Laparoscopy for Non-trauma Emergencies

7

Selman Uranues and Abe Fingerhut

Contents

Objectives

- Know how to position and prepare the patient.
- Know how to get open access to the peritoneal cavity/first trocar.
- Know how to explore the abdominal cavity.
- Know how to expose solid organs and hollow viscus.
- Know how to control bleeding and contamination.
- Know the principles of laparoscopic bowel resection and anastomosis.
- Know the principles of laparoscopic lavage and abdominal drainage.

Since its initial description in 1985, laparoscopy has acquired an increasing place in the diagnostic and therapeutic emergency setting and now has well-defined indications in the armamentarium of surgery for acute diseases. Laparoscopy is not only a technical variant or an additional therapeutic option; it has become a genuine component of the array of surgical treatment.

S. Uranues, MD, FACS (✉)
Professor and Head, Section for Surgical Research, Clinical Division for General Surgery, Medical University of Graz, University of Graz, Graz, Austria
e-mail: selman.uranues@medunigraz.at

A. Fingerhut, Doc hon c, FACS, FRCS(g), FRCS(Ed)
Department of Surgical Research, Clinical Division for General Surgery, Medical University of Graz, Graz, Austria
e-mail: abefingerhut@aol.com

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7.1 Ergonomics

- Are important issues and directly affect outcomes
- Entail patient position and preparation, the surgeon and table position, the operating room (OR) setup, the trocar setup, and the instruments and technology needed

7.1.1 Patient Position and Preparation

- The patient is positioned supine, legs spread apart allowing the (assisting) surgeon to stand between the legs enabling access to any point of the abdominal cavity including the diaphragm.
- Precautions must be taken so that the patient does not slide when the table is inclined or tilted.
- Pressure points should be protected.
- Arms in adduction especially in emergencies of the lower abdomen or pelvis.
- Routine bladder catheter inserted (not only when lower abdominal procedures are indicated but also because the duration of the procedure is often unknown).
- Patient should be prepped and draped in order to correctly deal with any unexpected findings and intraoperative accident or to convert without delay.

7.1.2 Surgeon and Table Position

- The patient, table, and monitor should be positioned so that full access can be obtained to all four quadrants of the abdomen as required (Fig. 7.1).
- The surgeon should be able to move to either side or between the legs as necessary or preferred.
- The table should allow inclination or tilting as necessary.

7.1.3 Monitor and Screen Position

- Optimal ergonomics call for:
  - A flat screen placed at 15° below eye level (or at the gaze-down level, i.e., at the level of the surgeon's elbows).
  - The monitor placed so that the surgeon's vision, hands, target, and screen are aligned.

Fig. 7.1 Setup of the operating table and the positioning of the patient

– Either several monitors or the video monitors should be mobile and moved according to the site of the pathology to maintain the [ideal] alignment necessary for optimal ergonomic conditions.

7.1.4 Trocar Setup, Creation of Pneumoperitoneum, and Instrumentation

- Trocar setup:
  - Initial trocar layout depends on clinical findings and diagnostic probabilities:
    Triangulation is recommended to allow resection and adequate suturing as necessary.
    Lateralization of trocar insertion is recommended in case of intestinal distension (intestinal obstruction or ileus secondary to peritonitis or abscess).
    Avoid insertion through previous scars (incisions or drainage sites) for the first trocar.
    Add additional trocars as needed.
  - Should allow full and unrestricted exploration of the entire abdominal cavity as necessary
  - First trocar insertion:
    Routine open approach is strongly recommended (without use of the Veress needle), especially when there is considerable intestinal distension.
    The periumbilical approach is recommended in case of diagnostic doubt, unless prior surgery indicates otherwise.
  - Further trocars can be inserted once a preliminary survey of the entire abdominal cavity has shown that there is no need to abort or to convert to a laparotomy.
    Two trocars are placed on the right and left and lateral to the rectus muscle sheath at the level of the umbilicus (Fig. 7.2).
- Pneumoperitoneum
  - Should be established progressively, under close monitoring:

Fig. 7.2 Trocar positions for diagnostic laparoscopy

    Insufflation should be stopped immediately in case of any drop in blood pressure, unexplained tachycardia, or rise in respiratory pressure.
    If the patient stabilizes, laparoscopy can be resumed but with extreme caution (reduced abdominal pressure and close monitoring).
- Instruments
  - 30° scopes are recommended:
    The 10 mm scope offers better lighting and view.
    The 5 and 3 mm laparoscopes offer less trauma but reduced lighting and view.
- Essential instrumentation includes:
  - 3, 5, 10, and 12 mm ports
  - Atraumatic grasping forceps and clamps
  - Right-angle forceps
  - Titanium and absorbable clips
  - At least two needle holders
  - Energy-driven devices for hemostasis and cutting according to availability and surgeon preference
  - Scissors
  - Adequate suction-irrigation device

- Suture material and endoloops
- Umbilical or vascular tapes
- Rubber drains, tourniquets, clamps and bulldog clamps, and bowel and vascular clamps
- Plastic bags for the extraction of the operative specimen as required

7.2 Exploration of the Abdominal Cavity

- Hemostasis
  - Active bleeding in unstable patients requires open surgery.
  - Otherwise, in stable patients:
    Small vessels can be closed with clips or with 3/0 monofilament sutures or with modern coagulation devices (ultrasonic devices or Ligasure™).
    Large wound surfaces and lacerations of solid organs can be sealed quickly and effectively with autologous fibrin adhesive (Tisseal®, Baxter) and tamponed in combination with a fleece (Hemopatch®, Baxter).
    More active bleeding can temporarily be stopped by applying pressure followed by FloSeal® for permanent hemostasis.

7.3 Indications

The wide range of disease that may be diagnosed and treated by emergency laparoscopy includes acute cholecystitis, perforated duodenal ulcer, appendicitis and other causes of acute right lower quadrant pain including adnexal disease, complicated diverticular disease, intestinal obstruction including intussusception, incarcerated or strangulated inguinal or incisional hernia, peritonitis of all origins, iatrogenic perforations, suspicion of mesenteric ischemia, as well as certain postoperative complications.

If the diagnosis is not recognized beforehand, the surgeon should note the area of maximal inflammation, concentration of pus, or blood, as in the case of ruptured ectopic pregnancy.

7.3.1 Acute Cholecystitis

- Acute cholecystitis requires cholecystectomy.
  - Cholecystectomy for acute cholecystitis can be challenging because of:
  - Inflammation (difficult dissection) of the gallbladder
    Increased bleeding
    Fragility (perforation is possible)
    Adhesion to adjacent organs
    Altered anatomy
- Timing of operation
  - Although still debated, most authors agree that early (within 7 days of onset of signs) cholecystectomy appears to be safe and shortens the total hospital stay. In fact, as long as the patient is in good general health and there is no major anesthesia problem, early cholecystectomy can be performed within 48 h from onset.
  - Delaying cholecystectomy results in significantly higher conversion rates, surgical postoperative complications reoperation rates, and significantly longer postoperative hospital stay, without any advantages.
- Of note, the main biliary ducts are at increased risk in acute cholecystitis, and this warrants particular attention.
  - As the critical view of safety (Fig. 7.3) is more difficult and the demarcation of Rouvière's sulcus is present in only 70 % of patients, anterograde dissection, intraoperative cholangiograms (Fig. 7.4), and/or the use of indocyanine green is strongly recommended to landmark and delineate the biliary tree. Indocyanine green cholangiography has the advantage of delineation before any dissection takes place.
- Ideal treatment is based on the acute cholecystitis Tokyo consensus guidelines:
  - Grade I (mild acute cholecystitis, with no organ dysfunction and limited disease
  - Grade II (moderate acute cholecystitis: extensive inflammation but no organ dysfunction)
  - Grade III (severe acute cholecystitis including gangrenous cholecystitis or empyema with organ dysfunction).

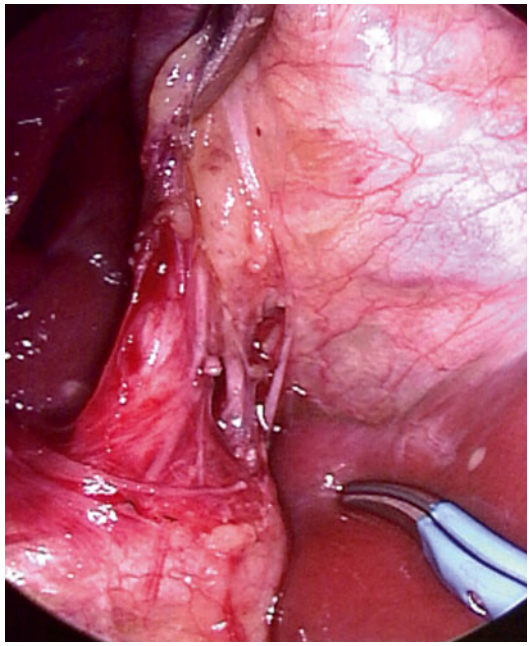

Fig. 7.3 Intraoperative view during laparoscopic cholecystectomy showing critical view of safety with cystic duct and artery at Calot's triangle

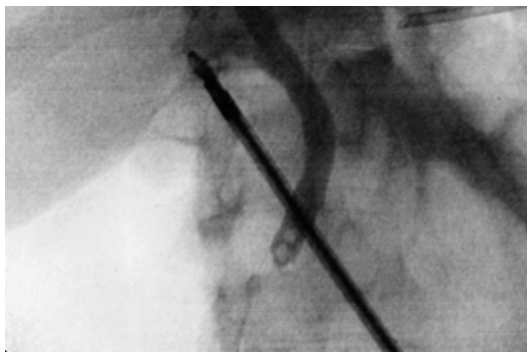

Fig. 7.4 Intraoperative cholangiogram showing the anatomy and (unexpected) common bile duct stones

- Both grades I and II (mild and moderate) cholecystitis can ideally be treated by laparoscopic cholecystectomy. In case of intraoperative difficulties subtotal cholecystectomy can be performed (although there are no proven advantages).
- Both grades II and III (moderate and severe) in high-risk patients can be treated by transhepatic drainage (cholecystostomy).

7.3.2 Perforated Gastroduodenal Ulcer

- Laparoscopic repair is feasible and should result in less postoperative pain and surgical site morbidity.
- The treatment of choice is simple closure of the perforation (Fig. 7.5) and adequate medical treatment of *Helicobacter pylori*.
  - Sutures, glue, and/or omentum, sometimes associated.
  - A hybrid procedure consists of drawing the omentum through the perforation by means of an endolumenal endoscope.
  - Open repair might be better when:
    Patients are hemodynamically unstable.
    Patients are at risk for pneumoperitoneum.
    Patients have already undergone previous upper GI surgery needing extensive adhesiolysis.
    More extensive time-consuming operations are necessary.
    Patients are at high risk (two or more Boey risk factors).
    Chronic ulcer with a diameter of more than 20 mm is present.

7.3.3 Acute Appendicitis and Acute Pelvic Problems in the Female

- Laparoscopic appendectomy (vs. open):
  - Can be advantageous in the obese and the elderly.
  - Can be performed in the pregnant women, but care is warranted to adjust trocar insertion to uterine height.

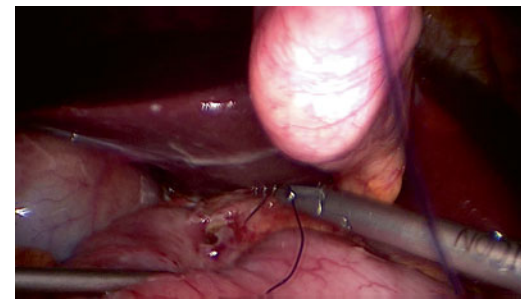

Fig. 7.5 Closure of a perforated acute post-pyloric peptic ulcer with two stitches

  - Stump closure is no longer a matter of debate: recent studies have reversed the purported advantages of staplers used routinely, and these should be reserved for patients when loop closure seems difficult or inappropriate (stump necrosis) or there is need for rapid closure. Higher costs for the staplers, however, must be considered, and loop-closure is often chosen instead
- Adnexal torsion and ruptured ectopic pregnancy:
  - Ideal settings for emergency laparoscopic surgery.
  - Patient must be hemodynamically stable.
  - Requires specific equipment (vacuum, special suction probe) for tubal preservation.

7.3.4 Complicated Diverticular Disease

- Hinchey stages I and IIa can be treated medically, sometimes combined with percutaneous drainage.
- Patients with persistent septic signs after drainage and in those with Hinchey IIb, Hinchey III and IV require surgical treatment.
  - Laparoscopic treatment has been shown to be safe and as effective as open treatment for Hinchey IIb and III.
  - Source control consisting of resection of the perforated colon segment, with or without immediate anastomosis, is still the standard treatment and can be performed laparoscopically.
  - However, some surgeons advocate simple laparoscopic lavage, associated or not with suture and/or drainage, the goal being to avoid a major bowel resection and potentially a stoma:
    Quantity: four liters of saline followed by drainage plus antibiotic therapy.
    Decreases mortality and morbidity (particularly surgical site complications).
    Suture or fibrin glue closure of the perforation (if obvious) can be attempted, sometimes reinforced with an omental patch.
    Usually no further surgery is required.

7.3.5 Intestinal Obstruction

- Laparoscopy can be indicated for obstruction related to adhesions or bands.
- It is of prime important to avoid all abdominal scars for the creation of pneumoperitoneum and/or initial trocar insertion.
- The first trocar insertion should be performed "open." at a location at a distance from the expected site of obstruction, if possible avoiding any scars.
- Intraoperatively, caution is warranted when running the distended intestinal loops.
  - The fragile serosa renders grasping and retraction dangerous. Tilting the table is of great help to move the distended and heavy bowel loops. The bowel should only be grasped at the mesenteric attachments (Fig. 7.6). It is recommendable first to find the collapsed loops and run them orally (Fig. 7.7).
  - Special atraumatic dissectors (Maryland) and retractors are a wise precaution.
  - Angled scopes may be useful for optimal viewing behind and lateral to adhesions, especially when mobilization of bowel is difficult.
  - Extreme caution is warranted in case of vascular compromise and/or necrotic bowel, as it is preferable to convert rather than to provoke a rupture with

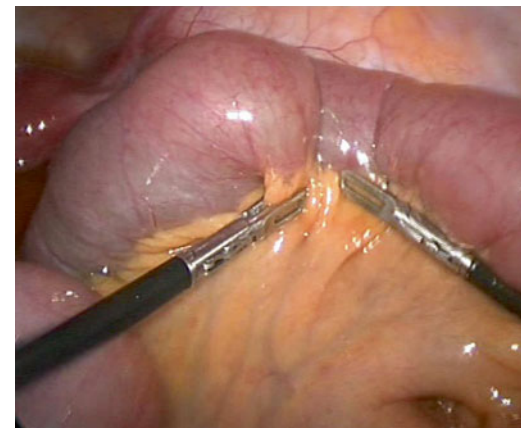

Fig. 7.6 Exploration of distended small bowel loops grasped at the mesenteric attachments

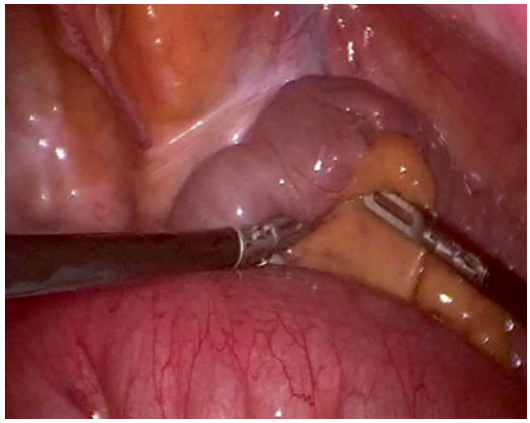

Fig. 7.7 Search for obstruction site by running the small bowel loops orally

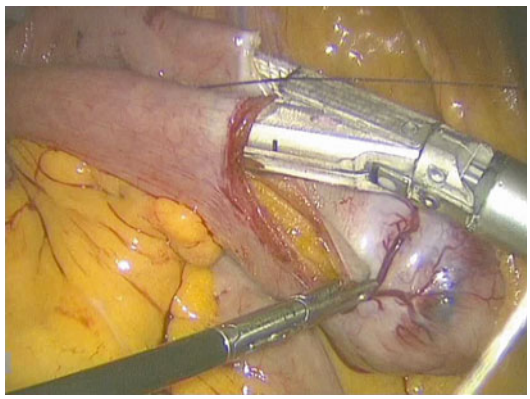

Fig. 7.8 Laparoscopic resection of a small bowel tumor causing obstruction. A stapled anastomosis is created with endostapler before resection

inundation of the peritoneal cavity with septic contents.

If necessary, intestinal resection with anastomosis may be performed via laparoscopy, but by using bulldog bowel clamps, spillage of septic intestinal contents has to be avoided at all costs (Fig. 7.8).

7.3.6 Incarcerated/Strangulated Hernias

- Only cohort and case series studies have been published on laparoscopic repair of incarcerated groin hernias.
- Either TEP or TAPP can be performed. but many surgeons would not recommend inserting prosthetic material in case of incarcerated hernia with intestinal necrosis or if resection is necessary.
- Laparoscopy has been used to repair complicated and/or nonreducible retro-xiphoid, Morgagni or diaphragmatic hernias, paraesophageal hernias, rare acute abdominal wall hernias, such as supra-vesical and Spigelian, or obturator hernias, internal hernias.

7.3.7 Mesenteric Ischemia

- As intestinal ischemia occurs most often in the elderly, frequently with comorbidity, diagnostic laparoscopy may be better tolerated (than laparotomy).
- Of note, however, creation of pneumoperitoneum may have a potentially adverse effect on mesenteric blood flow: low intra-abdominal pressure is recommended.
- After bowel resection with primary anastomosis trocars may be left in place to accomplish a second-look procedure, if indicated.

7.3.8 Peritonitis

- Performed more and more often in peritonitis by skilled laparoscopic surgeons, laparoscopy can be an excellent choice to perform source control (perforation closure, resection), reduction of bacterial contamination (lavage), and prevention of persistent or recurrent infection.
- Under low-pressure pneumoperitoneum not exceeding 12 mmHg, laparoscopic aspiration of gross purulent exudates, fecal debris, food particles, and intraperitoneal lavage is possible. Timing is important, as laparoscopy is best adapted to recent onset and localized peritonitis.
- All lavage fluid should be completely aspirated before the abdominal cavity is closed.
- The advantages of laparoscopic treatment of peritonitis include:
  - Complete exploration of the abdominal cavity with minimal parietal insult.

- Most causes of peritonitis (perforated duodenal ulcer, perforated appendicitis, perforation in diverticular disease, postoperative leakage after index laparoscopic operations) can, if done quickly after onset, be treated adequately via laparoscopy.
- Whenever needed, stoma may be fashioned laparoscopically.

7.3.9 Iatrogenic Perforations

- Laparoscopy is an ideal method to treat iatrogenic perforations, the most common being perforations during colonoscopy.
- Laparoscopic resection or suture repair of iatrogenic perforations is safe and is associated with reduced surgical and psychological stress for the patient because of its low morbidity and mortality.
- Laparoscopic suture, peritoneal rinsing, and drainage can be accomplished under optimal conditions, often without the need for protective stoma if performed early (<24 h after perforation (the colon is usually prepared for the colonoscopy, limiting the spillage of fecal matter)).
- Simple drainage performed laparoscopically also seems feasible for retroperitoneal ERCP perforations, but strict and close follow-up is necessary.

7.3.10 Immediate Laparoscopy for Postoperative Complications After Initial Laparotomy/Laparoscopy Operations

- Several postoperative complications including bleeding, intra-abdominal abscess, small bowel obstruction, bile leak, ischemic bowel disease, retrieval of retained foreign bodies, and anastomotic leakage, if revision is necessary, may be treated laparoscopically
- Indications for same-hospital stay include laparoscopic exploration and treatment of postoperative obstruction after laparoscopic bariatric surgery, reiterative adhesions, anastomotic leakage after colectomy, and gastrectomy. Of importance is the timing (as early as possible), the atraumatic handling of the gastrointestinal tract, and surgeon's level of experience in advanced laparoscopy.

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