

## THE MASTER CLASS

## 'Do No Harm'



BY CHARLES E. MILLER, M.D.

Physician, do no harm is a credo all gynecologic surgeons must live by. Nowhere do these words ring more true than during laparoscopic surgery. With the slightest lapse in technique, the simplest of laparoscopic procedures can quickly become a nightmare both for the patient as well as the surgeon.

And when is the greatest risk of injury during a laparoscopic procedure? *At entry.*

I have invited an expert from each coast to serve as

guides to safe access into the pelvic cavity via the laparoscope. Steven F. Palter, M.D., practices reproductive medicine and gynecologic surgery at Gold Coast IVF in Syosset, N.Y.

He is an immediate past member of the board of trustees of the AAGL. Over the years, Dr. Palter has won first prize awards for presentations at three separate world congress venues: at meetings of the American Society for Reproductive Medicine, the American Urological Association, and the AAGL, where he won first prize awards twice.

Dr. Palter has been a longtime advocate of safe laparoscopic access, stemming from his background in office-based laparoscopy. From 1995 to 2001, Steve served

as the director of the Yale Office Laparoscopy Program.

Duncan Turner, M.D., is a current member of the board of the International Society for Gynecologic Endoscopy. He is in private practice in Santa Barbara, Calif. Duncan first lectured on avoiding trocar-related injuries in 1995 at the World Congress of Gynecologic Laparoscopy in Israel.

Since then, not only has he lectured throughout the world, but he has been involved in trocar development and evaluation as well. ■

DR. MILLER, a reproductive endocrinologist in private practice in Arlington Heights, Ill., and Naperville, Ill., is the medical editor of this column.

## Ensuring Safe Laparoscopic Access



BY STEVEN F. PALTER, M.D.

Safe laparoscopic access begins before an incision is ever made.

It begins when you review the patient's history, which includes any pertinent previous surgeries. It extends to the examina-

tion, which should rule out pelvic or abdominal masses, hepatomegaly, or an enlarged spleen. If questions about the patient's anatomy arise, imaging may be helpful. I recently had an in vitro fertilization patient with ovarian torsion for whom ultrasound was needed to locate the limits of the ovaries, which reached the umbilicus.

During surgical preparation in the operating room, the patient's bladder should be drained with a Foley catheter to ensure that it is deflated; otherwise, it may extend into the operative field and be punctured on initial access. The anesthesiologist should drain the stomach contents with oral or nasogastric suction.

Optimal patient positioning is critical.

Keep the table at waist height. You want the movement of the trocar to be as controlled as possible, optimizing proprioception and fine muscle control of your hand so that the entry force arises from small, controlled muscle movements of the forearm, hand, and wrist—not from large, less-controlled movements from your shoulder girdle. By keeping your forearms perpendicular to the patient, the force is directed along the axis of the trocar. It is essential that you maintain control of that force upon entry, so that you neither push the trocar too far nor exert lateral force.

Ensure that the table is flat. Placing the patient into premature Trendelenburg's position will change the physical relationship of the major vessels. The patient's body should lie flat from left to right to allow better anticipation of the side wall and iliac vessels.

There are several schools of thought regarding trocar placement. I enter directly in the center of the umbilicus. Some surgeons prefer an infraumbilical approach; however, I have never seen a wound in-

fection in the center of the umbilicus when it has been meticulously disinfected with swabs during preparation of the patient. Here in the center of the umbilicus, the abdominal wall is at its thinnest, and all layers of the abdominal wall are fused. Above or below the umbilicus, there are thicker, unfused layers of tissue that are more difficult to cut through, increasing the risk of false passage.

Before initial trocar placement, palpate the promontory of the sacrum and the bifurcation of the aorta, which may be above (in most cases), at the level of, or even below the umbilicus, and make a mental map of your entry angle.

When you prepare to enter, place the trocars perfectly centrally from right to left and perpendicular to the skin; do not angle them laterally. Maintain control over the angle as you push. Iliac vessel injuries can

occur when the surgeon thinks the trocar is straight, but the angle of his or her hand shifts as more force is applied. It is difficult to push straight down with force. A right-handed surgeon will tend to angle to the left; a left-handed surgeon will tend to angle to the right. Recognize this tendency and avoid it.

Remember that the abdominal-peritoneal cavity is a potential space until you enter and air or gas is allowed to enter. During initial entry, keep the valve to the Veress or trocar open so that air can enter and allow organs to fall away from the abdominal wall. At this point, it is crucial to elevate the anterior abdominal wall as much as possible, either by hand or with towel clips. On my side of the patient, I grasp the anterior wall very firmly with my hand lateral to the umbilicus while, on the other side, my assistant elevates the wall with her hand lateral to the umbilicus. I find that this technique allows sharp retraction more effectively than grasping singly inferior to the umbilicus.

Other surgeons prefer to use two perforating towel clips on the umbilical ring. During your next case, when the laparoscope is already in, try different methods of abdominal wall elevation and see which grasping strategy lifts the abdominal wall

most effectively in your hands.

Keep in mind that you may have to adjust your angle of entry depending on the patient's degree of obesity; otherwise, you may find yourself tunneling in subcutaneous fat. The more obese the patient, the more perpendicular the angle of your initial entry should be.

Although you do have to tailor your technique to the obese patient's anatomy, obesity generally is not a contraindication to laparoscopic surgery. Surgical and post-surgical risks are elevated in obese patients; however, open surgery poses significant risks to these patients as well.

With very thin patients, use less force,

as the distance from the abdominal wall to retroperitoneal structures is closer, and injuries from hitting the posterior retroperitoneum are more likely.

There are various methods to ensure

that the initial entry into the peritoneal cavity is correct and that no injury occurs. None of these methods is foolproof. I most often use a radially dilating trocar inserted over a Veress needle. It is inserted initially with the valve open, so that air can enter and open up the potential space. Then, I inject saline and assess whether it flows easily. Next, I aspirate, checking for blood, feces, or saline from the subcutaneous space. I add a drop of saline as I lift up on the abdominal wall to perform the hanging-drop test. None of these maneuvers has good sensitivity or specificity.

The single most useful test to confirm correct intraperitoneal placement is the observation of low entry pressure from the carbon-dioxide gas. The observation of an initially negative pressure with elevation of the abdominal wall is reassuring as well. Some surgeons prefer to increase distention pressure for subsequent trocar placement.

Another method I sometimes use involves direct entry with a microlaparoscope. Insert a Veress needle with a 2-mm or 3-mm trocar over it and directly look inside with a 2-mm or 3-mm laparoscope before insufflation. In this method, elevation of the abdominal wall by hand is crucial for visualization.

Patients with a history of surgery may

have adhesions at or near the umbilicus. Although various alternative sites have been suggested, the one that provides the lowest-risk access in the majority of patients is the left upper quadrant at Palmer's point, the midclavicular line below the left lowermost inferior rib. In almost all patients, even those who've had many previous surgeries, this area will be free of adhesions.

This entry site is close to the stomach, so make sure the anesthesiologist has suctioned stomach contents before surgery. Splenomegaly could complicate entry at this site.

At this site the abdominal wall is much thicker, and you will lose the typical feel of an umbilical entry. Go in carefully and in a completely controlled manner with an adjusted angle of entry. I prefer to use a microlaparoscopic entry here, although some surgeons use a Veress needle and trocar.

The open-entry technique—also called the Hasson technique—was developed in the early 1970s to mimic the steps of entry during an open surgery but with a 10-mm incision. The surgeon makes an incision in the umbilicus and dissects down layer by layer until the peritoneum is entered. The fascia is often tagged with sutures for elevation, and a blunt-tipped trocar is inserted.

The benefit of this approach is that it eliminates the step of blindly inserting something into the abdominal cavity. The drawback is that cutting and dissecting can still cause injury to underlying or adherent vital structures and may result in larger injuries in these cases.

Bowel injuries from adhesions have been reported with all known techniques.

Obviously, it would be helpful to know which technique is safest based on a well-designed, randomized, controlled trial, as most experts believe injuries from all techniques are underreported. However, significant injuries are so rare that one study reported a power analysis indicating that it would require more than 200,000 surgeries to show a 50% reduction in injuries. Most reports suggest that visceral injuries (primarily bowel injuries) occur less than 1% of the time with either an open- or closed-entry technique. A study from the Netherlands found no statistical difference between the two techniques.

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Vascular injuries are even rarer than that. Advocates of open techniques suggest fewer vascular injuries occur with these techniques, but not statistically significantly so.

Recently, new trocars have been introduced that are aimed at improving safety. These devices include optical and radially dilating trocars and trocarless systems that screw or dilate their way into the abdomen. As these have come into more widespread use, injuries have been reported with them as well. It remains to be seen whether injury rates will decline significantly with other new alternatives.

Complications of laparoscopic surgery can occur when bowel or vascular injuries go unrecognized at the time of surgery. Vascular injuries can cause hemorrhage and hemodynamic instability. Retroperitoneal hematomas, in particular, can be missed unless the surgeon inspects for the presence of a large, expanding mass.

Bowel injuries may be difficult to see if the injury is small. Urinary tract injuries can also be subtle. Detection of these complications requires diligent postoperative follow-up and instructions to the patient that she should report postoperative fever, increasing pain, abdominal distention, vomiting, or heavy incisional bleeding. Be suspicious if any patient is not recovering as quickly as expected. Although most of us would recognize complications occurring within 24 hours, signs may not appear for up to a week after the procedure. Some patients with bowel perforation had no elevations in white blood count or fever at their initial postoperative checkups. The most serious complications have occurred when injuries went unrecognized.

In laparoscopic surgery, the most damage may occur during entry. Fortunately, such damage is almost totally avoidable if you use the proper techniques, a well-thought-out point of entry, and the safest equipment available.

I know laparoscopic surgeons who use a blind, primary trocar entry technique using no insufflation. They can all recount the number of cases they've done without a major adverse event; one surgeon proudly told me he "put a little nick in the common iliac artery with an accessory port" and solved the problem with rapid action and a quick stitch.

My response is that these surgeons have either been very lucky or simply haven't done enough procedures for the inevitable disasters to catch up with them. I am absolutely opposed to blindly putting large spikes into the abdomen, and I think doing so is an approach that should be condemned.

As laparoscopic surgeons, we generally operate on young, healthy patients, sometimes for elective reasons. The potential for tragedy here is great, and it makes no sense to risk lives and great bodily injury when safe and predictable alternatives are available. I conceptualize safe access by breaking it down into three precise goals:

- ▶ Avoiding damage to the anterior abdominal wall.
- ▶ Avoiding intraabdominal structures.
- ▶ Avoiding retroperi-

toneal structures. These goals are accomplished by using the most appropriate instruments available, such as a dilating trocar and adjunctive 2-mm laparoscope; choosing the optimal entry site; and properly insufflating the abdomen.

Anterior wall tissue damage can be greatly minimized by using expanding trocars that stretch the tissue rather than cut it. Many companies make disposable dilating trocars.

The reusable radially expanding system from Tyco has a sleeve that is passed into the abdominal cavity over a Veress needle; it is dilated solely with lateral pressure or force. No downward force is applied to the patient's abdomen.

When the tissue is stretched, less damage is done, less pain is caused, recovery is quicker, and the long-term risk of hernia formation is lower.

Avoiding intraabdominal structures is a matter of entry location. I agree with Dr. Palter that the thinnest tissue underlies the umbilicus, and that's where I like to place my primary port. But unfortunately, major vessels—and often adhesions—also directly underlie this spot. It's the place where laparoscopic entry is most likely to kill a patient, and I enter it only under direct visualization.

Several studies have assessed the rate of abdominal adhesions in patients who have had previous surgery. In a 1997 study, none of 45 patients had adhesions after laparoscopy, 17 of 29 had adhesions after a midvertical incision, and 11 of 39 had adhesions after a low transverse incision (*J. Am. Assoc. Gynecol. Laparosc.* 1997;4:353-6).

French gynecologic surgeon Alain Audebert, M.D., described adhesions in 331 patients with prior surgery. Adhesions were present in half of patients with a prior midline incision, in 21% with a lower transverse incision, and 1.8% of patients with prior laparoscopic surgery had adhesions. Even among 440 patients with no prior surgery, the rate of adhesions was 0.6%.

In a recent study of 100 of my own patients, I found adhesion formation in 16 of 36 who had midline incisions, 20 of 45 who had transverse incisions, and 7 of 19 who had other incisions.

Although it's rare, I recently operated on a patient whose only previous surgery was laparoscopic and even she had an adhesion directly under the umbilicus.

On the other hand, it is extremely rare for surgical adhesions to form over the left upper quadrant of the abdomen, because the gallbladder and appendix lie on the other side. Only trauma surgery or splenectomies are likely to result in adhesions at this anatomical location, which was first described as an entry site by Raoul Palmer, M.D., in 1972. Furthermore, although central obesity can complicate initial access at the umbilicus, the lower margin of the rib cage in the midclavicular line almost always can be pal-

pated, providing a landmark structure for entry at this site.

It is for all these reasons that I favor a left upper quadrant entry—not just in special cases, as Dr. Palter suggested, but as a matter of routine. I have performed approximately 500 laparoscopic procedures using this approach; Dr. Audebert has performed more than 2,000.

Patients receive a nasogastric tube so that their stomachs can be emptied before the procedure to reduce the chance of this underlying organ being damaged, although a needle injury to the stomach or liver is not a major complication.

Splenomegaly is a contraindication.

I palpate the edge of the ribs at the midclavicular line at the costal margin and carefully slide a #11 blade right along the lowermost rib to create an incision only large enough to accommodate a 2-mm scope. This incision will require no stitch—just a Steri-strip—to close.

I insert a Veress needle perpendicularly, feeding it through the abdominal wall with my finger and thumb. It's a very tactile move. You should feel the clicks.

Precisely because entry at this site feels



BY DUNCAN TURNER, M.D.



**Dr. Duncan Turner, who is performing this procedure, prefers an entry site in the left upper quadrant to avoid major structures and potential adhesions from previous surgery.**

different from entry at the umbilicus, I favor doing the entry this way every time; you learn the feel of doing it right.

I then inject saline through the needle and aspirate. If solution has entered the abdominal cavity, I don't get it back. If I had entered the bowel, the return would be greenish brown or blood-tinged, and further evaluation would be required.

I then insufflate the abdomen with enough carbon dioxide to increase the intraabdominal pressure to 25 mm Hg. The volume required will vary from patient to patient. A postpartum patient may require 12 L of carbon dioxide to reach that degree of pressure; a marathon runner with a tight abdomen may get there with 4 L.

This step accomplishes the third goal: optimizing conditions to avoid retroperitoneal structures, the major vessels.

When intraabdominal pressure is at only 12 mm Hg, the abdominal wall is very close to bowel, leaving no room for error.

Increased pressure leaves a bigger space between the anterior abdominal wall and the intraabdominal and retroperitoneal structures, pro-

viding a comfortable margin of safety. This is especially critical in very thin patients, whose major vessels may lie very close to the anterior abdominal wall.

Through the same small, upper-left quadrant incision, I insert a 2-mm trocar and cannula for a small laparoscope to inspect the abdomen, identify the inferior epigastric vessel, assess the location of any adhesions, and ensure that no structures have been damaged or are in the path of any intended trocar site.

For some cases, such as tubal ligation, it is possible to use this as the primary port.

More commonly, it is at this point that I determine whether I can place my primary port in the umbilicus, and I do so under direct visualization before proceeding with my surgical procedure.

It is widely believed that laparoscopic surgery injuries are underreported. Nonetheless, patterns can be determined.

A prospective, multicenter study of complications of laparoscopy conducted in the Netherlands identified 29 bowel injuries and 27 major vessel injuries in 25,764 procedures for an identical rate of 0.11%.

More importantly, with regard to entry technique, Richard Soderstrom, M.D., found in a medicolegal review that the primary port was responsible for half of all major vascular injuries during 47 endo-



**Direct visualization and adequate insufflation leave plenty of room for error when the trocar enters the intraabdominal space as shown in this image.**

scopic cases (*J. Am. Assoc. Gynecol. Laparosc.* 1997;4:395-8).

A review of malpractice cases after 296 laparoscopic cholecystectomies performed using a primary umbilical entry site found that 86% of major vascular injuries were caused by the primary port and 75% of gastrointestinal injuries were caused by a trocar (*J. Gastrointest. Surg.* 1997;1:138-45).

Bowel injuries can occur with any laparoscopic technique and with laparotomy as well; some studies suggest a greater risk of injury with the latter approach. Because no method has been devised to completely avoid these injuries, the key is to recognize them, either at the time of surgery, or when the patient fails to improve as expected during the postsurgical course.

We have the potential to entirely avoid major vascular injuries by use of upper left quadrant entry before placement of a central port at the umbilicus and placement of accessory trocars.

By combining appropriate entry tools, a left upper quadrant entry site, and adequate insufflation of the abdomen, risks can be reduced at every step of laparoscopic surgery. ■

**SURGERY**



<http://www.surgeryu.com/eobgyn/index3.php>

Go to this Web site to view a video of Dr. Turner performing the procedures described in his portion of this column. High-speed Internet access is required.