

# Making Laparoscopy Safe

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Laparoscopic surgery continues to expand its horizons and embrace new technology. Much has changed from the era of only diagnostic and sterilization procedures. Advanced laparoscopic surgery uses special techniques, some new and similar to others ones traditional to perform a growing range of procedures. Before embarking on such procedures, each surgeon should develop a safe technique, especially for the basic skills.

## Incidence

As in general surgical procedures, lack of consent and documentation, poor communication, unawareness of complications and delegation to junior staff are the basic causes of complications and potential medicolegal action. In addition, those specific to endoscopic surgery, are failure to recognize trauma, failure to counsel and inappropriate management of complications<sup>1</sup>. The overall risk of major complications in laparoscopy is often quoted as 34 per 1000 and risk of death as 0.08 per 1000<sup>2</sup>. However, a review of world experience shows that the incidence of complications could range from 2 to 100 per 1000 procedures and of mortality could even be 4.4 per 1000.

## Contraindications

The laparoscopic surgeon should be aware of the limitations of the technique in high risk situations.

The absolute contraindications to laparoscopic surgery are mechanical or paralytic ileus, large abdominal mass, peritonitis, irreducible hernias and cardiorespiratory compromise. Multiple abdominal incisions, gross obesity, hiatus hernia and ischemic heart disease are considered relative contraindications to laparoscopic surgery<sup>3</sup>.

## General precautions

Complications may arise in the operation theatre even before the induction of anesthesia. Mishaps may occur at relatively simple events such as transferring patients from the trolley to the operation table. Some important aspects of general accidents during laparoscopy which are preventable are:

- Positioning the patient and padding of the legs to prevent neurological and orthopedic trauma to the lower limbs and back.
- Light sources should never be left lying on the patient's skin or surgical drapes to prevent burns.
- Electrical safety through proper insulation.
- LASER safety precautions to prevent injury to the patient and the medical personnel.

## Preoperative preparations

Preoperative preparation is designed to minimize the risk of bowel complications and the dangers associated with such injury. Before a diagnostic laparoscopy, it is enough to keep the patient nil by mouth overnight and on a liquid diet the day before. For a laparoscopic surgical procedure, the bowel preparation should be more thorough along with oral antibiotics<sup>5</sup>. A prophylactic antibiotic given intravenously at the induction of anesthesia is recommended for all laparoscopic surgeries<sup>6</sup>. There is no need for shaving or routine Ryle's tube decompression. The anesthetist should ideally intubate all patients undergoing laparoscopic surgery.

## Safe Entry

The most dangerous period of laparoscopic surgery is the primary entry into the peritoneal cavity. More than one half of the complications of laparoscopic surgery are related to the entry technique<sup>7,8</sup>.

There is probably more disagreement about the safest way to begin laparoscopy than about any other single aspect. The promoters of various techniques are firmly entrenched in their camps. We prefer primary entry with a Verres needle as the standard procedure rather than direct trocar insertion. A Verres needle inserted intraumbilically into the peritoneal cavity allows creation of pneumoperitoneum and subsequent safe entry of the primary trocar. Entry into the peritoneal cavity should be confirmed using the standard syringe and saline test.

Injuries to the bowel with a Verres needle are small and can be managed conservatively. This may be seen as a disadvantage if the bowel injury escapes detection. On the other hand, if the bowel is injured on direct entry with a trocar, a laparotomy is required. In patients with contraindications to adequate pneumoperitoneum (e.g. hiatus hernia) where only a diagnostic procedure or a minor surgery is to be performed, one may use direct trocar entry.

There is only one randomized trial in literature comparing direct insertion of the primary trocar with insertion after Verres needle insufflation. No major complications occurred in either group.

Patients with multiple abdominal wall incisions and those with suspicion about extensive adhesions are at a high risk for bowel injury and extraperitoneal insufflation of gas. One must have a thoroughly prepared bowel to minimize the harm from bowel injury in such patients.

Various techniques have been recommended instead of the standard intraumbilical Verres needle entry. They can be divided into:

- Alteration in technique of entry – angling the Verres needle and trocar away from the scar, or a Z-puncture technique described by Semm.
- Alteration in site of entry – primary entry at a supraumbilical point, left costal margin (Palmer's point) and even through the cul-de-sac, uterovesical pouch and the uterine fundus have been described<sup>5</sup>.
- Open laparoscopy by the Hasson's technique – the layers of the abdominal wall are opened under vision by a scalpel and a suture is taken around the peritoneal opening to allow pneumoperitoneum. Although bowel injury can occur, it is easily recognized<sup>11</sup>.
- Use of shielded trocars
- Entry under vision – optical catheters which fit into the Verres' needle or which might replace the Verres needle are being developed which will allow the surgeon to directly visualize entry into the abdominal cavity.

These techniques are not infallible and one can have bowel injury in spite of all precautions and skills. In such a case, one should not remove the offending instrument and proceed to a laparotomy.

### Safety of the Bowel

Injury to the bowel is perhaps the most common serious complication of laparoscopic surgery. Bowel injury occurs in about 4 to 8 per 1000 cases of operative laparoscopy<sup>1</sup>. The bowel may be injured at entry (which has been discussed), intraoperatively or at trocar exit.

Intraoperative injury is likely in procedures such as extensive adhesiolysis, excision of severe endometriosis and posterior colpotomy for tissue retrieval. Injury may occur due to mechanical factors (instrument handling, dissection) or by energy sources, especially monopolar cautery. If injury to the large bowel is suspected intraoperatively, bowel integrity can be assessed by inserting a Foley's catheter transrectally and flushing with iodine. Injury to the large bowel should be treated with laparotomy and colostomy if there is a large laceration or fecal contamination has occurred. Injury to the small bowel if minute may be conservatively managed. Injuries due to energy sources may extend beyond the obviously visible margins and require resection and anastomosis.

The most important aspect of bowel complication management is postoperative surveillance; 40% of bowel injuries are diagnosed postoperatively. The mean delay in the diagnosis is 4 to 5 days postoperatively<sup>1</sup>. A high index of suspicion is essential. The tendency towards early discharge even after a major procedure increases the risk of misdiagnosis. It is far better to explore the patient suspected to have bowel injury and have an occasional negative finding than to delay the diagnosis through procrastination.

### Avoiding injury to large blood vessels

Blood vessels can be damaged in the abdominal wall; especially dangerous are damages to the inferior epigastric arteries, omental vessels and large vessels in the retroperitoneum. Of these, trauma to the large vessels is most frequently related to mortality. The risk of large vessel trauma is estimated to be one per 2000 laparoscopies<sup>1</sup>.

The classic patient at risk of large vessel trauma is the thin nulliparous woman. Here the aorta may lie less than an inch away from the skin of the umbilicus. On the other hand, the obese patient may also be at risk because of obliteration of anatomical landmarks and overzealous perpendicular entry. Elder and chronically ill patients with poor tissue turgor and patients with previous abdominal surgery are the other risk groups for vessel injury. Technical factors associated with retroperitoneal vessel injury are failure to stabilize the abdominal wall, forceful thrusting motion for insertion, lateral or perpendicular trocar insertion, and abnormal patient position. Putting the patient in Trendelenburg position before trocar entry rotates the sacral promontory closer to the umbilicus and puts the patient at higher risk for large vessel injury. These technical factors are largely avoidable. Injury to the large vessels may not always be dramatic. Significant damage to the large vessels may occur without any obvious bleeding. Retroperitoneal vessel injury should be suspected with sudden deterioration of vital signs in a previously stable patient, increased intrabdominal pressure, decreased venous return and when there is a retroperitoneal dissection and tamponade. If large vessel injury is suspected, the offending instrument should be left in situ and one should immediately proceed to an exploratory laparotomy with the assistance of a vascular surgeon.

### Second ports

The secondary ports should be such that they are ergonomically placed and damage to the inferior epigastric vessels is avoided. The ports should be placed outside the rectus sheath. The site of incision on the skin can be determined as the end of an imaginary Pfannensteil incision. All secondary instruments should be inserted under vision of the primary telescope and after ascertaining the course of the inferior epigastric vessels. Damage to the inferior epigastric artery will always cause significant bleeding. This can be seen as blood dripping down into the abdominal cavity or it may form an abdominal wall hematoma. If there is active bleeding from the vessel, it should be controlled by extending the lateral incision and securing the vessel with a mattress suture. Alternatively, a Foley catheter can be inserted through the lateral port and with the distended balloon pressure can be applied. If a hematoma is forming and growing in size, it is best to evacuate it through a generous paramedian incision and the wound should be closed with drainage.

## The Genitourinary tract

Injuries to the genitourinary tract have been thought to be largely underreported and are emerging as important complications with growingly complex laparoscopic surgeries. The incidence is reported as 0.02 to 1.7%<sup>3</sup>.

Injury to the ureter can occur during sharp dissection of the ovary adherent to the pelvic sidewall, uterine vessel occlusion at hysterectomy, uterosacral transection, or when a clumsy or hasty attempt is made to grasp bleeders. Methods to prevent injury to the ureter include visualizing it in the retroperitoneum by hydrodissection. The routine use of transilluminated ureteric stents is controversial.

The most common reason why the bladder is damaged is because it is full at the time of primary entry. The bladder may also be injured by secondary ports placed very low, during ablation of endometriotic implants in the anterior cul de sac, during hysterectomy if blunt dissection is used anteriorly and during dissection of the retropubic space for bladder neck suspension. Prevention of bladder injuries should include an empty bladder preoperatively and continuous drainage during all major procedure. If the anatomy is distorted and the boundaries of the bladder can not be visualized, they can be delineated by a bladder probe with a cold light source inserted in the bladder.

## Leaving the abdomen and closure

Trocar exit under vision is recommended to allow diagnosis of bowel injuries missed at entry and to prevent bowel/omental entrapment in the fascia which could later lead to bowel obstruction.

Hernias that develop at the trocar site usually result from the lack of closure or from improper closure of trocar wounds and, in most instances, are preventable<sup>15</sup>. In the same study, it was noted that the incidence of hernia was ten-fold higher (3.1%) for 12mm ports as compared to 10mm ports (0.23%). Attempts to close the fascial defect in incisions of 10 mm or more appear to reduce the chance of subsequent herniation, but they do not eliminate it<sup>16</sup>.

## Summary

Safe techniques for basic skills are an essential part of all laparoscopic procedures. Technical minutiae of each surgical procedure have been described but are beyond the scope of this editorial. Perioperative care and good anesthetic management can make a significant difference in the outcome for patients undergoing laparoscopic surgery. Last but not the least, there is no substitute for thorough training and the surgeon's discretion regarding the case he chooses to operate.

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