Current Status of Therapeutic Laparoscopic Intervention in Non-Acute Intestinal Pathologies
CURRENT STATUS OF THERAPEUTIC LAPAROSCOPIC INTERVENTION IN NON-ACUTE INTESTINAL PATHOLOGIES

POST-OPERATIVE ADHESIONS

Estimates have indicated that up to 93% of patients who have undergone abdominal surgery develop adhesions (11). In most cases they do not have clinical consequences, however in thirty-five percent of these have to be readmitted at some time for problems resulting from adhesions (12).

Postoperative adhesions after abdominal surgery generally present in two forms as frank episodes of occlusive crises of abdominal pain or as intercurrent episodes of chronic abdominal pain. Although it cannot be considered a clinical manifestation of adhesion syndrome, up to 20% of cases of infertility are reported to be the result of postoperative adhesions (13). Adhesions can present in various forms, ranging from single strips to multiple adhesions. They may develop between several intestinal loops, between intestinal loops and solid organs, or between the abdominal wall and the intestine. Postoperative adhesions account for 1% of all hospital admissions and 3.3% of all laparotomies (14).

In the early years of laparoscopy, prior abdominal surgery was thought to be an incontrovertible contraindication for laparoscopic abdominal surgery. These criteria have changed over time and it is now considered a relative contraindication only in certain cases. The advances in the technique are so significant that laparoscopy is even considered the approach of choice for adhesiolysis. In cases of elective surgery, the laparoscopic approach can be used successfully in up to 80% of patients, whereas in emergency surgery this decreases to 59% (15). The conversion rate to laparotomy in this type of surgery is between 5.4% and 16%, depending on the group (11,15). The conversion rates are higher in the case of emergency surgery versus elective surgery, being 36% and 7% respectively. At present laparoscopic adhesiolysis can be considered a safe, effective technique in patients who must undergo elective or emergency surgery for adhesion syndrome (11). It is suitable in surgery for any condition in which adhesiolysis is necessary to perform the specific procedure, in chronic abdominal pain directly related to the adhesions.
PREOPERATIVE ASSESSMENT OF ADHESIONS
Factors associated with the presence of adhesions

When considering laparoscopic adhesiolysis, it is difficult to determine how many adhesions may be present in the abdominal cavity before the actual operation. A medical history of one or more of the following is often associated with a large number of adhesions (13):

1. Process causing the previous surgery
   - Diffuse peritoneal abdominal processes

2. Type of Surgery
   - Significant dissection of tissues
   - Extensive manipulation of intestinal loops
   - Irrigation of cavity with irritating substances

3. Type of previous incision
   - Midline infraumbilical laparotomy

4. Evolution of the previous surgery
   - Intra-abdominal complications
     - Intra-abdominal abscess
     - Intestinal fistula
     - Re-operation
   - Wall complications
     - Deep infection
     - Evisceration

Detection of adhesions during the preoperative period

Even though there is some possibility of predicting the presence and type of adhesions based on the factors described, it is quite difficult to identify the cases with the greatest number of adhesions and, therefore, the ones involving the greatest difficulty for the surgeon.

Various imaging techniques (USG, MRI) have been studied in this context in an attempt to identify intra-abdominal adhesions prior to the surgery (16, 17)
In fact, an attempt has been made to create an imaging map of the abdominal cavity before performing laparoscopic procedures in patients who have previously undergone open surgery, in order to detect adhesion-free areas and thereby minimize the risk of lesions with the Veress needle used to create the pneumoperitoneum or with the insertion of the initial trocar. In published studies, sonography has shown a diagnostic accuracy of 88.5% with a specificity of 31.8% to 90% and a sensitivity of 90% to 100% in the detection of adhesions during the preoperative period in patients who will undergo laparoscopic surgery (16,17). Magnetic resonance (18) has also been used to create a map of intraperitoneal adhesions during the preoperative period in patients scheduled for laparoscopic surgery, showing a sensitivity of 87.5% and a specificity of 92.5%.

**Intraoperative complications of adhesionolysis**

1 *Intestinal perforation*

As is true with lesions of the main biliary tract during laparoscopic cholecystectomy, the importance of this complication lies in its intraoperative detection, due to the fatal consequences it may have in the postoperative period if it is missed, being necessarily a reoperation that involves a major risk of sepsis that may be life-threatening (21). All intestinal loops implicated in the adhesionolysis process must be meticulously examined before continuing the procedure.

If there is any suspicion of perforation, the indication is conversion to open surgery or performance of a minilaparotomy by lengthening one of the trocar holes to check the loop and then continue by laparoscopy.

Once the adhesionolysis is completed, the loops that were adhered to the wall are carefully checked. If a tear of the serosa of the bowel is found, one must ensure that there are no leaks and assess the need for suturing. This can be done by laparoscopy. If a perforation is detected, its extension should be determined, since a puncture or small perforation can be sutured by laparoscopy. As described earlier, when the perforation is large, one usually performs a minilaparotomy at the site used for the largest trocar in order to repair the loop.
2 Bleeding(20)

This usually occurs after dissection of greater omentum adhesions and is stopped in most cases with simple electrocoagulation. Sometimes the use of clips or endoloops is also necessary. In the case of hepatic parenchyma bleeding due to rupture of Glisson’s capsule, electrocoagulation should be attempted, as explained earlier. If bleeding continues, placement of an absorbable hemostatic material will generally control it.

Wall bleeding after completing adhesiolysis is usually stopped with simple electrocoagulation. Adequate hemostasis is extremely important since it helps to decrease the size of possible seromas and the creation of hematomas which, if they grow and create significant tension, adversely affect the entire area of adhesiolysis in order to coagulate small foci of bleeding and thereby, help to minimize the appearance of seromas.

3 Conversion(20)

Conversion is another of the complication of adhesiolysis. Open surgery may be required when there are numerous adhesions, when adhesions are so tightly attached to the abdominal wall that intense scar sectioning would make progress impossible or when the risk of injuring the intestinal loop is extremely high. On the other hand, conversion may be needed because of one of the complications described above, e.g. perforation or uncontrollable bleeding during the adhesiolysis process that requires repair by open surgery.

Postoperative complications of adhesiolysis

Intestinal perforation

This has been reported as one of the most serious complications of this type of surgery (21) and it should be taken into account although it is not unique to the laparoscopic approach since it has also been reported after open surgery (22). Patients who have undergone laparoscopic adhesiolysis develop fever and abdominal pain with signs of a peritonitis, missed perforation of the bowel should be immediately suspected. Early detection is key to preventing a life-threatening
septic condition. For this reason, if there is any suspicion of this condition of the patient should be operated on again by open surgery. In the event that the diagnosis is unclear because of the clinical and analytical condition of the patient or the imaging findings, laparoscopy should be performed followed by laparotomy if confirmed, since abundant irrigation and suction of the cavity plus resection of the effected segment will be necessary. Depending on the intra-abdominal situation, an ostomy or primary anastomosis should be performed and the prosthesis should be removed, since it has been exposed to a septic environment.

Bleeding

Although it has been also described as a complication of adhesionolysis (23), bleeding is a rather infrequent fact after this type of surgery. However, it may require the performance of another laparoscopic or open procedure to suck blood from the cavity and to identify and inhibit the focus of bleeding.

Complications associated with adhesionolysis in one series

Complications associated with the presence of adhesions during other laparoscopic procedures (data from the C. Ballesta and I. Poves series)

The results of 225 patients operated on by laparoscopy between January 1992 and June 1997 who had previously undergone some kind of open surgery (28% supramesocolic and 72% inframesocolic) are presented. The surgeries carried out were 164 cholecystectomies, 45 anti-reflux procedures, 4 partial gastrectomies, 4 adhesionolysis procedures, 3 cholecystectomies with choledochotomy, 2 gastroenteroanastomoses, 2 left colectomies and 1 colectomy with polypectomy. A 0-degree telescope was used in all cases.

Although adhesionolysis as such was only carried out in four cases, all these surgeries were undertaken after performing extensive release of adhesions (to one degree or another), and the adhesions were one of the main reasons for conversion to laparotomy. The conversion rate to laparotomy in this series was 1.3%. Three patients were converted, one because it was impossible to continue due to dense adhesions and another two due to uncontrollable bleeding.
LAPAROSCOPIC COLECTOMY FOR BENIGN AND MALIGNANT CONDITIONS

Following the success and excitement surrounding laparoscopic gallbladder surgery in the late 1980s, surgeons began applying this technology to the treatment of other organ systems, including the large intestine. Initial reports of laparoscopic and laparoscopically assisted colon surgery for both benign and malignant disease first appeared in 1990. Laparoscopic colon resection has been successfully performed for the treatment of a wide spectrum of disease processes of the colon. The most common diagnosis for which laparoscopic assisted bowel surgery was performed by Ambrose et al. (80) is inflammatory bowel disease, however the most common indication for laparoscopic assisted left colectomy was diverticulitis.

Indications for Laparoscopy-assisted Bowel Procedures (80)

1. Carcinoma
2. Crohn’s disease
3. Polyps/polyposis
4. Ulcerative colitis
5. Diverticulitis
6. Colonic inertia
7. Anal incontinence
8. Rectovaginal fistula
9. Rectal prolapse
10. Volvulus
11. Endometriosis
12. Arteriovenous malformation
Laparoscopy has a significant role in bowel surgery, as is evident by the number and variety of procedures performed in colorectal practice.

Procedure

1. Right colectomy
2. Left / sigmoid colectomy
3. Proctocolectomy / J-pouch
4. Total / subtotal colectomy
5. Stoma / bypass
6. Ileocolic resection
7. Low anterior resection
8. Abdominoperineal resection
9. Small bowel resection
10. Lysis of adhesions
11. Colotomy
12. Colostomy takedown

Because colon cancer is one of the most common malignancies in the United States, early success with laparoscopic resection of benign disease sparked interest in the curative and palliative treatment of this malignancy using these new techniques. Early studies (25) echoed the benefits of the laparoscopic techniques, citing a safe and effective procedure, improved postoperative pain management, faster postoperative recovery, and shorter hospital-lengths of stay. However, more recent reports (28) have dampened this initial enthusiasm by identifying an alarming rate of trocar site and wound recurrences of malignancies with the laparoscopic procedure. This controversy has led to a universal reevaluation of laparoscopic procedures in the treatment of all malignancies, including colon carcinoma.

Preoperative evaluation and preparation

Colon resections are among the most technically challenging laparoscopic procedures being performed. These techniques encompass a wide variety of procedures and approaches for lesions located from the caecum to the anal canal.
Each patient must have their operation tailored to the specific circumstances surrounding their disease process. A dedicated team of physician, nurses, and technicians working in concert preoperatively, intraoperatively and postoperatively is necessary for a successful outcome. A steep learning curve for mastering these techniques exists because of the complexity of skills needed for these operations. These hurdles are not insurmountable and can be built on basic skills already familiar to the laparoscopic surgeon. An important part of the developing a safe and successful laparoscopic program is skill assessments with graded complexity scales.

The development of appropriate techniques for laparoscopic and laparoscopically assisted colon resection of malignant disease requires that accepted principles of conventional colon resection be followed. These include avoidance of tumour-spill, obtaining adequate resection margins and harvesting adequate lymph node basins. Intraoperative staging with evaluation of the liver, omentum, peritoneum and remaining colon for synchronous lesions can be accomplished using both laparoscopic evaluation and intraoperative ultrasonography. Lesions selected for laparoscopically assisted resection have included T1 to T3 lesions, but typically not T4 lesions. Patients with evidence of metastatic disease may be candidates to undergo palliative laparoscopic procedures and enjoy the same short-term benefits of this procedure. Laparoscopic surgery also can be used for segmental or sleeve resections of large or broad-based polyps that are not amenable to colonoscopic removal. Resection of rectal lesions within 15cm of the anal verge can be extremely challenging using a laparoscopically assisted approach and should be reserved for experienced laparoscopic surgeons.

Tumor localization is critical in laparoscopic colon surgery. The loss of the tactile of sensation with laparoscopic surgery stresses the importance of other localization techniques. Lesions can be evaluated by barium enemas are not always a part of the routine pre-operative workup for colon cancer. However, they do help to localize the lesion more precisely, particularly if colonoscopic measurements are inaccurate. In addition, computed tomography scan may provide some anatomic information of the primary lesion and is helpful in evaluating the remainder of the abdomen for evidence of metastatic disease.
Colon pathology is being discovered at earlier stages with routine surveillance protocols. Improved methods for identifying these smaller lesions become crucial for both open and laparoscopically assisted surgery. These lesions often may not be visible or easily palpable from the serosal surface of the bowel at the time of surgery. In addition, palpation of the colon during laparoscopy is limited by the lack of sensory feedback from the laparoscopic instrumentation. Lesions may be marked with colored dye or India ink during colonoscopy that is then visible transmurally during surgery (26). Also radiopaque markers may be used that would be localized intraoperatively with fluoroscopy. Finally, intraoperative colonoscopy may be necessary to confirm the location of the lesion.

RESULTS AND POSTOPERATIVE CARE

Following laparoscopic colon surgery, patients experience earlier return of gastrointestinal function and require a shorter hospital stay. On average, patients are able to tolerate an oral diet by the first postoperative day and length of hospitalization decreases from 10 days with open surgery to 3 to 5 days following laparoscopic colon surgery (27). Patients undergoing laparoscopic resections also have less perceived pain and lower narcotic requirements as compared with patients undergoing open surgery. Patients undergoing laparoscopic surgery have equivalent results as compared with open surgery regarding overall survival, length of specimens resected, adequacy of margins, and numbers of lymph nodes collected. Improved postoperative T cell-mediated immunity, lymphocyte function, and neutrophil chemotaxis are seen with laparoscopic surgery (27).

In one series, Richard D Ing et al have reviewed 280 consecutive laparoscopically assisted colon and rectal resections for carcinoma performed since 1990. These data summarize the work of four surgeons who have compiled information from six institutions in the Miami area. The average follow-up of patients from this study was 2.9 years, with an overall survival rate for this group of 67%. Thirty-eight patients had stage 0 disease, 41 patients I, 99 patients stage II, 65 patients stage III, and 37 patients stage IV. The average length of stay for all patients was 6.2+5.3 days. The average ASA was 2.2+0.8. The average procedure time was 137.8+56.5 minutes. For all patients, our conversion rate was 12%, with a major complication rate of 15.3% and a minor complication rate of
11.3% There were two trocar site recurrences (0.71%) and two wound/extraction site recurrences, for a combined trocar and wound recurrence rate of 1.4%. The trocar site recurrences were not at a site where the lesion was removed. The other two wound recurrences occurred at the site of tumor extraction prior to protection of the wound with an impermeable barrier. Since that time, there have been no wound or trocar site recurrences in any patients since 1993.

**COMPLICATIONS**

Several series of laparoscopic colectomy surgery have been reported in the literature. Laparoscopic surgery is associated with a significant decrease in both major and minor postoperative complications postoperatively. Laparoscopic surgery has a much smaller intraoperative blood loss. Operative times are longer initially because of the steep learning curve, but as the surgeon's experience with laparoscopy grows, operative times decrease significantly. Operative times ranging from 45 to 90 minutes is not uncommon.

**PORT SITE RECURRENCES**

An area of tremendous controversy concerns tumor recurrences at trocar sites used during the initial tumor resection. Initial reports of trocar site recurrences were isolated to case reports of biliary tract and ovarian tumors removed laparoscopically. Since then, several other reports have described recurrences of gastric cancer as well as colon cancer at instrument trocar sites. These port site recurrences have not been limited to regions where the tumor was removed from the peritoneal cavity. Recurrences include lateral trocar positions where no instrumentation had come in direct contact with the tumor or was the site of tumor extraction. They have occurred in both early and advanced stage tumors and following both potentially curable and palliative resections. These initial results did not appear to reflect the experience seen with conventional surgery.

There are several factors that may be related to these recurrences. These include increased local tissue trauma, augmentation of tumor nutritional supply by local hyperemia, and alterations in immunomodulation with the release of tumor
growth factors. In addition, the pneumoperitoneum created by insufflating carbon dioxide may create an optimal pH environment that assists tumor cell implantation. Possible mechanisms (28, 29) for trocar site recurrences include spread of tumor cells by direct contact, exfoliation of cells by laparoscopic manipulation, spread of air-borne tumor cells by the circulating pneumoperitoneum, or spread of malignant cells intraluminally or by transvenous circulation. Direct spread of cancer cells by contact with wound edges does not explain recurrences at lateral trocar sites. Pneumoperitoneum has been shown to increase port site recurrences in an animal model, but human data are inconclusive. Shedding of tumor cells and local tissue traumatization during laparoscopic procedures may be a possible explanation, but this does not completely explain the patterns of recurrences (29). Similarly, intraluminal or hematogenous spread does not correlate with trocar site recurrences.

Animal studies offer conflicting data on wound recurrence as related to pneumoperitoneum. It is difficult to draw conclusions from isolated case reports of trocar site implants with initial surveys as high as 4% to 20%. Since their initial descriptions, several retrospective series have reported varying prevalences from single and multiple institutions, ranging from none to as high as 1.6% (28). If the recurrence rates of conventional surgery are more carefully examined, interesting patterns emerge. The incisional wound is the site of tumor regrowth in 1% of recurrences seen with open colon cancer resections (28). More recently, several large prospective studies have compared laparoscopic colon surgery for cancer with conventional surgery. These studies show equivalent pathologic data for specimens retrieved, with definite clinical benefits seen with the laparoscopic procedure, including improved pain relief, shorter lengths of stay, less blood loss, fewer complications, and quicker return of bowel function and return to normal activities. Because laparoscopic colon surgery is a relatively recent advancement, follow-up from these studies has been limited, ranging from several years to as long as 5 years. Nevertheless, overall cervical, local recurrence, and death rates appear to be similar. Specifically, an increased trocar site recurrence rate was not observed for patients undergoing laparoscopic colon resections (0.5%–1.7%) (28). Moreover, these rates appear equivalent to local cancer.
LAPAROSCOPIC SURGERY FOR RECTAL PROLAPSE

History

Prolapse of the rectum, or procidentia, denotes a full-thickness eversion of the rectal wall through the anal canal. Thus uncommon clinical entity has plagued mankind and challenged physicians since ancient times. The earliest clinical case of rectal prolapse was identified in a male mummy from Antinoe, Egypt (400 to 500 BC). A Biblical description of a disease that caused “bowels (to) fall out by reason of the sickness day by day” is testimony to the ancient history of this affliction. As surgeons’ understanding of pelvic floor, colorectal, and anal anatomy improved, so did the operative procedures devised to treat rectal prolapse. Current surgical therapies employed to treat rectal prolapse are based largely on causes originally postulated by surgeons during the Renaissance period and 18th century.

Patients who must undergo transabdominal operations for the treatment of rectal prolapse are ideal candidates for the application of laparoscopic surgery (30). Elderly patients who previously were deemed unfit for abdominal surgery may be candidates for laparoscopic abdominal procedures such as rectopexy and anterior resection.

Rectal prolapse has been successfully treated by means of a laparoscope by rectopexy, anterior resection with and without fixation, abdominal perineal resection, and perineal rectosigmoidectomy. The operations remain conceptually the same, but the technical aspects have changed.

Rectopexy is the most frequently performed laparoscopic operation for the control of rectal prolapse. All the steps of the equivalent open operation ie. mobilization of the rectum to the pelvic floor with preservation of the presacral nerve, division of the lateral sacral ligaments and posterior rectopexy, can satisfactorily be accomplished laparoscopically.

A number of series and case reports (table 43) have described techniques using mesh and sutures. The length of the procedure seems to be related to a surgeon’s experience. Intraoperative complications have been limited to minor bleeding, which can be easily addressed by converting to an open procedure if necessary.
### Results after Laparoscopic Rectopexy

<table>
<thead>
<tr>
<th>Study</th>
<th>No of Patient</th>
<th>Follow-up (mo)</th>
<th>Mortality</th>
<th>Complications</th>
<th>Recurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Henry, 1994</td>
<td>5</td>
<td>2-10(6)</td>
<td>Incarcerated</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hernia in port site</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Solomon, 1996</td>
<td>21</td>
<td>1</td>
<td>1 converted to Open, 1 port site hernia</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Cuschieri, 1994</td>
<td>6</td>
<td>4-27</td>
<td>Constipation(2)</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Herold, 1994</td>
<td>19</td>
<td>6-18</td>
<td>Bleeding (1)</td>
<td>0</td>
</tr>
</tbody>
</table>

Longer operative times may increase potential risks. Intraoperative complications have been limited to minor bleeding, which can be easily addressed by converting to an open procedure if necessary. The incidence of deep venous thrombosis may increase especially in patients in a Lloyd-Davies position with flexed legs. The position of the patients during surgery, the high intraabdominal pressure and the length of the procedure may all contribute to the development of this complication. The Lloyd-Davies position, although helpful, is not strictly necessary for laparoscopic rectopexy and patients are now placed supine for pelvic laparoscopic procedures that do not involve endoanal manipulation. There are no published data on the incidence of postoperative DVT in patients undergoing laparoscopic colorectal surgery.

Functional results are encouraging, with restoration of continence observed in 4 of 5 patients in one series (Graf et al, 1995). The virtual absence of postoperative abdominal pain and ileus has accelerated recovery time and mobilization. The length of the hospital stay usually is 4 to 6 days.

The laparoscopic rectopexy is therefore a safe and effective option for the treatment of rectal prolapse. It is less invasive than an open rectopexy procedure with decreased postoperative disability.
LAPAROSCOPIC APPENDECTOMY

Since Kurt Semm reported the first laparoscopic appendectomy in 1983, the procedure has increasingly been utilized, and now prospective evaluations have been completed. Even though laparoscopic treatment for appendicitis has been documented to be a feasible and safe alternative to conventional methods and has enjoyed relative success to date, there remains skepticism in the surgical community with respect to its widespread implementation.

Surgical Complications and Postoperative Care

Complications are inherent to all surgical procedures, and laparoscopic appendectomy shares with open appendectomy the complications of wound infection, abscess or fistula formation, appendiceal stump necrosis, and small bowel obstruction. In addition, laparoscopic appendectomy carries the potential risk of Veress needle or trocar injury, depression of cardiac preload or exacerbation of obstructive airway disease secondary to pneumoperitoneum, and trocar-site Richter's hernia. To decrease the likelihood of these events, placement of all trocars under direct visualization, careful patient selection, and suture closure of all trocar defects larger than 5 mm are recommended.

Results of Laparoscopic Appendectomy

Data available from several prospective randomized trials are summarized in Table 37-1. Based on current prospective trials, several general conclusions have been drawn by experienced laparoscopic surgeons:

1. Indications for laparoscopic appendectomy should be the same as those for open appendectomy, and diagnostic laparoscopy dramatically improves the accuracy of the operative diagnosis.

2. Laparoscopic appendectomy can be safely performed in both children and adults with minimal increases in operative time, compared to open appendectomy. Perforation or abscess formation is not a strict contraindication to the laparoscopic approach, but successful endoscopic management will depend on the experience of the operating surgeon. The safety of laparoscopic appendectomy in pregnancy is yet to be demonstrated in a prospective study.
3 Wound infections are reduced with laparoscopic appendectomy and are dramatically lower when the appendix is removed via a specimen bag.

4 Hospital stays are similar for laparoscopic and open appendectomy patients, but adult patients have less pain and return to normal activities more rapidly following laparoscopic appendectomy.

**Conclusion**

Laparoscopic appendectomy presents a safe and effective alternative to open surgery when utilized in a competent manner, if established surgical principles are maintained. Advantages including a shortened hospital stay, reduced incidence of wound infection, and hastened convalescence justify a moderately increased operating room expense secondary to advanced instrumentation.

**Contraindications to laparoscopic surgery:**

**Absolute:**

1. Uncorrectable coagulopathy
2. “Frozen” abdomen from adhesions
3. Intestinal obstruction with massive abdominal distension
4. Haemorrhagic shock
5. Severe cardiac dysfunction
6. Concomitant disease requiring laparotomy

**Relative:**

1. Inability to tolerate general anesthesia
2. Abdominal sepsis/peritonitis
3. Intra-abdominal malignancy (excluding colon carcinoma)
4. Pregnancy
5. Morbid obesity
6. Multiple previous abdominal operations
7 Severe chronic obstructive pulmonary disease
8 Diaphragmatic hernia

Abdominal sepsis with generalized peritonitis is usually an indication for open laparotomy, although patients with peritonitis from perforated ulcer(37) and perforated appendicitis(38) have been managed successfully.

Pregnancy once was considered as absolute contraindication to laparoscopy because of the unknown effects of CO₂ pneumoperitoneum on the foetus. However several reports have demonstrated successful laparoscopic cholecystectomy in patients with severe biliary symptoms during the second trimester of pregnancy, without untoward effects in either the fetus or mother(40).

The management of patients with severe COPD remains problematic. In some case, it may be possible to carry out the procedure under regional or local anaesthesia. However the increased diaphragmatic pressure and CO₂ absorption from the pneumoperitoneum and intravenous sedation required may further compromise the pulmonary condition of the patient. However, the advantage of a minimally invasive approach in such patients is that there is less impairment of post-operative pulmonary function than that with conventional open surgery.

Monitoring during laparoscopy should include electrocardiographic monitoring, end tidal CO₂ monitoring, blood pressure evaluation using either a cuff or an indwelling arterial line, and a bladder catheter that follows the urine output to be evaluated and decompression of the bladder for trocar insertion. A nasogastric tube should routinely be passed, in order to facilitate gastric emptying during the procedure.

Laparoscopic complications

Insertion Related:

1 Major vascular injury
2 Gastrointestinal injury
3 Bladder injury
4 CO₂ embolism
5 Abdominal wall haemorrhage

Post-insertional Complications:
1 Gastrointestinal perforation (acute or delayed)
2 Laceration/bleeding from solid organs (liver, spleen, kidney)
3 Hernias of abdominal wall

**Pneumoperitoneum Related:**

1 CO2 embolism
2 Hypercarbia
3 Respiratory acidosis
4 Subcutaneous emphysema
5 Pneumothorax
7 Pneumomediastinum