

The Role of Laparoscopy in Upper Abdominal Surgical Emergencies in Adults: A Retrospective Observational Study

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ABSTRACT

Introduction: Laparoscopy can diagnose and treat the etiologies of acute upper abdominal pain. This study aimed to assess the effectiveness of laparoscopy in upper gastrointestinal (G.I.T) emergencies regarding intraoperative and postoperative outcomes.

Method: A retrospective observational study was conducted in the emergency departments of Zagazig University on 215 patients who had upper abdominal emergency surgeries between June 2017 and June 2020.

Results: The majority of patients (68%) were ≤ 40 years old, with a male predominance (67%). Acute cholecystitis (54%), perforated peptic ulcer (PU) (18%), splenic injuries (26%), and acute pancreatitis with necrosis (2%) were the most common reasons for surgical upper G.I.T. emergencies. Intraoperative complications occurred in 10 cases(5%) in the form of omental bleeding (2%), cystic artery bleeding(1%), liver injuries (0.5%), injury to the duodenum (0.5%), injury to the colon (0.5%), and bile duct injury (0.5%). Intraoperative conversion occurred in 10 patients (5%), with the most common reasons being uncontrolled bleeding (2%), obstructed anatomy or difficult dissection (1%), difficult closure of perforated peptic ulcer (0.5%), duodenal injury (0.5%), colonic injury (0.5%), and bile duct injury (0.2%). Postoperative complications occurred in 41 patients(20%) in the form of wound infection (5%), hematoma (3%), ileus (2.5%), seroma (2%), pneumonia (1.5%), and intra-abdominal abscess formation (1%), omental bleeding (1%), adhesive IO (1%), cystic duct stump leakage (1%), biliary stricture (0.5%), port site hernia (0.5%), port site bleeding (0.5%), and cystic artery stump bleeding(0.5%). Re-intervention occurred in 9 patients (4.5%), with a mortality rate of 1.5%.

Conclusion: In upper G.I.T. emergencies, the laparoscopic approach is safe and feasible, with good intraoperative and postoperative outcomes.

Key words: Emergency surgery; Laparoscopy; Upper abdominal surgery

INTRODUCTION

When surgical procedures are standardized, the benefits of laparoscopy in a range of emergency scenarios are acknowledged without question. When only a basic strategy is set for the surgery, and the surgical approach entirely depends on intra-abdominal findings, the benefits are diminished or unknown. The evidence unequivocally supports the superiority of a laparoscopic approach in

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numerous emergency cases, such as acute cholecystitis, gastroduodenal perforated ulcers, infected pancreatic necrosis, and splenic injuries (1-4).

Laparoscopy gives the primary advantages of a shorter hospital stay, a quicker procedure, and faster recovery without complications. Rapid recovery is connected with early enteral feeding. Adequate nutritional support aids in maintaining homeostasis and, as a result, enhances immunity, thereby decreasing the incidence of wound infection. Laparoscopy should be considered with caution whenever abdominal access is considered difficult, as in cases of organ enlargement, adhesion, and bowel distension. In actuality, creating the pneumoperitoneum is an essential step in the procedure. Increased intraperitoneal pressure produces cardio-respiratory and neurological effects (5-9). In this study, we designed a retrospective observational study to present our experience in assessing the outcomes of a laparoscopic approach in emergent upper abdominal surgery in terms of intraoperative and postoperative complications.

PATIENTS AND METHODS

Design of the study and participants

Between June 2017 and June 2020, 215 patients were admitted to Zagazig University Hospital emergency surgical unit with clinical diagnoses of upper G.I.T. emergencies, namely acute cholecystitis, perforated P.U., acute necrotizing pancreatitis, and splenic trauma. The work has been reported following STROBE guidelines. To be included in the study, patients must meet the following criteria: >18 years of both sexes complaining of acute upper G.I.T. emergencies and undergoing laparoscopic surgeries, namely acute cholecystitis, perforated peptic ulcer, pancreatic necrosis, and splenic injuries. < 18 years of age and open surgeries for upper G.I.T. emergency surgeries were excluded.

Types of outcomes (clinical endpoints)

The primary outcome was the occurrence of intraoperative complications. The secondary outcome was postoperative complications.

Method

Perioperative assessment and approach

The diagnosis was based on plain x-rays, abdominal ultrasonography, and computed tomography (C.T.). General anesthesia with cuffed endotracheal intubation

to prevent vomiting aspiration. For three years, all procedures were performed in a single facility. The operative steps were carried out exactly as described before (4,10-12).

Drains were placed, one in the pelvis and the other at the subphrenic site, and were left in place as long as discharge came out. Daily outputs from all operatively positioned drains were recorded. CT-guided percutaneous drainage may be employed in cases of intra-abdominal abscess. Patients were given clear fluid as soon as they could tolerate it. Antibiotic prophylaxis was continued for 24 hours after the procedure. The drainage tube was withdrawn when the patient had defecated, and the drain was normal.

Following hospital discharge, all patients were followed for 24 months. Patients were reached by phone, outpatient clinic visits, or e-mail messages. After 12 months, a full history and clinical examination were completed, as well as U.S.S. and C.T. (to detect late complications). During the follow-up period, no patients were lost to follow-up.

Statistical analysis

The mean S.D. was used for normally distributed continuous variables; the median was used for non-normally distributed continuous variables. Percentages represented categorical variables. The laboratory findings were evaluated to see if they were within the usual range. All statistical analyses were performed using S.P.S.S. version 20 (S.P.S.S., Chicago, IL).

RESULTS

Table 1 displays demographic and preoperative data. The majority of patients (68%) were ≤ 40 years old, with a male predominance (67%). The most prevalent causes of surgical upper G.I.T. emergencies were acute cholecystitis (54%), perforated PU (18%), splenic injuries (26%), and acute pancreatitis with necrosis (2%). Diabetes mellitus was the most common related co-morbidity (31%), followed by hypertension (24%). The majority of cases (92%) had $\leq$ ASA III. The initial B.M.I. was 35.5 ± 2.35 , and 18% had previous abdominal operations.

Table 2 displays the intraoperative data. Most cases (55%) required more than 60 minutes of surgery. The most common intraoperative consequences were omental bleeding (2%), cystic artery bleeding (1%), liver injuries (0.5%), duodenal injury (0.5%), and bile duct injury (0.5%). Conversion occurred in 10 patients (5%); the most common reasons for conversion were

Table 1 - demographic and preoperative data of patients (215 patients)

data	N (%)
Age (years)	
20-30	65 (30%)
31-40	82 (38%)
41-50	43 (20%)
>50	25 (12%)
Sex	
male	144 (67%)
female	71 (33%)
<i>Causes of surgical gastrointestinal emergencies</i>	
Acute cholecystitis	116 (54%)
• Acute calculous cholecystitis	25 (12%)
• Acute non calculous cholecystitis	5 (2%)
• Biliary colic	40 (19%)
• Mucocele	2 (1%)
• Pyocele	1 (0.5%)
Perforated peptic ulcer	38 (18%)
Splenic injury	57 (26%)
Acute pancreatitis with necrosis	4 (2%)
Co-morbidities	
• Diabetes Mellitus	67 (31%)
• Hypertension	52 (24%)
• Respiratory problems	26 (12%)
• Cardiac and valvular problems	41 (19%)
Initial Body mass index	35.5±2.35
American Society of Anesthesiology	
I	131 (61%)
II	47 (22%)
III	19 (9%)
IV	9 (4%)
V	9 (4%)
Previous abdominal surgery	39 (18%)

uncontrolled bleeding (2%), clogged anatomy or difficult dissection (1%), difficult closure of a perforated duodenum (0.5%), injury to the duodenum (0.5%), injury to the colon (0.5%), and injury to the bile duct (0.5%).

Table 2 - intraoperative data (215 patients)

Operative time	
< 60 min	97 (45%)
> 60 min	118 (55%)
Intraoperative complications	10 (5%)
• Cystic artery bleeding	2 (1%)
• Liver injury	1 (0.5%)
• Omental bleeding	4 (2%)
• Bile duct injury	1 (0.5%)
• Colonic injury	1 (0.5%)
• Duodenal injury	1 (0.5%)
Conversion to open	10 (5%)
Causes of conversion	
Obstructed anatomy or difficult dissection	2 (1%)
Uncontrolled bleeding	4 (2%)
Colonic injury	1 (0.5%)
Duodenal injury	1 (0.5%)
Bile duct injury	1 (0.5%)
Difficult closure of perforated peptic ulcer	1 (0.5%)

Table 3 displays the postoperative data for the patients investigated. The majority of cases (73%) were hospitalized for more than one day; the majority (78%) received analgesics for more than two days, with 13% admitted to the I.C.U. In the postoperative period, the majority of cases (63%) took more than one week to return to work, and 67% of patients had drain removal within six days. The most common causes of post-operative early and delayed problems were wound infection (5%), hematoma (3%), ileus (2.5%), seroma (2%), pneumonia (1.5%), and intra-abdominal abscess

Table 3 - postoperative data (215 patients)

data	N (%)
Hospital stay	
1 day	58 (27%)
>1 day	157 (73%)
Time of analgesic intake	
< 2 days	47 (22%)
> 2 days	168 (78%)
Intensive care unit admission	28 (13%)
Time return to work	
Within one week	80 (37%)
> one week	135 (63%)
Drain removal	
Within six days	144 (67%)
> six days	71 (33%)
Clavien-Dindo classification	
0	97 (45%)
I	65 (30%)
II	43 (20%)
III	10 (5%)
Causes of early and late postoperative complications	41 (20%)
Seroma	4 (2%)
Hematoma	6 (3%)
Wound infection	11 (5%)
Abscess formation	2 (1%)
Ileus	5 (2.5%)
Pneumonia	3 (1.5%)
Cystic artery stump bleeding	1 (0.5%)
Cystic duct stump leakage	2 (1%)
Port site bleeding	1 (0.5%)
Omental bleeding	2 (1%)
Biliary stricture	1 (0.5%)
Port site hernia	1 (0.5%)
Adhesive intestinal obstruction	2 (1%)
Re-intervention	9 (4.5%)
Following acute cholecystitis surgery	4 (2%)
Cystic artery bleeding	1 (0.5%)
Cystic duct stump leakage	2 (1%)
Biliary stricture	1 (0.5%)
Following peptic ulcer surgery	1 (0.5%)
Adhesive IO	1 (0.5%)
Following pancreatic necrosis surgery	1 (0.5%)
Omental bleeding	1 (0.5%)
Following splenic injury surgery	3 (1.5%)
Omental bleeding	1 (0.5%)
Adhesive IO	1 (0.5%)
Port site hernia	1 (0.5%)
Mortality	3 (1.5%)

formation (1%), omental bleeding (1%), adhesive IO (1%), cystic duct stump leakage (1%), biliary stricture (0.5%), port site hernia (0.5%), port site bleeding (0.5%), and cystic artery stump bleeding (0.5%). Re-exploration happened in 9 patients (4.5%), with a mortality rate of 1.5%.

DISCUSSION

The role of laparoscopy in upper G.I.T. emergencies, such as acute cholecystitis, perforated P.U., pancreatic necrosis, and splenic trauma, is debatable. Our study aimed to evaluate the role of laparoscopy in these situations. We found that the most prevalent causes of surgical upper G.I.T. emergencies were acute cholecystitis (54%), perforated PU (18%), splenic injuries (26%), and acute pancreatitis with necrosis (2%). The most common intraoperative consequences were omental bleeding (2%) and cystic artery bleeding (1%). Conversion to open surgery occurred in 10 patients (5%), with the most prevalent reasons being uncontrolled bleeding (2%), clogged anatomy, or difficult dissection (1%). The most common causes of postoperative early and delayed problems were wound infection (5%), hematoma (3%), ileus (2.5%), seroma (2%), pneumonia (1.5%), and intra-abdominal abscess formation (1%), omental bleeding (1%), adhesive IO (1%), cystic duct stump leakage (1%), biliary stricture (0.5%), port site hernia (0.5%), port site bleeding (0.5%), and cystic artery stump bleeding (0.5%). Re-exploration happened in 9 patients (4.5%), with a mortality rate of 1.5%.

Acute gallbladder diseases

Acute cholecystitis affects 20% to 30% of the population, making it the third most common cause of acute abdomen treated in emergency rooms (13). Conversion, re-exploration, and biliary damage were among the postoperative problems feared to arise from laparoscopy procedures performed in emergency conditions. Predictive indicators for difficult cholecystectomy with a high conversion rate have been studied previously (14). Other research has shown that performing a cholecystectomy as soon as possible (within the first 72 hours) is preferable since it shortens the operative time and time patients need to stay in the hospital (1). However, a different study examined how severity levels affected patients' treatment preferences (15).

In our center, acute cholecystitis is the most common emergency upper G.I.T. procedure (54%). It is



Figure 1 - fundus first approach helps to elevate Calot triangle with subsequent easy Calot dissection

most likely linked to high-fat dietary variables. The most prevalent reason for surgery was persistent biliary colic, followed by acute calculous cholecystitis. We operate within three days of the onset of symptoms and begin with identifying the Calot triangle. If the Calot triangle cannot be identified, we proceed with the fundus first approach (*fig. 1*). The incidence of intraoperative and postoperative complications was low in our study, with excellent outcomes due to the panoramic view of the laparoscope, high experience, and finally, thanks to the recent technology expressed by the use of harmonic scalpel with minimal bleeding. The most prevalent intraoperative consequences were cystic artery hemorrhage (1%) and bile duct damage (0.5%). One case of cystic artery bleeding was managed intraoperatively by clipping, whereas the other required open conversion for bleeding control. One case of intraoperative bile duct injuries that could not be detected by laparoscopy was handled by open conversion and satisfactory tear detection with suture repair by Vicryl 5/0 interrupted suture. The most common postoperative complications were seroma (n=4), hematoma (n=6), wound infection (n=11), ileus (n=5), gallbladder bed abscess (n=2), cystic artery bleeding (n=1), cystic duct stump leakage (n=2) and biliary stricture (n=1). Re-intervention occurred in 9 patients (4.5%).

A previous study identified conversion risk variables as male, old, very overweight, having cirrhosis, previous upper abdominal surgery, severe acute cholecystitis, and emergency laparoscopic cholecystectomy (16). While several studies have confirmed that upper G.I.T. surgery is not a contraindication for laparoscopic cholecystectomy (17) and that cholecystectomy after the sleeve is safe (18).

Another study stated that the main reasons for the conversion to open surgery are the lack of a critical view of safety, a fully buried gallbladder, a stone stuck in the gallbladder, and the inability to hold the gallbladder. (19). We faced the problem of difficulty handling the fundus of the gallbladder in acute cholecystitis, especially if mucocele or pyocele, and we solved this problem by needle evacuation of gallbladder content. That helped us immensely to hold the fundus and push the gallbladder over the liver to identify the Calot triangle, which was challenging in circumstances of acute inflammation. In this case, if the Calot triangle could not be defined well, we used a fundus first approach, which greatly aided us in elevating the Calot triangle and facilitating dissection (20). The important thing in our approach was not to injure the biliary tract in any way, so if there was difficulty identifying the Calot triangle safely, we performed a subtotal cholecystectomy. However, we faced gallbladder remnant and cystic duct stump stone formation, which necessitated further operation by laparoscopic completion cholecystectomy, which has proven superior to open completion cholecystectomy (21).

In our study, the most common reasons for re-intervention were cystic artery stump bleeding (one case), which was controlled by suture ligation; cystic duct stump leakage (two cases), which was controlled by endoscopic stenting using ERCP; and biliary stricture (one case), which was controlled by endoscopic dilatation and stent insertion via ERCP.

Another challenging factor is elderly people who may complain of acute cholecystitis and have an inadequate cardiopulmonary reserve, particularly during the COVID-19 era, with consequent post-COVID-19 pulmonary fibrosis and therefore, pneumoperitoneum emerging as a hazard during laparoscopic cholecystectomy. We solved this problem by creating a low-pressure pneumoperitoneum (10 mmHg) and starting with a fundus-first cholecystectomy. This helped move the gallbladder higher over the liver during the dissection of the Calot triangle, which led to a lower rate of complications (22). A comparable study demonstrated the efficiency of low-pressure pneumoperitoneum in laparoscopic cholecystectomy for acute cholecystitis with a fundus-first approach over open cholecystectomy with a superior outcome (23-24).

Perforated gastro-duodenal ulcer

A perforated peptic ulcer is an acute gastrointestinal condition most commonly caused by peptic ulcers, with

an incidence of 2-10% (25). A study found that the laparoscopic approach is an essential diagnostic tool for the ulcer site, size, and etiology (26). All cases in our study underwent simple closure with an omental patch by laparoscope and had excellent intraoperative and postoperative outcomes, which was agreed upon by other studies (2, 27-28).

Conversion is an essential item during laparoscopic P.U. repair, with an incidence of 5.3%-8%, and they attributed the causes of conversion to the size of the perforation, the friable edges of the lesion, the degree of peritonitis, shock at the time of hospitalization, and more than a day delay in diagnosis (29-30). The conversion happened in four patients in our investigation due to obstructed anatomy (1 patient), uncontrolled bleeding (2 patients), and difficult closure of the ulcer (1 patient). This incidence was lower than in the previous studies, presumably due to sampling size variance, and most cases were smaller perforated ulcers < 2 cm in size. In the current series, postoperative complications included wound infection (4 cases), hematoma (2 cases), seroma (1 patient), ileus (1 patient), pneumonia (1 patient), and adhesive IO (one patient). Re-intervention occurred in one case of adhesive I.O. and needed adhesiolysis.

Pancreatic emergencies

Approximately 20% of acute pancreatitis patients develop pancreatic necrosis, and 30% are infected, with a 30%-39% mortality rate (31-32). Surgical intervention is indispensable in treating infected pancreatic necrosis (31,33) but with significant complications such as new organ failure, sepsis, abdominal hemorrhage, and gastrointestinal fistula (34-35).

In our analysis, four patients (2%) had laparoscopic transperitoneal necrosectomy. Intraoperative omental hemorrhage occurred in three patients, two of whom were treated intraoperatively, while the third was controlled after conversion. Another intraoperative complication was a duodenal injury during pancreatic necrosis debridement, which needed conversion and closure of the tear with a gastro-jejunostomy.

Splenic trauma

Laparoscopy is a reliable and safe treatment in low-grade hemodynamically stable splenic injuries (*fig. 2*) with a shorter hospital stay and a lower morbidity and mortality rate (36-38). In our study, 57 patients with splenic injuries (26%) were treated with a laparoscopic method (*fig. 3*), with two cases experiencing intra-

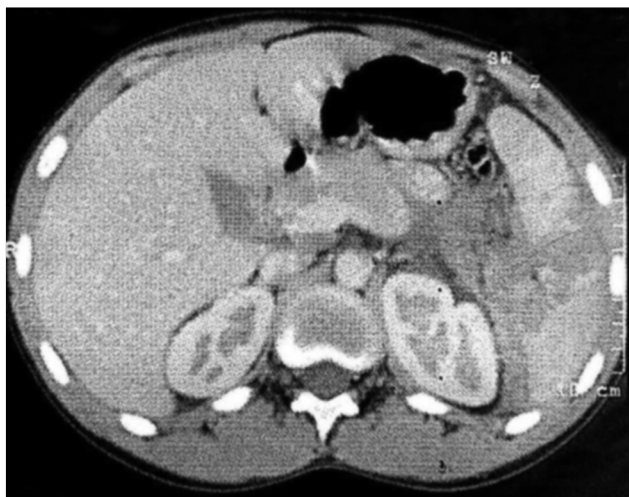


Figure 2 - CT abdomen showing splenic injuries

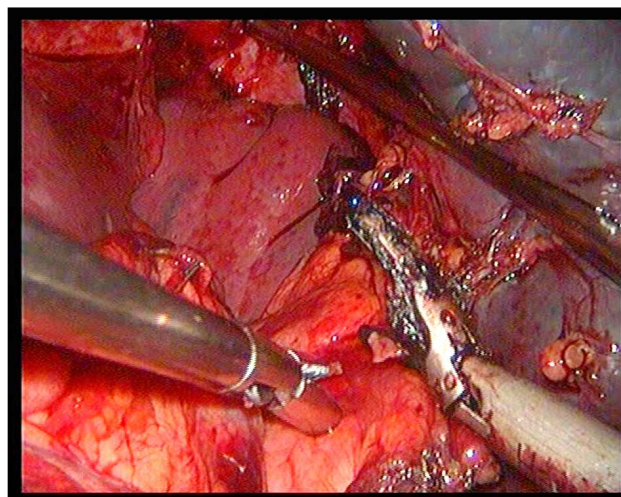


Figure 3 - Laparoscopic approach is feasible in splenic injuries

operative difficulties (one of omental bleeding and one of colonic injury). The omental bleeding was successfully controlled with a laparoscope, whereas the colonic damage case required open conversion with tear repair and a right transverse colostomy. Another incidence of conversion happened as a result of difficult dissection (*fig. 4*). The commonest postoperative complications were seroma (n=2), hematoma (n=2), abscess formation (n=1), ileus (n=1), pneumonia (n=2), omental bleeding (n=1), port site hernia (n=1), and adhesive IO (n=1).

CONCLUSION

The laparoscopic approach is safe and feasible in upper abdominal emergency surgeries with low morbidity and mortality.

Registration

Criteria for registering on the quality control review protocol on clinical trials.

Ethical approval, consent to participate

The faculty of the Medical Ethical Committee at Zagazig University granted us all the ethical agreements.

The described work has been carried out for human experiments following the World Medical Association's Code of Ethics (Helsinki Declaration).

The work followed STROBE guidelines.

Authors' contributions

All Authors contributed equally to the study as

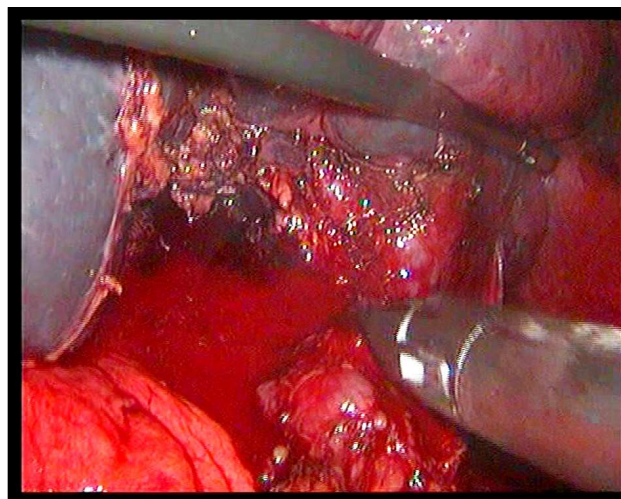


Figure 4 - Intraoperative bleeding that was controlled.

regards the conception and design of the study, acquisition of data, analysis and interpretation of data, drafting the article or revising it critically for important intellectual content, and final approval of the version to be submitted.

Competing interests

The authors declare that they have no competing financial or non-financial interests.

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