

Complications of Laparoscopic Surgery

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Abstract

Laparoscopic cholecystectomy and appendicectomy remains one of the most common laparoscopic surgeries being performed worldwide in the present era. The advantages of laparoscopic surgery over open surgery has already been proven. Since the first documented laparoscopic cholecystectomy by Prof Muhe in 1985, over the years it has become the gold standard for cholecystectomy. The advantages of laparoscopic surgery has been questioned recently due to reports of some complications inherent to the approach. These complications may be due to

- Induction of pneumoperitoneum
- Insertion of trocars
- Use of thermal instruments
- Lack of experience and expertise.

Complications like bowel perforation and vascular injury may not be recognised intraoperatively and are the main cause of procedure specific morbidity and mortality related to laparoscopic surgery.

Keywords: Laparoscopic Surgery, Complications, Injury.

Introduction

Approximately 30 years after its introduction, the use of laparoscopy in gynecology has expanded from diagnosis and tubal sterilization to more sophisticated operations and is even being used for the management of malignancies. Despite rapidly improving technical equipment and surgical skill, complication rates and preventable injuries demonstrate a continuous pattern. The actual incidence of complications possibly exceeds reported rates [1]. Because levels of operative laparoscopy, study populations, and definitions of complications vary in different series, it is difficult to determine the exact incidence of complications. Also there may be bias in reporting, especially of minor complications. Delayed recognition and intervention adds to morbidity and mortality. Reported overall complication rates range from 0.2% and 10.3%. Major laparoscopic procedures are associated with a higher rate of complications compared with minor procedures, 0.6% to 18% and 0.06% to 7.0%, respectively [2].

Complications may be associated with:

- A. The anesthesia.
- B. Due to pneumoperitoneum.
- C. Trocars.
- D. Diathermy Instruments.
- E. Operative Instruments.

The Anesthesia

The complications due to the general anesthesia are the same as

any other type of surgery is performed. Trendelenburg position and the distension of the abdomen may reduce excursion of the diaphragm.

Some time Carbon dioxide (CO₂) may be absorbed particularly during prolonged operations. If arrhythmia occurs the anesthetist will be responsible for its management and

The surgeon should:

- Return the patient to the normal supine position,
- Evacuate the pneumoperitoneum by decompressing the abdomen
- Discontinue the surgery.

Laparoscopy methods - Open Method

Safe and effective performance of open laparoscopy is based on four tenets:

Dissection of the minilaparotomy incision in layers and elevation of the fascia and deeper layers during incision. After visual confirmation of abdominal entry, insufflation of gas into the abdomen directly through the cannula with the blunt obturator in place blocking the escape of gas from the abdomen. Proper closure of the fascial defect at the end of the procedure.

Extra-peritoneal gas insufflation

Failure to introduce the Veress' needle into the peritoneal cavity may produce extra-peritoneal emphysema. This occurs in about 2% of cases. The diagnosis is made by palpation of crepitus caused by bubbles of CO₂ under the skin. If this is recognized early, the gas may be allowed to escape and the needle re-introduced

through the same or another site. The aspiration test and the high insufflation pressure will make it obvious that the needle is sited incorrectly in which case it should be withdrawn and re-sited.

In this study complications related to carbon dioxide pneumoperitoneum and increased intra-abdominal pressure did not really occur, except a cerebral vessel attack case, which led to death in a patient with possible predisposition [3]. This is just a hypothesis, which cannot be proved or even predicted. In our series, the mortality rate (0.08%), as well as the morbidity, were low and acceptable [4].

Complications from the distension medium

Carbon dioxide (CO₂) is the distension medium most commonly used for operative laparoscopy. Gas embolism is possible but uncommon because the gas is highly soluble and is reabsorbed so quickly that, even if there has been a moderate embolus, the circulatory changes return to normal within a few minutes and the patient recovers. Up to 400 ml of gas may be intravasated without producing changes in the ECG.

Cardiac arrhythmia may be due to excessive absorption of CO₂. Monitor the intra-abdominal pressure throughout the operation and use an automatic pneumoflator for all but the simplest forms of surgery. This will cut out if the intra-abdominal pressure rises. Endotracheal intubation and positive pressure respiration will help to prevent complications from CO₂ insufflation. Post-operative pain is common with CO₂ insufflation due to peritoneal irritation which is a result of conversion of CO₂ to carbonic acid. The chest pain may be confused with coronary heart disease and be treated inappropriately with anti-coagulants.

Mediastinal emphysema

Gas may extend from a correctly induced pneumoperitoneum into the mediastinum and create mediastinal emphysema. Extensive emphysema may cause cardiac embarrassment which will be diagnosed by the anaesthetist.

Pneumothorax

May result from insertion of the Veress' needle into the pleural cavity. Whenever a high site of insertion is chosen the needle should be directed away from the diaphragm and, as always, the standard protocol of aspiration and sounding tests employed.

Pneumo-omentum

The omentum is penetrated by the Veress' needle in about 2 % of cases. The misplacement should be recognized by the aspiration test and the position of the tip altered to free the needle. There will also be a raised insufflation pressure which should lead the surgeon to suspect an error in the position of the needle. The condition is usually innocuous unless omental blood vessel is punctured [5].

Injury to gastro-intestinal tract

Certain conditions may predispose to injury by the Veress' needle. These include:

- Distension of the gastro-intestinal tract or

- Adhesions of bowel to the abdominal wall.

Diagnosis of intestinal perforation is often difficult, being masked by factors such as postoperative pain, use of analgesic drugs or the use of antibiotics. Persistent abdominal pain, sepsis data or signs of peritoneal irritation scans, are suggestive of this complication. In many cases the peritoneal irritation is absent. One theory supports the unusual presentation of intestinal perforation in laparoscopic surgery compared to open surgery, based on the lower postoperative immune and metabolic response in the first case. When there is a clinical suspicion, an abdominal CT that allows us to identify intestinal perforation must be performed [6].

Penetration of the stomach may occur when an upper abdominal site of insertion is chosen or the stomach is distended during induction of anesthesia. Gastric distension may also occur if anesthesia is maintained with a mask and should be suspected if there is upper abdominal distension or increased tympanium. In this case the stomach should be aspirated with a naso-gastric tube. The diagnosis of gastric perforation by the Veress' needle may be made when the patient belches gas. The laparoscope should be introduced and the stomach inspected carefully. Provided the stomach wall has not been torn, no surgical treatment is necessary but a broad spectrum antibiotic should be given. If the stomach has been torn, surgical repair either by laparotomy or laparoscopy is mandatory.

Bowel penetration should be suspected if there is

- Asymmetric abdominal distension,
- Belching,
- Passing of flatus or a fecal odour.

Bladder injury

Routine catheterization of the bladder and proper sitting of the needle should prevent bladder penetration. If pneumaturia is noted the needle should be partially withdrawn and the creation of pneumoperitoneum continued.

The most common type of urinary injury during laparoscopy is bladder perforation with an incidence of 0.02% to 8.3% [7]. Most injuries occur during hysterectomy operations. Pillet et al. reported the incidence of bladder injury during laparoscopic hysterectomy to range between 1%. Endometriosis, previous surgery, an inexperienced surgeon, over distended bladder, and pelvic adhesions are proposed risk factors for bladder injury [8].

Blood vessel injury

The Veress' needle may penetrate:

Omental or mesenteric vessels or any of the major abdominal or pelvic arteries or veins. Minimal bleeding may usually be controlled by bipolar coagulation or a laparoscopic suture. Laparotomy is not usually necessary except in the case of injury to the superior mesenteric artery. Such injury requires repair by a vascular surgeon [5]. Injury to the major vessels may be prevented by: Lifting the abdominal wall, Angling the needle towards the pelvis once the initial thrust through the fascia has been made and by Inserting

only as much of the needle as necessary. Dramatic collapse may result from penetration of a major vessel but the bleeding may not be immediately evident if it is retro-peritoneal. The loose areolar tissue anterior to the aorta can allow accumulation of a considerable amount of blood before frank intra-abdominal bleeding is seen.

Gas embolism

Intravascular insufflation of gas may lead to gas embolism or even death. This can only happen if the penetration by the Veress' needle goes unrecognized as insufflation commences. It should be prevented by routine use of the aspiration test. The patient should be turned on to the left lateral position and, if immediate recovery does not take place, cardiac puncture performed to release the gas.

Puncture of liver or spleen

The liver or spleen may be punctured by the Veress.

Introduction of trocars and cannulae

Some of the most serious injuries that occur during laparoscopy are caused by the insertion of the trocars and cannulae. Insertion of the primary trocar and cannula is, of necessity, blind. The causation of injuries by the primary trocar are similar to those caused by the Veress' needle but the magnitude of the injury is greater.

Introduction of Trocars and Cannulae

The sites of the secondary portals of entry must be selected carefully and the insertion must always be made under visual control.

Injury to vessels in the abdominal wall

Superficial bleeding from the incision rarely gives rise to concern and always stops with application of pressure. Bleeding from puncture of the deep inferior epigastric artery is more serious.

It is believed that up to one-third of all trocar injuries cause incisional hernia formation. It is a preventable complication with an incidence of 0.17% to 0.2% [9,10]. Generally, extraumbilical and >5-mm trocar sites are prone to herniation; however, Nezhat et al [10] have reported 5 hernia cases (out of 11) to occur at 5-mm trocar sites. Intestines, colon, and omentum may be involved. Signs of intestinal obstruction, increased bowel sounds, diarrhea, nausea, and vomiting may indicate a hernia.

Inferior epigastric artery

Injury may be prevented by transilluminating the abdominal wall before insertion in a thin patient or by visualizing the artery laparoscopically as it runs lateral to the obliterated umbilical artery. Alternatively, the incision should be enlarged to about 2 cm in length to expose the anterior rectus sheath. A round bodied needle should be inserted through the full thickness of the abdominal wall from the sheath to the peritoneum under laparoscopic control.

Injury to an intra-abdominal vessel

Injury to minor blood vessels is usually self-limiting or can be controlled by bipolar electro-coagulation. Damage to major vessels is more serious than with a Verres' needle because of the size of the

trocar tip and may result in profuse bleeding.

Injury to omental vessels may compromise the vitality of a segment of bowel.

Treatment of these injuries is by:

- Resuscitation,
- Laparotomy,
- Vascular repair or ligation and, where necessary,

Bowel resection and anastomosis with the assistance of the appropriate surgical colleague. It is essential to proceed to laparotomy to repair the vessel. A vascular surgeon should be consulted and the vessel compressed until the arrival of specialized assistance.

Early diagnosis of vascular injury is essential, considering that delay is an important factor to increase postoperative morbidity and mortality. However, it is often a delay in diagnosis because the retroperitoneal bleeding vascular lesion is not visible in the field. It is produced is a bulge of retroperitoneum, elevating intestine and producing that pneumoperitoneum is insufficient despite being correct [11].

Injury to a hollow viscus

Injury to a hollow viscus may vary from superficial damage of the serosa to complete penetration into the lumen.

If penetration has occurred:

- The viscus may slip off the trocar,
- The trocar may remain within the lumen or, rarely:
- The trocar may pass right through the a loop of bowel which becomes impaled upon it.
- Damage to other organs
- Minor injuries to other organs are usually self-limiting.

They should be inspected at the completion of the procedure.

Peritoneal lavage must be carried out to remove blood and clot and ensure that the bleeding has stopped.

Thermal damage

Electrical diathermy burns were one of the major causes of complications when monopolar tubal coagulation was the female sterilization. The damages were less in bipolar and thermal coagulation and mechanical devices to occlude the tubes.

Monopolar electric current passes into the patient's body from the electrode which may be forceps or a needle. The current passes into the patient's tissues at the point of contact and then must return to the generator via the return plate. This is usually placed on the patient's leg. The bowel is the most commonly injured organ. The injury may range from minor blanching of the serosa to frank perforation. Perforation requires laparotomy, excision of the surrounding devitalized bowel and repair of the defect. Fecal peritonitis slowly develops and the patient may become seriously ill over a period of days before re-admission is requested. Radiology followed by laparotomy reveals the desperate situation.

Injury-mechanical instruments

The injuries caused by the operative instruments are to blood

vessels. Bleeding will be immediately obvious and should be controlled by bipolar or thermo coagulation or by suturing. Direct inadvertent injury to other organs by mechanical instruments may result from careless or clumsy use.

Omental and Richter's herniation-If the primary cannula is withdrawn with its valve closed, it is possible to draw a piece of omentum into the umbilical wound by the negative pressure so produced. This is usually recognized immediately and the omentum is easily replaced. Herniation may occur some hours after the operation. It is usually easy to replace it under local anesthesia and resuture the wound. Herniation does not occur commonly with 5 mm skin incisions. Incisions greater than 7 mm should be sutured in layers to prevent formation of a Richter's hernia.

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