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TOPIC HIGHLIGHT

2016 Laparoscopic Surgery: Global view

Laparoscopic approach in gastrointestinal emergencies

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Abstract

This review focuses on the laparoscopic approach to gastrointestinal emergencies and its more recent indications. Laparoscopic surgery has a specific place in elective procedures, but that does not apply in emergency situations. In specific emergencies, there is a huge range of indications and different techniques to apply, and not all of them are equally settle. We consider that the most controversial points in minimally invasive procedures are indications in emergency situations due to technical difficulties. Some pathologies, such as oesophageal emergencies, obstruction due to colon cancer, abdominal hernias or incarcerated postsurgical hernias, are nearly always resolved by conventional surgery, that is, an open approach due to limited intraabdominal cavity space or due to the vulnerability of the bowel. These technical problems have been solved in many diseases, such as for perforated peptic ulcer or acute appendectomy for which a laparoscopic approach has become a well-known and globally supported procedure. On the other hand, endoscopic procedures have acquired further indications, relegating surgical solutions to a second place; this happens in cholangitis or pancreatic abscess drainage. This endoluminal approach avoids the need for laparoscopic development in these diseases. Nevertheless, new instruments and new technologies could extend the laparoscopic approach to a broader array of potentials procedures. There remains, however, a long way to go.

Key words: Minimally invasive surgery; Gastrointestinal surgery; Emergency surgery; Digestive emergencies; Abdominal emergencies

Core tip: Laparoscopic surgery represents a technological revolution in the management of gastrointestinal conditions. However, the use of this minimally invasive technique has not yet been extended to emergency situations. The most likely reason is the long learning curve and the even longer operative time of emergency laparoscopy compared to elective laparoscopy.

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INTRODUCTION

Laparoscopic surgery offers multiple advantages for patients, including faster recovery and better cosmetic outcomes than conventional open surgery. Consequently, the laparoscopic approach is now widely used all over the world. However, the use of this minimally invasive technique is not as pervasive in emergency settings. The aim of the present study, therefore, is to determine the current status of laparoscopic surgery in gastrointestinal emergencies.

LAPAROSCOPIC APPROACH IN UPPER GASTROINTESTINAL EMERGENCIES

Laparoscopic surgery in gastric and oesophageal life-threatening conditions has proved a feasible and safe technique, but several conditions must be considered.

Oesophageal perforation

The most common cause of oesophageal perforation is iatrogenic, which is related to oesophageal instrumentation. Recent advances in endoscopic and minimally invasive techniques (endoluminal stents, endoscopic intraluminal clipping, use of various sealant substances, *etc*.) have resulted in lower rates of reoperation, open surgical interventions, oesophagostomies, morbidity and mortality, in comparison to conventional surgery[1,2].

According to Ben-David *et al*[3], a laparoscopic approach is feasible in the event of: (1) Uncontained leak into the chest: treatment may include oesophageal stent plus laparoscopic or thoracoscopic drainage and laparoscopic feeding jejunostomy; (2) Uncontained leak into the abdomen < 24 h: treatment may include minimally invasive repair, a gastric wrap and jejunostomy; and (3) Uncontained leak into the abdomen > 24 h: treatment may include a stent plus laparoscopic drainage and feeding jejunostomy.

Laparoscopic treatment for perforations secondary to pneumatic dilation for achalasia and Boerhaave syndrome have also been described in the literature[4-8].

In any case, only an expert in laparoscopic surgery can perform these techniques.

Perforated peptic ulcer

The therapeutic goal in the treatment of perforated peptic ulcer is to repair the hole in the gastrointestinal tract and to treat any peritoneal contamination. Perforation is more common at the duodenal bulb (62%), followed by the pyloric region (20%) and the gastric body (18%)[9,10].

The feasibility and safety of laparoscopic closure of perforated ulcers has already been reported in several large series. There are numerous potential benefits associated with this minimally invasive technique. Laparoscopic simple patch closure of the perforation can be accomplished relatively easily and seems to be an effective treatment[11,12].

The three most common reasons for conversion are: large perforation size (often > 10 mm), inadequate ulcer localization and difficulties placing reliable sutures due to friable edges[13-17].

In the Cochrane review, we observed a tendency for laparoscopic repair to present with a lower incidence of septic intra-abdominal complications, surgical site infection, postoperative ileus, pulmonary complications and mortality than open surgery. The time of nasogastric aspiration and time to oral diet were reported in a non-parametric format, and the between-group differences were not statistically significant. With regard to cost and outcomes, there were no differences between laparoscopy and an open technique[18].

Nevertheless, the results of this systematic review must be interpreted carefully because of the small size of the examined samples.

In selected patients, the initial outcomes of laparoscopic repair of perforated peptic ulcers seem promising and allow for an early recovery. This is particularly important in the case of elderly and/or immunocompromised patients. Technical aspects and patient selection criteria continue to evolve in this respect[19-21].

A case report has described single-port laparoscopic repair as a feasible and safe procedure that may be a less invasive and scarless surgical treatment for perforated duodenal ulcers[22-24].

LAPAROSCOPIC APPROACH IN HEPATOBILIARY EMERGENCIES

Acute cholecystitis

Acute cholecystitis (AC) is the leading cause of infection of the biliary tree, which affects 20%-30% of patients with biliary colic and is the third most common cause of acute abdomen in emergency departments.

The treatment of AC has varied in recent years. Although the laparoscopic approach has meant a

Table 1 Treatment for acute cholecystitis depending on severity grading

Grade	Management
Grade Ⅰ	Early laparoscopic cholecystectomy is the treatment of choice. Conservative treatment is indicated for high-risk patients
Grade Ⅱ	Laparoscopic cholecystectomy carried out by expert surgeons is preferred. In cases of severe inflammation, the most adequate treatment is emergency laparoscopic cholecystectomy or cholecystostomy
Grade Ⅲ	The treatment of choice consists of adequate organ support together with medical management and biliary drainage or emergency cholecystectomy. In the event of choleperitoneum after gallbladder perforation, emergency laparoscopic cholecystectomy is the treatment of choice

Table 2 Recommended treatment for acute cholangitis by severity

Grade	Management
Grade Ⅰ	Initial medical management suffices in a majority of patients. Patients who do not respond to initial treatment undergo endoscopic, percutaneous or surgical drainage of bile ducts[28]
Grade Ⅱ	After initiating medical treatment, patients undergo endoscopic, percutaneous or surgical T-tube drainage to avoid a deterioration of their condition
Grade Ⅲ	Management entails organ supportive treatment together with urgent drainage of bile ducts. Once the patient is stable, endoscopic drainage must be performed. Percutaneous transhepatic cholangiography is indicated when the papilla is inaccessible and as a third-line approach when drainage is not possible or is contraindicated

revolution in the treatment of biliary diseases, it was not until the last decade of the 20th century that laparoscopic cholecystectomy became the treatment of choice for the management of gallbladder lesions as well as the treatment of choice for AC[25,26].

Decision-making regarding surgical timing has been a controversial subject[25-27]. Currently, early laparoscopic cholecystectomy (within the first 72 h) is considered to be a safe and effective procedure which reduces recovery time and hospital stays relative to deferred laparoscopic cholecystectomy[25,28].

The duration of disease evolution has been associated with a higher incidence of conversion. Therefore, most studies recommend that laparoscopic cholecystectomy be conducted within the first 24 h[25,27,29]. The indications for laparoscopic cholecystectomy after such a period, however, remain controversial. Several revision studies and meta-analyses have shown that laparoscopic surgery during the first week of disease evolution does not increase the incidence of complications or conversion in comparison to deferred surgery. However, sanitary costs are reduced and quality-adjusted life year is increased[25,30-32].

The updated Tokyo guidelines present new standards for the management of AC, such as the choice of treatment depending on severity grading[24] (Table 1).

Acute cholangitis

Acute cholangitis (AC) is caused by an obstruction of the biliary tree, which leads to an increase in intraductal pressure which eventually results in rapid bacteremia and sepsis. The obstruction can result from lithiasis, stenoses or the presence of tumoural cells[27]. AC has elevated mortality rates ranging from 11% to 27% and are usually associated with a delay in the diagnosis and initiation of appropriate treatment[33].

Most patients (70%) show a favourable initial response to medical treatment. When there is no response to medication, urgent endoscopic decompression of the bile ducts is indicated.

The recommended treatment for AC depends on the severity grading (Table 2).

Choledocolithiasis

There are many options for the treatment of choledocolithiasis, but few studies have provided convincing evidence for the superiority of one method over another[34].

An open approach is restricted to institutions where an endoscopic approach and minimally invasive surgery are unavailable or to certain patients whose previous open surgery limits the application of endoscopic techniques (*i.e.*, Roux-en-Y)[34].

Concomitant laparoscopic cholecystectomy with common bile duct exploration has been indicated by expert laparoscopic surgeons. However, the steep learning curve, necessity of a T-tube and the lack of advantages shown in recent studies have hindered the spread of this approach[34].

The most commonly accepted approach combines laparoscopic cholecystectomy with ERCP. No consensus currently exists on the timing of intervention, and different options are proposed in the literature. These include ERCP first followed by laparoscopic cholecystectomy, laparoscopic cholecystectomy first followed by ERCP and even a one-stage procedure combining ERCP with laparoscopic cholecystectomy. None of the options has proved superior to the others, so the timing of ERCP will depend on expertise and resources[34].

Hepatic abscess

Hepatic abscesses have a reported mortality of 6 to 14% depending on the series[34,35].

Initial management requires early initiation of intravenous antibiotic therapy. Percutaneous aspiration is the most common approach, having an 85%-95% success rate and low morbidity and mortality. Predictive factors for aspiration include age ⩾ 55 years, an abscess size ⩾ 5 cm, involvement of both lobes of the liver and a symptom duration ⩾ 7 d[36]. Surgical

drainage is indicated for abscesses of biliary origin, intraabdominal collections secondary to surgery or in cases where percutaneous aspiration is contraindicated or expected to fail due to the presence of multiloculated abscess, biliary communication, elevated urea, creatinine and total bilirubin levels[35,37]. In these cases, laparoscopic surgery may be an effective alternative to conventional open surgery, but further studies must be conducted to support this assumption.

LAPAROSCOPIC APPROACH IN PANCREATIC EMERGENCIES

Pancreatitis and its complications

Pancreatic disorders requiring an urgent surgical approach, with the exception of pancreatic trauma managed as abdominal trauma, are in practice limited to cases of acute pancreatitis, its aetiology and complications. Index admission laparoscopic cholecystectomy is indicated for patients with mild pancreatitis[38,39].

The Atlanta classification for acute pancreatitis describes two clinical forms of the disease: interstitial edematous pancreatitis and necrotizing pancreatitis. Through their progression, both forms may present with local complications, such as peripancreatic collections, pseudocysts, acute necrotic collections, organized pancreatic necrotic collections, infected necrotizing pancreatitis, gastroduodenal obstruction, portal vein thrombosis, colonic ischaemia, bleeding, pancreatic duct rupture or visceral artery pseudoaneurysm[40]. Approximately 20% of patients present with necrotizing pancreatitis, while 30% of them develop a secondary infection with a mortality rate of approximately 39%[41].

The management of acute pancreatitis is mainly medical. Patients with severe symptoms are monitored in Intensive Care Units and may require invasive surgery, especially in cases of complicated necrotizing pancreatitis[42]. The evidence-based guidelines for the management of acute pancreatitis published in 2013 by the International Association of Pancreatology and the American Pancreatic Association recommend intervention (radiological, endoscopic or surgical) in cases of necrotizing pancreatitis with clinical suspicion of, or documented evidence for, infected necrotizing pancreatitis with clinical deterioration, preferably when the necrosis is encapsulated (> 4 wk of onset of symptoms). In the absence of documented infected necrotizing pancreatitis, these interventions are recommended in cases of ongoing organ failure, preferably when the necrosis is encapsulated or leads to gastrointestinal obstruction (4-8 wk after onset of symptoms). The best recommended approach is percutaneous retroperitoneal catheter or endoscopic transluminal drainage followed, if necessary, by endoscopic or surgical necrosectomy[38].

For years, open necrosectomy has been the mainstay treatment option for acute pancreatitis. However, this approach has been associated with high mortality rates (11%-39%) and an elevated incidence of complications (34%-95%). Therefore, in recent years, minimally invasive techniques have increasingly been chosen, such as percutaneous drainage, endoscopic transluminal drainage and minimally invasive necrosectomy[43].

The step-up approach, which consists of initial percutaneous or endoscopic drainage and continues with minimally invasive necrosectomy, if necessary, has bene shown to reduce morbidity, mortality and complications when compared with open necrosectomy[44-46].

Two minimally invasive techniques have become generally accepted as treatment options: minimal access retroperitoneal pancreatic necrosectomy (MARPN)[9] and video-assisted retroperitoneal debridement (VARD)[47].

VARD consists of drainage and debridement by means of a subcostal incision of 5 cm made in the left flank. A videoscope is then introduced into the incision using a single extra-long laparoscopic port. The cavity is inflated with CO_2 gas to facilitate laparoscopic work and videoscopic inspection. VARD is described as fairly easy to implement, and the technique can be used in most cases of infected necrotizing pancreatitis[48]. Several prospective studies of this technique have reported positive morbidity and mortality outcomes. However, VARD has not been directly compared with open necrosectomy; rather, it is only a part of the step-up approach[49]. A shortcoming of this technique is that it may require several repeated procedures to completely remove the necrotic tissue. In addition, serious complications are possible, such as retroperitoneal bleeding[50].

Different laparoscopic debridement and necrosectomy techniques have been described for the management of acute pancreatitis as follows:

Laparoscopic cystogastrostomy

This procedure consists of debridement and drainage of necrotic tissue, creating a fistula between the cystic cavity and the stomach using laparoscopic techniques. Laparoscopic cystogastrostomy may be endoluminal, intragastric or transgastric. In the endoluminal approach, 2-3 trocars are inserted into the abdominal and gastric walls. A balloon is then inserted into the stomach, inflated and secured against the abdominal wall. Cystogastrostomy is then performed using the ultrasonic dissector or electrocautery. The intragastric procedure is performed to open the anterior abdominal wall to expose the gastric wall in close contact with the necrotic cavity. The cystogastrostomy is first secured using endoscopic staplers, followed by drainage of the necrotic tissue from the cavity. Recent studies have claimed that these techniques reduce morbidity and mortality rates associated with open necrosectomy and consider them safe and effective techniques in selected patients[51,52]. Moreover, these techniques allow for the management of larger and more solid collections in a

one-step intervention while also making it possible to treat cholelithiasis in the same procedure[43].

Laparoscopic transperitoneal necrosectomy

The laparoscopic transperitoneal approach *via* different pathways (transgastrocolic, transmesocolic and infracolic) has been described for the treatment of acute necrotizing pancreatitis[53,54]. Parehk described a hand-assisted laparoscopic surgical approach for the treatment of pancreatic necrosis. Utilizing three ports, he reaches the lesser sac *via* an infracolic approach or through the greater omentum between the stomach and the colon. All the necrotic areas are carefully debrided, and once this step is completed, drains are placed in the lesser sac for drainage[55].

The advantage of these approaches is that they enable access to the lesser sac and ease the use of additional techniques such as cholecystectomy. However, we must consider such drawbacks as the necessity of pneumoperitoneum in critically-ill patients, the risk of infection dissemination through the peritoneal cavity and the risk of injuries during the intervention[56].

Retroperitoneal laparoscopic debridement

Tu *et al*[57] described retroperitoneal laparoscopic debridement and drainage of infected necrosis in severe acute pancreatitis via both flanks, depending on the localization of the necrosis and/or collections. Once a saline injection is used to expand the retroperitoneal space, four ports are inserted and CO_2 retropneumoperitoneum is created. Once the necrotic tissue is debrided, two or three drains are left inside the cavity. The authors have published a series of 18 patients who underwent this technique and compared the outcomes with another series of 32 patients who had laparoscopic necrosectomy. The authors concluded that retroperitoneal laparoscopic debridement is a feasible, safe and effective technique for the treatment of infected necrosis.

It is possible to conclude that the step-up approach, consisting of drainage followed, if necessary, by minimally invasive techniques shows lower morbidity and mortality rates than open surgery, and as such, should be the only surgical approach considered.

However, no first-rate evidence exists to favour one minimally invasive technique over another.

LAPAROSCOPIC APPROACH IN SMALL-BOWEL EMERGENCIES

Acute small-bowel obstruction

Small-bowel obstruction (SBO) is a common surgical emergency frequently caused by postoperative adhesions. In a large number of cases, adhesive SBO resolves with nonoperative treatment, but an important group of patients requires emergency surgery. For decades, open surgery has been the gold standard in treating adhesive SBO. Currently, laparoscopy has been adopted as a first-line option in many elective indications, and it is also emerging as a feasible alternative to treat this condition[58-61].

Open surgery remains the first option for the surgical treatment of strangulated ASBO after failed conservative treatment. Nevertheless, in selected groups of patients, laparoscopy can be a safe and effective approach using an open access technique through the left upper quadrant[58,59].

Laparoscopic adhesiolysis should preferably be attempted in patients with a first episode of ASBO and/or a single adhesive band. A low threshold for open conversion should be maintained, as we may expect complications associated with the use of this technique[59]. In fact, age and a prior history of laparotomy seem to be predictive factors of the occurrence of inadvertent enterotomy[60]. No statistically significant differences have been observed between open and laparoscopic adhesiolysis with regard to the incidence of intraoperative bowel injuries, wound infections and overall mortality[61].

Li *et al*[61] reported statistically significant differences between a laparoscopic and open surgery group, with fewer overall complications (OR = 0.42, 0.25-0.70, $P < 0.01$), as well as a lower incidence of prolonged ileus (OR = 0.28, 0.10-0.73, $P = 0.01$) in the laparoscopic group. According to the authors, the laparoscopic approach is safer than the open procedure, provided that it is carried out by experienced surgeons and in selected patients.

Moreover, laparoscopy in animal models has shown a lower incidence, extent and severity of intra-abdominal adhesions when compared with open surgery, and it may reduce the recurrence of adhesive small bowel obstruction[62]. Laparoscopy seems to offer an advantage over laparotomy in terms of the formation of adhesions in the abdominal wall and in the operative site[63,64].

Laparoscopic adhesiolysis for small bowel obstruction has a number of potential advantages[65,66], such as improved visualization of the entire abdominal cavity, diagnostic laparoscopy, less postoperative pain, earlier recovery of gastrointestinal function, shorter hospital stay, a faster recovery time, earlier return to full activity, decreased wound complications and lower incidence of postoperative adhesion formation.

Other less common causes of ASBO have been reported, such as intussusception[67], GISTs[68] and bezoars. Laparoscopy has been used to treat all of them with favourable outcomes. However, only case reports are available, and further studies are necessary to provide greater evidence and adequate recommendations.

In the case of small bowel obstruction due to incarcerated inguinal hernia, laparoscopic surgery, including TEP or TAPP repair, may be used to treat incarcerated or strangulated inguinal hernias[58].

While no known studies have examined laparoscopy

Table 3 Selection criteria for a laparoscopic approach to incarcerated hernias

Criteria for a laparoscopic approach to treatment of an incarcerated ventral hernia[58]:
Absence of marked abdominal distension
Absence of peritonitis
Absence of clinical signs of intestinal ischaemia
Absence of high septic risk situations
Absence of major defects with loss of domain
Absence of haemodynamic instability and severe comorbidity
Morbid obesity, old age and debilitation are not considered contraindications to the procedure

with open surgery in adult patients undergoing emergency hernia repair, Watson *et al*[69] demonstrated that laparoscopic hernia repair is a feasible option for the treatment of incarcerated hernias.

Deeba *et al*[70], in their review of the literature on this subject, found 328 cases reported, including 6 conversions, 34 complications (25 of which were considered minor), and 17 bowel resections, performed either laparoscopically or through a mini-laparotomy incision guided by laparoscopy. They concluded that the laparoscopic approach, either TEP or TAPP, is a feasible procedure for repairing incarcerated hernias, providing adequate anatomical knowledge and expertise to dissect and reduce the sac with favourable outcomes. However, further studies should be conducted, with a particular emphasis on larger multicentre randomized controlled trials.

Incarcerated ventral hernias

In 2010, an Italian Consensus Conference attended by the main National Scientific Societies underlined that the incidences of intra- and postoperative complications and recurrences in emergency surgery were the same as in elective cases[58]. Therefore, the laparoscopic approach to incarcerated ventral hernias might be performed in patients, according to a series of selection criteria (Table 3).

With regard to the operative procedure, the use of atraumatic graspers is essential, adhesiolysis should be proper and careful, and the contents of the defect should always be thoroughly tested for blood supply, motility and integrity. In the event of an enterotomy, the defect can be repaired by means of laparoscopy[58].

Meckel's diverticulum

The treatment of symptomatic Meckel's diverticulum is resection. Although more than 75% of resections are still open procedures[71], laparoscopic diverticulectomy is as safe and effective an approach as open surgery[72], and it can reduce the time to oral intake and patient discharge[73,74]. The lack of sensory feedback can be overcome using a trans-umbilical approach, which offers the cosmetic and postoperative advantages of laparoscopy but also allows surgeons to touch the specimen and confirm entire resection and the absence of masses[75,76].

Acute mesenteric ischaemia

There are no reports in the literature underlining any benefits or advantages of laparoscopy in the diagnosis or treatment of acute mesenteric ischaemia relative to classic imaging techniques[58]. However, laparoscopy may have a role as a "second-look procedure" in patients who have already had surgery for acute mesenteric ischaemia, as it allows for minimally invasive exploration[58,75].

LAPAROSCOPIC APPROACH IN COLORECTAL EMERGENCIES

Since the first laparoscopic colectomy was described in 1991, its use has been extended from the treatment of benign and inflammatory disease to the treatment of colorectal cancer. Laparoscopic colectomy offers the same advantages of other laparoscopic procedures: shorter hospital stay, less postoperative pain and earlier return to full activity[77-79].

Whereas elective colorectal laparoscopic surgery is a well-established procedure, the use of this technique in emergency colorectal settings remains unclear[80,81]. At present, emergency colorectal laparoscopy is frequently used to treat acute appendicitis or else as a diagnostic technique to identify the origin of abdominal pain, especially in the right iliac fossa. The reason to avoid the use of laparoscopy for the treatment of emergency colorectal disease is the complexity of the condition which distorts the normal anatomy due to inflammation or tissue infection. Likewise, colon distension has traditionally posed a contraindication for laparoscopy preventing the use of this approach in colorectal emergencies[80,81].

Acute appendicitis

Acute appendicitis is probably the colorectal disease most frequently managed by means of laparoscopy in emergency settings.

The duration of surgery is greater in laparoscopic appendectomy but it shows less complications, earlier return to normal activity and greater patient's satisfaction[82,83]. In pediatric patients, the laparoscopic approach is associated with shorter hospital stay and a lower incidence of postoperative complications, especially in the case of perforated appendicitis[82,83]. Southgate *et al*[84] confirm the same outcomes in adult patients (> 60 years) and observe lower postoperative morbidity and mortality rates and shorter hospital stay.

With the growing adoption and standardization of laparoscopic technique, minimally invasive approaches have also been developed, such as the use of procedures leaving less scars, single-port appendectomy and transgastric appendectomy. All of them are feasible techniques which have not been equally accepted by all surgeons[85,86] due to the greater technical complexity

or the higher costs; the latter being also reported of laparoscopic appendectomy in comparison with conventional open technique[87].

Inflammatory bowel disease

Patients with inflammatory bowel disease have a higher risk of requiring surgery at some point of their lives. The laparoscopic approach for the treatment of this condition has increased in recent years. In case of complications associated with bowel obstruction and free perforations into the peritoneal cavity, a minimally invasive approach has demonstrated shorter hospital stays but longer operative time[88-91].

Nash *et al*[88] have compared 22 patients with ulcerative colitis requiring emergency surgery and have divided them into two groups: open and laparoscopic approach. They described a longer operative time in the laparoscopic group. Watanabe et al. described also a shorter recovery period for patients undergoing minimally invasive surgery[88,89].

Nevertheless, in the absence of prospective comparative studies, authors like Qazi *et al*[90] and Bell *et al*[91] have also confirmed an increase of post-operative comorbidities, which may be the result of the immunosuppression provoked by the administration of immunosuppressants and/ or corticoids.

Acute diverticulitis

The laparoscopic approach for the treatment of acute diverticulitis has proved to be a feasible and safe technique with variable complication rates that may range from 0% to 54%. The use of this technique depends on the severity of diverticulitis. Most reports have described its effectiveness in the treatment of Hinchey stage Ⅲ diverticulitis (purulent peritonitis without colonic perforation). The rate of stoma formation in these cases is very low as most patients underwent lavage and drainage of abdominal cavity without colonic resection. In these patients, laparoscopic colectomy shows a higher incidence of complications than laparoscopic peritoneal lavage. Moreover, ageing patients, immunosuppressed patients or those with systemic comorbidities have a higher risk of reintervention after laparoscopic lavage.

Some authors have described the use of laparoscopic surgery for the treatment of diverticulitis and have reported promising outcomes with low complication rates, no deaths and GI recovery rates reaching 90%. Conversion rate was minimal and operative time was not longer than in elective sigmoidectomy. Nevertheless, most patients included in the study presented with Hinchey stage Ⅰ or Ⅱ diverticulitis[92-94].

Colorectal cancer emergencies

Despite the lower mortality rates associated with elective laparoscopy for colorectal cancer, emergency laparoscopic surgery still shows elevated perioperative mortality rates due to patients characteristics and the technical difficulties provoked by the dilation and vulnerability of intestinal loops in emergency settings[95].

With the introduction of endoluminal stents, laparoscopy became a feasible approach in left-sided colonic cancer by means of the so-called deferred surgery. However, several studies aiming at demonstrating the usefulness of stenting as a bridge to surgery were cancelled due to the negative outcomes[96,97].

Odermatt *et al*[98] in a prospective observational study showed that emergency laparoscopic colonic resection is a safe and feasible procedure with short- and long-term outcomes very similar to those obtained by means of open surgery and with lower hospital stays. Most of the patients included in the study presented with right-sided colonic cancer and only 8% required conversion to open surgery, which suggests that many of the patients who underwent open surgery might have been managed by means of laparoscopy. However, although these authors report the resection of stage 4 tumors by means of laparoscopy, they confirm the complexity of the procedure in these settings and defend the use of palpation for accurate tumor assessment[98].

CONCLUSION

Although laparoscopic surgery has been adopted as a gold standard in the treatment of gastrointestinal diseases by means of such approaches as cholecystectomy or colectomy, its presence in emergency settings has to be reaffirmed.

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