RESEARCH PAPER

Study On Factors Predicting Conversion From Laparoscopic To Open Cholecystectomy

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ABSTRACT

The abstract for this article was not provided in the content. This study evaluates the predictive factors for conversion from laparoscopic cholecystectomy to open cholecystectomy, including patient demographics, clinical parameters, intraoperative findings, and surgeon experience. Further details regarding methodology, results, and conclusions are expected to be included in the full manuscript.

Keywords: Laparoscopic cholecystectomy, Open cholecystectomy, Conversion factors, Gallstone disease, Surgical outcomes, Risk factors, Cholecystectomy complications.

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INTRODUCTION

Biliary diseases constitute a major portion of digestive tract disorders. Among these gall stone disease is the most common biliary pathology. Laparoscopic Cholecystectomy is the most commonly performed surgery for gall bladder diseases.

Alternative treatments like chemical dissolution, percutaneous extraction and ultrasonic lithotripsy were tried. Although these methods were minimally invasive, most individuals require subsequent therapy for recurrent symptoms. Because of the frequency of recurrent calculi after stone removal alone, cholecystectomy remains the standard therapy.

Carl-Langenbuch performed first ever open cholecystectomy on 15th July 1882 in Berlin on a 42-year-old man.

The most common complications that occur after open cholecystectomy are postoperative ileus, atelectasis and wound infection other rare complications include pulmonary embolus, pneumonia, myocardial infraction, biliary peritonitis, subphrenic abscess, bacterial peritonitis and delayed haemorrhage, due to which patients are hospitalized for several days and disabled from normal activity for several months in a year. In an attempt to reduce morbidity and disability, open cholecystectomy has been replaced by minimally invasive laparoscopic cholecystectomy. However, the conversion rate of intraoperative conversion from laparoscopic cholecystectomy to open cholecystectomy is 1-15% and the causes can be multi factorial.

Laparoscopic cholecystectomy was first performed in March 1987 by Philipe Moret in Lyon, France, a revolution in the treatment of cholelithiasis[1].

Since the National Institutes of Health Consensus Conference in 1993, laparoscopic cholecystectomy has replaced open cholecystectomy as the standard treatment in patients with symptomatic cholelithiasis[2].

In the last decade more than 90% of cholecystectomies were performed laparoscopically due to its advantages such as decreased postoperative pain and ileus, shorter hospital stay, earlier return to normal activity, earlier oral intake and improved cosmetic result over open cholecystectomy[3,4,5,6,7,8].

However, in some difficult situation laparoscopic cholecystectomy converted to open cholecystectomy should not be considered as failure on complication but as an attempt to overcome possible intraoperative complication like bile duct injury, bleeding etc. There is still a substantial proportion of patients who need open cholecystectomy such as patients with severe cardiac diseases, pulmonary disease, concomitant disease like Common Bile Duct (CBD) Stones, Gallbladder Cancer, Severe Acute Cholecystitis with Gangrene or Perforation, multiple previous abdominal incisions and in whom LC cannot be successfully performed, and conversion to open surgery is required because of technical difficulties, to avoid or repair intra-operative

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injury, not clearly visualized anatomic relationships, or to treat associated conditions.

Conversion to open cholecystectomy has been associated with increased overall morbidity, surgical site and pulmonary infections, and longer hospital stays, increased total cost, and dissatisfaction of the patients[9,10,11].

Knowledge regarding the underlying reasons for conversion could help surgeons during preoperative assessment and obtain consent of patients with all information provided to them about the conversion to be done if required, so that they could have adequate psychological preparation and planning of convalescence.
The prediction of a high risk of conversion or a difficult laparoscopic procedure would also allow efficient and appropriate arrangement of the operating schedule and the availability of experienced laparoscopic surgeons for the procedure. It would also allow an earlier intra-operative decision to convert if difficulty is encountered.
Salleh Ibrahim Et. al in their study at Changi general hospital, Singapore in 2006 identified many risk factors for the conversion of laparoscopic cholecystectomy to open cholecystectomy which included males of elderly age group, higher body weight, acute cholecystitis, previous upper abdominal surgery and junior surgeons.
Melmet Kaplan et al in 2007 identified that male gender, previous upper abdominal incisions, history of acute attacks, had a higher rate of conversion in their study at Gazi University, Ankara.
All these studies are done in western conditions. The aim of this study is to study and identify the risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy in our environment to allow safer procedures and better surgical planning, and to determine the predictive factors of conversion in patients undergoing laparoscopic cholecystectomy.

AIMS & OBJECTIVES

The aims and objectives of this study to identify risk factors responsible for conversion of laparoscopic cholecystectomy to open cholecystectomy.

REVIEW OF LITERATURE

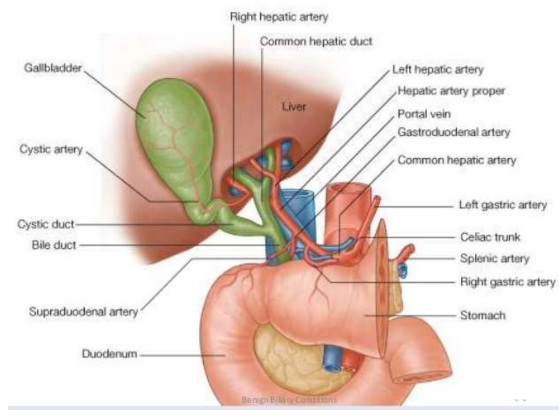
HISTORY

The treatment of biliary colic, in the very early times, was ingestion of waters rich in magnesium sulfate which brought relief of pain. We now recognize that magnesium sulfate is a potent stimulus for gall bladder contraction and may have helped to evacuate small stones.
John Bobbs attempted to perform cholecystolithotomy but the frequency of recurrence of symptoms was high. In 1882, Karl Langenbuch, a German surgeon, performed the first successful cholecystectomy. During the last 100 years, open cholecystectomy has remained the gold standard for the definitive management of patients with symptomatic cholelithiasis.
Despite the efficacy and safety of open cholecystectomy, surgeons pursued and investigated less invasive options. Laparoscopic cholecystectomy has revolutionized the management of galls stones over the last decade and half.
The first laparoscopic cholecystectomy was performed by Muhe in 1985, but he was greeted with disbelief and outright hostility. The first laparoscopic cholecystectomy recorded in the medical literature was performed in March 1987 by Mouret, in Lyon, France.
The technique was perfected a year later, in March 1988 by Dubois in Paris, and later that year by Perrisat in Bordeaux, France, and by Reddick in Tennesse. In 1991, Tehemton Udwadia performed the first laparoscopic cholecystectomy in India. Now laparoscopic cholecystectomy has become the procedure of choice for diseases of the gall bladder.

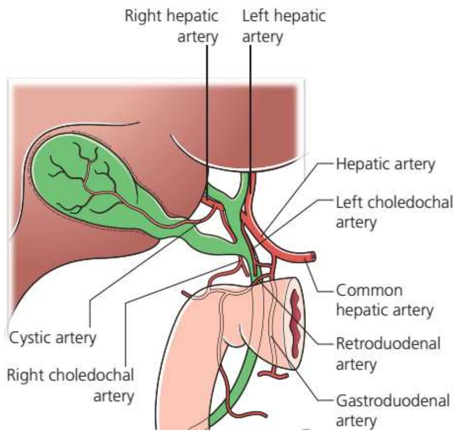
ANATOMY

Gall Bladder:

The gall bladder is a flask-shaped, blind-ending diverticulum attached to the common bile duct by the cystic duct. The gall bladder is about 7 to 10 cm long, with an average capacity of 30 to 50ml. It usually lies in a shallow fossa in the liver parenchyma covered by peritoneum continued from the liver surgace. This



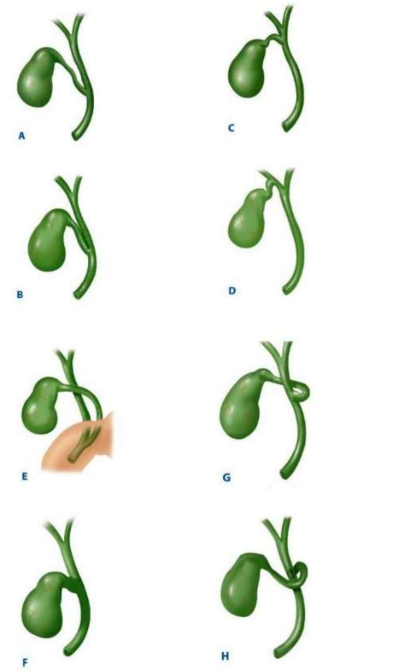
attachment can vary widely. At one extreme the gall bladder may be almost completely buried within the liver surface, having no peritoneal covering (INTRAPARENCHYMAL PATTERN); at the other end extreme it may hang from a short mesentery formed by the two layers of peritoneum separated only by connective tissue and a few small vessels (MESENTERIC PATTERN).



The gall bladder is divided into four anatomic areas: the fundus, the corpus (body), the infundibulum, and the neck. The fundus is the rounded, blind end that normally extends 1 to 2 cm beyond the liver's margin. It contains most of the smooth muscles of the organ, in contrast to the body, which is the main storage area and contains most of the elastic tissue. The body extends from the fundus and tapers into the neck, a funnel-shaped area that connects with the cystic duct. The neck usually follows a gentle curve, the convexity of which may be enlarged to form the infundibulum or Hartmann's pouch. The neck lies in the deepest part of the gall bladder fossa and extends into the free portion of the hepatoduodenal ligament (4)

Cystic Duct:
It is about 3 to 4 cm in length, passes posteriorly to the left from the neck of gallbladder, and joins the common hepatic duct to form the common bile duct. It almost runs parallel to it and is adherent to common hepatic duct for a short distance before joining it. The junction usually occurs near the portahepatis but may be lower down in the free edge of the lesser omentum.
The length of the cystic duct is quite variable. Anatomical variations of the cystic duct and its point of union with the common hepatic duct are surgically important.

a) Low junction between cystic duct and common hepatic duct
b) Cystic duct adherent to common hepatic duct
c) High junction between cystic duct and common hepatic duct
d) Cystic duct draining into right hepatic duct
e) Long cystic duct joining common hepatic duct behind the duodenum
f) Absence of cystic duct



Variations of the cystic duct anatomy. **A.** Low junction between the cystic duct and common hepatic duct. **B.** Cystic duct adherent to the common hepatic duct. **C.** High junction between the cystic and the common hepatic duct. **D.** Cystic duct drains into right hepatic duct. **E.** Long cystic duct that joins common hepatic duct behind the duodenum. **F.** Absence of cystic duct. **G.** Cystic duct crosses posterior to common hepatic duct and joins it anteriorly. **H.** Cystic duct courses anterior to common hepatic duct and joins it posteriorly.

g) Cystic duct process posterior to common hepatic duct and joins it anteriorly.
h) Cystic duct crosses anterior to common hepatic duct and joins it posteriorly.

Common Bile Duct
The common bile duct is about 7 to 11 cm in length and 5 to 10 mm in diameter. The upper third (supraduodenal portion) passes downward in the free edge of the hepatoduodenal ligament, to the right of the hepatic artery and anterior to the portal vein. The middle third (retroduodenal portion) of the common bile duct curves behind the first portion of the duodenum and diverges laterally from the portal vein and the hepatic arteries. The lower third (pancreatic portion) curves behind the head of the pancreas in a groove, or traverses through it and enters the second part of the duodenum and frequently joins it. The common bile duct runs obliquely downward within the wall of the duodenum for 1 to 2 cm before opening on a papilla of mucous membrane (ampulla of Vater), about 10 cm distal to the pylorus. The union of the common bile duct and the main pancreatic duct follows one of three configurations. In about 70% of people, these ducts unite outside the duodenal wall and traverse the duodenal wall as a single duct. In about 20%, they join within the duodenal wall and have a short or no common duct, but open through the same opening into the duodenum. In about 10% they exit via separate openings into the duodenum. The sphincter of Oddi, a thick coat of circular smooth muscle, surrounds the common bile duct at the ampulla of Vater. It controls the flow of bile, and in some cases pancreatic juice, into the duodenum.

Calot's Traingle (Cholecystohepatic Triangle)

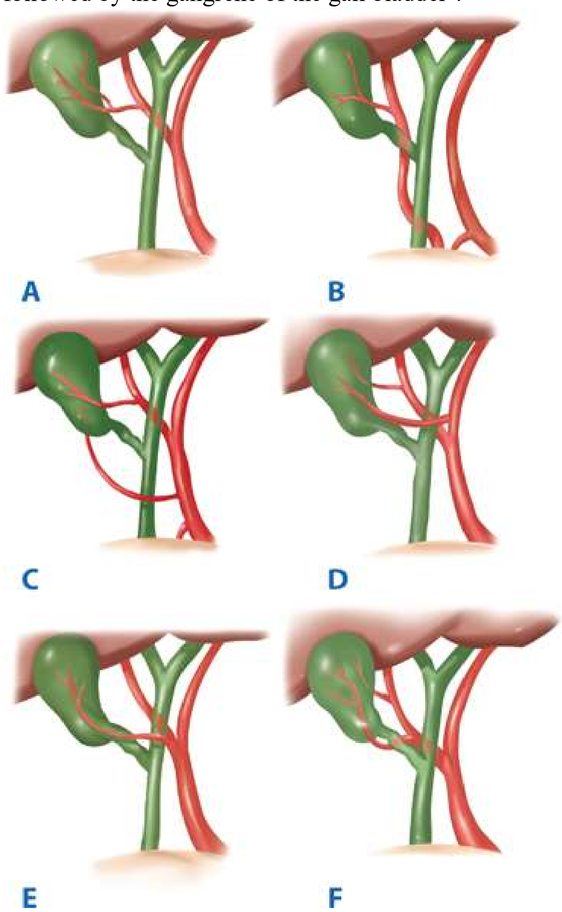
The near triangular space formed between the cystic duct, common hepatic duct and the inferior surface of the segment V of the liver is commonly referred to as Calot's triangle. It is enclosed by double layer of peritoneum which forms the short mesentery of the cystic duct.

Contents Of The Calot's Traingle

1) Cystic artery as it approaches the GB.
2) Cystic lymph node.
3) Lymphatics from the GB.
4) 1 or 2 small cystic veins.
5) Autonomic nerves running to the GB.
6) Some adipose tissue.
7) May contain any accessory ducts which drain into GB from liver.

Cystic Artery

The cystic artery usually arises from the right hepatic artery. It usually passes posterior to the common hepatic duct and anterior to the cystic duct to reach the superior aspect of the neck of the gallbladder. It divides into superficial and deep branches. Superficial branches ramify on the inferior aspect of the gallbladder, the deep branches on the superior aspect. These arteries anastomose over the surface of the body and fundus. The cystic artery is an end artery and its occlusion is followed by the gangrene of the gall bladder[5].



A) Cystic artery from right hepatic artery, about 80-90%.

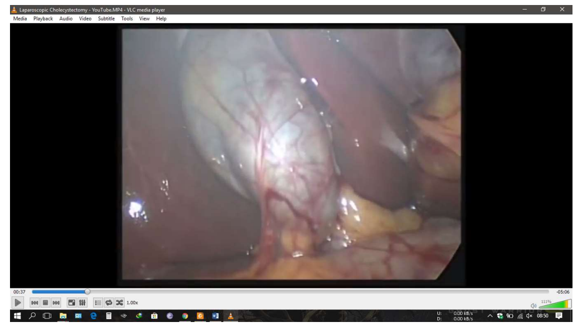
B) Cystic artery from right hepatic artery (accessory or replaced) from superior mesenteric artery, about 10%.

C) Two cystic arteries, one from the right hepatic, the other from the common hepatic artery, rare.

D) Two cystic arteries, one from the right hepatic, the other from the left hepatic artery, rare.

E) The cystic artery branching from the right hepatic artery and running anterior to the common hepatic duct, rare.

F) Two cystic arteries arising from the right hepatic artery, rare



CLINICAL PRESENTATION

Most patients remain asymptomatic from their gallstones. Although the mechanism is unclear, some patients develop symptomatic gallstones with biliary colic caused by a stone obstructing the cystic duct. Approximately 3% of asymptomatic individuals becomes symptomatic per year (i.e. develop biliary colic). Once symptomatic, patients tend to have recurring bouts of biliary colic. Complicated gallstone disease develops in 3 to 5% of symptomatic patients per year. Over a 20-year period, about two thirds of a symptomatic patients with gallstones remain symptom free[4].

The primary symptom associated with chronic cholecystitis or symptomatic cholelithiasis is pain often labelled as biliary colic. The term biliary colic is inaccurate and suggests that the pain related to gallstone is intermittent and spasmodic like other colicky pain. However, this pattern is rarely the case. Obstruction of the cystic duct results in a progressive increase in tension in the gallbladder wall, leading to constant pain in most patients. The pain usually located in the right upper quadrant and / or epigastrium and frequently radiates to the right upper back, right scapula, or between the scapulae. The intensity of the pain is often severe enough to seek immediate medical attention with the first episode. Classically, the pain of biliary colic occurs following a greasy meal, although this situation does not occur in most these patients, the pain often develops more than an hour after eating. In the remaining patients, the pain is not temporally related to meals and often begins at night-time, waking the patient from sleep.

The duration of pain is typically 1 to 5 hours. The attacks rarely persist for more than 24 hours and are rarely shorted than 1 hour. Pain lasting beyond 24 hours suggests that acute inflammation or cholecystitis is present. The attacks are often discrete and severe enough that the patient can accurately recall and number them. The episodes of biliary colic are usually less frequent than one episode per week. Other symptoms such as nausea and vomiting often accompany each episode (60% to 70% of cases). Bloating and belching are also present in 50% of patients. Fever and jaundice occur much less frequently with simple biliary colic.

The diagnosis of symptomatic cholelithiasis or chronic calculous cholecystitis requires two findings: (1) Abdominal pain consistent with biliary colic and (2) Radiological evidence of the presence of gallstones.

ULTRASOUND ABDOMEN

Ultrasound is quite sensitive (95% to 98%) for documenting the presence of gallstones and also provides additional anatomic information presence of polyps, common bile duct diameter, or any hepatic parenchymal abnormalities. USG abdomen is helpful to look for any thickening of GB wall, impacted stone at the neck of GB, presence of any pericholecystic collection.

INDICATIONS AND CONTRAINDICATIONS FOR LAPAROSCOPIC CHOLECYSTECTOMY

Indications:

The indications for laparoscopic cholecystectomy remain the same, as these should not be liberalized because the laparoscopic procedure is viewed as lower in morbidity than open operation.

1) Symptomatic cholelithiasis
2) Acute cholecystitis

a) Gall bladder stones are the most common cause of acute cholecystitis.

b) Acute acalculous cholecystitis occurs in critically ill patients, those on prolonged total parental nutrition, and some with immunosuppression.

3) Asymptomatic cholelithiasis under specific circumstances like candidates for transplantation, diabetes, hereditary spherocytosis sickle cell disease and incidental with other procedures.

4) Episodes of right upper quadrant pain which are classic for biliary pain without evidence of cholelithiasis with positive objectives tests Ex: Biliary dyskinesia

5) Gall stone pancreatitis

6) Gallbladder polyps > 1 cm in diameter.

Contraindications:

Absolute

- Uncorrectable coagulopathy
- Significant portal hypertension
- Gall bladder carcinoma
- Frozen abdomen from adhesions
- Intestinal obstruction with massive abdominal distension
- Haemorrhagic shock
- Severe cardiac dysfunction

Relative:

- Inability to tolerate general anesthesia
- Abdominal sepsis / peritonitis
- Extensive scarring in Calot's triangle and
- Thickened gall bladder
- Abnormal anatomy
- Acute pancreatitis
- Acute cholecystitis
- Cirrhotic liver
- Pregnancy
- Morbid obesity
- Multiple previous abdominal operations
- Severe COPD
- Diaphragmatic hernia

Table 1: Advantages and Disadvantages of LC compared to OC[9]

ADVANTAGES	DISADVANTAGES
• Less post-operative pain • Smaller incision • Better cosmesis • Shorter hospitalization • Earlier return to full activity • Decreased total costs	• Lack of depth perception • View controlled by camera operator • More difficult to control hemorrhage • Decreased tactile discrimination (haptics) • Potential CO2 insufflations complications • Adhesions / inflammation limit use • Slight increase in bile duct injury

Operative room layout and requirement:

In laparoscopic cholecystectomy the following are to be considered

a) Surgeon
b) Assistant, one or two
c) Staff nurse
d) Video monitors
e) Equipment trolly
f) Suction irrigator
g) Electro surgical unit with ground pad equipped with current monitoring system.

Equipment Required

1. Videoscopic equipment

a) Light source: Either a xenon light source or a 250-watt halogen lamp.
b) Light cable: Thicker cable is preferable
c) Video Camera: are of two types
(i) Single chip
(ii) Three chip

Single chip camera gives a resolution of 450 lines. Three chip gives resolution of 700 lines but is expensive.

2. Monitor

If 3 chip camera is used it requires a monitor with a least 700-line resolution. A simple 14" home TV can also be used.

3. Video Recorder:

In case if we want to record

4. Laparoscope:

Comes in 3 sizes 10mm, 7mm and 5mm. These can be forward viewing (0°) or angled to 30° or 45°.

Instruments for exposure and manipulation

1. Insufflator:

The electronic insufflators are used which are capable of delivering flow rates of a least 6 L/min. Preferably 8-10 L/min. The electronic insufflators have a digital display, which continuously monitors.

a) Pressure at the tip of verses needle or trocar sheath during insufflations.
b) The flow rate in liters / minute
c) The volume of gas insufflated
d) The intra-abdominal pressure, with a display for the cylinder pressure to forewarn of an empty cylinder.

Flow rate settings are available permitting low-pressure insufflations at 1L/min to 6-12L/min to compensate for major gas loss during procedure. The insufflators also have an adjustment, which controls and maintains the maximum intra-abdominal pressures at a present level, which is kept at 12mmHg usually. An inadvertent rise of intra-abdominal pressure triggers off a visual and audio alarm.

2. Puncture Instruments:

Verses Needle: Used to induce pnuemoperitoneum. This needle has a spring-loaded safety mechanism whereby an obturator projects beyond the sharp tip avoiding injury to intra peritoneal structures. Trocars: Available in two sizes. 11mm introduction trocars for 10mm telescope introduction and 5.5mm trocars for 5mm instruments. Gas escape is prevented by a flap gate valve or trumpet valve. The outer end of trocar has a gasket or washer, which tightly grips any instrument passing through, to minimize gas leaks. All trocars have stopcocks, through which CO_2 can be insufflated or smoke evacuated.

Reducer tube: Used when a smaller instrument (5mm) has to be passed through a larger (10mm) trocar which has 10mm outer diameter whose external end has a gasket or washer which fits 5mm instrument snugly preventing gas escape.

3. Hand Instruments:

1. Graspers & Dissectors
2. Diathermy hook, dissector and spatula
3. Instruments for division / coagulation
   a) Scissors – curved scissors 5mm & 10mm size
   b) Diathermy – Bipolar, Monopolar
4. Instruments for irrigation and suction: 2 way suction cannula
5. Instruments for occlusion, ligation and suturing
   - Occlusion clip applicators
   - Ligating instruments
   - Knot pusher
   - Suturing – szabo – bercineddle driver
   - Staplers
6. Wound closure instruments
7. Instruments for laparotomy: Kept ready in case it requires conversion of open surgery.

Anaesthesia

The choice of anesthetic technique for upper abdominal Laparoscopic surgery is mostly limited to general anesthesia because of patient discomfort associated with the creation of pnuemoperitoneum, and the extent of position changes associated with the procedure.

Preoperative workup:

Preoperative evaluation should include ultrasound confirmation of gallstones and assessment of CBD for evidence of stones, as well as liver function tests. An electrocardiogram and cardiac evaluation are compulsory to exclude the rare patient in whom cardiac ischaemia masquerades are biliary colic.

Size of the common bile duct is important, as dilated duct is a principal indirect sign of CBD stones. ERCP is indicated in patients with a history of jaundice, abnormal LFT or dilated common duct on US. Without one of these, only less than 4% of them are likely to have CBD stones and hence routine ERCP does not justifiable.

The role of nuclear medicine biliary images for the diagnosis of GB disease remains unclear and is reserved for patients where diagnosis remains uncertain after ultra sound evaluation. In patients with atypical symptoms or presentation, every effort is made to rule out nonbiliary causes such as peptic ulcer disease, gastro esophageal reflux disease (GERD), irritable bowel syndrome, diverticulitis.

Obese patients undergoing laparoscopic cholecystectomy should receive some form of deep vein thrombosis (DVT) prophylaxis. In some institutions patients scheduled for laparoscopic biliary surgery routinely have pneumatic leg compressive devices placed on both lower extremities prior to starting the operative procedure. Low dose heparin may be administered in all the elderly, high-risk patients. The procedure is explained to the patient who should be aware of the possibility of conversion to open surgery at discretion of the surgeon.

Technique of laparoscopic surgery

The following approached are commonly followed

1) North American Approach
2) French Approach

We routinely follow North American approach

Operative Procedure

Steps of Laparoscopic Cholecystectomy

In North American approach, surgeon stands on the left side to perform laparoscopic cholecystectomy. In Europe, French approach is commonly followed where the surgeon performs laparoscopic cholecystectomy standing between the legs.

North American approach:

Position of the patients is supine. Two monitors are placed on the right and left side of the patient near the head. Nasogastric tube is placed routinely after induction of anesthesia to decompress stomach. Surgeon stands on the left side of the patient with the first assistant and staff nurse stands on the patients right and camera assistant to the left of the surgeon. Trocar Positions: Laparoscopic cholecystectomy is usually performed with four trocars. Two 10mm trocars (in the mid epigastric for working and umbilicus for camera) and two 5mm trocars (the right mid clavicular and anterior axillary line).

1) Pnuemoperitoneum and trocar insertion:

The first step in performing laparoscopic surgery is to create a pnuemoperitoneum. The pnuemoperitoneum may be achieved using either a closed technique with the verses needle or by an open technique. The preferred site for insertion of the verses needle is at the umbilicus, where the abdominal wall is thinnest and is well away from fixed internal organs. A small vertical or horizontal incision is made at the inferior aspect of the umbilicus. The incision should be large enough to accommodate the desired trocar. If the incision is too large, the trocar is more likely to slip out of the puncture site while the laparoscope repeatedly is moved. The subcutaneous tissue is bluntly dissected away until the umbilical fascia is palpable. The abdominal wall inferior to the umbilicus then is lifted with one hand while the verses needle is inserted through the fascia at the base of the umbilicus. The needle should be inserted at a 45 degrees angle towards the pelvis and away from the aorta and inferior venacava. One can appreciate two clicks of the spring – loaded verses needle as it penetrates first the fascia and then the peritoneum. First the needle is aspirated and irrigated to demonstrate the absence of return of blood or bowel contents and a free flow of fluid. The needle is moved back and forth, which indicates that the tip is free within the peritoneal cavity. The needle is connected to the insufflators and carbon dioxide is instilled at a rate of 1/lit per mtr. The opening pressure recorded on the insufflator should be less than 10mm Hg. A low flow rate for carbon dioxide should be used initially to avoid gas embolism or vagal stimulation from sudden stretching of the peritonmeum. Once intra abdominal pressure has reached 15mm Hg which generally requires 3 to 6L of carbon dioxide, the verses needle is removed and the trocar is inserted through the same site. Although 0 degree laparoscope can be used, a 30 degree scope allows more flexibility in obtaining complete view of all structures in the hilum. Place the patient in reverse Trendelenburg position approximately 20-30 degrees and turn the operating table to the left. A 10mm trocar is placed in epigastric region under laparoscopic visual control and should be directed vertically till it pierces the linea alba and turned to right of the falciform ligament as it enters the abdominal cavity.

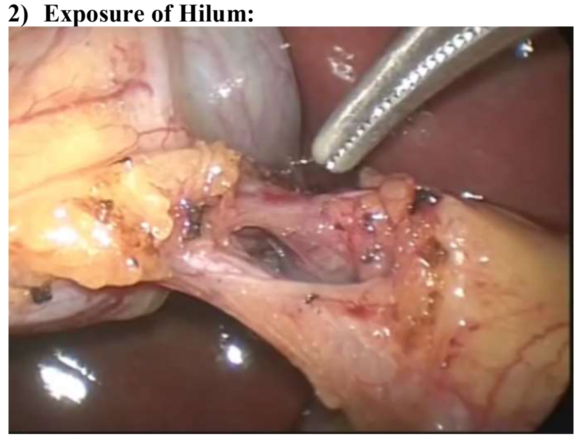
Under visual control, place two 5mm trocar along the right costal margin in mid clavicular and anterior axillary line.

Place additional ports for retraction if adequate exposure is not obtained by above measures.

a) Left lumbar 10 or 5mm for three prong of flat bade retractor for down ward traction of the colon, omentum and duodenum. This maneuver gives wide exposure of the hilum.

b) Place 5mm trocar midway between epigastric and right mid clavicular ports for lifting the quadrate lobe using blunt tipped dipping retractor (French technique).

2) Exposure of Hilum:



The gall bladder fundus is secured with 5mm ratchet grasping forceps (right anterior axillary port). Cranial traction of the fundus of gall bladder shifts the right lobe of liver in a cephalad manner give adequate exposure of the Calot's triangle and hilum of the liver.

3) Adhesion Release:

Adhesions to the underside of the liver and gallbladder are carefully taken down beginning near the fundus and proceeding down towards the neck. Retract the adhesion caudally with left hand grasper, to expose the plane of division. It is prudent to use cautery as little as possible to avoid transmission of thermal energy to the attached structures (which might result in delayed perforation of viscus).

4) Preliminary Decompression:

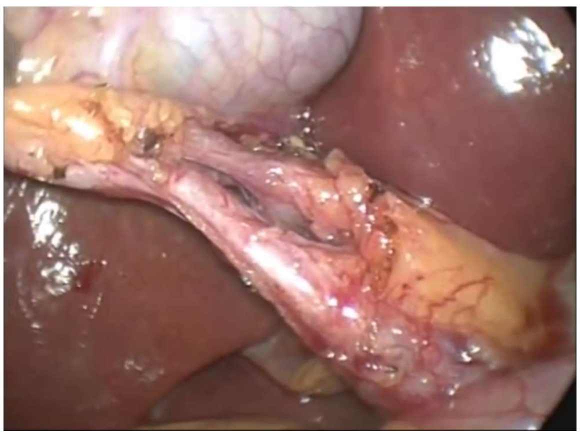
If the gall bladder is acutely inflamed and tense, decompress it under visual control.

a) Percutaneous Veress needle aspiration.

b) Introduce the 5mm trocar in to the fundus of the gall bladder directly and aspirate infected fluid by suction. By repeated instillation of saline and aspiration, whole infected contents may be removed. This is the most successful way of aspirating thick empyema of the gall bladder.

5) Calot's Triangle Dissection:

Surgeon uses atraumatic grasper on the Hartmann's pouch for lateral and caudal traction, which widens the triangle of Calto's and places the structures in tension.



a) Throughout dissection, the direction of traction by this infundibular grasper is critical to prevent errors in identification of the ductal structures in this area.

b) Retract the infundibular grasper laterally to expose anterior aspect of the Calot's triangle.

c) Hartmann's pouch is retracted upwards and laterally to expose the posterior layer of peritoneal fold, which is then opened (posterior windowing) to identify and dissect the duct behind.

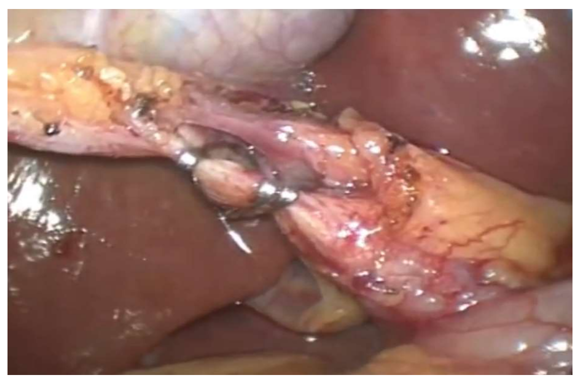
d) Begin dissection directly adjacent to the gall bladder. Take down any adhesion to the base of the gall bladder.

e) Identify the cystic duct junction with the gall bladder (safety zone). Move the infundibular grasper backward and forward and from side to side (flag technique) so that gall bladder cystic duct junction may be carefully delineated.

f) Cystic duct is identified at the junction with the gall bladder (Safety zone) and followed down for an adequate length for cholangiography if desire. That is in those patients in whom they suspect common bile duct stones.

Intraoperative Cholangiography: A small oblique incision is made on the cystic duct using microscissors, which are inserted with the tip angled towards the CBD. The tip of the microscissors is then used to dilate the cystic duct opening and the presence of bile will indicate that the duct is ready to be canulated. This procedure is recommended each time a cystic duct is opened, as an absence of bile indicates that there is no communication between the cystic duct and common bile duct and attempts to cannulate the cystic duct will be very difficult. It is possible to dilate the cystic duct by removing the microscissors and replacing them with atruamatic long Kelly forceps. These are introduced into the cystic duct lumen and opened in order to dilate the duct. At this point the Kelly forceps are placed in the 10mm operating trocar to hold the hartmann's pouch retracted laterally. The assistant now holds these forceps in order to free the surgeon's two hands allowing him to focus on the introduction of the cholangiogram clamp. This description is based on use of the Oslencholangiogram clamp with a smooth ureteral cathether no 4, which must be checked before insertion. This catheter should be introduced through the left lateral grasper into the cystic duct. It is not necessary to introduce more than 4cm of the catheter into the cystic duct of not more than one dot on the tip of the catheter. The clamp is secured in place and the cholangiogram is performed.

The clamp is removed and the clip applicator introduced. Two clips are applied as close as possible to the cystic duct opening.



A normal choangiography shows:

a) Free flow of the dye into the duodenum.

b) Normal width of the common bile duct.

c) Narrow terminal segment of the dye seen in at least one film.

d) No filling defects

A stone in the common bile duct shows

I. A filling defect

II. Dilation of the proximal biliary system

III. Failure to visualize the lower end.

IV. Absence of free flow of the dye into the duodenum.

V. Excessive retrograde filling of the intrahepatic radicles.

g) It is not always necessary to identify and dissect out the cystic common duct junction (Danger Zone).

h) Cystic artery is identified along with this anterior and posterior branches by blunt dissection using curved dissector.

i) Both cystic duct and artery are clipped, two clips on the common duct side and one clip to the gall bladder side.
j) Impacted cystic duct stone: cystic duct is clipped at its junction with the gallbladder. Partial cut is made just distal to its clipping and the impacted stone is “milked” back and extracted.

6) Dissection of the Gallbladder:
a) The gall bladder can be detached from the liver bed, taking care to stay away from the porta hepatis and liver bed and to avoid perforating the gall bladder.
b) Any inadvertent spillage of bile or stones from the gallbladder during the procedure should be immediately controlled by use of clips, prettied loop sutures or by reapplying the grasping clamp. Spilled infected fluid of the gallbladder is sucked out now and then to minimize postoperative infection. Spilled stones are also removed immediately or may placed within a sterile bag and removed later.
c) After complete detachment of the gallbladder, the liver bed is re-inspected for adequate haemostasis or bile

7) Extraction of the gall bladder:
It is done either through umbilical or epigastric ports.
Majority of the surgeons extract the gallbladder through the umbilicus after shifting the laparoscope to the epigastric port. Claw shaped gallbladder extraction forceps is introduced through the umbilical cannula and placed firm on the gall bladder neck. The forceps, cannula and neck of the gall bladder are pulled out of the umbilical fascial opening.
i. If the gallbladder is too distended, the neck is opened outside the abdomen and the suction cannula is inserted, bile is sucked out and if necessary, stones are debulked by using Desjardin’s forceps.
ii. If the gallbladder is thick, preventing it’s extraction, incision of fascia is extended to facilitate gall bladder removal.
iii. Surgeon should avoid the temptation of excessive traction.
iv. Infected or necrotic gall bladder can be placed within a sterile bag in order to facilitate its retrieval and to prevent contamination of the trocar puncture sites.

8) Peritoneal cavity Irrigation and final Inspection:
After gall bladder extraction, replace the epigastric port and inspect the surgical site for bleeding. Irrigate and suck the gall bladder bed, Morrison’s pounch, paracolic gutter and perihepatic areas with copious amount of saline.

9) Haemostasis:
Venous oozing from the superficially placed veins is a frequent occurrence. Haemostatic solution (hemolok) soaked gelatin sponge more often seals the oozing.

10) Drainage:
If a drain is needed, it can be placed through the lateral axillary prot. 14F Redivactube which goes through 5.5 trocar.

11) Port Closure:
Remove the trocars under direct visual control to ensure no bleeding. The larger 10mm ports are closed with vicryl stitches. No fascial closure is necessary at the 5mm trocar sites. Skin closure if accomplished with 3-0 vicryl subcuticular stitches or skin clips or can be sealed with Dermobond (Ethicon) without stitches.
All trocar sites are then injected with bupivacaine for post operative pain relief.

French Approach:
The so called French Technique, with the patient in lithotomy position and surgeon standing between the legs of the patient is the most favored one in Europe. Reverse Trendelenburg’s psotion of 15-20 degree and slight rotation on to the left facilitate the exposure of the Calot’s triangle especially in obese patients, smaller right lobes and transverse lie of the gallbladder. This approach is highly suited to left lobe gall bladder, situsinversus, combined CBD approach.

Four trocars, two 5mm and 10mm in diameter are usually used. Epigastric 5mm trocar is used for retraction, aspiration and irrigation and the most right lateral one for grasping instruments. The fourth (10mm) port is placed in the left hypochondrium used for scissors, hook, clip application.

Dangerous cholecystectomy:
In some cases of gangrenous gall bladder there may not be an obvious plane of dissection. If the surgeon has limited skills or feels that the situation is dangerous, he or she should perform a partial removal of the gall bladder leaving part of its neck next to the common bile duct.

This is also true when the cystic duct is either atrophic, extremely short, or virtually absent owing to the amount of inflammation. Then rather than applying clips that will not hold, it is preferable to use a preformed Endoloop, create a knot using extracorporeal technique or perform intracorporeal knot tying using a 2-0 PDS to close the cystic duct.

COMPLICATIONS:
1. Haemorrhage
a) Abdominal wall Bleeding
It can be avoided by diaphanoscopy through the abdominal wall to identify vessels. Tearing of the abdominal musculature may be prevented by

perpendicular insertion of trocars. Avoid supraumbilical trocar placement in case of portal hypertension.

Management:
Strategies for dealing with this kind of bleeding
a) Temporarily angulating the trocars.
b) Reintroduction of trocar in perpendicular fashion
c) Injection of epinephrine (1:1000) in the vicinity of the bleeding site.
d) Suture ligature. Remember to double check the area for hemostasis at the conclusion of the case. Remove the trocar under laparoscopic visual control and watch for recurrence of bleeding.

Triangle of Calot's
a) Avoid clipping blindly
b) Do not hesitate to put additional ports for effective exposure of the hilum.
c) Temporary tamponande may be obtained by gently pushing the gall bladder against the Calot's triangle by manipulating the infundibular grasper. Patiently waiting by keeping pressure most often stops bleeding, irrigating and aspirate the bleeding area to determine the exact site of bleeding. Identify the bleeding vessel, and grasp with left hand. Apply clips after precise isolation of the bleeding vessel.

Bleeding from gall bladder bed:
It can be usually controlled by:
a) Judicious use of electrocautery using the blunt tip of the grasper.
b) Multiple small areas of bleeding can be controlled by application of oxidized cellulose or topical collagen haemostatic agents (hemolok).
c) Superficially running portal venous radicals are vulnerable to injury and may be controlled by a figure of eight structure ligature.
d) Bleeding from omental vessels may be avoided by working close to the gallbladder wall. In case of bleeding it is ideal to place endoloop sutures.

2. Gallbladder Problems:

a) Acute Cholecystits:
The tensely inflamed gallbladder is difficult to grasp and retract. Preliminary decompression is performed either with percutaneous Veress needle aspiration or inserting the right mid clavicular trocar into the gallbladder on the fundus. Sample of aspirate sent for culture and sensitivity. It is ideal techniques to decompress empyema gallbladder. Specially designed forceps or Babcock clamp may be used for holding and retraction.

b) Perforation:
Perforation of the gallbladder can lead to contamination of the peritoneal cavity with potentially infected bile and gallstones. Preliminary decompression minimizes contamination. Removing spilled infected fluid by aspirating is found to be safe and does not increase the incidence of postoperative infection rate.

Sample of aspirate sent for culture and sensitivity.

3. Postoperative bile leakage:
Bile leaks or collection (bilioma) may be due to
1) Common duct, right hepatic duct injury or cystic duct injury
2) Injury to an accessory bile duct.
3) Cystic stump leakage.
i. Common duct or hepatic duct injury:
Instrumental or thermal injury following excessive use of electro cautery close to the common or hepatic duct can result in bile leak.
ii. Accessory ducts:
If recognized by intra operative cholangiogram or billiary leak from the bed, either suturing or clipping can deal it with.
iii. Cystic duct stump leak:
If it appears edematous, inflamed, highly thickened, wide and short then endoloops or suturing may be indicated, as clips are likely to slip back. ERCP should be performed and decompression of the pressure of common duct to be done in the following ways.
Endoscopic sphincterotomy Placement of transpapillary stents.
All of these methods decrease the pressure in the bile duct and allow rapid closure in cases of both cystic stump leaks and accessory bile duct leaks.

Open cholecystectomy
Cholecystectomy is the surgical removal of the gallbladder so that an individual whose gallbladder has been removed can live a normal, active and healthy life. Cholecystectomy not only removes a diseased organ but also removes the site of formation of gallstones. It may also eliminate the source of infection in chronic typhoid carriers.

Dangers and Safeguards:
Obesity and or previous inflammation or operation in the right upper quadrant greatly increases the difficulty of performing the procedure. Cholecystectomy has been associated with accidental injury to the bile ducts that requires late operative procedures for correction. The incidence of common bile duct injury for open cholecystectomy ranges from 0.1 to 0.2% Injury to the hepatic duct or to the common bile duct occurs most commonly by mistaking either of identifying these structures as the cystic duct. Anatomic variation, bleeding, inadequate exposure and failure to identify structure before ligating and dividing them are most common cause of biliary injury.
In about 25% of patients, some variation from normal anatomy will be found; often the variation can be recognized only by its relationship to other structures when all are visualized at the same moment. The point of union between the cystic and main hepatic ducts to form the common bile duct varies and the course of the cystic duct may vary. The cystic duct may lie in front of or behind the main hepatic duct may vary. The cystic duct may lie in front of or behind the main hepatic duct, or it may parallel the main hepatic duct for several cms. It may be short and when traction is paced on it, the junction of the main hepatic and common duct may be pulled outward so as to resemble the cystic duct and be

mistakenly clamped, divided and ligated. When this accident has occurred, bile flow is completely obstructed and immediate repair is imperative to restore duct continuity.

Most often the cystic artery arises fairly early from the right hepatic artery and runs to the gallbladder parallel with, and not far from, the cystic duct, but variations in origin and course are common. The cystic artery and cystic duct should be out, indentified and ligated separately.

One of greatest dangers of cholecystectomy is haemorrhage from the cystic artery. Haemorrhage may occur during the operation because the vessel slipped out of a clamp or ligature while being tied or was torn by too much traction of the gallbladder. To avoid injury to the hepatic duct or common bile duct, it is exceedingly important that the structures in this area be visualized and identified accurately while the bleeding point is being clamped. This can be accomplished by immediately inserting the left index finger into the foramen of Winslow beneath the hepatic artery, which is then compressed between the finger and the left thumb until the bleeding stops (PRINGLE MANOEUVRE).

Blood is aspirated from the operative field and the structures are identified. Pressure of the thumb is relaxed temporarily so the point of bleeding can be recognized and accurately clamped without injury to the other structures. One should never clamp blindly in this area.

The common duct should be opened and explored if a stone or mass is felt on palpation of the duct or is detected by intraoperative cholangiography.

It is a good practice to not remove the gallbladder at the beginning of an operation for biliary obstruction but to wait until the exploration of the duct has revealed that the cause of obstruction can be corrected. When there is free passage of bile between the liver and gallbladder, and the distal duct system is irremediably obstructed, the gallbladder is valuable because it can be anastomosed to the duodenum or jejunum and internal bile flow can be maintained.

Anaesthesia:

A balanced general anaesthesia technique using muscle relaxants, inhalational agents and judicious amounts of narcotics is optimal for cholecystectomy. When used in excess, narcotic agents can cause spasm of sphincter of Oddi and may slow the passage of contrast into the duodenum during intraoperative cholangiography.

Reversing the narcotic and administering intravenous glucagons should relax the aphincter and permit the flow of contrast from the common bile duct into the duodenum. Epidural anaesthesia is gaining in popularity for more extensive biliary operations because it provides good post –operative pain control.

Spinal or local anaesthesia provides inadequate or difficult-to-control anaesthesia.

TECHNIQUE:

Incision:

i) Kocher's Incision:

Begins in the midline below the xiphoid process, and runs downwards and laterally 1 inch (2.5cm) below and parallel to the costal margin. All muscles, including the rectus, are divided in the same line. The 8th, 9th and 10thintercostals nerves are found running downwards and medially between internal oblique and transverses. Not more than one of these nerves should be divide; the others are carefully retracted and preserved. Closure is effected in three layers. The first layer comprises peritoneum, posterior rectus sheath and (more laterally) internal oblique and transverses. The anterior rectus sheath and external oblique are now repaired. And finally the skin. No attempt is made to suture the rectus muscle itself. A right sub costal incision is used most commonly for cholecystectomy when the costal angle is wide. Exposure of biliary tract is good. It is cosmetically better.

ii) Right Paramedian Incision:

Chief advantage is the exceptionally strong scar which results. The incision is made parallel to the midline, and at a distance of 1 inch (2-3 cm) from it. The anterior rectus sheath is divided in the line of the skin incision. The rectus muscle is displaced laterally to expose to posterior sheath. The posterior sheath is incised in the line of the skin incision, together with transversalis fascia and peritoneum. The incision is sutured in 3 layers – fastly peritoneum and posterior sheath as one layer, secondly anterior sheath and thirdly skin. Paramedian incision gives a good exposure to the viliary tract. The changes of incisional hernia less,

A modified paramedian incision, in which the posterior rectus sheath is split transversely in the line of its fibres, instead of being incised vertically, can be used for cases of uncomplicated cholecystectomy. It is especially applicable to adipose patients with flabby musculature, in whom incisional hernia is a comparatively frequent sequel to operation. This incision is very simply closed, since the split posterior sheath trends to fall together without tension, and the repair is an extremely strong one. If the access is found to be inadequate, the incision is very easily converted into an ordinary paramedian one by vertical incision of posterior sheath.

Upper Midline:

If the costal angle is narrow, an upper midline incision is preferable. It provides adequate exposure for any operation on the biliary tract. It can be cnlarged upward, downward, or transversely, or it can be converted into an abdominothoracic incision if unexpected conditions are cncountered requiring additional exposure. Injuries to the nerve and blood supply to the rectus muscle are minimal and closure is technically easy.

The right transrectus incision can cause injury to the arterial and nerve supply to the rectus muscle, which may increase the incidence of post-operative hernia. The upper transverse incision is satisfactory for operations on the biliary tract.

Holman's incision, which combines a subcostal with an upper midline incision, is useful for a difficult gallbladder operation, but it is very disfiguring.
After the abdomen is entered, cholecystectomy may be performed in one of several ways.

Basic Principles:
The first step consists in careful packing off. At least two large-sized packs are required. The first is placed in the lower part of the wound, displacing downward the duodenum, transverse colon and small intestine; the second is placed medially to cover and retract the stomach. A third pack may be inserted laterally to fill the right kidney pouch. Deep retractors are then placed in position and are held by the assistant so as to give the best exposure. The next step in cholecystectomy is the identification and isolation of the cystic duct. Its entrance into the common bile duct is palpated to ensure that no stones are present. If any stones are present, they are manipulated into the gallbladder and the cystic duct is encircled using a Pott's tie below them. This manoeuvre prevents stones from being forced into the common duct during the subsequent stages of cholecystectomy. The second into the common duct during the subsequent stages of cholecystectomy. The second step is the identification of the cystic artery, with subsequent ligation and division. The gallbladder is dissected from its bad, a transcystic duct cholangiogram is performed, the cystic duct is ligated about 5 to 10 mm from the common bile duct and divided and the gallbladder is removed.

Cholecystectomy from the neck toward the Fundus:
In an uncomplicated case, most surgeons remove the gallbladder from the neck toward the fundus. Cystic artery lies in the Calot's triangle bounded by the inferior surface of liver, common hepatic duct and cystic duct. The triangle also contains the cystic node of lund. When the cystic artery and duct are ligated early in the dissection, the most difficult part of the operation is finished first, and the gallbladder is removed from a relatively dry bed. This method may be difficult if adhesions made identification of the components of the hepatic pedicle uncertain. In such cases, excision from the fundus towaed the cystic duct is safer.

The abdomen is opened and adhesions in the field of operation are divided. Fundus of the gallbladder is retracted cephalad and the ampulla is retracted laterally. This helps in straightening the cystic duct. A longitudinal incision is made in the peritoneum forming the anterior leaf of the hepatoduodenal ligament, parallel to the ducts, which are bared and identified the cystic duct is isolated by blunt dissection, and its junction with the common duct identified. The cystic duct. The cystic duct is ligated. An intraoperative cholangiogram is performed at this time. The cystic artery lies usually just medial and superior to the cystic duct. The artery can be identified by its visible or palpable pulsations. It is isolated, and its proximal stump secured with a ligature. After the cystic artery has been divided, the most difficult part of the operation has been completed. The gallbladder is held to the liver by a leaf of peritoneum on either side. The peritoneum is incised and the gallbladder dissected from its bed. Drainage of the subhepatic fossa is indicated in difficult cholecystectomy or when severe infection is closed in layers with a long lasting absorbable suture or a monofilament nonabsorable suture.

Cholecystectomy from the Fundus toward the Cystic Duct:
This method is indicated when the fundus is accessible and the neck of the gallbladder, the cystic duct and the cystic artery are concealed by adhesions and inflammation. It is the safest method of excising the gallbladder, but is a bloodier procedure than excision from the cystic duct toward the fundus.
After the abdomen is entered and explored, the gallbladder is identified and its surface is freed of any adhesions. An incision is made through the serosa into the subserous connective tissue on the lateral wall of the gallbladder.
After the subserous areolar tissue plane is opened on each side of the gallbladder, the fundus is grasped with a clamp and drawn downward and medially away from the liver. The gallbladder is freed down ward out of its fossa by sharp and blunt dissection. Often a sizeable blood vessel is encountered running from the posterior surface of the gallbladder to the liver; this vessel must be ligated. In severe gallbladder disease in which the shrunken organ is densely adherent to the liver, it may be difficult to free the gallbladder from the liver bed. This dissection may have accomplished more easily if the contents of the gallbladder are not aspirated because a full viscus better outlines its limits. In some instance, however, the gallbladder may be so distended that it obstructs the view of the operative field, which may necessitate its evacuation in order to see. If it is difficult to dissect a collapsed gallbladder from it's fossa in the liver, a useful procedure is to insert the left index finger as a guide, the gallbladder can be dissected over it with greater speed and safety.
The fundus and body of the gallbladder are shelved out of their bed by blunt dissection, in the connective tissue cleavage plane between the serosa and the muscularis. The dissection is continued well down on the ampulla and neck of the gallbladder until the cystic artery and vein are encountered on the superomedial side of the gallbladder and are identified. The cystic artery is exposed, isolated and carefully distinguished from the hepatic artery, after which it is clamped, cut and ligated proximal to its terminal branches.
Traction on the gallbladder exposes the cystic duct, which is bared and traced down to its junction with the common bile duct. After identifying the main hepatic and common bile ducts, the cystic duct is clamped and transected between the two clamps and is ligated about 5 to 10 mm from the common duct. The gallbladder is then removed. The peritoneal flaps are usually cauterized and not closed.
When a drain is used, it is placed in the gallbladder fossa down to the stump of the cystic duct. The drain is

brought out through a separate lateral stab wound. The drain is removed in 24-48 hours if drainage is negligible. Rarely, the diseased gallbladder is completely or almost completely intrahepatic. The liver substance that has encroached over the lateral margins of the gallbladder or has covered it completely must be incised before the gallbladder can be dissected from its fossa.

There is always considerable amount of bleeding in the downward dissection of the gallbladder, because many terminal branches of the cystic vessels must be divided after the main vessels are ligated in the hepatic pedicle. To minimize bleeding, Lahey and Pyrtek stated that in cholecystectomy for acute or subacutecholecystitis, the first step in the operation consists of inserting a finger through the mesentery of the gallbladder between the cystic duct and hepatic duct and above the cystic artery. The finger is inserted close to the bed of the liver so that the hepatic duct is medial and superior to it, while the cystic duct and artery are lateral and inferior. The finger is passed upwards separating the oedematous gallbladder from its bed in the liver. The gallbladder is then turned to its left and its lower portion is exposed using blunt dissection. This step provides visualization of the cystic artery, hepatic duct and CBD. The cystic artery and duct are clamped separately, cut and ligated with safety. This procedure combines the safety of cholecystectomy from above downwards with the relative bloodlessness of a cholecystectomy from below upwards. This is not applicable for a chronically scarred and densely adherent gallbladder.

Post-operative Care:

The most common complications that occur after a cholecystectomy are postoperative ‘ileus’, atelectasis and wound infection. Other rare complications include pulmonary embolus, pneumonia, myocardial infarction, biliary peritonitis, subphrenic abscess, bacterial peritonitis and delayed haemorrhage.

Postoperative care is directed at preventing these complications and promptly recognizing and treating any that may occur.

Nasogastric suction, although rarely needed, can be helpful in patients with nausea and emesis in the post-operative period. Early ambulation is encouraged as soon as patient is fully awake and alert from anaesthesia. Drain is removed by 24-48 hours if no bile drainage is noted. If bile drainage is noted, the drain should not be removed until the aetiology of drainage has been determined.

Complications of Cholecystectomy:

The morbidity or complication rate from open cholecystectomy is less than 10% and is usually minor.

Intra-operative complications:

Anatomic identification of the cystic duct, cystic artery, and common bile duct combined with good exposure should ensure a safe and uncomplicated operation. Despite diligent care, bile duct injuries occasionally occur (0.3%). Injury to the common bile duct can be repaired over a T-tube, if the injury is limited to less than 1cm. If a large area of the duct is avulsed or resected, reconstruction with a Roux-en-Y choledochojeunostomy is recommended. Injury to the hepatic artery may be difficult to repair. Injuries to the portal vein should be repaired.

Post-operative complications:

Specific complications of cholecystectomy may occur rarely. Persistent drainage of bile can occur from an accessory duct, intrahepatic bile radicles, or if the suture slips off the cystic duct. Generally, drainage ceases in 2 weeks, but may persist for a month. The fistula will not close if the common bile duct is obstructed distal to the cystic duct. A contrast study through the fistulous tract, a transhepaticcholangiogram or an endoscopic retrograde cholangiogram should define the anatomy and demonstrate a distal obstruction. Occasionally, a papillotomy or endoscopic stent is necessary to bypass the sphincter of Oddi and lower the pressure in the bile duct and allow the leak to seal.

Retained CBD stones demonstrated by T-tube cholangiogram are another complication. Premature removal of the T-tube is an infrequent problem. If the tube is dislodged within a few days after operation, bile peritonitis may occur. Re-operation or transhepatic stenting or Endoscopic insertion of biliary stent may be necessary. Bile duct stricture is a late complication.

METHODOLOGY

This study was done prospectively over a period of two years, from May 2023 to April 2025, included all patients who underwent LC for indicated gallbladder disease in all Surgical Units of M.K.C.G Medical College & Hospital, Berhampur.

The study included 206 patients who underwent LC between May 2023 to April 2025.

The inclusion criteria for the study were: all patients with symptomatic cholelithiasis, and ultrasound abdomen (US) demonstrating cholelithiasis and normal CBD and patients with acalculous cholecystitis. In patients with choledocholithiasis.

Patients with severe heart and/or pulmonary diseases, concomitant disease requiring Open surgery, or multiple previous upper abdominal incisions, were excluded from the study. Patients with a single upper abdominal incision were assigned for LC.

The variables recorded and studied in this study are:

- Sex
- Age
- Obesity
- History of previous upper abdominal surgeries,
- Co-morbid illnesses (chronic obstructive pulmonary disease, ischemic heart disease, hypertension, chronic renal failure, and diabetes)
- White blood cell (WBC) count,
- Serum total bilirubin,
- Sonographic findings, including gallbladder wall thickness, pericholecystic fluid, CBD stone, and CBD diameter.
- Operative details like operation time,
- Causes for the conversion to open surgery

Cholecystitis was diagnosed by clinical and laboratory assessments and radiological report. Patients who presented with acute cholecystitis in the first 72 hours underwent emergency LC. The patients whose radiological results did not support the clinical and laboratory data were not considered to have acute cholecystitis. If the patients with acute infection were admitted more than 72 hours after the onset of symptoms, elective LC was carried out 8-10 weeks later following a course of conservative treatment (delayed cholecystectomy).
Obesity was defined as body mass index above the cut off value of 27.5 (kg/m^2).
A patient was categorized as having co-morbidity when at least one of the following conditions was present at the time of cholecystectomy:

- Diabetes mellitus,
- Hypertension,
- Myocardial infarction,
- Congestive heart failure or
- Chronic obstructive pulmonary disease
- Chronic renal failure.

Laparoscopic cholecystectomy was performed by experienced surgeons and surgical residents under supervision. The operation was performed using a four-port technique with the surgeon standing on the left side of the patient. Veress needle insertion was attempted in all patients. Minimal diathermy was used to dissect a critical view of safety. Method of dissecting the gallbladder from the liver bed, using the diathermy spatula or hook, was left to the preference of the surgeon.
Conversion to Open cholecystectomy was performed through a right subcostal incision. The cystic artery and cystic duct ligated separately. The duration of operation was taken from the time of the initial skin incision to the time of skin closure. The postoperative duration of hospital stay was taken as the number of nights the patient stayed in the hospital after the procedure.
Total patients in this study are divided into two groups based on completion of LC. One group is LC completed group and other one is LC converted to OC group. Variables recorded are compared between the two groups. Results are analysed by Fischer's exact probability test. P-value of <0.05 is considered to be significant. Based on the statistical significance of the p value, risk factors for conversion are identified.

OBSERVATION AND RESULTS

This study was done prospectively over a period of two years, from May 2023 to April 2025, included 164 patients who underwent LC for symptomatic gallbladder disease in all Surgical Units of M.K.C.G M.C.H.
Among the 164 patients in the study 18(10.97%) patients were converted to OC.

Table -2 SUMMARY TABLE OF REASONS FOR CONVERSION

SI.No.	REASONS FOR CONVERSION	n=18
1.	Dense adhesions between GB &bowel	9(50%)
2.	Inability to define anatomy at calot's triangle	3(16.66%)
3.	Bleeding from cystic artery injury	2(11.11%)
4.	Bleeding from GB bed	1(5.55%)
5.	Choledocholithiasis (preoperatively undiagnosed)	1
6.	Bile duct injury	1
7.	Equipment failure	1

The most common reasons for conversion are severe adhesions caused by tissue inflammation {9 patients (50%)} and inability to define anatomy due to fibrosis of Calot's triangle {3 patients (16.66%)}.

Conversion to OC due to intraoperative hemorrhage occurred in 3 patients. Conversion was enforced due to uncontrolled bleeding from gallbladder bed in 1 patient (5.55%), which occurred during diathermic dissection of GB. In another 2 patients (11.11%), there was uncontrolled bleeding from Calot's triangle, which occurred during dissection of cystic duct and artery.

Conversion to OC was required to achieve successful haemostasis, as they could not be controlled laparoscopically.

Conversion to OC caused by injury of the common bile duct occurred in 1 patient (5.55%), and the injury is identified intraoperatively and repaired over a T-tube.

Conversion to OC occurred due to equipment failure in 1 patient (5.55%). Conversion was due to inability to establish and/or maintain sufficient pneumoperitoneum during the course of LC and due to clip applicator failure.

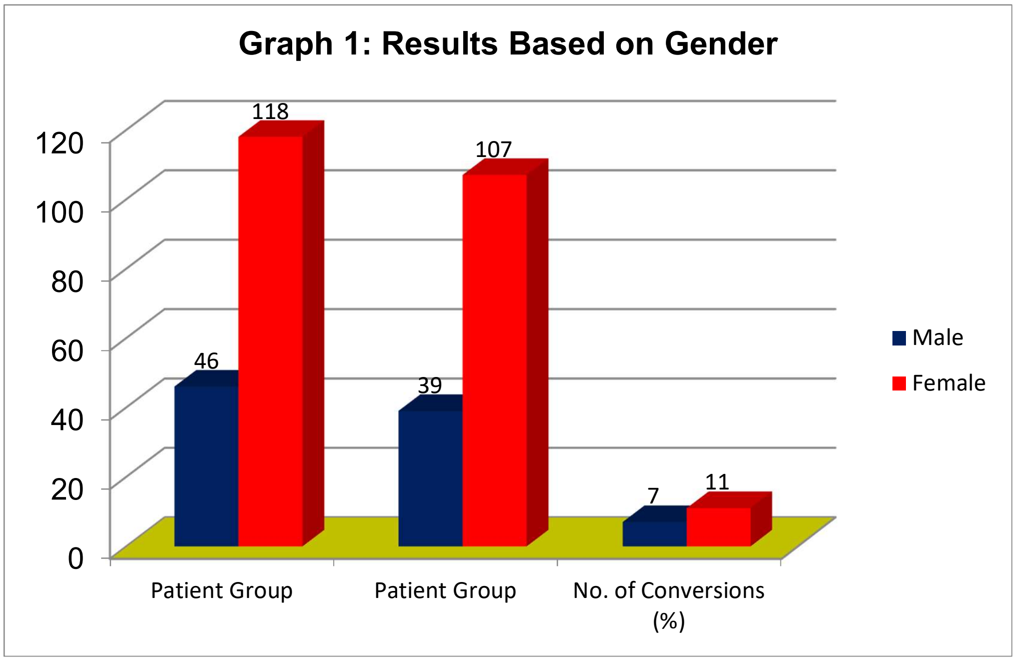
GENDER

In this study out of 164 patients in the study 118 were females and 46 were males. Successful LC was performed in 107 females and 39 males, whereas conversion was required in 11 females (9.32%) and 7 males (15.21%).

Table 4: RESULTS BASED ON GENDER

Patient Group	No. of patients	No. of completed (%)	No. of Conversions (%)
Male	46	39(84.78%)	7(15.21%)
Female	118	107(90.67%)	11(9.32%)

P value according to Fischer's test is 0.2 which is not statistically significant.



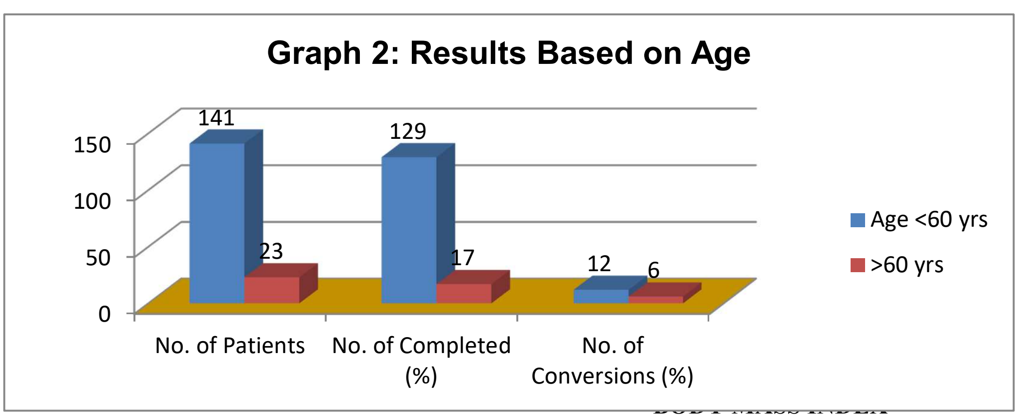
AGE

In this study, age was identified as a significant factor influencing the success of laparoscopic cholecystectomy (LC) and the likelihood of conversion to open cholecystectomy (OC). Among 141 patients under 60 years of age, 129 (91.49%) successfully underwent LC, while 12 patients (8.51%) required conversion. In contrast, among 23 patients aged 60 years and older, only 17 (73.98%) had a successful LC, whereas 6 patients (26.02%) required conversion to OC. The increased conversion rate in older patients may be attributed to several factors, including higher rates of chronic inflammation, dense adhesions, gallbladder wall fibrosis, and anatomic distortions due to long-standing gallstone disease

Table 5: RESULTS BASED ON AGE

Patient Group	No. of Patients	No. of Completed (%)	No. of Conversions (%)
Age <60 yrs	141	129 (91.48%)	12 (8.51%)
≥60 yrs	23	17 (73.91%)	6 (26.02%)

P value according to Fischer's test is 0.02 which is statistically significant



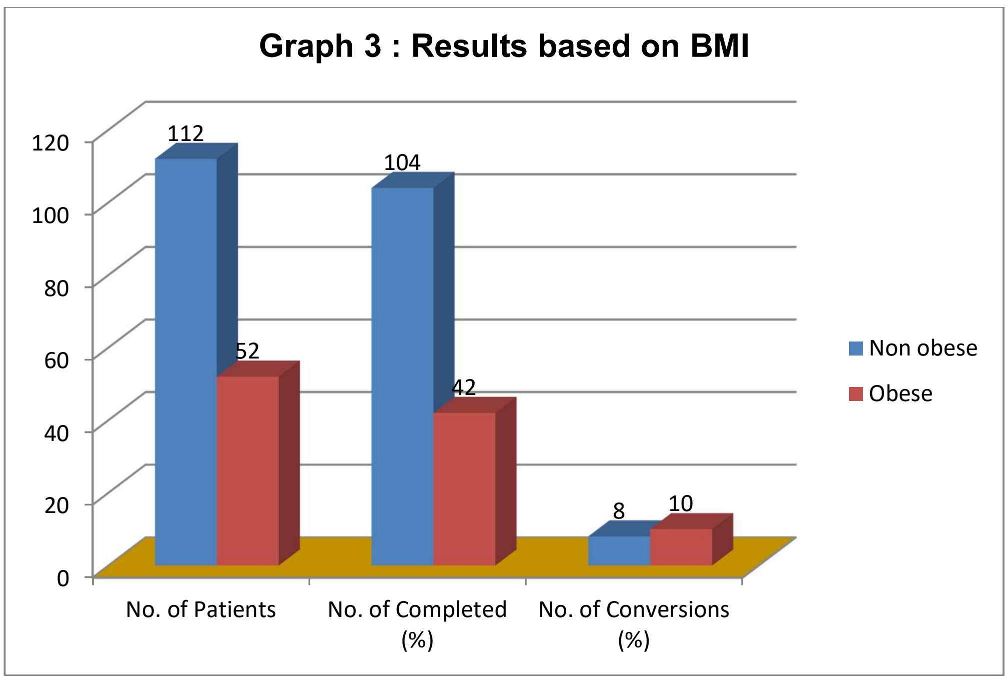
In this study, among 112 non-obese patients (BMI < 30 kg/m²), 104 (92.86%) successfully underwent laparoscopic cholecystectomy (LC), while 8 patients (7.14%) required conversion to OC. In contrast, 52 obese patients (BMI ≥ 30 kg/m²) demonstrated a markedly higher conversion rate, with 10 patients (19.23%) requiring conversion to OC, compared to 42 (80.77%) who successfully underwent LC.

The increased conversion rate in obese patients is likely due to excess intra-abdominal fat, which leads to poor visualization of Calot's triangle, difficult gallbladder dissection, increased operative time, and a higher risk of perioperative complications such as bleeding and bile duct injury. Additionally, thicker abdominal walls and reduced pneumoperitoneum efficiency can further complicate laparoscopic maneuvers. In contrast, non-obese patients generally have better surgical exposure, fewer adhesions, and a lower incidence of technical difficulties, resulting in higher LC completion rates.

Table 6: RESULTS BASED ON BMI

Patient Group	No. of Patients	No. of Completed (%)	No. of Conversions (%)
Non obese	112	104 (92.85%)	8(7.14%)
Obese	52	42 (71.42%)	10 (19.23%)

P value according to Fischer's test is 0.03 which is statistically significant.



PREVIOUS UPPER ABDOMINAL SURGERY

In this study, out of 164 patients, 5 patients had a history of preceding upper abdominal surgery, as evidenced by the presence of upper abdominal scars. Among these 5 patients, 3 patient had history of surgery for hollow viscus perforation, resection and anastomosis for volvulus and ruptured liver abscess and two patient had no document of surgery of which 3 efficiently underwent laparoscopic cholecystectomy (LC) without requiring conversion, while two patients (40%) required for conversion to open surgical procedure. The remaining 159 patients had no history of upper abdominal surgical operation. Among this group, 143 patients (89.93%) completed LC, whereas 16 patients (10.06%) required conversion.

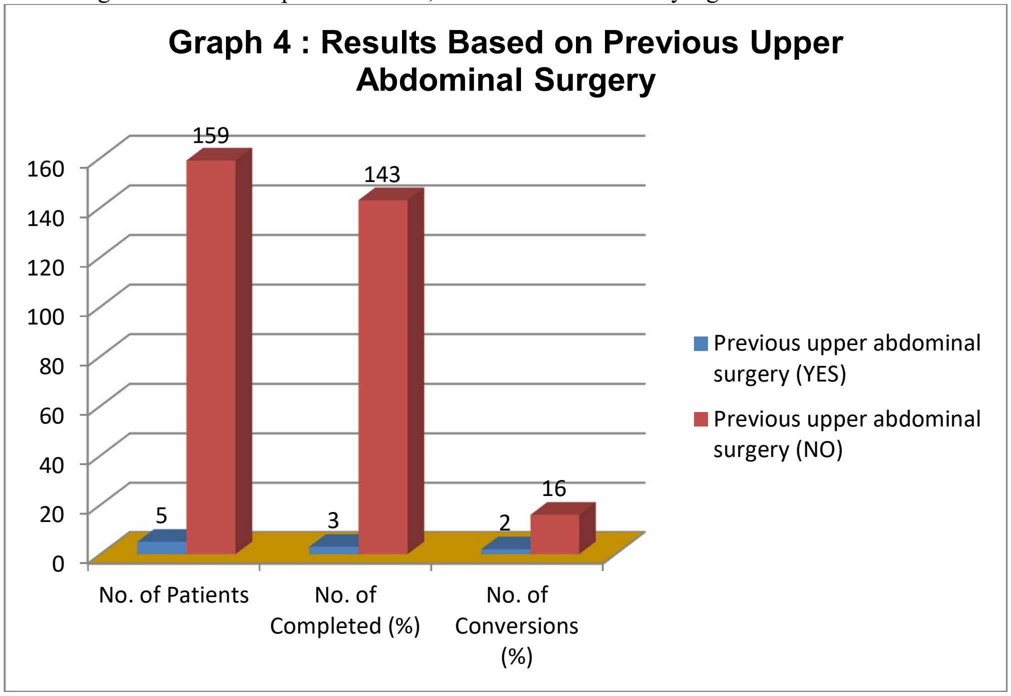
The chance of conversion in patients with previous upper abdominal surgery can be attributed to factors which include postoperative adhesions, altered anatomical landmarks, fibrosis, or tough to get plane of dissection due to frozen Calot's triangle. These findings spotlight the capacity challenges posed by means of previous surgical interventions within the upper stomach, which may additionally necessitate careful preoperative assessment and intraoperative decision-making.

Table 7: RESULTS BASED ON PREVIOUS UPPER ABDOMINAL SURGERY

Patient Group	No. of Patients	No. of Completed (%)	No. of Conversions (%)

Previous upper abdominal surgery	Yes	5	3 (60%)	2 (40%)
Previous upper abdominal surgery	No	159	143(89.93%)	16(10.06%)

According to Fischer's test p value is 0.09, which is not statistically significant.



COMORBIDITY

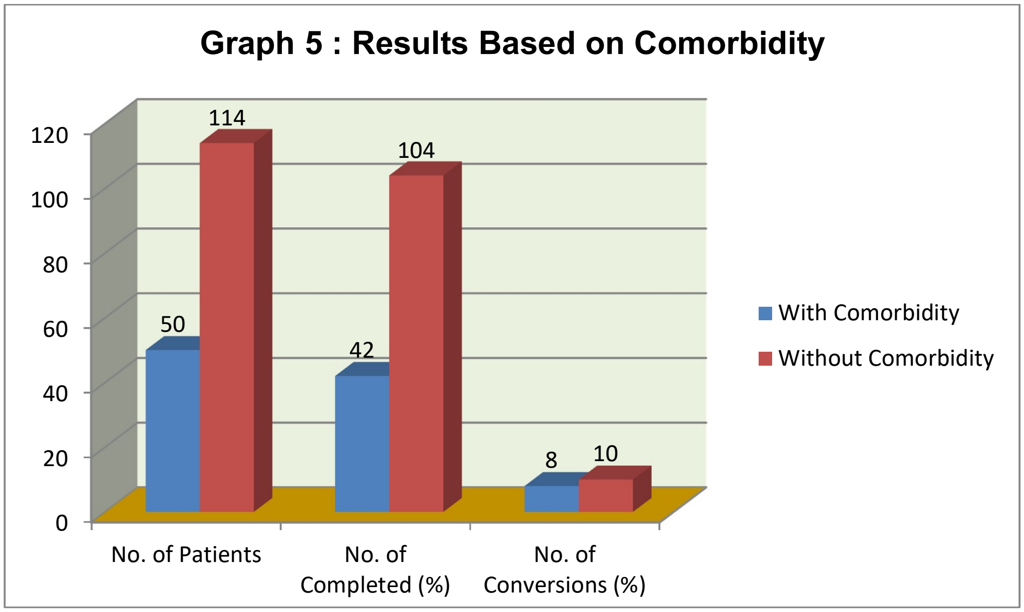
Among 164 patients, 50 patients had one or more comorbid situations such as hypertension, diabetes mellitus, coronary artery disease, chronic obstructive pulmonary diseases (COPD), sickle cell anemia, pancreatitis. Among those patients, 42 (84%) effectively underwent laparoscopic cholecystectomy (LC) without requiring conversion, although 8 patients (16%) required conversion to open surgical operation. The remaining 114 patients had no associated comorbidities. Among them, 104 (91.23%) complete LC, while 10 patients (8.77%) required conversion.

The higher conversion in patients with comorbidities may be because of elements such as intra-abdominal adhesions, intraoperative bleeding, decreased physiological reserve, or difficulties in tolerating extended pneumo-peritoneum. These findings spotlight the capacity impact of pre-existing medical conditions on surgical consequences, underscoring the importance of preoperative danger evaluation and perioperative management to optimize patient safety and surgical success.

Table 8: RESULTS BASED ON COMORBIDITY

Patient Group	**No. of Patients**	**No. of Completed (%)**	**No. of Conversions (%)**
With Comorbidity	50	42 (84%)	8 (16%)
Without Comorbidity	114	104 (91.22%)	10(8.77%)

P value according to Fischer's test is 0.2 which his not statistically significant.



LEUCOCYTOSIS

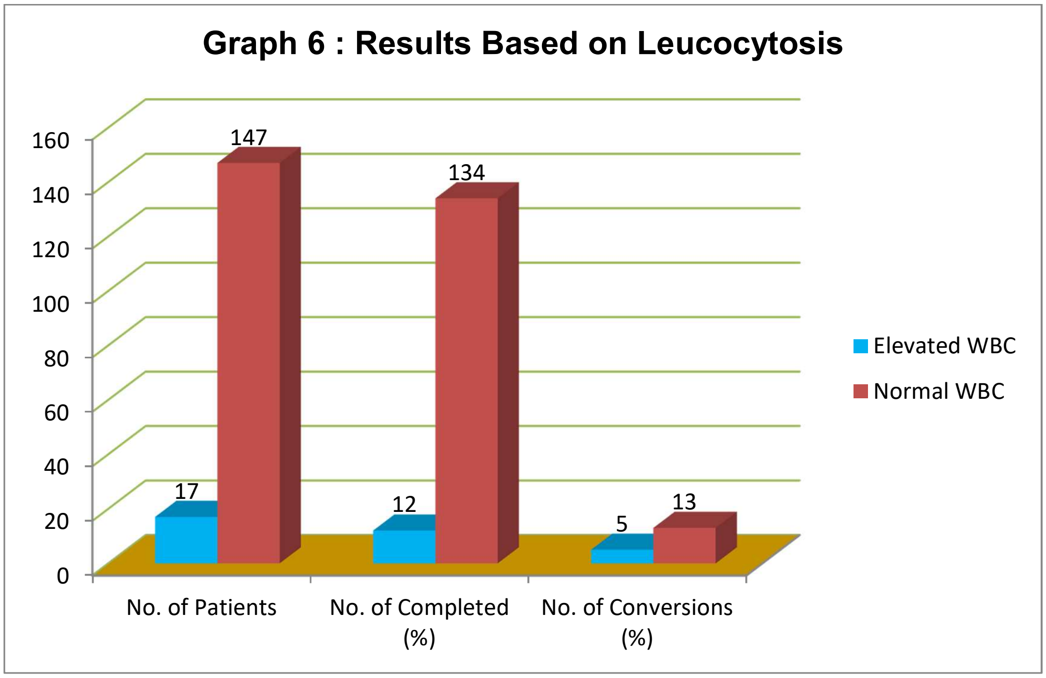
In this study, out of 164 patients, 18 patients who underwent early laparoscopic cholecystectomy (LC) (e.g within 7 days of onset of symptoms) had higher WBC count (>11000). Among those 18 patients, 5 patients (29.41%) required conversion to open surgical operation. However, the higher conversion rate on this group suggests that extreme inflammation and tissue edema may additionally make contributions to surgical difficulties.

In contrast the remaining 146 patients who underwent interval laparoscopic cholecystectomy (LC) of them 143 had normal WBC counts and 3 patients had high WBC count (>11000). Among 143 patients who had normal WBC count, 139 (97.20%) efficiently completed LC, while 3 patients who had high WBC count, 1 patient require conversion to open cholecystectomy. In evaluation, interval LC may additionally have decrease conversion in stable patients, although adhesions from previous inflammation could still pose challenges.

Table 9: RESULTS BASED ON LEUCOCYTOSIS

Patient Group	No. of Patients	No. of Completed (%)	No. of Conversions (%)
Elevated WBC	21	15 (71.42%)	6(28.57%)
Normal WBC	143	139 (97.20%)	4 (2.79%)

P value according to Fischer's test is <0.0001 which is statistically significant.



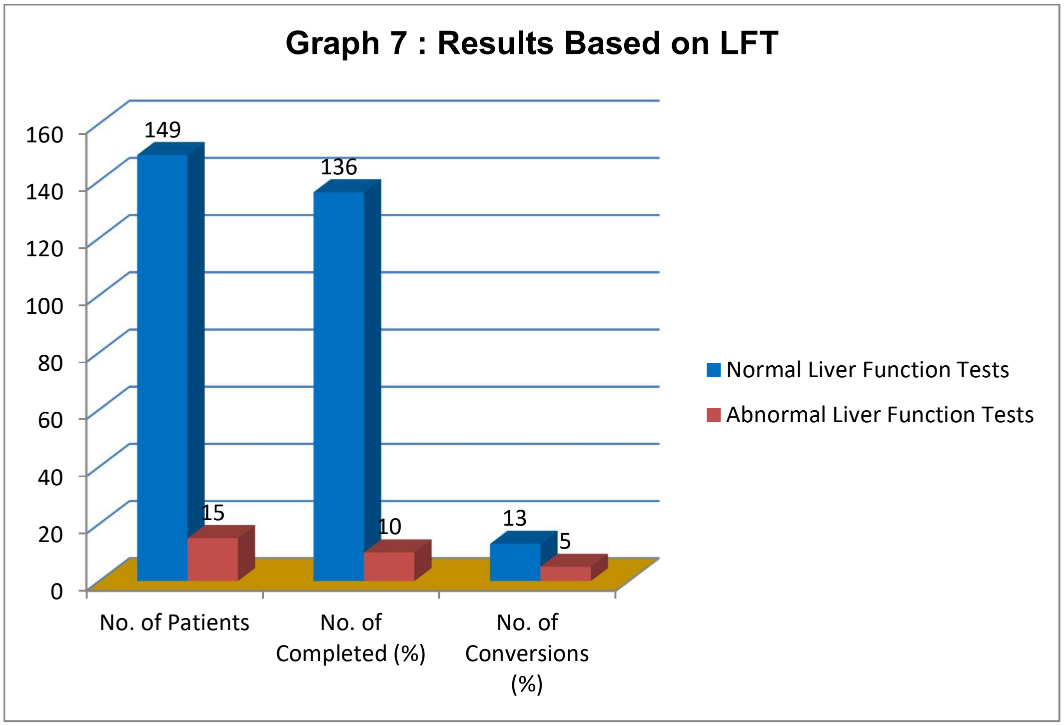
ABNORMAL LFT

Among 164 patients in this study, 15 patients are with abnormal LFT, e.g increased total and direct serum bilirubin which may indicate **biliary obstruction** due to choledocholithiasis, Mirizzi syndrome, of these 5 (33.33%) converted to OC. 149 patients are with normal LFT, 13 (8.72%) in converted group.

Table 10: RESULTS BASED ON LFT

Patient Group	No. of Patients	No. of Completed (%)	No. of Conversions (%)
Normal Liver Function Tests	149	136 (91.2%)	13 (8.72%)
Abnormal Liver Function Tests	15	10 (66.66%)	5 (33.33%)

P value according to Fischer’s test is 0.01 which is statistically significant.



USG FINDINGS

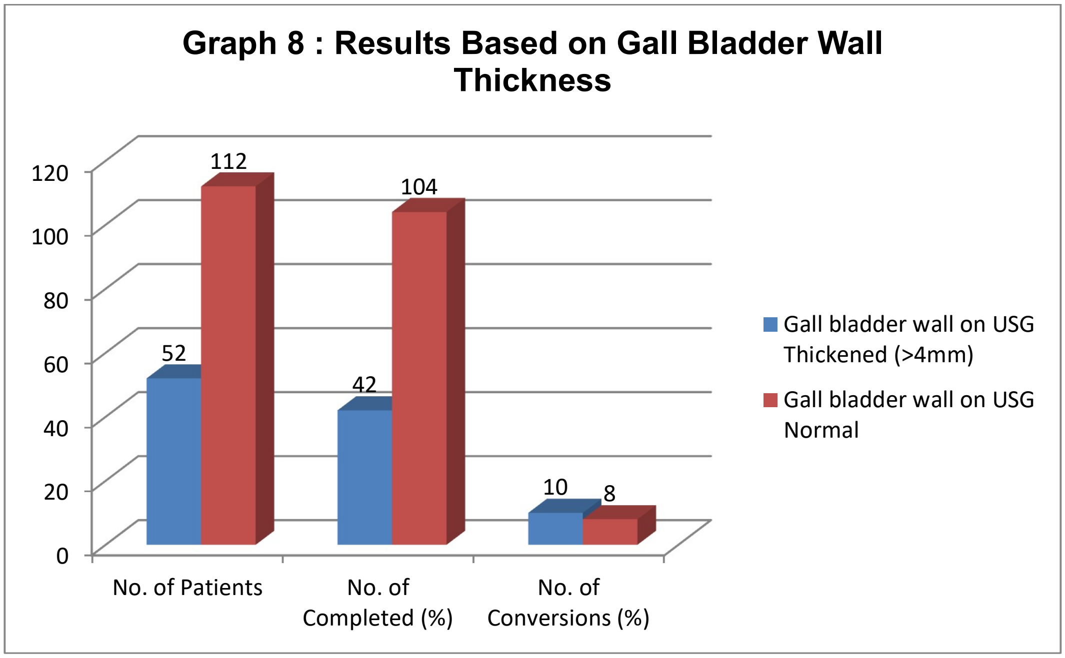
Gallbladder wall thickness is an important radiological parameter assessed via ultrasound before laparoscopic cholecystectomy (LC). A normal gallbladder wall measures ≤4 mm in thickness. Thickened gallbladder wall (>4 mm) is often associated with inflammation, fibrosis, or systemic conditions affecting the gallbladder.

In this study, 52 patients are with thickened gall bladder wall (>4mm) of these 10(19.23%) patients in converted group. 112 patients with normal GB wall thickness (>4mm), of these 8 (7.14%) in converted group. Gallbladder wall thickness is a crucial predictor of surgical difficulty and conversion rates in laparoscopic cholecystectomy. Proper preoperative evaluation and intraoperative decision-making are essential to reduce complications and improve patient outcomes.

Table 11: RESULTS BASED ON GALL BLADDER WALL THICKNESS

Patient Group	No. of Patients	No. of Completed (%)	No. of Conversions (%)
Gall bladder wall on USG Thickened (>4mm)	52	42 (80.76%)	10 (19.7%)
Gall bladder wall on USG Normal (<4mm)	112	104 (92.8%)	8 (7.14%)

P value according to Fischer's test is 0.03 which is statistically significant.



According to Fischer's exact probability test analysis, advanced age (p=0.02), obesity (p=0.03), leukocytosis (p=0.001), abnormal LFT (p=0.01) and thickened gall bladder (0.03) are statistically significant risk factors for conversion.

DISCUSSION

Laparoscopic cholecystectomy is regarded as the gold standard in treating all gall bladder diseases. Its benefits compared to open cholecystectomy are lower morbidity, shorter hospital stay, quicker recovery and decreased postoperative pain[55]. Conversion to open cholecystectomy is, however, still necessary in up to 20% of the overall cases[53].

This study was done prospectively over a period of two years, from May 2023 to April 2025, included 164 patients who underwent LC for indicated gallbladder disease in all Surgical Units of M.K.C.G Medical College & Hospital, Berhampur.

This study evaluated the effects of patient characteristics on conversion, such as gender, age, body mass index, history of previous upper abdominal operation, associated co-morbid illnesses, leucocytosis, liver function tests and USG findings including gall bladder wall thickness, pericholecystic fluid, acute or chronic cholecystitis, surgery setting, operative details like operation time, causes for conversion.

This study prospectively analysed 164 patients who underwent LC for indicated gall bladder diseases, of these 18(10.97%) patients required conversion to open cholecystectomy.

In this study the overall conversion rate was 10.97%, somewhat higher than reports that have been published from highly specialized centres with extensive and special expertise in laparoscopic surgery[51 52,55]. General surgical practice might have somewhat less favourable results.

GENDER

Of 164 patients in the study 118 were females and 46 were males. Successful LC was performed in 107 females and 39 males, whereas conversion was required in 11 females (9.32%) and 7 males (15.21%).

Table: 13 COMPARISON STUDIES BASED ON GENDER

Male sex	**Present study n=164**	**Randhawa, Pujahari et al[14] (2009) n =228**	**Yol. S Kartal et al[16] (2006) n =80**
P Value	0.2 (Not significant)	0.736 (Not significant)	<0.05 (significant)

In this study, male gender is given higher score; but gender did not have significant influence on the outcome of surgery as per the results of this study (p= 0.2). Similar type of result is seen with study done by J.S Randhawa, A.K Pujahari et al (p= 0.736) [(14)]

This study result is in contradiction to study done by Simon E et al [(15)] Kennametal, Kama et al, Liu et al, Yoi. skartal et al Rosen et al Gabriel et al [(10)]. They all concluded. male gender as a significant predictor of difficult laparoscopic cholecystectomy.

According to Simon E et al[15] men more frequently had attacks of acute cholecystitis and sequelae of acute cholecystitis, which makes dissection of gall bladder difficult in them.

Yol.Skartai et al[16] found histological evidence of excess counts of inflammatory cells and excess collagen, hydroxyproline in gall bladder wall and pericholecystic tissue of males, making the dissection and gall bladder separation difficult during laparoscopic cholecystectomy.

AGE:

In this study, Patients under 60 years are 141 and over 60 years are 23, successful LC performed in 129 patients under 60 and 17 patients over 60 years, whereas conversion was required in 12(8.51%) patients under 60 years and in 6(26.02 %) patients over 60 years.

Table: 14 COMPARISON STUDIES BASED ON AGE

	Present study n =164	Liu et al[44] (1996) n = 500	Gurkanyetkin et al[22] (2009) n= 108	Randhawa, Pujahari et al[14] (2009) n= 228
Age (Yrs)	>60	>65	>60	>50
P Value	0.02 (significant)	<0.05 (significant)	0.029 (significant)	0.937 (Not significant)

❖ P value according to Fischer's test is 0.02 which is statistically significant.
❖ Conversion rates in this study are found to be significantly higher in patients over the age of 60. (p=0.02).
❖ This is in accordance to the study done by Gurkanyetkin et al (22) (p=0.029), Kama et al (27). They found age > 60 years as a significant predictor of difficult laparoscopic cholecystectomy. Liu et a/44) also reported significant difficulty in laparoscopic cholecystectomy in patients above 65 yrs,
❖ R.S Randhawa, A.K Pujahari et al(14) did not find significant correlation between higher age group and outcome of surgery (p=0.937). Gabriel R. et al also concluded that advancing age had not significantly increased the risk of conversion to open cholecystectomy.
❖ According to Kanaan et al (23) conversion rate of lap cholecystectomy to open cholecystectomy is higher with increasing age.
Increased age has been noted in literature as a preoperative risk factor for conversion, perhaps due to longer history of gall stones and increased number of cholecystitis attacks(47)

BODY MASS INDEX:
In this study, out of 112 non obese patients, 104 are in LC completed group and 8(7.14%) in converted group. Out of 52 obese patients, 42 are in LC completed group and 10(19.23%) in converted.

Table: 15 COMPARISON STUDIES BASED ON BMI

	Present Study n=164	Rosen et al[43] (2002) n=1347	Gurkanyetkin et al[22] (2009) n=108	Randhawa, Pujahari et al[14] (2009) n=228
BMI	>27.5	>30	>30	>27.5
P Value	0.03 (significant)	0.02 (significant)	0.024 (significant)	0.010 (significant)

BMI>27.5 is found to be a significant risk factor for conversion to open surgery according to the present study. (p=0.03).
This is in accordance with J. S. Randhawa, A.K.Pujahari et al They encountered significant difficulty with BMI>27.5(p=0.010).
According to Liu et al(44), Gurkanyetkin et al[22] (p=0.024), Rosen et al[43](p=0.02), BMI>30 was a significant predictor of difficult laparoscopic cholecystectomy.
❖ Hussein et al (39) and The odoros et a/42 > found obesity as a significant risk factor for difficulty during LC, as the increased fat in Calot's triangle made dissection more difficult in these patients.In Fried et a/37), obese group had conversion rate of 6.2%, compared to the overall conversion rate of 5.4%
Explanations for higher conversion rate in the obese group may include difficult trocar placement, obscured anatomy because of excessive intra-peritoneal fat, inability to retract the liver sufficiently and difficulty with instrument manipulation through excessively thick abdominal walls.

PREVIOUS UPPER ABDOMINAL SURGERY:
In this study, 5 patients have upper abdominal scar, of these 3 patients in LC completed group, 2(40%) in converted group. 159 patients have no upper abdominal scar, of these 143 patients in LC completed group, 16(10.06%) in converted group.

Table: 17 COMPARISON STUDIES BASED ON PREVIOUS UPPER ABDOMINAL SURGERY

	Present study n=164	Akyurak et al[24] (2005) n=600	Kama et al [27] (2001) n=1000	Randhawa, Pujahari et al[14] (2009) n=228

H/o previous upper abdominal surgery	P=0.09 Not Significant	P<0.05 Significant	P<0.001 significant	P=0.882 Not significant

- ❖ History of previous upper abdominal surgery is not found to be a significant risk factor for conversion to open surgery according to the results of this study. (p=0.09)
- ❖ These findings were in agreement with J. S. Randhawa, A.K.Pujahari et al, Yu Sc. et at who concluded that lap cholecystectomy can be performed safely in patients with previous upper abdominal surgery. Whereas it is contrary to the results of Akyurak N. et al[24]Kama et al[27]and Karayiannakis et.al[29]. They found previous upper abdominal surgery poses problems in creating pneumoperitoneum and the need for adhesiolysis to gain adequate access to the operative field.
- ❖ Indication for previous upper abdominal surgery (emergency/ elective) is also important in deciding conversion as surgeries done in emergency situation results in more adhesions.

COMORBIDITY:

In this study, patients with comorbidity are 50, of these 42in LC completed group. 8(16%)in converted group, patients without comorbidity are 114, of these 104 in LC completed group. 10(8.77%)in converted group.

P value according to Fischer's test is 0.2. which is not statistically significant.

This study observed that co-morbid illnesses did not increase the incidence of conversion significantly(p=0.25).

Vander Steeg et al and S. Alexander et al reported that Co-morbidity was found to be a predictive factor for conversion in their univariate analysis, however not in the multivariate analysis. Some authors showed that diabetes mellitus is associated with an increased conversion rate of 18-30%[51,52], but this finding has not been reported consistently[53 54 55]. The reason for the greater conversion rate in this group of patients is unclear. One explanation may be the presence of more severe inflammation among diabetic patients with acute cholecystitis compared with nondiabetics.[56] Because of autonomic and peripheral neuropathy, some diabetic patients may not develop symptoms of gallbladder disease until later in the course of their illness. This may lead to delayed diagnosis, which can result in more advanced disease and a greater risk for conversion[57]. Other factors as cardiovascular disease and hypertension have given variable results[51 55 58]

LEUCOCYTOSIS

In this study, 17 patients are with elevated WBC, out of these 12 in LC completed group. 5(29.41%) in converted group.147 patients with normal WBC, out of these 134 in LC completed group. 13(8.84%) in converted group.

Table: 18 COMPARISON STUDIES BASED ON LEUCOCYTOSIS

	Present study n=164	**Simopoulus[47] (2005) n=300**	**Lipman[48] (2007) n=500**
Leucocytosis	P=0.02 Significant	P<0.04 Significant	P<0.003 Significant

P value according to Fischer's test is 0.02. Which is statistically significant.

This study observed that leucocytosis increase the incidence of conversion significantly (p=0.03).

The association between an elevated WBC and conversion has been reported previously[47,48]. This parameter likely reflects the inflammatory response associated with more acute diseases and is more commonly present with acute cholecystitis. Leucocytosis as a result of acute gall bladder inflammation have been shown to be risk factor for conversion[47,48.]

ABNORMAL LIVER FUNCTION TEST:

Among 164 patients in this study, 15 patients are with abnormal LFT, of these 5(33.3%) converted to OC. 149 patients are with normal LFT, 13(8.72%) in converted group.

Table: 19 COMPARISON STUDIES BASED LFT

	Present study n=164	**Simopoulus[49] (2005) n=300**	**Schrenk P[50] (1998) n=1000**
Hyperbilirubinemia	P=0.02 Significant	P<0.02 Significant	P<0.004 Significant

P value according to Fischer's test is 0.02. which is statistically significant.

This study observed that abnormal liver function tests predicted conversion to open cholecystectomy. (p=0.02)

An elevated bilirubin has been previously recognized as a significant predictor of conversion to open cholecystectomy in acute cholecystitis[49,50]. We have found that it is predictive of conversion for patients with both acute and chronic cholecystitis. Hyperbilirubinemia is most likely a marker for inflammation in this setting rather than an indicator of biliary obstruction. Elevated bilirubin may increase the probability of conversion.[49]

ULTRASOUND FINDINGS:

In this study, 52 patients are with thickened gall bladder wall, of these 10(19.23%)patients in converted group. 112 patients with normal GB wall thickness, of these 8(7.14%) in converted group.

Table: 20 COMPARISON STUDIES BASED ON GALL BLADDER WALL THICKNESS

	Present study n=164	**Rosen et al[43] (2002) n =1347**	**Randhawa, Pujahari et al[14] (2009) n=228**	**Gabriel et al[10] (2005) n=234**
GB wall thickness	>4mm	>4mm	>4mm	>3mm
P VALUE	0.03 Significant	<0.001 Significant	0.038 Significant	<0.05 Significant

- ❖ P value according to Fischer's test is 0.03. Which is statistically significant.
- ❖ This study showed that USG abdomen finding of increased GB wall thickness > 4mm is found to be a significant risk factor for conversion to open surgery(p=0.01).
- ❖ This is in support to studies by J. S. Randhawa, A. K. Pujahari et al[14], Liu et al[44], Daradekh et al[(21)], Alponat et al[(36)], Kama et al[27], Rosen et al [(43)]. Increase in Gall bladder wall thickness had resulted in difficulty in dissection of gall bladder in all these studies.
- ❖ Daradekh et al[21] explained, GB wall thickness is related to the inflammation or fibrosis that follows previous attacks of cholecystitis.

CONCLUSION

From the above study it is concluded that the need for conversion to laparotomy is neither a failure nor a complication, but attempt to avoid complications. Difficult in LC can be fairly predicted based on a composite system comprising simple history taking, analysis of laboratory reports & imaging of the hepato-biliary system. This may allow the patients to be better prepared for surgery. Also, such prediction may allow a surgeon to be better prepared, to take extra precautions to reduce intra-operative complications, and to convert from LC to OC at an earlier stage The Operating surgeons could successfully predict the conversion in 36% patients only without formal scoring system, which increased to 86% on basis of these factors. In this study the following factors are identified as significant risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy.

i. Advanced age (>60 years)
ii. Obesity (BMI>27.5kg/m2)
iii. Leucocytosis
iv. Abnormal liver function tests
v. USG findings

Thickened gall bladder wall > 4mm

Not significant risk factors -

1. Gender
2. Previous upper abdominal surgery
3. Comorbidities

In patients with these risk factors, management can be improved by

i. Preoperative counselling of the patient regarding these risk factors and high chances of conversion.
ii. Early conversion to open cholecystectomy.

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