COMPLICATIONS OF LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT:
Objective: *To assess the complications of Laparoscopic Cholecystectomy in our setting.*
Design & Duration: *A prospective observational study from Nov. 1997 to Oct. 2004.*
Setting: *Surgical Unit I, Civil Hospital, Karachi.*
Patients: *All patients who underwent Laparoscopic Cholecystectomy for gall stone disease between Nov. 1997 and Oct. 1999 were included in the study, whereas cases with acute cholecystitis, bile duct calculi, obstructive jaundice, cholangitis, acute pancreatitis, portal hypertension, gall bladder malignancy, sepsis, and severe cardiopul-monary or other medical diseases were excluded from the study.*
Methodology: *The data of all the patients who underwent Laparoscopic Cholecystectomy for gall stone disease was entered on a standardized proforma and analyzed for age, sex, symptomatology, examination findings, investigations, operative findings, post-operative complication and the outcome. The patients were followed-up for five years i.e. the last patient operated in Oct. 1999 was followed-up till Oct. 2004.*
Results: *Amongst the 160 patients that were included, there were 138 females and 22 males, with ages ranging from 17-82 years. Laparoscopic cholecystectomy was successfully completed in 144 (90%) cases with a conversion rate of 10%. Major complications were seen in eight (5%) patients including common bile duct (CBD) injury in three and cystic duct injury, bleeding from gall bladder bed, duodenal injury, colonic injury and retained CBD stone in one case each.There was no mortality in this series.*
Conclusion: *Laparoscopic Cholecystectomy is a safe procedure with minimal complications.*

KEY WORDS: *Cholelithiasis, Gall Stones, Cholecystectomy, Laparoscopy, Minimal Access Surgery, Complications*

INTRODUCTION

With the advent of Laparoscopic Cholecystectomy (LC) in France in 1987, as the gateway into the field of interventional laparoscopy, the management of biliary disease has dramatically changed. At present laparoscopic cholecystectomy is considered the "Gold Standard" for the treatment of cholelithiasis as it offers unquestionable advantages in comparison to the conventional approaches. Reduced trauma, minimal post-operative pain and dramatic shortening of post-operative hospital stay are the main reasons for its popularity[1]. The enthusiasm brought about by laparoscopic cholecystectomy is almost unprecedented, and is emphasised by the fact that it is often the patient who specifically requests this technique.

The indications for LC include all patients with symptomatic cholelithiasis and/or acute cholecystitis. Body morphology, age, and previous abdominal surgical intervention are no longer contraindications. Formerly limited to uncomplicated cholelithiasis, the horizon of indications has progressively extended and, at present, very few patients require the conventional 'open' approach. Most surgeons can perform this procedure quickly with a minimal conversion rate.

During the initial phase of the use of this technique, the complication rate is much higher than the standard procedure of open cholecystectomy. This is attributed largely to technical limitations. Monitors are two dimensional and instruments lack the tactile feedback, making complex manoeuvers like suturing difficult. Rigid ports fixed in the abdominal wall restrict range of the motion, whereas visualisation of structures replaces palpation for the detection of abnormalities[2].

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Complications of LC are sometimes related to intraperitoneal access, and at other times to a specific step of the procedure. The reported complications include intraoperative bile spillage, infectious complications secondary to calculi left in the abdominal cavity, injury to the duodenum and transverse colon, postoperative bile leaks, postoperative persistent right upper quadrant pain, missed or retained stone in the common bile duct, post-operative diarrhoea, postoperative ileus, and port site problems.

The majority of iatrogenic injuries can be successfully avoided by appreciating the limitations and pitfalls of laparoscopic surgery, and by carefully dissecting the Calot's triangle before dividing any structure. Earlyidentification and management of complications will minimise potentially devastating complications of small, unrecognised injuries. The overall mortality after laparoscopic cholecystectomy ranges from 0-1%, and the frequency of major complications is less than 5%[2].

PATIENTS & METHODS

This prospective and descriptive study was carried out on 160 patients who underwent laparoscopic cholecystectomy for symptomatic gall stones at Surgical Unit I of Civil Hospital, Karachi between Nov. 1997 to Oct. 1999. As no new case was included after Oct. 1999 and the patients were followed-up for five years, hence the study continued till Oct. 2004.

The inclusion criteria were patients of all ages and both sexes with symptomatic gall stone disease, having normal blood counts and liver function tests (LFTs), and ultrasound abdomen clearly demonstrating gall stone disease, with absence of any signs suggesting acute cholecystitis.

Patients with history, physical examination, ultrasound abdomen and laboratoring investigations suggesting acute cholecystitis, bile duct calculi, obstructive jaundice, cholangitis, acute pancreatitis, portal hypertension, gall bladder malignancy, sepsis, and severe cardiopulmonary or other medical diseases were excluded from the study.

A thorough history taking and clinical examination was carried out; findings that were recorded included the demographic data, body weight, presenting complaints, past history of jaundice or any abdominal surgery, associated medical diseases, drug history, vital signs, anemia, jaundice and abdominal tenderness. Routine laboratory investigations performed included blood CP, blood sugar and urea, serum creatinine and electrolytes (UCE), LFTs, serum amylase, X-ray chest and ultrasound abdomen. Further investigations were done as and when requiredlike the CT scan, magnetic resonance cholangiopancreatography (MRCP), percutaneous transhepatic cholangiography (PTC) and endoscopic retrograde cholangiopancreatography (ERCP). We have no facility of intraoperative cholangiography or choledochoscopy.

ECG and cardiac assessment was done if the patient was over 40 years. A medical opinion was obtained in cases of significant medical problems like hypertension or diabetes mellitus; these were first treated and stabilized before proceeding for LC. All patients were peroperatively assessed by an anesthetist. Informed consent was taken and the patients were fully explained about the nature of the procedure, the risks involved and the likely need of conversion to open cholecystectomy.

Peri-operative antibiotic prophylaxis was given to all the patients, as ceforanide (precef) 1gm intravenously at the time of induction, followed by one or two doses post-operatively at 12 hourly interval. The antibiotics were continued longer in cases of complications. All patients were operated under general anaesthesia with endotracheal intubation. A nasogastric tube was passed intraoperatively to decompress the stomach and reduce the risk of visceral puncture at the time of the creation of the pneumo-peritoneum. The patient was operated upon in the supine position with the table tilted 20^{o} up (reversed Trendelenberg). The surgeon, camera man and the scrub nurse stood on the left and the assistant on the right side of the patient. The insufflator, suction/irrigation system, camera, electrocautery unit and xenon light source were placed on the right of the patient and the instrument trolley on the left side. The video monitor, linked to the endovideo camera, was placed on the right side of the patient such that the assistant could clearly visualise the progress of the operation. Before beginning the procedure the entire electronic equipment was checked to ensure proper functioning. Skin was prepared with a chlorhexidine-alcohol antiseptic solution and standard towelling done.

For creating the pneumo-peritoneum, we routinely used the open technique through a one cm vertical incision below umbilicus. After insufflation with CO_2, the remaining three ports (10 cm epigastric port, 5 mm port in mid-clavicular line between first the first two ports and another 5 mm port in anterior axillary line at the level of umbilicus) were inserted under direct vision. The fundus of the GB was grasped, retracted in a cephalad direction and the GB pulled away from liver by applying infero-lateral traction on the Hartmann's pouch. This helped in identification of the cystic and common bile ducts by pulling them out of alignment. The cystic duct was usually the first tubular structure to present itself;

it was dissected, clipped and divided followed by the cystic artery. The GB was then dissected free from the liver and removed through the epigastric port. In cases of bleeding or GB perforation, irrigation and suction was performed. Finally a drain was placed in the sub-hepatic area.

The pneumo-peritoneum was decompressed by disconnecting the tubing from the insufflator and by opening the valve on the cannulas allowing the gas to escape.The cannulas were then removed and the port-sites closed with interrupted silk sutures (2/0), followed by aseptic dressings. Conversion to the open cholecystectomy was carried out due to complication or operative findings that were difficult to deal with LC. The operative findings at LC, duration of operation and the pathological findings of the GB were recorded in all the cases.

Post-operatively regular analgesics (diclofenac sodium) and antiemetics (metoclopromide) were given. In cases of postoperative fever, tachycardia, severe pain, jaundice or continuous collection in the drain bag, urgent investigations were done including Blood CP, LFTs and ultrasound abdomen. If bile duct leakage was suspected then MRCP, ERCP or PTC was done. In cases of doubt laparotomy was performed early rather than late.

Oral fluids were started as soon as the patient's bowel sounds returned, and the nasogastric tube was removed as soon as the patient tolerated oral fluids and was free of nausea and vomiting. Patients were encouraged to get out of bed as soon as they have recovered from the anaesthesia. The drain was removed 24 hours after the operation, if there was no significant collection. In the absence of any problems, the patient was discharged within 24-48 hours with the advice to return if anything goes wrong. Skin sutures were removed on the eighth postoperative day. Every case was followed weekly during the 1st month, monthly for next five months, and then yearly for the next five years. During the follow-up if a patient developed any complication, then appropriate investigations were done and the patient managed accordingly.

RESULTS

Amongst the 160 patients that underwent Laparoscopic Cholecystectomy, there were 138 (86.25%) females and 22 (13.75%) males with a sex ratio of one male: 6.27 females. The age of the patients ranged from 17-82 years, with maximum number (31.25%) seen in the 30s i.e. the 4th decade). The mean weight of the patients was 64 Kg, the range varying from 40-125 Kg. There were 11 female patients who weighed more than 110 Kg, and were classified as morbidly obese. Based on the symptoms we classified the patients into three groups as follows:

Group-I: Patients(135 - 84.38%) with biliary colic defined as intermittent episodes of right upper quadrant and epigastric pain.

Group-II: Patients (22 - 13.75%) with symptoms associated with gall stones such as fatty food intolerance, dyspepsia, flatulence and postparandial nausea/vomitting.

Group-III: Patients (3 - 1.88%) with right iliac fossa(2) or substernal pain (1).

Ultrasonography showed cholelithiasis with chronic cholecystitis in 151 (94.38%) patients, cholelithiasis with acute cholecystitis in seven (4.38%) and chronic acalculous cholecystitis in two (1.25%) patients. The seven patients with acute cholecystitis were those patients who developed recurrent attack during the six weeks interval period, when it was decided to operate so as to prevent further recurrences.

Thirty-five (21.88%) cases presented with one or more co-morbid diseases including 19 with diabetes mellitus, 15 with hypertension, two with ischaemic heart disease, four with chronic pulmonary disease and eight with peptic ulcer disease. Seven patients had past history of jaundice and eleven patients surgery: six had Caesarean section through lower midline incision (two with incisional hernia) two had appendicectomy, and one each had hysterectomy, left inguinal herniorrhaphy and open prostatectomy. In one patient with pregnancy (second trimester) LC was safely performed.

Out of 160 cases Laparoscopic Cholecystectomy was successfully completed in 144 (90%) cases. The remaining 16 (10%) patients had to be converted; in three cases there were major complications, while in 13 cases it was due to disturbed anatomy at Calot's triangle (5), wide cystic duct (2), choledocholithiasis (2), dense adhesions between gall bladder and stomach (2), biliodigestive fistula (1) and instrument malfunction (1).

Our criteria for major complications were any unexpected happening which required another major surgical intervention during the course of LC (i.e. conversion to open cholecystectomy) or re-operation postoperatively, and/or which caused the patient to stay for more than seven days postoperatively. Eight (5%) patients experienced major complications either peroperatively or in early postoperative period (Table I): three had CBD injury, while one each had cystic duct injury, bleeding from gall bladder bed, duodenal injury, colonic injury and retained CBD stone. Forty-five patients (28.13%) had minor complications either peroperatively or in the

Complication	Presentations	Management
CBD injury (3)	-Rt. Upper Quadrant (RUQ) Pain & Biliary Fistula	-Repair of CBD injury + T-tube placement
	-RUQ Pain, continous bile in drain & Postop. Jaundice	-Roux-en-Y Hepaticojejunostomy
	-Biliary Fistula	-Conservative
Retained CBD Stone (1)	-RUQ Pain & Jaundice	-Choledochlithotomy
Cystic duct injury(1)	-Bile leakage peroperatively	Completed laparoscopically
Bleeding from GB bed (1)	-Bleeding peroperatively	Conversion to open procedure
Duodenal injury (1)	-Peroperative recognition	Conversion to open procedure
Colonic injury (1)	-Peroperative recognition	Conversion to open procedure

Table I. Major Complications

early post-operative period (Table II).In the 5-year follow-up period, 17 (10.63%) patients were lost to follow-up at varying periods; all of them underwent unremarkable LC with no peri-operative complications. There were no late major or minor complication such as bile duct strictures, port-site hernia, etc. There was no peri-operative mortality in our study. The results of statistical analysis (Chi-Squarea of 93.838 and Asymp. Sig. of .000) also showed that the study was highly significant.

Table II. Minor Complications

Complications	Presentations (No.)	Management
GB perforation & biliary leak (13)	-Peroperative biliary leak (10)	-Irrigation, suction &drain
	Gall stone spillage (3)	-Stone retrieval
Hemorrhage at Calot's triangle (11)	-Peroperative bleeding (11)	-Hemostasis secured with clips or electrocautery
Port site problems (7)	-Port site infection (7)	-Appropriate antibiotic after C/S
Gastointestinal problems (11)	-Postoperative diarrhea (1)	-Metronidazole
	Postoperative ileus (4)	-NPO, NG tube, IV fluids & antibiotics
	Vomiting (6)	-Antiemetics
Respiratory tract infection (3)	-Fever & productive cough	-Steam inhalation, Antibiotics/Antipyretic

DISCUSSION

Laparoscopic cholecystectomy has gained favour among surgeons and popularity among the patients as it offers minimal surgical trauma, reduced hospital stay and early resumption of normal working activity[3]. This study aims at assessing the complications of LC.

Sometimes complications in LC are seen during the creation of the pneumo-peritoneum i.e. while introducing the Veress needle and insertion of trocars, which can directly damage internal structures. The incidence of major vascular and visceral lesions, although considered to be rare, may be higher than expected because of under reporting. Deziel[4] cited 13 cases of aortic injuries with one death, while Roviaro[1] reported one injury to aorta and one to middle colic artery. These complications were not seen in our study as instead of Veress needle we used the technique of sequential clipping and elevation of all layers of the abdominal wall during the insertion of the Hasson cannula for safer entry into the peritoneal cavity[5].

Injuries to intra-abdominal viscera, which occur with rates of 0.03-0.5%, are usually caused with the same dynamics as the vascular lesions[1]. They may result from direct trauma either by the Veress needle or trocar insertion, or be inflicted by instruments during the surgery, or by misperception of the anatomy especially fibrosis.

Previous open surgery should not be considered a contraindication to LC, but require great care and precaution especially during the initial access. In our series nine (5.63%) patients had a past history of operations; most were cases of Caesarean section, other being appendicectomies and hysterectomy. However, none of these cases required conversion.

There were no intra or post-operative deaths in our study, whereas Rehman[6] reported one death in 100 LCs, because of bleeding from traumatized hepatic artery. Bhopal[3,7] in two studies of 150 and 300 patients, and Roviaro[1] in a single centre study of 1007 patients reported no peri-operative deaths.

In our study the incidence of conversion from LC to open cholecystectomy was 10%, while Peter[8] reported an incidence of 14%, mostly due to difficult dissection secondary to inflammation or adhesion, and per-operative detection of CBD stones. Rehman[6] cited a conversion rate of 9%; the reasons were bleeding, cholecystogastric fistula, cholecystocolic fistula, instrument failure, exploration of CBD, carcinoma of GB and inability to identify anatomy. Wolnerhanssen[9] and Bhopal[7] reported a conversion rate of 6.6% and 2% respectively in their series. The largest LC series now show conversion rates ranging between 2.5 and 3.1%[1].

In our study the conversions were mostly due to disturbed anatomy, CBD stones and adhesions. One patient needed conversion because of a fistula between the GB and the pylorus. Chowdhury[10] also reported 0.51% fistulae between GB and duodenum or colon out of 3750 LCs; he concluded that with experience and training in advanced laparoscopic surgery, these fistulae can be operated safely laparoscopically. The need for conversion can occur in every LC. No pre-operative examination can assess this possibility and it must not be considered as a defeat for the surgeon. Elective conversion is preferable to enforced conversion because of a serious iatrogenic injury.

The incidence of CBD injury following LC had been previously shown to be higher than that after open cholecystectomy (0.6% versus 0.3%)[4,11]. The incidence reported by Letwin[12] was 0.1%, while Arain[13] described a figure of 0.27%, Mahatharadol[14] 0.59%, Adamsen[15] 0.7%) and Ahmed[16] 1%. In most cases the leading cause of CBD injury was difficulty in identifying the structures at Calot's triangle. These injuries can be prevented by adequate surgical experience, care and proper case selection[17]. In our series the incidence of CBD injury was 1.88%; which was also due to difficulty in identifying structures in the Calot's triangle and difficulty in dissection. Most (77.78%) CBD injuries were not recognised at LC, those (22.22%) that were detected required conversion to an open procedure[15].

Depending on the type of injury the treatment options are suture with or without T tube, endoscopic stenting, end-to-end anastomosis and biliary-enteric anastomosis[15]. In our series there were three cases of CBD injury; out of the two cases of incisional injury to proximal CBD one was managed successfully by conservative treatment while the other required laparotomy with suture and T-tube placement. In the third case the injury was of Strausberg[11] Type E3; hence Roux-en-Y hepaticojejunostomy was performed[18,19]. The facility of per operative cholangiography was not available in our centre.

Haemorrhage is reported as a complication in nearly every series[20]. The injury may be due to Veress needle or trocar insertion, or operative dissection[21]. Mostly the bleeding result from accidental injury to the cystic artery or small vessels around the Calot's triangle or from the GB bed[2]. In our study serious bleeding occurred in one (0.63%) case from the GB bed which was revealed peroperatively. It could not be controlled laparoscopically, and needed conversion. Besides this, there were

11 (6.88%) cases of minor bleeding, which were successfully secured laparoscopically via clipping or electrocautery. Vascular injuries are the most lethal technical injuries of LC[7,13]. Usal[21] reported an incidence of 0.11% major vessel injury (aorta, portal vein and inferior vena cava), while Roviaro[1] reported an incidence of 0.1% and Arain[13] 3.18%, which included bleeding from falciform ligament, cystic artery and others.

The small or large bowel can be damaged by the inadvertent introduction of the Veress needle or sharp-tipped trocar, forcible dissection while freeing adhesions or by thermal burns[22]. Often such injury remains unrecognised during LC and manifest later[7]; if evident peroperatively then conversion to open surgery is required[22]. Perforation may be delayed for several days with thermal injury, devascularisation, or necrosis due to mesenteric or venous thrombosis. The patient presents with complications like sepsis, peritonitis, intraabdominal abscess, or external fistulas. There were two (1.25%) cases of bowel injury in our study; one was duodenal and the other colonic. Both were recognised peroperatively and repaired by open surgery. Singh[23] reported duodenal injury in 0.17% of patients. The incidence of serious bowel injuries during LC ranges from 0-5%[12,24].

In our study GB perforation with bile leakage occurred in 13 (8.13%) cases; in three (1.88%) there was spillage of gall stones also occurred. The stones were retrieved and the sub-hepatic space washed thoroughly with normal saline. No early or late sequelae occurred in these patients, apart from mild diarrhoea in one patient and shoulder tip pain in four patients. In a study of 18280 LCs, Woodfield[25] reported a GB perforation rate of 18.3%, with spillage of stones in 7.3% and that of unretrieved stones in 2.4% cases. In a study of 1100 LCs, Arain[13] reported GB perforation and bile leakage in 9.8% of patients, with spilled stones in 3.9%. Barrat[26] and other authors[26] also found no long-term complications in similar cases. Most surgeons leave small stones behind[27] as they are innocuous, though in a minority of cases this could be untrue[22], hence it is important to try and retrieve as many of the dropped stones as possible[24]. The reported sequelae of this complication include residual abscesses, adhesions, cutaneous sinuses, small bowel obstruction, incarcerated hernia, generalized septicemia, middle colic vessel erosion and thrombosis, dyspareunia from implantation of stones into ovary, and empyema and cholelithoptysis from stone migration into the chest[28-30].

Other than from GB puncture, bile leak usually comes from an unsecured cystic duct or accessory ducts in the liver bed, in the postoperative period. It can result in the formation of a bilioma. Tzeng[31] reported a case of bilioma in periumbilical area. In our series we encountered one case of bile leak from the injured cystic duct, which was successfully dealt with clippage and lavage.

There were two (1.25%) cases of retained CBD stones in this study. They were managed by open CBD exploration, extraction of the stone and T-tube placement. Ali[32] reported retained CBD stones in 0.78% cases and Braghetto[33] in 2.3% patients. He also concluded that LC without routine IOC can be performed safely without the discovery of a high percentage of retained CBD stones at a later follow-up. Management approaches are open laparotomy or re-laparoscopy with trans-cystic duct removal, choledochotomy or antegrade sphincterotomy. ERCP with sphincterotomy is an established method for the treatment of retained CBD stones[34,35]. Fanning[35] reported a complication rate of 12.4% with ERCP, 14% with open surgery, and zero with laparoscopic CBD exploration.

Shea[36] reported the complications of urinary tract infection (0.69%), ileus (0.88%), wound infection (1.11%), wound haematoma (0.63%), pulmonary oedema (0.2%), atelactasis (1.0%), pulmonary embolism (0.24%) and postoperative fever (0.93%) in his meta-analysis; while Arain[13] in his study described the complications of umbilical wound infection (1.63%), chest infection (1.91%), urinary tract infection (1.1%), bleeding from ports (0.91%) and ileus (1.37%). Bhopal[7] reported three cases of port hernia in 300 LCs. In our series we found port site problems (infection and pain) in seven cases, gastrointestinal problems (ileus-2.5%, diarrhoea-0.63%, vomiting-3.75%) in eleven and respiratory tract infection (1.88%) cases.

CONCLUSION

The incidence of major complications in LC is low, which is greatly influenced by the training skill and judgment of the surgeon performing the procedure; patients' selection criteria also influence the outcome. Sometimes, anatomic or pathologic findings preclude the laparoscopic approach, and elective conversion to an open operation reflects sound surgical judgment and should not be considered a complication. Usually the complications are recognised per-operatively or early in the post-operative period, and the management includes various available options like conservative, endoscopic or laparotomy. The long-term results of LC are good.

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