

Clinical Outcomes of Gall Bladder Perforation During Laparoscopic Cholecystectomy

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Abstract

Background: The most common surgical procedure as laparoscopy, performed all over the world is Lap chole. It has now become the golden procedure of management for gallstones. Even though, there are many attempts to explore the influence of perforation of gallbladder on the clinical outcomes, but the conflicting results are still. Because of increasing in the attempts at minimally invasive surgery, during lap chole; accidental gallbladder perforation is on rise. **Aims:** The researcher tries to investigate criteria and the clinical outcomes and the risk factors in patients who develop gallbladder perforation during Lap Chole. **Methods:** An (80) patients had been undergo Lapachol. by a cross sectional comparative analytical study in prospective pattern had been carried out in Al-Hussain teaching hospital-Thi-Qar-Iraq. The data collection phase extended over a period of 7 months from 2nd of January 2018 to 1st of August 2018. Each participant subjected to a questionnaire that includes: personal socio-demography, and followed up for at least one week to assess the outcome. The data analyzed by using SPSS (version 23). p value less than 0.05 was considered as statistically significant. **Results:** Eighty (80) patients sustained a gallbladder perforation, the bulk of the sampled cases taken was females were mostly at age of 40-60 years, and Al-Nasiriya residency, and these are not the total number of cases of accidental gallbladder perforation during laparoscopic cholecystectomy within 7 months of the study, only two cases ended with sub-hepatic collection, there was statistical association between type of perforation and some determinants such age and gender (p value=0.001), while there was no sig. Statistical association between complication and studied variables (P value >0.05). **Conclusion:** The most age of occurrence of the complication is the peak age of gall stone development, and because the large number of female patients in our study, so female consider the main affected gender for both gall bladder diseases and perforation during lap chole. Accidental gallbladder perforation can be caused mainly by technical errors.

Keywords: Gall Bladder Perforation, Laparoscopic Cholecystectomy, Laparotomies, Duodenum

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1. Introduction

The gallbladder is a small hollow organ, it has thin wall pear-shaped. It is receiving, concentrate and store bile, which produced by the liver via the common hepatic duct, and release the bile by the common bile duct into the duodenum, where the bile helps in the digestion of fats.[1] The gallbladder located at the upper right quarter of abdomen, it is about (7-10) cm in long and is located in an indentation under the liver, it holds about (30-80) milliliters of fluid.[2]

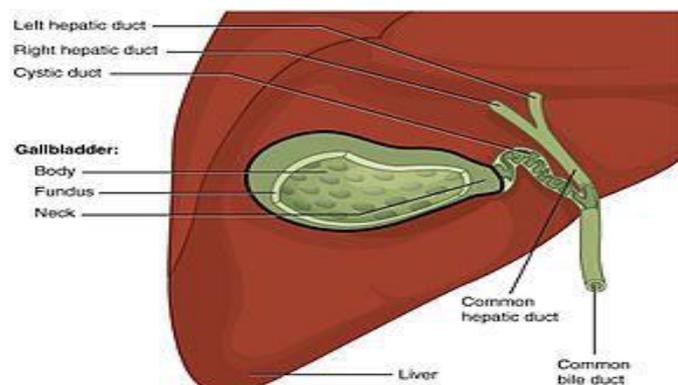


Figure1. Anatomy of gallbladder and bile ducts

In general surgery, cholecystectomy is the second most commonly performed abdominal operation. There is a spontaneous preoperative Gallbladder perforation, according to Neimeir's classification type 1, 2, 3, which is a rare condition but its life-threatening complication of acute cholecystitis, with reported mortality rate of 12-42 %. The outcome of laparoscopic cholecystectomy is affected by training, experience, skill, judgment of surgeon and quality of instruments that used for operation. Bile leak during laparoscopic cholecystectomy should be stopped by surgeon and examine the source of bile leakage. The main source of bile leak either from opening in gallbladder or from the

cystic duct[3]. Bile from the gallbladder is greenish yellow, thick, and viscid, while bile from common bile duct is bright yellow, thin, and watery [4].

In 2011, cholecystectomy was the 8th most common operating room procedure performed in hospitals in the United States. Cholecystectomy can be performed either by laparoscopy or an open surgery. Laparoscopic Cholecystectomy is removal of gallbladder by laparoscopy. It is performed through several small incisions. Laparoscopic cholecystectomy provides a safe and effective treatment for most patients with symptomatic gallstones and has become the best choice for many patients. Laparoscopic cholecystectomy decrease pain without increasing in mortality rate, the cost of laparoscopic cholecystectomy is higher than of open cholecystectomy [5].

1.1 Epidemiology of Laparoscopic Cholecystectomy.

In general surgery, cholecystectomy is the second most commonly performed abdominal operation after appendectomy [6]. Laparoscopic cholecystectomy has some advantages over the open technique, including better cosmetic, lesser postoperative pain, a shorter hospital stays, and early return to ordinary activities [7]. Cholecystectomy is not a risk-free procedure and may cause severe complications, including bile duct injury, bleeding, abscess, and pancreatitis. Gallbladder perforation, which is a common complication during cholecystectomy, has been reported to occur with a high incidence of 10-33%[8]. The risk factors for gallbladder perforation also related to mal sex, a history of acute cholecystitis or previous laparotomies, and difficult operation increase the risk of gallbladder perforation[9].

1.2 Indication of Lap. Cholecystectomy

Pain and other complication caused by gallstones are the most common reasons for removal of the gallbladder, also the gallbladder can be removed in order to treat biliary dyskinesia or gallbladder cancer [10] gallstones are common but 50-80 % of people with gallstone are asymptomatic and do not need to surgery, these stones noticed incidentally on abdominal ultrasound or CT[11].

1.2.1. Biliary colic: it is pain caused by gallstones, occurs when a gall stone blocks the bile duct that drains the gallbladder. This pain felt in the right upper part of the abdomen. Biliary colic usually occurs after meals when the gallbladder contracts to push the bile into the digestive tract. Repeated attacks of biliary colic are indicated to removing of the gallbladder, and it is lead to 300000 operations in US each year[12].

1.2.2 Acute cholecystitis: it is the most common complication of gallstones, 90-95% of acute cholecystitis is caused by gallstones blocking drainage of gallbladder [13].

Pain in cholecystitis is similar to that of biliary colic, but last longer than 6 hours with signs of infection such as fever, chills, and elevated white blood cell count [14]. 5-10% of acute cholecystitis occurs without gallstones, it is usually developing in people who have abnormal bile drainage secondary to a serious illness, likes multiple organ failure, trauma, recent major surgery, or long stay in the intensive care unit [15].

Acute cholecystitis distinguished from biliary colic by the presence of two of the following signs:

- A. Right upper quadrant pain lasting for more than 24 hours.
- B. Fever more than 37c.
- C. The presence of palpable distended tender gallbladder.
- D. Elevation of WBC count greater than 11,000/mm³.
- E. Ultra-sonographic findings demonstrating thickening of the gallbladder wall > 4mm.
- F. Pericholecystic fluid collection seen in U/S.

b. Cholelithiasis.

c. Mucocele of gallbladder

d. empyema of gallbladder

e. Porcelain gallbladder

f. Adenomatous gallbladder polyp

g. Injuries of gallbladder

h. As a part of other procedures like Whipples procedure.

i. Cholangitis and gallstone pancreatitis: it is rare and more serious complications from gallstone disease. Both conditions can occur if the gallstone pass through the cystic duct, and get stuck in the common bile duct. The

common bile duct drains in the liver and pancreas and this blockage can leads to the infection in pancreas and biliary system [16].

2. Contraindications of laparoscopic cholecystectomy

Divided to relative and absolute contraindication

1. Gallbladder carcinoma
2. Septic shock
3. Severe acute pancreatitis
4. Cirrhosis with portal hypertension
5. Uncontrolled coagulopathy
6. Pregnancy (third trimester)
7. Severe cardiorespiratory insufficiency

2.1 Risk of Lap.Chole:

All surgery may become as a risk of serious complication, likes damage to nearby structures, bleeding, infection, or death.

2.1.1 Biliary Injury: it is a serious complication of cholecystectomy, laparoscopic cholecystectomy has a high risk of bile duct injury than the open cholecystectomy, which occurs about 0.3% to 0.5% of laparoscopic cases and 0.1% to 0.2% in open cases [16].

In laparoscopic cholecystectomy, approximately 25-30% of biliary injury are during operation, and the rest become in the early post-operative period [17]. Damage to the bile duct is very serious because it leads to leakage of bile into the abdomen. The bile leakage symptoms include abdominal pain, tenderness, fever, and signs of sepsis for several days after surgery.

2.2 Type of CBD injury according to Bismuth classification:

- Type 1 – CHD stump >2 cm.
- Type 2 – CHD stump <2 cm.
- Type 3 – Hilar, right and left hepatic duct confluence intact.
- Type 4 – Hilar, separation of right and left duct.
- Type 5 – injury to aberrant right duct with or without CBD.

2.3 Risk factors of bile duct injury are:

1. learning curve.
2. Male sex.
3. Thermal injury because of faulty instruments.
4. Disease severity.
5. Difficult or rare anatomy.
6. Chronic inflammation, dense scarring, and fat in portal region.
7. Per-operative bleeding.
8. No intra-operative cholangiography.
9. Recent history of acute cholecystitis.
10. Age more than 60.
11. Pre-operative U/S finding include thickened gallbladder wall.

2.4 Impact of biliary injury: Acute bile duct injury result in rapid complication such as biome, bile peritonitis, sepsis, multiple organ failure, external biliary fistula, cholangitis, and liver abscess [18]. These complications if not managed may lead to increase mortality rate.

2.5 Investigations for biliary injury:

- Abnormal liver function test.
- Abdominal ultrasonography.
- Abdominal CT.
- Endoscopic retrograde cholangiography (ERCP).
- Magnetic resonance cholangiography (MRC).
- Scintigraphy.

2.6 Avoidance of biliary injury:

- Adequate Training in A Laparoscopic Surgery
- Scientific Background to Biliary Anatomy
- Experienced Using of Electro Cautery
- Avoid Blind Application of Clips
- Avoid Knowledge and Judgment Error

2.7 Management of biliary injury:

Bile leak during laparoscopic cholecystectomy should be stopped by surgeon and examine the source of bile leakage. The main source of bile leak either from opening in gallbladder or from the cystic duct.

2.8 Intra-operative management of biliary injury:

- A. Intra-operative reconstructive surgery
 - B. For high complete transection, Roux-en-y hepaticojejunostomy.
 - C. For lower complete injury, primary repair over T- tube.
 - D. For partial injuries, insertion of T- tube and Roux-en-y serosal patch.
- All these procedures should be performed by hepato-biliary surgeon has sufficient experience.

2.9 Strategy to handle complication recognized post-operatively:

- U/S guide + ERCP + MRCP.
- Fluid + electrolyte and systemic antibiotics.
- Conservative treatment and biliary drainage for 6 weeks by ERCP stent insertion or.
- PTBD (percutaneous transhepatic biliary drainage). If endoscopic stent application is not possible.
- After several weeks, reconstructive surgery, Roux-en-y choledochoduodenostomy or hepaticojejunostomy.
- All these about 1st complication of laparoscopic cholecystectomy (1.2.5. Risk of Lap.Chole) which is biliary injury, other complications are: -

3. General complication:

- Wound infection 1.25%.
- Urinary retention 0.9%.
- Respiratory complication 0.48%.
- Cardiac complication 0.36%.
- Ports sites hernia 0.21%.
- pancreatitis, pulmonary embolism, and deep vein thrombosis represented about 0.15%. [19].

3.1 Laparoscopic cholecystectomy procedure:

Laparoscopic cholecystectomy uses several small incisions (usually 4) in the abdomen to allowing the insertion of operating ports, small cylindrical tubes about 5 to 10 mm in diameter through which instruments are placed into the abdominal cavity. In 2008, 90% of cholecystectomies in the United States were done laparoscopically [20]. It is thought to have fewer complications, shorter hospital stays, and quicker recovery than open cholecystectomy.

3.2 Standard Laparoscopic cholecystectomy:

This Technique Uses 4 Ports. The pneumoperitoneum is achieved by either closed Verses needle technique or open technique by using a Hasson's technique. 10 mm telescope is used at the umbilical region either infra, intra, or supra umbilical area. Another 10 mm trocar used in the epigastric area, which is represented the main right port to surgeon. One 5mm trocar in the right lumbar area used for gallbladder fundus traction and another 5 mm trocar in the right hypochondrium used as left hand port for surgeon. Gallbladder extraction is done either from epigastric or umbilical port.

3.3 Modified Laparoscopic cholecystectomy:the modification either by reducing the port size from 10mm to 5mm or from 5mm to 3 or 2mm, or by reducing the numbers of ports to three.

3.4 Single incision: it is single incision laparoscopic surgery, in which a single incision is made through the navel, instead of the 3-4 small different incisions used in standard laparoscopy.

3.5 Natural orifice trans luminal: it is an experimental technique where the laparoscope is inserted through natural orifice and internal incisions, rather than skin incisions, to access to the abdominal cavity [21]. This technique was reported in 2006 and 2007[22]. It has various techniques which had been used are:

3.5.1 Transvaginal: used long angle telescope 45 degree or even flexible endoscope. The main limitations are ethical problems in using vagina, the risk of sepsis, and dyspareunia in the long term.

3.5.2 Trans gastric and trans colonic: it uses flexible endoscope to perform the surgery with double channel endoscope for at least two instruments. This is not a stable platform and the vision and light travels with the instrument arm, which is the major limitation of this technique.

3.6 Hybrid laparoscopic cholecystectomy: in this technique three trocars are placed into the umbilicus, one trocar (active dissection) trocar placed into the epigastrium lower down and more on the left side. The other two trocars are placed under direct vision with the telescope from this trocar. Pain and cosmetic are good in this technique.

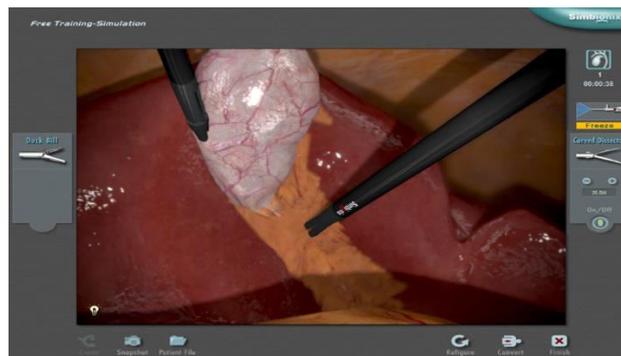


Figure 2. Lap. Cholecystectomy Full procedure



Figure 3. Separation procedure

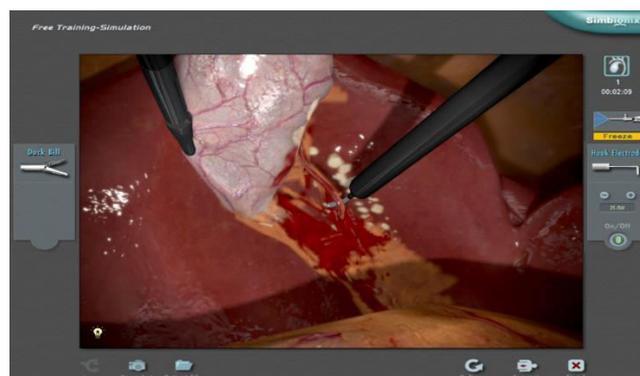


Figure 4. Dissection procedure



Figure 5. Clipping procedure

3. 7 Long term prognoses of laparoscopic cholecystectomy:

- In 95% of people doing laparoscopic cholecystectomy, the gallbladder completely resolves their symptoms [12].
- 2.10% of those people with laparoscopic cholecystectomy will developed post cholecystectomy syndrome [23], symptoms of this condition similar to pain and discomfort of biliary colic, and dyspepsia.
- Some people will develop diarrhea.

4. Aims of the study

The researcher tries to investigate criteria and the clinical outcomes and the risk factors in patients who develop a gallbladder perforation during Lap. Chole.

5. Patients and Methods

5. 1 Design of the study

A cross sectional comparative analytical study in prospective pattern had been carried out in Al-Husain teaching hospital- Thi-Qar-Iraq. The data collection phase extends over a period of 7months from 2/1/2018 to 1/8/2018.

This type of study helps the researcher to explore how and why a disease complication is started or maintained in a given population, through the following benefits:

- 1-Respondant can be seen directly by researcher with all available reports, investigations, and treatment.
- 2-Questions can be delivered and translated to the respondents in simple and easy way to be well understood.
- 3- Some indicators can be calculated exactly especially in patient with mental illnesses and those who are illiterates.
- 4- It is pleasurable for the individuals to make interview with some examinations and investigations like those listed in the definition of the variables.

5.2 Study population

The study population includes the attendants to Al-Husain teaching hospital to underwent laparoscopic cholecystectomy, were the targeted population of the study at the period of the study. All attendants are included regardless to their gender or age. The non- participants who disagreed to share in the study are excluded.

5. 3Sample size sampling process

A-Sample size: It was a convenience sample limited by the duration of work (of the study) and availability of the cases.

Eighty patients who are fit for inclusion criteria were the targeted population of the study.

While exclusion criteria: -

- 1- Empyema of gallbladder.
- 2- Cuscheria Grade 4
- 3- Patient need conversion for any cause.

5. 4Ethical considerations

An ethical clearance was obtained from Al-Husain teaching hospital and management directorate to perform the study. An informed consent also was taken from all participants or the parents. The ethical considerations can be specified as one of the most important parts of research, it included the following principles:

1. Research participants should not be subjected to harm in any ways.
2. Respect for the dignity of research participants should be prioritized.
3. Full consent should be obtained from participants prior to the study.
4. The protection of the privacy of participants has to be ensured.
5. Adequate level of confidentiality of the research data should be ensured.
6. Anonymity of individuals and organizations participating in the research must be avoided.
7. Affiliations in any forms, sources of funding, and any possible conflicts of interests have to be declared.
8. Any deception or exaggeration about the aim and objectives of the research must be avoided.
9. Any type of communication in relation to the research should be done with honesty and transparency.
10. Any type of misleading information and representation of primary data finding in a biased way must be avoided.

The forma of research proposal had been proved by the higher ethical committee of research in the college of medicine Thi-qar University and Al-Husain teaching hospital directorate to do laboratory investigations. At the beginning the researchers introduced himself to the respondent and then permission, verbal consent had been taken to participate in the study and explain the aims of this study.

6. The questionnaire

Special form of questionnaire was constructed to gather data and it was reviewed and revised by three subject matter experts for testing the validity and enrichment of the questionnaire.

- The questionnaire consisted of following sections:
- Include questions about the identity information (name, age, gender, phone number and address)
- Include questions about family, past medical and past surgical history.
- Clinical presentation and etiology.
- Investigations: Pre-operative hematological in the form of complete blood count, Biochemical and enzymology investigations (according to their availability). Finally, radiological evaluation in the form of abdominal ultra sound and or CT scan and or MRI abdomen.
- Surgical procedure: patients underwent surgery were registered in this variable with illustration operation, postoperative morbidity and mortality, and outcome of intervention.

6. 1 Diagnostic procedures

All available facilities that help in diagnosis of indicated cases included in the study (abdominal ultra sound, CT scan, MRI abdomen).

6. 2 Field working procedure

All patients with perforated cholecystectomy were as a targeted population of this study reviewed again by history, clinical examination, and hematological investigations, and ultra sound, CT scan, MRI post to surgery if indicated. All patient underwent surgery in an elective list after informed consent was taken and possible intensive care unit stay was calculated for every patient. The targeted population underwent surgical options according to radiological imaging and surgeon preference intra operatively. Postoperative evaluation of morbidity done and 10-14day surgical outcome were evaluated.

6. 3Experimental study

An experimental study was carried out from 2/1/2018 to 1/3/2018 on 8 participants to know the feasibility, cost and time required for the final study and also knows the adequacy of the questionnaire and the extent of non-response among participants (refusal and non-contacts). The results of this study were discussed with the supervisor for any management or modification and all the 8 cases were included in the final study.

6.4 Statistical analysis

Statistical Package for Social Sciences (SPSS) version 24 had been used for data analysis. Descriptive statistics expressed in form of, frequencies, percentages, while inferential statistics for testing of associations by test of significance (Chi-square test, or Fisher exact test were used for analysis variable. Correlation analysis were performed to recognize the independent predictors of complication. A p-value < 0.05 was considered statistically significant.

7. Results

Across sectional study extended to include eighty patients with mean age of 47+- 7.6 years, most affected age were 41-60 years ,followed by 20-40 while those with less than 20. were constituting the minimum proportion(1.3%) as shown in figure 1.

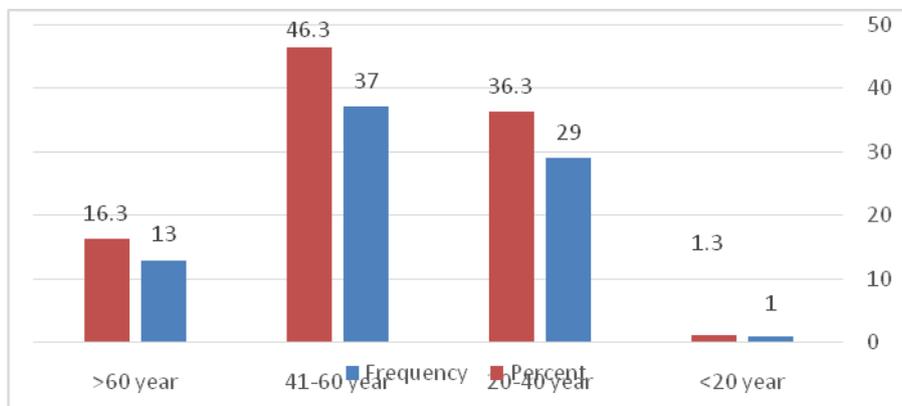


Figure 6. Age distribution of the studied patients

Female composing nearly three quarter of the affected population as shown in figure 2

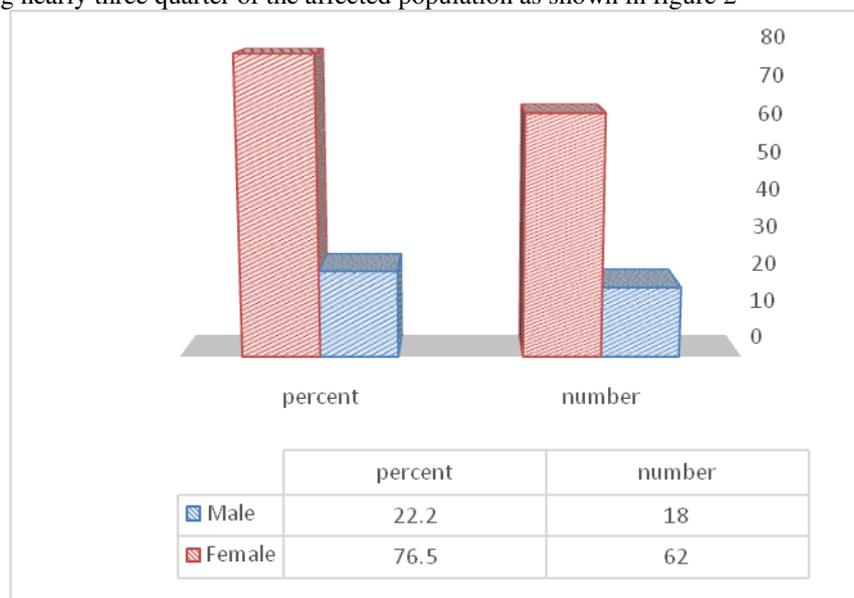


Figure 7. Distribution of gender

50% of the attender were from Al-Nasiriayhcity followed by suq-Al-Sheyok, while (27.5%), while those from al-chibayesh and Al-Rifa'econstuting the lesser proportion.

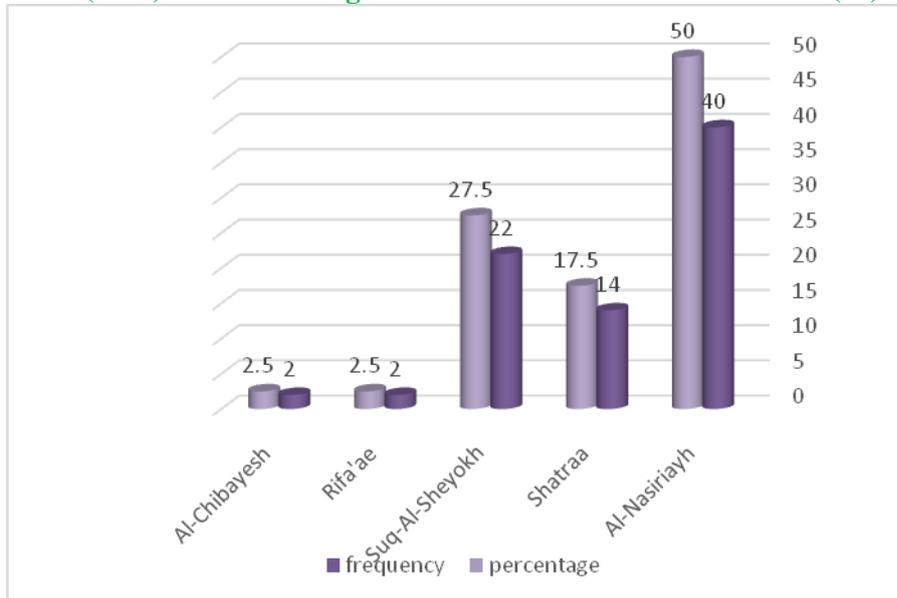


Figure 8. Patients according to residence of inhabitant.

Most of perforated cases were due to technical causes (57.5%), followed by adhesion causes (31.1) lastly acute causes (operated upon within 3 days of acute attack of cholecystitis) representing the minority among the studied causes.

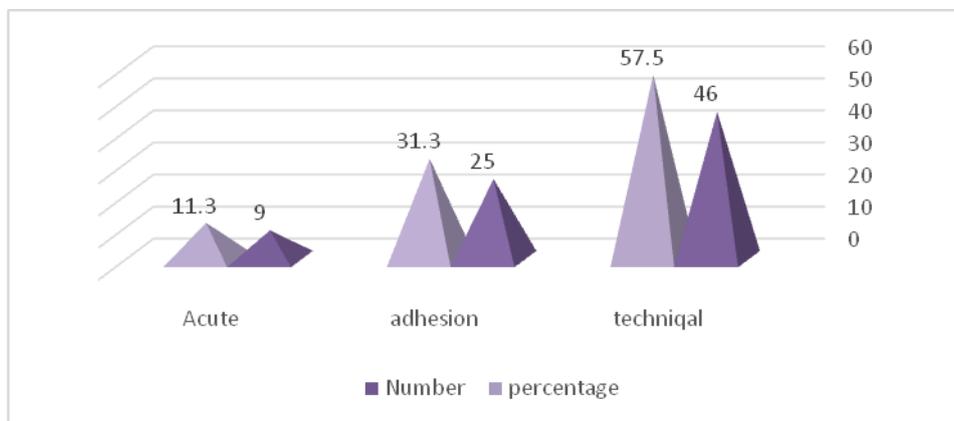


Figure 9. distribution of patients according to their types of perforation

Table 1: Age distribution according to sex

Age	sex		Total	X ² P value
	Male	Female		
<20 year	Count	0	1	
	% within age	0.0%	100.0%	6.942
	% within sex	0.0%	1.6%	1.3%
20-40	Count	2	27	0.026
	% within age	6.9%	93.1%	100%
	% within sex	11.1%	43.5%	36.3%
41-60	Count	12	25	
	% within age	32.4%	67.6%	100%
	% within sex	66.7%	40.3%	46.3%
>60	Count	4	9	
	% within age	30.8%	69.2%	100%
	% within sex	22.2%	14.5%	16.3%
Total	Count	18	62	
	% within age	22.5%	77.5%	100%
	% within sex	100.0%	100.0%	100%

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There was significant statistical association between gender and age of the studied patients, where most of the female patients were at age of 40-60 years and followed by the age above sixty years, while those below forty years were representing the minority of the patients, regarding male distributed in nearly similar pattern of female.

Table 2: Type of perforation and sex cross tabulation

Types of perforation		sex		Total	X ²
		Male	Female		P value
Technical	Count	3	43	46	19.212, 0.001
	% within type of perforation	6.5%	93.5%	100.0%	
	% within sex	16.7%	69.4%	57.5%	
Adhesion	Count	13	12	25	
	% within type of perforation	52.0%	48.0%	100.0%	
	% within sex	72.2%	19.4%	31.3%	
Acute	Count	2	7	9	
	% within type of perforation	22.2%	77.8%	100.0%	
Total	% within sex	11.1%	11.3%	11.3%	
	Count	18	62	80	
	% within type of perforation	22.5%	77.5%	100.0%	
		% within sex	100.0%	100.0%	100.0%

There was very high significant statistical association between gender and type of perforation, where most of the female cases were due to technical error while adhesion was the most cause of male cases.

Table 3: Relationship between age and types of perforation

Age		Type of perforation			Total	Fisher's Exact Test
		Technical	Adhesion	Acute		P value
<20 year	Count	1	0	0	1	18.896
	% within age	100.0%	0.0%	0.0%	100.0%	
	% within type of perforation	2.2%	0.0%	0.0%	1.3%	
20-40	Count	24	2	3	29	0.001
	% within age	82.8%	6.9%	10.3%	100.0%	
	% within type of perforation	52.2%	8.0%	33.3%	36.3%	
41-60	Count	16	18	3	37	0.001
	% within age	43.2%	48.6%	8.1%	100.0%	
	% within type of perforation	34.8%	72.0%	33.3%	46.3%	
>60	Count	5	5	3	13	0.001
	% within age	38.5%	38.5%	23.1%	100.0%	
	% within type of perforation	10.9%	20.0%	33.3%	16.3%	
Total	Count	46	25	9	80	0.439
	% within age	57.5%	31.3%	11.3%	100.0%	
	% within type of perforation	100.0%	100.0%	100.0%	100.0%	

There was significant statistical association between age and causes of perforation P value 0.439.

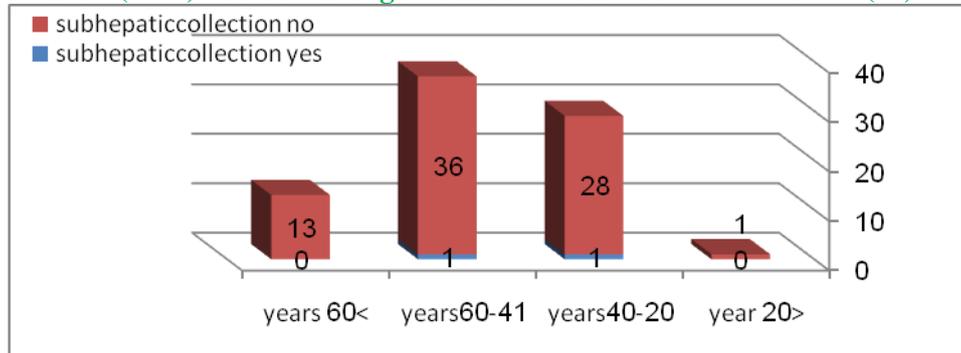


Figure 5. Sub-hepatic collection according to the age

There was no significant statistical association between age and sub-hepatic collections, where the only 2 cases were at aged from 20 to 40.

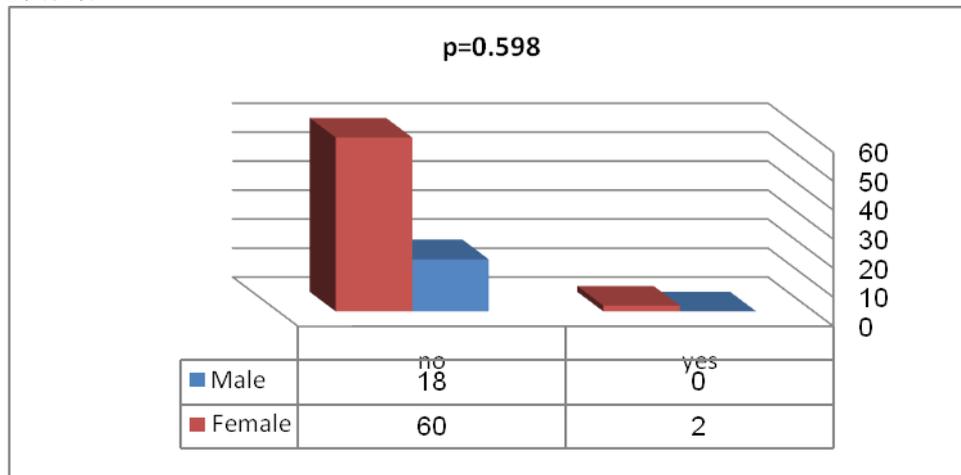


Figure 5. Distribution of sub hepatic collection in gender

The surgeon should be aware about certain step of lap. Chole. In which common incidence of perforation can occur. There was significant association between surgical step in which perforation occur and gender. where most of cases occur during dissection of gallbladder from its liver bed. And most of cases are female where this is because the bulk of the studied cases are female.

Table 4: Technical cause of perforation (surgical steps of cholecystectomy) and sex cross tabulation

Perforation during Step of cholecystectomy	sex		Total	X ² P value
	Male	Female		
During adhesiolysis	0 0.0%	1 1.6%	1 100%	3.421
During dissection in Calot's triangle	2 6.9%	25 67.6%	37 100%	
During dissection	12 32.4%	27 93.1%	29 100%	
During extraction of gallbladder	4 30.8%	9 69.2%	13 100.0%	
Total	18 22.5%	62 77.5%	80 100.0%	

Table 5: Relationship between type of perforation and sub-hepatic collection

Type of perforation		Sub-hepatic collection		Total	F.E
		yes	no		P value
Technical	Count	1	45	46	0.912
	% within type of perforation	2.2%	97.8%	100.0%	
	% within sub-hepatic collection	50.0%	57.7%	57.5%	
Adhesion	Count	1	24	25	
	% within type of perforation	4.0%	96.0%	100.0%	
	% within sub-hepatic collection	50.0%	30.8%	31.3%	
Acute	Count	0	9	9	0.689
	% within type of perforation	0.0%	100.0%	100.0%	
	% within sub-hepatic collection	0.0%	11.5%	11.3%	
Total	Count	2	78	80	
	% within type of perforation	2.5%	97.5%	100%	
	% within sub-hepatic collection	100%	100%	100%	

Only 2 cases were suffering from subhepatic collection, where not significantly associated with the cause of perforation, even though there was big discrepancy in the distribution of the data among different sub-categories.

8. Discussion

8.1 Strength of the study

It is the first study of the lap. Chole in our hospital to evaluate the perforation criteria.

8.2 Limitations of the Study:

- It is the cross-sectional study limitation, that involving lack of follow up and difficulty to predict the outcome.
- Mainly focus on variance analysis and descriptive analysis.
- Future work will pay more attention to the correlation coefficients among all variables with a multivariable approach.

8.3 Cholecystectomy in general (criteria, procedures & its complications):

Cholecystectomy is one of the most common indications for surgery worldwide [53]. Besides, GP frequently occurs during laparoscopic cholecystectomy. A recent review on 18,280 patients has revealed that the incidence of GP is 18.3% [55]. In another analysis, the rate of GP in 1059 consecutive laparoscopic cholecystectomies was 29% [56]. However, it is possible that even this higher rate may not be the actual incidence of GP because prospective information has shown that the frequency of GP during laparoscopic cholecystectomy reaches up to 33% [54]. Consequently, it may be more reasonable to consider the highest reported rates in the literature because most perforations may not be documented in operation records. The controversy probably arises from the fact that some surgeons do not report GP in the operation records, which are the data sources of retrospective studies. A recent analysis on operative notes has revealed that GP with or without bile and stone spillage was not documented in some instances [57]

Several studies have evaluated the potential risk factors for Gallbladder perforation during laparoscopic cholecystectomy. A multi-variant logistic regression analysis has revealed male sex, a history of acute cholecystitis, the use of a laser, and the presence of a grossly inflamed gallbladder as individually significant risk factors for gallbladder perforation [9]. Other studies have underlined some other parameters influencing the frequency of gallbladder perforation, for example, age; preoperative ultrasound findings, including a thickened gallbladder wall and hydrops; the presence of a previous laparotomy; the nature of the stone (pigment stones); and the surgeon's experience [9, 52, 54, 58]. However, these studies may be criticized to include both groups of patients who

underwent emergent and elective procedures, which are probably different types of operations. Thus, the patients who underwent emergent cholecystectomies were excluded in the present study. In addition, the patients for whom conversion to open surgery was undertaken were also excluded because it was generally impossible to determine whether the adverse consequences in these cases were due to gallbladder perforation or the conversion itself. Thus, the present study focuses on a more specific condition that only includes elective non-problematic laparoscopic cholecystectomy, which is actually the case in most instances.

The consequences of GP have been extensively evaluated previously. In animal models, it has been generally shown that GP and the consequent spillage of bile and/or stones are harmless and do not cause any infection or mortality during the follow-up period [59, 60]. In contrast, the data derived from human studies remain controversial. Although, at least theoretically, GP leads to the contamination of the peritoneal cavity with bile, calculi, and bacteria, some believe that the adverse consequences of spillage after GP during laparoscopic cholecystectomy may be minimized by the prompt retrieval of as many of the spilled stones as possible, abundant irrigation of the peritoneal cavity, and adequate antibiotic therapy [51]. It has been shown in most studies that GP does not increase the complication risk, reoperations, or hospital stay [51, 61]. A recent prospective study has also advocated that GP and retained gallstones do not adversely affect respiratory mechanics or alter postoperative pain [54]. Besides, other studies have reported adverse consequences of bile spillage due to GP because bile is frequently contaminated in the presence of gallstones [62]. In an analysis of 1059 consecutive laparoscopic cholecystectomies, increased incidences of fever and intra-abdominal abscesses have been reported if GP had happened at the time of the operation [56]. In addition, some case reports have advocated that retained gallstones and bile spillage cause infection or abscesses, fibrosis, adhesions, cutaneous sinuses, small-bowel obstructions, or generalized septicemia [63, 64]. Finally, even conversion to open surgery has been recommended in a study in patients with a loss of numerous or large pigment stones that cannot be retrieved by laparoscopy [8]. However, we believe that the adverse consequences of spillage after GP during laparoscopic cholecystectomy may be minimized by the prompt retrieval of as many of the spilled stones as possible, abundant irrigation of the peritoneal cavity, and adequate prophylactic antibiotic therapy [51], as mentioned above. With this approach, we have found that GP and consequent intra-abdominal contamination does not increase the risk of complications or alter the outcomes during the early postoperative period. Consequently, the present study reveals that GP increases the incidence of drain use and lengthens the operation time, both of which are probably the consequences of GP because the retrieval of stones and peritoneal irrigation are required in these case

It was strongly believed that laparoscopy in male patients was more difficult & thus fewer indications were approved. One of the possible reasons for this low number of indicated LCs in male patients during the inexperienced stage of period 1 may be the high degree of difficulty and greater requirement for conversion to open cholecystectomy.

8. 4 Perforation according to specific criteria:

8.4. 1 According to the Age:

Our study include eighty patients with mean age of 47+- 7.6 years, most affected age were 41-60 years, followed by 20-40 while those with less than 20 were constituting the minimum proportion(1.3%) as shown in figure 1. There was significant statistical association between gender and age of the studied patients, where most of the female patients were at age of 40-60 years and followed by the age above sixty years, while those below forty years were representing the minority of the patients, regarding male distributed in nearly similar pattern of female. As shown in table 1. There was significant statistical association between age and causes of perforation. As shown in table 3. Other studies show that the age association does not seem as important now as it once was. In relation to the cholecystectomy prevalence lifetime, a positive association there was, but if the restricted for the first two years of follow-up analysis, they found that there was no significant statistical association between aging and cholecystectomy. However, it is possible that we did not have sufficient statistical power because of the low number of cases. This difference might be attributed to the difference in the study design and sampling procedure or due to inhabitant characters [37]

8.4. 2 According to Sex:

Female composing nearly three quarter of the affected population as shown in figure 2. There was very high significant statistical association between gender and type of perforation, where most of the female cases were due to technical error while adhesion was the most cause of male cases. As shown in table 3. There was no significant statistical association between age and sub-hepatic collections, where the only 2 cases were at aged from 20 to 40 years.

Where meta-analysis demonstrated that, these were significantly associated with increased risk for conversion. ⁽³⁵⁾. Patients aged over 65 years prior to surgery did not undergo Lap Chole. some male and elderly patients, and with obesity, and some patients with previous upper abdominal surgery undergo Open Cholecystectomy. LCs in the early days was not a highly accepted approach for minimally invasive interventions. When it was understood that

the use of drains did not increase complications or costs, surgeons started to use them routinely⁽⁴⁰⁾. The intraoperative complications risk has declined with increasing experience in surgical practice & use of cholangiography intra-operatively⁽⁴¹⁾. We were not able to perform intraoperative cholangiography.

Various available literatures suggest that male gender is as a risk factor of difficult cholecystectomy. A.Zisman, R. Gold-Deutch, et al⁽⁴²⁾ identified a statistically significant difference in probability of conversions rates in males over females i.e. 21% & 4.5%, respectively (p =0.0001). This five- fold greater probability was explained by more adhesions significant (p 0.0002) and anatomical difficulties (p 0.003) in males. Similar conclusions were drawn by Heng-HuiLein, Ching-Shui Huang¹⁰ of Taiwan in 2002. They found that male patients had significantly longer (p = 0.04) operating time than females and they suggested that surgeons are more likely to offer men an open procedure rather than a procedure by laparoscopic with a “high likelihood” of conversion.

8.4. 3 According to the cause of perforation:

In this study ,Most of perforated cases were due to technical causes (57.5%), followed by adhesional causes (31.1) lastly acute causes representing the minority among the studied causes because the number of cases of acute cholecystitis that operated in our hospital are less than other cases .There was very high significant statistical association between gender and type of perforation, where most of the female cases were due to technical error while adhesion was the most cause of male cases.

Accidental gallbladder perforation during lap chole is on the rise because of increased attempts at minimally invasive surgery. A number of studies have been attempting to determine the influence of gallbladder perforation on the clinical outcomes, but the conflicting results are still. Therefore, we investigated the clinical outcomes and the risk factors in patients who sustained a perforation of gallbladder during lap. chole. Increasing age is a predictive factor for difficulty owing to the risk of recurrent attacks of colic and resulting adhesions. Though there is no consensus regarding the upper limit of safe age, patients more than 60 years are generally considered at high risk by some surgeons. There is also an additional risk of co-morbid diseases as age advances which adds to the peri-operative morbidity. Diabetes has a significant influence in deciding the severity of inflammatory process. Long term diabetic control reflected by glycosylated hemoglobin levels influences increasing the intra-operative difficulty due to a severely inflamed gall bladder. because the difference in the pain threshold among different sexes and the difference in the severity of inflammation that might causing empyema, severe inflammatory adhesions, and gallbladder gangrene. So many authors such Am-beetle recommend even an early intervention in male patients than their female counterparts in Acute calculous cholecystitis.⁵ Obesity as well as adhesions due to previous upper abdominal surgery poses problems in trocar access. When thickness of abdominal wall is more, lengthier instrumentation is needed. These patients may have higher risk of fatty liver which causes difficulty in retraction of gall bladder and fat deposition in peritoneal layers would require more meticulous dissection at the Calot's triangle. Higher limit of safe BMI varies according to various authors. Generally, BMI more than 30 is considered to be obese and pose a risk factor for safe Lap cholecystectomy. Previous upper abdominal surgeries cause adhesions at the Calot's triangle and port sites predisposing to verses and trocar injuries during access. It also increases the operating time, intra-operative blood loss and CBD injuries due to the requirement of adhesiolysis at Calot's triangle. Adhesions were identified as the single most factor intra-operatively that influences the operating time and technical difficulty. One of the most important factors predicting difficulty during Laparoscopic cholecystectomy is severity of the disease. This can be assessed either clinically, by laboratory tests or imaging studies. The degree of difficulty was calculated according to Cuschirii scale which defines the complexity of the procedure in four grades:

Grade I easy cholecystectomy without any problems.

Grade II refers to the presence of light peri cholecystitis or adherence or fatty tissue masking the cystic pedicle or mucocele.

Grade III defines severely difficult cholecystectomies in patient with gangrenous cholecystitis (shrunken fibrotic gallbladder).

Grade IV intense peri cholecystitis, advanced hepatic disease, dissection of body of gallbladder and cystic pedicle is impossible and adherent of Hartmann's pouch over CBD → conversion to open cholecystectomy.

9. Conclusion:

- Most affected age were 41-60 years; most affected gender are female. But this is due to the bulk of selected cases in our study are middle aged females.
- Most of perforated cases were due to technical causes followed by adhesion causes lastly acute causes representing the minority among the studied causes. Because the cases of adhesions (previous surgery) and cases of acute cholecystitis are less frequently operated in our hospital.
- There was significant statistical association between age and causes of perforation.
- Very high significant statistical association between gender and type of perforation.

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- Only 2 cases were suffering from sub-hepatic collection, where not significantly associated with the cause of perforation, even though there was big discrepancy in the distribution of the data among different sub-categories.
- Gallbladder perforation causes an increase in the operation time.
- Gallbladder perforation does not increase the risk of complications or alter the outcomes during early post-operative period.
- Gallbladder perforation increases the use of drain.

10. Recommendation:

- Surgeons must evaluate patients for their age (age>65 years), male sex, thickened gall bladder wall, acute cholecystitis and co-morbid conditions pre-operatively, as an important risk for a proper operation plan.
- Gallbladder perforation during lap chole should be recorded in the operative note to help follow up and diagnosis if post-operative complications occur.
- Spillage of bile due to gallbladder perforation during lap. chole. may be minimized by abundant irrigation of peritoneal cavity and adequate prophylactic antibiotics therapy longer than non-perforated.
- Spillage of gall stones minimized by removal of spilled stones and abundant irrigation of the peritoneal cavity.
- Operative information and procedures should be recorded in CD for follow up and retrospective studies in the future.

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