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Original article

Feasibility of Laparoscopic Cholecystectomy in Patients with Previous Upper Abdominal Surgery

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ABSTRACT

Background: Previous abdominal surgery usually lead to adhesion formation, which considered as a contraindication of laparoscopic cholecystectomy [LC]. However, it had been reported that, careful adhesiolysis could be performed and thus LC becomes feasible.

Aim of the work: To assess the feasibility and outcome of laparoscopic cholecystectomy in patients with previous upper abdominal surgery.

Patients and Methods: This study included 30 patients, who were presented by symptomatic gallstones. All participants assessed clinically. Then, a full lab profile was performed. Finally, abdominal ultrasound was done and if there was a dilatation of common bile duct, patients were submitted to magnetic resonance cholangiopancreatography. Both intra-and postoperative data were collected and any complications were documented.

Results: 26 patients [86.7%] had chronic calcular cholecystitis, two had acute calcular cholecystitis and two had mucocele of gallbladder. Adhesions were grade 1 in 13.3%, grade 2 in 46.7%, grade 3 in 20% and grade 4 in 20.0%. Adhesiolysis was needed in twenty patients [66.7%]. Intraoperative complications were reported in nine patients [40%]. Bleeding reported in six patients and rupture of the gall bladder in three patients [10%]. Three patients [10%] were converted to open surgery. Postoperatively, 12 patients [26.7%] had complications [3, 1, 2, 1 and 5 for port site wound infection, bile leakage, bleeding, and chest infection respectively]. Post operative pain was mild in half of patients and moderate in other half.

Conclusion: laparoscopic cholecystectomy after previous abdominal operations is feasible and relatively safe, as minority of patients had difficulties and complications.

Keywords: Laparoscopic Cholecystectomy; Adhesions; Feasibility; Upper Abdomen; Surgery.

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* Main subject and any subcategories have been classified according to the research topic.

INTRODUCTION

Laparoscopic cholecystectomy has revolutionized the care of the patient with symptomatic cholecystitis and cholelithiasis. The rapid acceptance of this technique among patients and surgeons leads to an explosion of minimally invasive surgical techniques [1].

This technique leads to a more rapid improvement in quality of life than open cholecystectomy with advantages of this procedure. This technique has advantages over the open approach in terms of better cosmetic result, less postoperative pain, and shorter recovery time [2]. However, there are still a considerable percentage of patients in whom laparo-scopic cholecystectomy [LC] cannot be successfully performed and conversion to open surgery is required. A number of relative contra-indications, such as morbid obesity, previous upper abdominal surgery [UAS], and acute cholecystitis, have been proposed in determining whether a patient is a candidate for LC [3].

When LC began in the early 1990s, pregnancy, previous abdominal surgery, obesity, cirrhosis, and acute cholecystitis were considered absolute contraindications for performance of the laparoscopic technique. As advances in laparoscopic skills and instruments have evolved, a range of increasingly complex procedures have been done, making all of these traditional contraindications at best relative [1].

Standard LC involves access to the abdominal cavity through two or three incisions outside the umbilicus in the right upper quadrant. Up to 50% of patients undergoing attempted LC would have had prior abdominal surgery. UAS does not always result in adhesions preventing safe right upper quadrant access [4].

Previous abdominal surgery particularly is associated with difficulty placing the initial trocar and obtaining adequate exposure to the gallbladder. The potential risk for injury of organs adherent to the abdominal wall during Veress needle or trocar insertion as well as the necessity for adhesiolysis and its attendant complications are the two major specific problems constraining surgeons from performing LC for patients with previous abdominal surgery [5].

LC had history of previous abdominal surgery and 60% of these require adhesiolysis. Patients with previous abdominal surgery pose two specific problems: Obtaining safe access to the abdominal cavity to achieve the pneumoperitoneum and performing a safe adhesiolysis to gain adequate exposure to the operative field. Interference with access depends strongly on the location of the previous surgery [6].

Most vascular injuries are associated with a blind insertion technique of the first port, where as more than half of all bowel injuries are associated with this technique .The risks for bowel injury or vascular injury are even higher if the needle is blindly placed through a previous incision [7].

Incidence of umbilical adhesions may be high [68%] in patients with previous abdominal surgery especially in those where a midline scar extends to the umbilical region. Safer alternatives include placement of the needle and first trocar at a site far from the previous scar, this allows improved ability to see the abdominal cavity because vision is not obscured by adhesions and better assessment of location of remaining ports can be done and surgeons have appropriate working distance necessary to manipulate instruments. Palmer's point, located 3 cm inferior to the subcostal arch in the left mid clavicular line is a popular safe alternative [8].

AIM OF THE WORK

To assess the feasibility and outcome of LC in patients with previous upper abdominal surgery.

PATIENTS AND METHODS

This prospective study carried out at the Department of General Surgery [Al-Azhar University Hospital, Damietta]. It included 30 patients [A convenient sample] who were presented by symptomatic gallstones. It carried out from October 2019 to June 2020. Patients who were unfit for general anesthesia, suffer from bile duct disease, end stage liver cirrhosis, portal hypertension, generalized peritonitis, severe coagulopathy, carcinoma of gall bladder, with evidence of pancreatitis, cholecystitis with complications [empyema, perforation], and pregnant females were not enrolled in the study.

Ethical considerations: The study protocol was approved by the local research and ethics congress of Damietta Faculty of Medicine. In addition, each participant signed an informed consent and codes presented in the ethical guide of the faculty were

followed up. All patient's rights were respected and their privacy were guaranteed.

All participants gave full history about their illness, underwent complete clinical examination [e.g., vital signs, systematic review, and scars of previous upper abdominal surgery]. Then, a full lab profile was performed to check patient fitness for surgery and anesthesia. Lab investigations included complete blood picture, fasting blood sugar, and liver and kidney function profiles. Finally, abdominal ultrasound was done to confirm presences of gallbladder stones, check the health of intra-abdominal organs, and determine factors related to gallbladder and common bile duct [CBD] [size, wall thickness, diameter of CBD]. If there was a dilatation of CBD by ultrasound or elevation of alkaline phosphatase enzyme, patients were submitted to magnetic resonance cholangio-pancreatography [MRCP] to exclude the presence of obstructing lesion or stones in biliary system. Lastly, computed tomography [CT] and electrocardiogram were performed.

The operative technique was completed as described by Welty *et al*. [9]. Briefly, patients instructed for 6 hours fasting before operation. An Endoscope set "Karl-Storz endoscope set, was used.

The protocol of general anesthesia was uniform in all patients; Isoflurane 1-2% for maintenance. Prophylactic antibiotics were given in the form of 3 doses of 1 gm 3rd generation cephalosporin: the 1st is preoperative, the 2nd intraoperative and the 3rd, 8 hours postoperatively. All patients were put supine position.

A naso-gastric tube was inserted to deflate the stomach. The operating surgeon stands on the left side of the patient with the camera holder-assistant, one assistant who hold the fundus grasping forceps stand right to the patient and the scrub nurse on the right side near foot end of the patient. Laparoscopic instruments were placed on a separate stand located on the patient's left.

This arrangement allowed efficient surgeon access to the instruments with the least chaos. Ports were placed in the standard approach used in LC. A four ports technique was employed with a zero degree laparoscope.

If the previous scar was away from umbilicus, pneumoperitoneum was created using Veress needle with closed method. Hasson's technique or open method was used in patients with umbilical scars or adhesions; one cm horizontal incision was made. Blunt dissection was carried out until the underlying fascia is identified. The fascia was elevated with a pair of Kocher's clamps. Adherent subcutaneous tissue is gently dissected free. It is then incised to permit entry of trocar into the peritoneal cavity.

Two heavy, absorbable sutures were placed on either side of the fascial incision just like repair of umbilical hernia. Care was taken when applying these sutures to prevent injury of the underlying viscera. The Kocher clamps were next removed, and 10mm blunt trocar is advanced into the peritoneal cavity. The obturator was removed and the sleeve was secured in position with the previously placed two suture. We used also the Palmer's point which is located 3 cm inferior to the subcostal arch in the left mid clavicular line as a safe alternative for placement of first trocar in some patients with severe umbilical adhesions. An incision of 1 cm long was made in the area of the abdominal wall distant from the previous scars. The forceps was used to elevate the abdomen. The Visiport optical trocar was introduced with telescope. The optical trocar was advanced slowly through the different planes of the abdominal wall. The blade at the tip of the visiport cuts the tissue which was visible also and there was very less chance of injury to intra-abdominal organ. Carbon dioxide insufflations was performed using automatic insufflators set at 1 liter/minute initially and then insufflation rate was increased so that maximum pressure of 12 mmHg was obtained, at this point the patient was placed in a reverse trendelenburg position with the right shoulder elevated. Once the peritoneal cavity was reached safely, only those adhesions that truly interfered with visualization of the area of interest were lysed. Intra-abdominal adhesion scores were assigned according to criteria defined by Blauer and Collins [10].

Adhesions encountered between the GB and the omentum or duodenum were carefully lysed with electrocautery. Once all the four ports are in position, the fundus of GB was grasped by the assistant and flipped upwards and over the superior edge of the right lobe of liver [Figure 1].

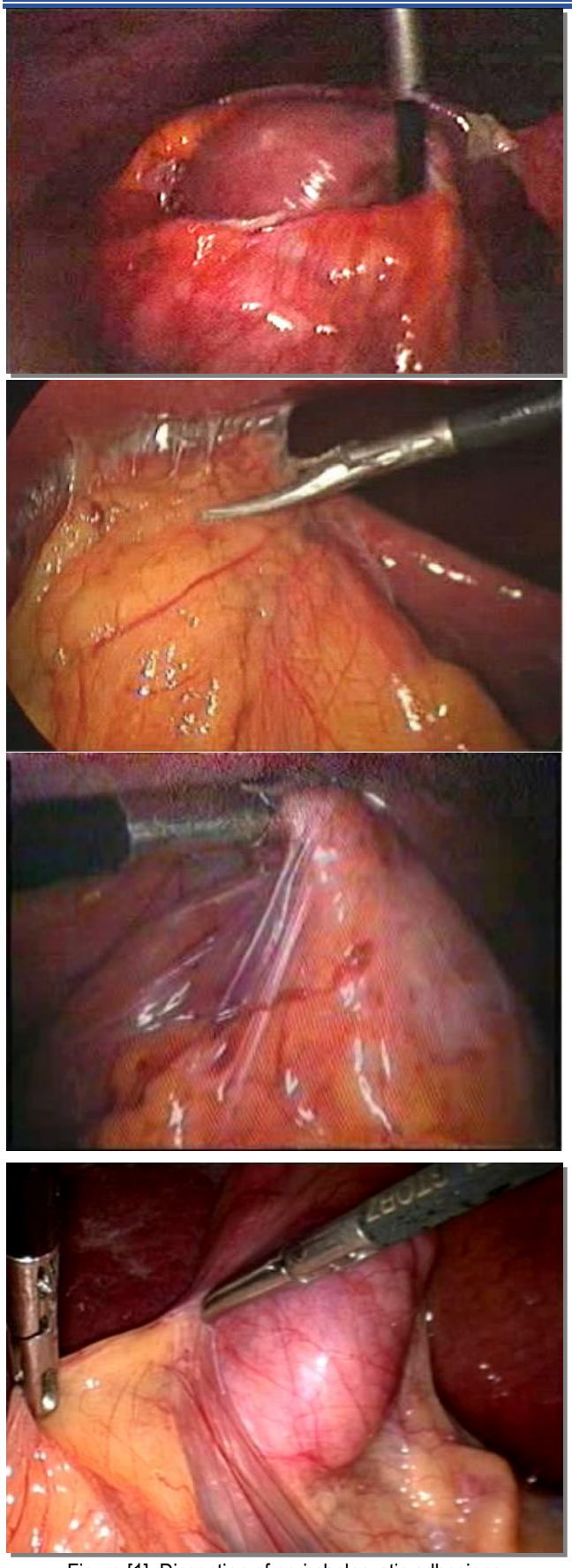

Figure [1]: Dissection of peri-cholecystic adhesions

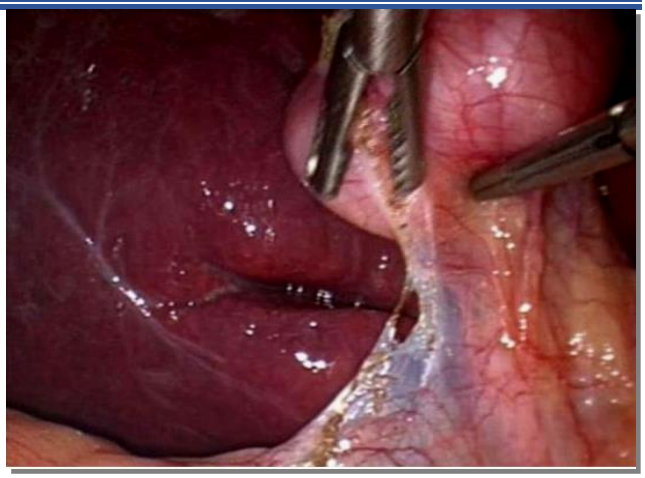

Figure [2]: Dissection is close to GB above Rouviere's sulcus

We identified the sulcus of Rouviere [fixed anatomical landmark] and dissected the hepatocystic triangle above the level of the sulcus [Figure 2]. The dissection using Maryland forceps began directly adjacent to the gall bladder, took down any adhesions to the base of the gall bladder. Dissection of peritoneal covering in Calot's triangle was started only after the gallbladder cystic duct junction was identified and once the peritoneal covering was dissected off the Calot's triangle, the cystic duct and cystic artery were clearly identified and dissected individually using blunt dissection [Figure 3].

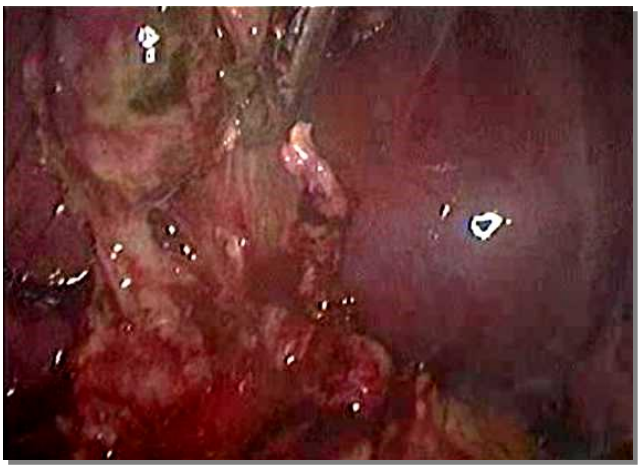

Figure [3]: Identification of Calot's triangle

Critical view of safety [CVS] was established when only two dissected structures [cystic duct, cystic artery] found to enter the gallbladder. Both cystic duct and artery were clipped, two clips on cystic duct side and one clip to the gallbladder side. It was desirable to divide the artery before the duct [Figures 4 and 5]. The gall bladder was detached from liver bed with monopolar cautery hook, traction and counter traction [Figure 6].

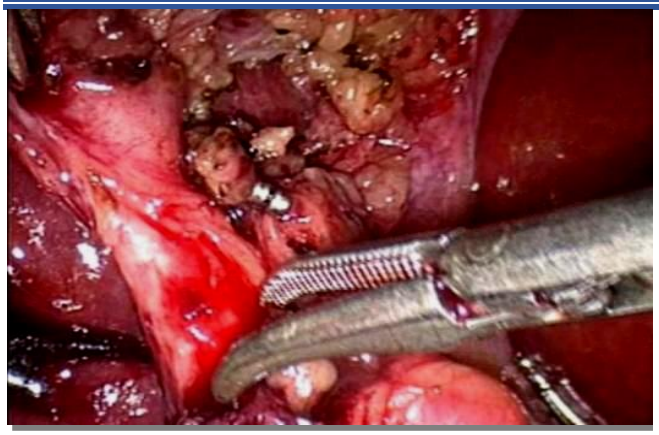

Figure [4]: Clipping of cystic artery

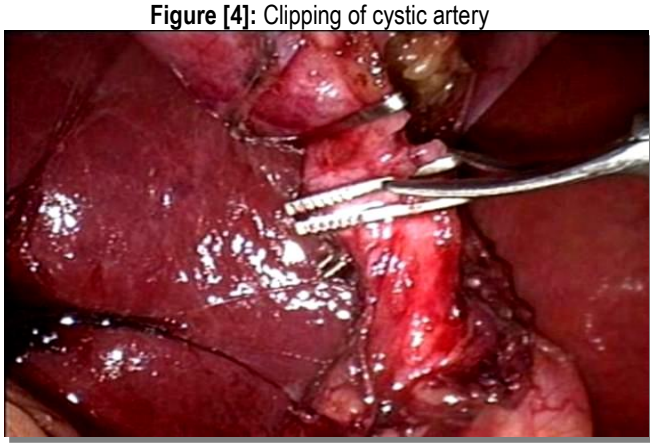

Figure [5]: Cutting of cystic duct after its clipping

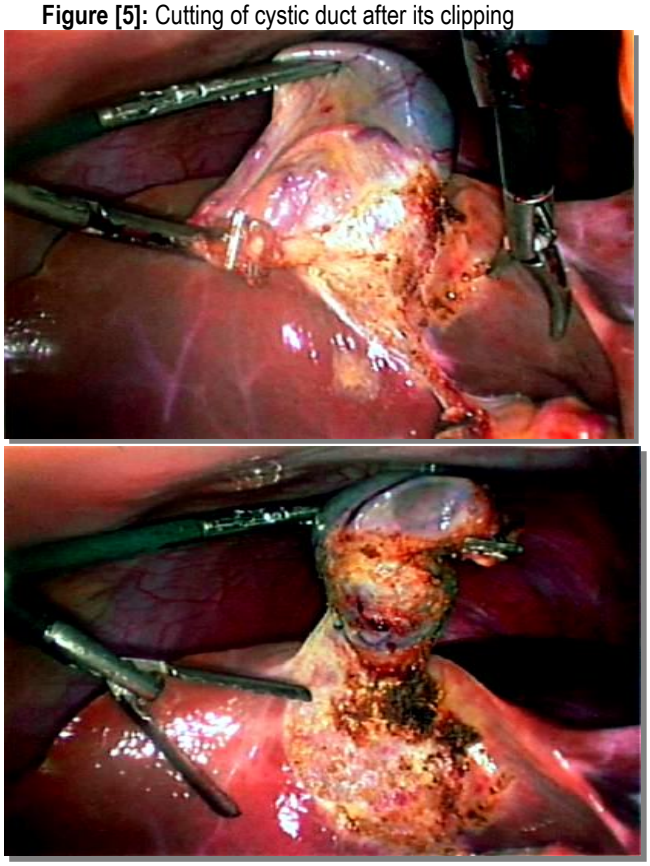

Figure [6]: Removal of GB from its bed

Spilled infected fluid of gallbladder was sucked out. Spilled stones were removed immediate or were placed in an endo bag and removed later. Prior to complete detachment of the gallbladder the liver bed was re inspected for adequate hemostasis or bile leak the cystic duct remnant and cystic artery were examined once again to ensure that previously placed clips or sutures remain secure. After ensuring complete hemostasis, the remainder of the separation was carried out and gallbladder was extracted through the epigastric port. The gallbladder was then opened externally to prevent any spillage into the port site and the bile emptied by applying the suction; stones were extracted using sponge holding forceps. Large stones were crushed or broken up and removed piecemeal. A laparoscopic view of the gallbladder was maintained through the laparoscope in the abdomen to make sure that there were no signs of spillage or rupture. If required exit port was enlarged. After gallbladder was extracted, irrigation and suction of the GB bed, Morrison's pouch, and paracolic gutter and perihepatic areas with copious amount of saline was done. The saline was suctioned out. Hemostasis was ensured in the GB bed, porta hepatis, and elsewhere in the abdomen. Drain was inserted in all patients through lateral axillary port for assessment of any postoperative complications that would occur as bile leakage, injury to bowel or bleeding. The trocars were removed under direct visual control and at last port site closure was done by applying the sutures. If, at any point during the operation, the surgeon thought that the patient would be better served by an open cholecystectomy, conversion to the open technique was performed. In converted patients cholecystectomy was done through the standard right subcostal incision.

Intra-operative data that were assessed: Operative difficulties that faced the surgeon during the operation were assessed as difficulty of creation of pneumoperitoneum, 1st trocar insertion, excessive adhesions with obscured anatomy, difficult dissection, injury to viscera, bleeding, operation time which was recorded from first port insertion to last port site closure, conversion to open cholecystectomy was estimated.

Post-operative management: Postoperative analgesia was carried out with ketorolac during the first 24 hours postoperatively and thereafter at the

request of the patient. Postoperative pain was assessed by using the visual analog score [VAS] within 24 hours postoperatively, zero equaled no pain and 10 was the worst pain. Patients were observed for sepsis, bleeding, intestinal leak, and jaundice and bile leak. These complications could occur usually within 24 hours postoperatively. All patients had warm oral liquids at the evening, provided there was normal bowel movements and no nausea nor vomiting [ileus]. The majority of patients were discharged from the hospital after 24 hours. Otherwise hospital stay was assessed. Patients were reviewed at weeks one and four postoperatively in the surgical outpatient clinic.

Statistical analysis of the data: Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. [Armonk, NY: IBM Corp] Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range [minimum and maximum], mean, standard deviation and median. Significance of the obtained results was judged at the 5% level.

RESULTS

In the current work, patient age ranged between 30-62 years with a mean age of 47.03±7.61 years. Seventeen patients were females [56.7%] and thirteen were males [43.3%]. All patients had previous abdominal surgery, the details about such operations are presented in table [1]. In addition, different abdominal incisions were found: midline incisions were found in eight patients [26.7%], upper midline incision in 5 patients [16.7%] while upper plus lower incision was found in 3 patients [10%], in ten patients [33.3%] transverse upper abdominal incisions were found, left subcostal incision was found in 3 patients [10%], 5 patients [16.7%] who were subjected to laparoscopic bariatric surgery had five port site small incisions, left para median incision was found in 3 patients [10%] and lastly right para median incision was found in one patient [3.3%] [Table 1].

Ten patients [33.3%] had comorbidities; three had liver cirrhosis [two mild and one moderate], two had diabetes mellitus, one had obesity, one had hypertension, one had [diabetes, hypothyroidism and obesity], one had acute cholecystitis, and one had [acute cholecystitis and hypertension].

All patients of the present study were diagnosed by ultrasound examination of the abdomen, 26 patients [86.7%] had chronic calcular cholecystitis, two had acute calcular cholecystitis and two had mucocele of gallbladder.

In the present study we used different methods for first trocar insertion and creation of pneumo-peritoneum that were applied according to the site of previous incision. Methods used were Veress needle [closed method] was used in 10 patients [33.3%], Hasson's technique [open method] was used in 15 patients [50%], visiport trocar was the technique used in one patient [3.3%] while entry through the Palmer's point was used in 4 patients [13.3%] [Table 2].

After safe entry to abdomen and successful pneumoperitoneum established the degree of adhesions was assessed and classified; four patients had adhesions of grade 1 [13.3%]; grade 2 discovered in 14 patients [46.7%], 6 patients [20%] had adhesions of grade 3 while grade 4 was encountered in 6 patients [20%]. The mean adhesion score was 2.47±0.97. Adhesiolysis was needed in twenty patients [66.7%] while there was no need for adhesiolysis in ten patients [33.3%] as adhesions were distant from the laparoscopic field **[Table 3].**

The operative time ranged between 45-125 minutes, the mean value was 66.03±19.62 minutes; laparoscopic surgery was completed in less than one hour in half of the patients and in one hour or more in the other half of the patients [3 cases were converted to open surgery and thus took more time [> 100 minutes]. Intraoperative complications were reported in nine patients [40%]. Bleeding reported in six patients [three from adhesiolysis, two from injury to the cystic artery and in the sixth case there was combined bleeding from adhesiolysis and from injury to cystic artery]. Rupture of the gall bladder encountered in three patients [10%] [Two had only GB rupture but in the other case GB rupture was combined with bleeding], operation was completed laparoscopically and ruptured gallbladder didn't affect the conversion rate. In the present study, 3 patients [10%] were converted to open surgery with a conversion rate of 10%; the cause of conversion was failure to initiate pneumoperitoneum due to dense adhesions [one patient], dense adhesion in the periportal area that was very difficult to make adhesiolysis [one patient], and in the third converted case, small intestine injury was developed that

resulted during performance of adhesiolysis, chole-cystectomy completed by open laparotomy and SI injury treated by direct suturing and closure of the injured part without any post operative complications [Table 4]. Postoperatively, 12 patients [26.7%] had complications. Port site wound infection had detected in three patients. Bile leakage reported in one patient [MRCP was done and there was neither CBD and hepatic ducts injury nor CBD stones, the patient was treated conservatively and the leakage stopped after four days and the patient was discharged in the seventh day, the exact cause of the leakage wasn't detected]. Bleeding encountered in two cases [conservative treatment were applied to both patients and the bleeding stopped after ne day in one case and after 2 days in the other case, bleeding most occasionally was generated from sites of adhesion dissection during operation]. Intraperitoneal collection of pus was manifested in one patient diagnosed by ultrasound that occurred after discharge of the patients in the seventh day of operation and the patient was readmitted to hospital and treated by inserting a pig-tail catheter under U/S guidance, this patient had intraoperative gallbladder rupture as a result of periportal adhesion dissection with spillage of stones and infected mud inside the abdomen and that would be the cause of pus formation in spite of administration of proper irrigation and suction of the spilled contents. Chest infection was detected in 5 patients whom were treated by parenteral antibiotics and follow up, they improved without any long term sequels. The total hospital stay ranged between one to seven days with a mean period of 1.90±1.60 days, 19 patients were discharged after one day while the delay in discharge of other patients was due to occurrence of either operative or postoperative complications. Pain score ranged from one to seven, the mean value was 3.70±1.60; half of patients had mild pain and the other half had moderate pain [Table 5].

Table [1]: Type of previous surgery and incision among studied patients

		Statistics
Previous of Previous surgery	Para-umbilical hernia repair	6[20.0%]
	Sleeve gastrectomy [2 open, 4 laparoscopic]	6[20.0%]
	Splenectomy	6[20.0%]
	Exploration [After blunt abdominal trauma, stab injury and RTA [one for each]	3[10.0%]
	Perforated peptic ulcer	2[6.7%]
	Epigastric hernia repair surgery	2[6.7%]
	Gastric bypass [one laparoscopic and one open]	2[6.7%]
	Fatty hernia of linea alba repair operation	1[3.3%]
	Right nephrectomy	1[3.3%]
	Congenital umbilical hernia repair	1[3.3%]
Type of Previous incision	Transverse upper abdominal incision [2 epigastric, 7 supraumbilical, 1 umbilical]	10[33.3%]
	Midline incision [5 upper and 3 exploratory [upper and lower]].	8[26.7%]
	Five port site small incisions	5[16.7%]
	Para-median incision [one on the right and 3 on the left]	4[13.3%]
	Left subcostal incision	3[10.0%]

Table [2]: Distribution of the studied cases according to techniques used in first trocar insertion

Techniques used in first trocar insertion	No.	%
Hasson's technique	15	50.0
Veress needle	10	33.3
Palmer's point	4	13.3
Visiport	1	3.3

Table [3]: Distribution of the studied cases according to intra-abdominal adhesion score and need for adhesiolysis

		Statistics
Intra-abdominal Adhesion score	Zero	0[0.0%]
	One	4[13.3%]
	Two	14[46.7%]
	Three	6[20.0%]
	Four	6[20.0%]
	Mean±SD	2.47±0.97
Need for Adhesiolysis	Yes	20[66.7%]
	No	10[33.3%]

Table [4]: Distribution of the studied cases according to operative data

			Statistics
Operative time	<60 minutes		15[50.0%]
	≥60 minutes		15[50.0%]
	Mean±SD [min. – max.]		66.03±19.62 [45-125]
Intraoperative Complications	Yes		9[30.0%]
	Bleeding	**Total**	6[20.0%]
		From adhesiolysis	3[10.0%]
		Injury of cystic artery	2[6.7%]
		Combined	1[3.3%]
	Rupture of GB	Total	3[10.0%]
		Alone	2[6.7%]
		Combined with bleeding	1[3.3%]
Conversion to Open surgery	No		27[90.0%]
	Yes		3[10.0%]
	Failed pneumoperitoneum from massive intraperitoneal adhesions		1[3.3%]
	Dense adhesions in periportal area		1[3.3%]
	Small intestine injury		1[3.3%]

Table [5]: Distribution of the studied cases according to postoperative data

			Statistics
Postoperative Complications	No		18[60.0%]
	Yes	**Total**	**12[40.0%]**
		Chest infection	5[16.7%]
		Port site wound infection	3[10.0%]
		Bleeding	2[6.7%]
		Bile leakage	1[3.3%]
		Intra-peritoneal collection	1[3.3%]
Hospital stay duration	< 2 days		19[63.3%]
	≥2 days		11[36.7%]
	Mean±SD [min. – max.]; median		1.90±1.60 [1-7]; 1.0
Postoperative pain score	Mean±SD [min.-max.]		3.70±1.60 [1-7]
	Mild [1-3]		15[50.0%]
	Moderate [4-7]		15[50.0%]
	Severe [>7]		0

DISCUSSION

Previous upper abdominal surgery has been listed as one of the relative contraindications to LC because of adhesion formation, which causes bowel or vascular injury during first trocar placement higher than those without history of previous operations also the time needed for adhesiolysis and the time needed for elimination of complications from adhesiolysis making some surgeons prefer not to do LC in those patients [11].

In the current research, males represented 56.7%, the mean age of studied populations was 47.03±7.61 years. Bukhari *et al*. [12] reported that, males represented 51.0% and age ranged from 35 -45 years However and unlike current study both upper and lower abdominal incisions were included in their study [55% lower abdominal and 45% upper abdominal surgery]. Karayiannakis *et al*. [5] conducted a retrospective study on 473 patients, and reported that [402 patients had one, 59 had two, 11 had three, and one had 4 pervious operations]. In the current study, we only included patients with previous one incision only.

In the current work, 26 patients [86.7%] had chronic calcular cholecystitis, two had acute calcular cholecystitis and two had mucocele of gallbladder. Ercan *et al*. [13], and Kohli *et al*. [14] excluded patients with acute cholecystitis from their study to examine only one variant [previous surgery] on the outcome of LC.

Safe entry of first trocar was our goal in all patients so we used different methods for first trocar insertion to prevent injury to bowel or any structure adherent to abdominal wall. We used three techniques, Veress Needle [33.3%], open Hasson's [50.0%], insertion of trocar through Palmer's point [13.3%], and visiport in 1 [3.3%] patient. We decided which technique could be used according to type of incision found [for example, in patients with incisions away from umbilicus we used veress needle while in patients whom incisions were close to the umbilicus or placing mesh in the previous hernia repair site, we used open method. Palmer's point was used in patients with midline incisions. All methods were safe for 1st trocar insertion if proper method for each case were applied. Karayiannakis *et al*. [5] used open technique in about one third of the studied cases and used another techniques as Veress needle or visiport trocar realizing that open method was superior to other methods in the avoidance of vascular or visceral injuries.

Once safe access has been achieved, priorities were changed and the main goal was to perform an adhesiolysis sufficient for insertion of a second cannula to aid in visualization, retraction and dissection, as well as for the planned and flexible use of additional ports. Adhesiolysis was confined to adhesions that interfered with adequate access to the operative field and the performance of the procedure. Adhesiolysis was needed only in 66.7% of patients while 33.3% patients experienced adhesions distant from operative field thus there was no necessity for adhesiolysis. The type of previous incision and operation were the main determinant of the extent. Ercan *et al*. [13] studied the effects of previous abdominal surgery incision type either upper or lower on outcome of LC and concluded that, the lower abdominal incision had fewer adhesions than other types and as a consequence had a much lower rate of complications and conversion to open surgery.

Matching with current findings, Akyurek *et al*. [15] discovered adhesions in 90.2% of patents with previous upper abdominal surgery and adhesiolysis was required in 77.1%. However, Vikas J *et al*. [16] reported adhesions in 92.3%, and adhesiolysis all patients with adhesions. Karayiannakis *et al*. [5] reported that, adhesions were more frequent among patients with previous upper abdominal [70.7%] than patients with previous lower [58.8%] abdominal surgery. Adhesions in the upper abdomen were more extensive and denser than those lower abdominal surgery. Akyurek *et al*. [15] believed that the majority of adhesions from prior upper abdominal surgery do not alter the anatomy of the abdominal right upper quadrant and do not negatively impact the performance of a successful laparoscopic cholecystectomy. On the other hand, Singh *et al*. [17] showed that adhesions were the leading cause for conversion to open cholecystectomy in patients with upper abdominal surgery and mentioned that an experienced surgeon is able to lower this rate of conversion by his experience. Yasemin *et al*. [18] and Uslu Yuvaci *et al*. [19] recommended preoperative ultrasound to detect intra-abdominal adhesions and increase safety of abdominal laparoscopy.

We reported intraoperative complications in 30% [GB rupture in 3 patients and bleeding in 6 patients]. Both of these complications didn't affect the conversion rate but increased the mean operative time. Kohli *et al*. [14] reported bleeding in 11% of patients with previous upper abdominal incisions, but in most cases, it was easily controlled. They recommend the following to control bleeding: avoid extensive use of cautery, compression by gall bladder, sponge piece or by roll gauze for 5 minutes, irrigation and aspiration of the bleeding area, then grasping the bleeding vessel]. If bleeding site was not clearly identified and bleeding controlled after these maneuvers, conversion to open was recommended. In the same study rupture of gall bladder was reported in 28%, while it was 12% in Schafer *et al*. [20], while Phillips *et al*. [21] reported a higher incidence [40%].

In the current study, the rate o conversion to open procedure was 10%. This rate is comparable to Karayiannakis *et al*. [5] study where the conversion rate was 19%, 3.3%, 5.4% among the patients with previous upper, lower and without abdominal surgery respectively [9.23% for the overall conversion rate]. However, it is lower than Kohli *et al*. [14] who reported rate of 30%, and higher than Akyurek *et al*. [15] study where the conversion rate was 2.2%.

Some studies argue that previous abdominal operations are not predictive of conversion because adhesions from these operations do not change the anatomy of the upper right quadrant, and therefore do not negatively affect the success of LC [15,22]. However, others suggest that previous upper abdominal operations can be a predictive risk factor for conversion [23-25].

Operative time in the current work lies within previous literature. Variations in operative time were prominent in different studies. For example Karayiannakis *et al.* [5] reported a mean time of 66.4±34.2 minutes, while in Akyurek *et al*. [15] study, it was 57± 9.8 minutes, Lee *et al*.[26] reported 144.2± 56.1 minutes, Kohli *et al*.[14] reported 76.2±13.2 minutes, and Fanaei et al. reported a mean time of 75.0±3.2 minutes. The prolonged operative time noted in the study of Lee *et al*. [26] was a consequence of being applied among patients who had a scar of previous gastrectomy.

In the current study, 40% patients had postoperative complications [port site wound infection in three, bile leak in one patient, bleeding in 2 patients, chest infection in 5 patients and the last one had intra-abdominal collection of pus. These complications didn't affect the status of the patient later on in the term of postoperative disability or adverse long-term complications. Postoperative pain mild or moderate, two thirds of patients discharge within two days and one third after two days. Zhu *et al.* [27] reported an overall rate of about 7.3% of postoperative complications, and a conversion rate of 5.0%, which is lower than the current work. They concluded that, laparoscopic common bile duct exploration is a safe and feasible technique for patients with previous upper abdominal surgery. They added that, the keys of this technique are careful separation of the adhesions and clear exposure of the common bile duct, and use of different methods to remove stones. Tan *et al*. [28] reported an overall complications rate of 30% and longer duration of hospital stay [the mean duration was 7 days]. However, they concluded that, laparoscopy was feasible, effective, and advantageous for patients with previous upper abdominal operations.

Geraci *et al*. [29] reported that, LC can be carried out with great safety in patients with previous abdominal scar if we [1] know well clinical history of the patient, [2] use the adequate technique for the insertion of first trocar, by placing the Veress needle in the left upper quadrant, [3] dissect the adhesion before the upper midline port is inserted, [4] and retrogradely dissect the gallbladder from the liver bed, and [5] divide the cystic artery and duct last. Moreover, rarely, unintentional injuries to the intestines can occur, and therefore particular attention should be paid to this possibility during the dissection of adhesions. Patients with previous lower abdominal incisions [appendectomy, hysterectomy] had fewer adhesions in the upper abdomen than did patients with upper incision: probably, in these cases adhesiolysis is unnecessary, if the surgical field is well exposed.

The limitations of the current study are: it is a single center study being conducted to a small sample size of patients. It is a descriptive study not a comparable study in which we can compare between

different variants, and different upper abdominal incisions were included in the study. However, we could conclude that, LC after previous abdominal operations is feasible, as minority of patients had difficulties [especially when previous incisions are close to laparoscopic field of LC] and they are usually associated with longer operative time, high graded adhesions, intraoperative complications, high conversion rate and longer duration of hospital stay.

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