related to placement of the primary trocar.<sup>5</sup>

The classic “closed” method of laparoscopy has been used successfully for decades. In thin patients, insert the Veress needle toward the uterus. In computed tomography studies, an angle of at least 34 degrees has been shown to avoid the aorta and its bifurcation (FIGURE 1).<sup>6</sup>

The right common iliac vessel is most commonly involved in injury, given its anatomic relationship overriding the inferior vena cava (FIGURE 2, page 64). When you stand at the patient’s left, the Veress needle can inadvertently be directed off to the right of midline, in harm’s way of the right common iliac vessels.

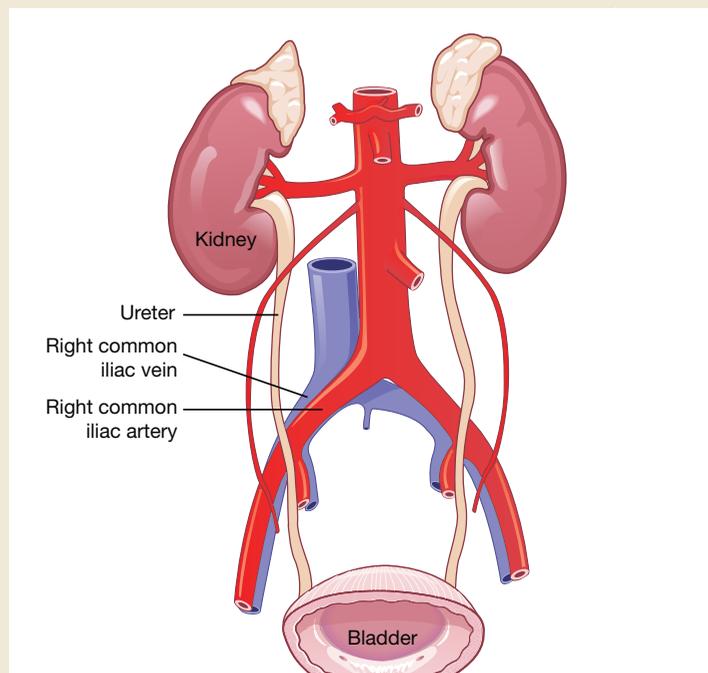
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### FAST TRACK

**Placement of the Veress needle and trocars is the occasion of greatest risk of injury**

**FIGURE 2**

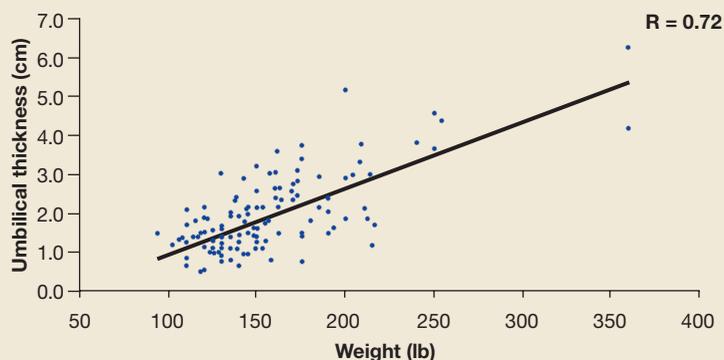
**At risk: The right common iliac artery**



The right common iliac artery overlies its corresponding vein, which puts the artery at risk of injury at initial insertion of the Veress needle. ©2008 Rob Flewell

**FIGURE 3**

**The umbilicus is at its thinnest at low body weight**



The distance (cm) into the peritoneal cavity after insufflation correlates with a patient's weight. SOURCE: Milad and Terkildsen.<sup>7</sup>

**Tips to facilitate entry**

After insufflation, the distance from the base of the navel to the peritoneum is approximately 1.5 to 2.0 cm (FIGURE 3).<sup>7</sup> It is neither necessary nor prudent to bury the needle to its hub when placing the initial trocar. Some authors report that over-

inflation to 25 mm Hg lowers the risk of vascular injury, creating a longer distance to the retroperitoneal structures.<sup>8</sup> In addition, the reduction of tenting means that less force is required.

Patients with a high BMI are likely to be protected from MVI, given the greater distances to major vessels.<sup>9</sup> The distance between the entry trocar and retroperitoneal vessels increases directly with BMI, commensurate with increasing abdominal-wall thickness (FIGURE 4, page 67).

**No single trocar is fail-safe**

Even optical trocars have been associated with MVI. Between 1994 and 2002, 79 serious complications, including 37 MVIs, were associated with use of these trocars.<sup>10</sup>

Direct insertion, open technique, and optical trocars have not been studied in comparable numbers. Although the Hasson cannula was not associated with MVI in two large trials involving 10,840 and 5,284 procedures, respectively, there have been case reports to the contrary.<sup>11-14</sup>

Rubinstein and colleagues<sup>15</sup> evaluated the efficacy and safety of the radial dilating trocar VersaStep (US Surgical) for laparoscopic access. This trocar system has a blunt tip and circumferentially dilates rather than directly incising the fascia of the abdominal wall. Use of the blunt-tip trocar may decrease the incidence of initial access injury.

**3. Don't be the King or Queen of denial**

Because MVI is estimated to occur in one in every 1,000 to one in every 10,000 procedures, and a typical gynecologic surgeon performs roughly 12 laparoscopies a year, it is unlikely that he or she will encounter more than one MVI over the course of a career. Nevertheless, when a retroperitoneal hematoma or brisk bleeding is visualized at laparoscopy, an MVI should immediately be suspected.

Do not enter into a state of denial and attempt to manage this complication

conservatively. The earlier the MVI can be diagnosed, the better the outcome. A retroperitoneal hematoma, dark venous blood pooling in the abdomen, and bright red pulsatile blood are all signs of MVI. Do not wait for systemic changes such as hypotension or cardiac arrhythmias, as these are late findings.

#### 4. No man is an island. Get help when you need it!

As residents, we had the shoulder-dystocia drill burned into memory, the first step being: “Call for help.” Regrettably, there is much less emphasis placed on the need to call for help in a surgical emergency.

All members of the surgical team should be notified of the situation and its associated gravity. The anesthesia team will need to ensure that there are adequate intravenous (IV) access, IV fluids, and blood products for resuscitation. The circulator will need to recruit help so that there will be additional hands to call consults, obtain blood, bring in abdominal trays, scrub in and retract, and so on.

#### 5. Identify, secure, and control the site of injury

Just as a pilot must memorize the early response to an emergency, so must a surgeon be prepared for MVI. In the setting of potential catastrophic hemorrhage, time is of the essence.

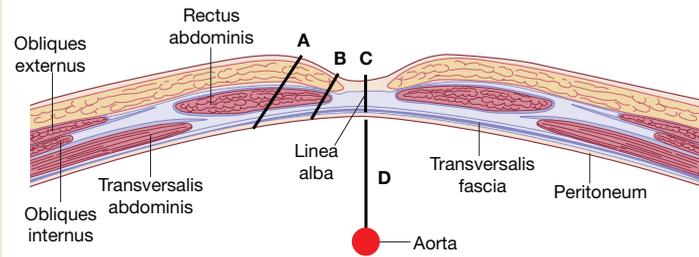
The first task is to stay calm and avoid panic. Your role as the surgeon is to identify, secure, and control the site of injury while other team members work on their duties.

#### Laparoscopy usually not an option

It is the rare laparoscopic surgeon who can manage catastrophic hemorrhage endoscopically. It usually is best to remove the trocar from the vessel wall and convert to laparotomy. Attempting to leave a trocar in a vessel may extend the injury and create greater trauma to the vessel.

**FIGURE 4**

### How far is it from umbilical skin to the peritoneum and vascular structures?



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### Distance in centimeters, based on body mass index

GROUP (NUMBER OF WOMEN)	A	B	C	D
Nonobese (14)	3 ± 2	2 ± 2	2 ± 1	6 ± 3
Overweight (9)	6 ± 3	3 ± 2	2 ± 1	10 ± 2
Obese (10)	>16	12	4 ± 2	13 ± 4

SOURCE: Hurd et al.<sup>9</sup>

It is likely that patients will need to undergo secondary procedures if traditional laparoscopic interventions are used.

#### A vertical skin incision is best

The vertical incision is preferable because it allows greater access and visibility. Sadly, that information does not seem to translate into common practice. One study reported that 27 of 31 women with vascular injury were opened with a Pfannenstiel incision for emergency laparotomy.<sup>16</sup>

#### Control the bleeding

Apply pressure in an atraumatic fashion. Call for vascular instruments and a second suction device.

Control the bleeding digitally at first, followed by proximal and distal occlusion. Never use traumatic clamps because of the high rate of intimal damage associated with thrombi and secondary occlusion. Clips, staplers, or electrocautery

#### **FAST TRACK**

**Systemic changes—hypotension, arrhythmias—are late signs of hemorrhage. Don't wait for them before you take action!**

## How common is major vascular injury?

The frequency of MVI is thought to range from one in every 1,000 to one in every 10,000 gynecologic laparoscopic procedures.<sup>17-19</sup> In a large review of 29,966 gynecologic laparoscopies, the risk of MVI was 0.02%.<sup>2</sup>

may cause vascular occlusion, thrombi, claudication, or lower-extremity edema.

Debride the blood and clots and identify the defect.

### Repair the laceration

Polypropylene (6-0) can be used to close the defect in an interrupted fashion with sutures running parallel to the line of the vascular structure.

A vascular surgeon can be very helpful in the repair of vessels and should be consulted in the event of MVI. If extensive intimal damage has occurred, primary closure may not be possible and the vascular surgeon may perform a graft angioplasty repair or place a short interposition graft. Proximal and distal control is achieved by applying atraumatic clamps proximal and distal to the injury. Intravenous anticoagulation (5,000 U of heparin) is common but not mandatory. A longitudinal arteriotomy is extended, and any areas of thrombi are removed. The damaged intima is endarterectomized, and tacking sutures, using 7-0 Prolene, can be used to prevent propagation of the intimal dissection. Last, a venous or synthetic patch is sewn into place using 6-0 Prolene.

Patients typically remain on aspirin for 3 to 6 weeks.

### CASE Resolved

Sophia's procedure is immediately converted to a midline vertical laparotomy, a vascular surgery consult is obtained, and exploration reveals a 5-mm defect in the right common iliac artery consistent with an extended Veress needle injury. A vascular patch is used for the vessel repair, and the

patient is discharged 4 days later in stable condition. She takes clopidogrel bisulfate (Plavix) for 6 weeks and has no lower-limb compromise. ■

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### FAST TRACK

**Extensive intimal damage may make primary closure impossible and require a graft**