

**DISSERTATION ON**

**Study on preoperative predictors of difficult laparoscopic  
cholecystectomy using clinico-sonographic scoring in Government  
Vellore Medical College and Hospital**

*Submitted to*

**Tamil Nadu Dr. M.G.R MEDICAL UNIVERSITY**

*With fulfilments of the regulations for the award of*

**MS DEGREE GENERAL SURGERY**

**BRANCH-I**



**GOVERNMENT VELLORE MEDICAL COLLEGE AND**

**HOSPITAL**

**VELLORE**

**MAY 2020**

## DECLARATION BY THE CANDIDATE

I solemnly declared that the dissertation titled “**Study on preoperative predictors of difficult laparoscopic cholecystectomy using clinico-sonographic scoring in Government Vellore Medical College and Hospital**” was done by me at Government Vellore Medical College and Hospital, Vellore during the period of January 2019 to September 2019 under the guidance and supervision of **Prof. Dr. D LOGANATHAN, M.S., DA.**, and co-guide **Dr. K.V. SARAVANAN, M.S.** The dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University towards the partial fulfilments for the requirement for the award of **M.S. DEGREE IN GENERAL SURGERY, BRANCH-I**

Place:

Date:

Dr. JERINA K MARAK

Post Graduate

MS General Surgery

Government Vellore Medical College & Hospital

Adukkamparai-632011

## CERTIFICATE BY THE GUIDE

This is to certify that this dissertation entitled, “**Study on preoperative predictors of difficult laparoscopic cholecystectomy using clinico-sonographic scoring in Government Vellore Medical College and Hospital**” is the bonafide original work of Dr. JERINA K. MARAK in partial fulfillment for the requirement of M.S. Branch-I (General Surgery) examination of the Tamil Nadu Dr. M.G.R. Medical University to be held in May 2020. the period of study was from January 2019 to September 2019.

Place : Vellore

Date :

Dr.K.V.SARAVANAN , M.S.

Senior Assistant Professor

Department of General Surgery

Government Vellore Medical College & Hospital

Adukkamparai-632011

**CERTIFICATE BY THE HEAD OF DEPARTMENT OF  
GENERAL SURGERY**

This is to certify that this dissertation entitled, “**Study on preoperative predictors of difficult laparoscopic cholecystectomy using clinico-sonographic scoring in Government Vellore Medical College and Hospital**” is the bonafide original work of **Dr. JERINA K. MARAK** in partial fulfillment for the requirement of M.S. Branch-I (General Surgery) examination of the Tamil Nadu Dr. M.G.R. Medical University to be held in May 2020. The period of study was from January 2019 to September 2019.

Place : Vellore

Date :

Dr. D. LOGANATHAN, MS, DA

Head of Department

Department of General Surgery

Government Vellore Medical College &

Hospital

Adukkamparai- 632011

## **CERTIFICATE BY THE HEAD OF INSTITUTION**

This is to certify that this dissertation entitled, **“Study on preoperative predictors of difficult laparoscopic cholecystectomy using clinico-sonographic scoring in Government Vellore Medical College and Hospital”** is the bonafide original work of Dr. JERINA K. MARAK in partial fulfillment for the requirement of M.S. Branch-I (General Surgery) examination of the Tamil Nadu Dr. M.G.R. Medical University to be held in May 2020. the period of study was from January 2019 to September 2019.

Place : Vellore

Date :

Dr. R. SELVI, M.D.

DEAN

Government Vellore Medical College & Hospital

Adukkamparai- 632011

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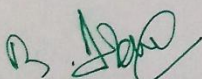
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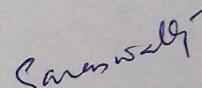
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- Guide** - Dr.D.Loganathan, MS  
Professor of General Surgery

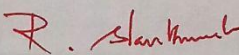
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The Principal Investigator is instructed to submit the status of this project periodically to this College Office.

  
**Member Secretary**  
**MEMBER SECRETARY**  
Institutional Ethics Committee  
Government Vellore Medical College & Hos  
Vellore-632 011.

  
**Chairperson**

  
**Convenor**  
**Dean**  
Govt. Vellore Medical College, Vellore  
**DEAN**  
GOVERNMENT VELLORE MEDICAL COLLEGE,  
VELLORE - 11.

Dr. Radha Saraswathy, Ph.D., FIMSA  
Senior Professor  
120TT Biomedical Genetics Research Lab  
Dept of Biomedical Science  
School of Biosciences & Techno  
Vellore Institute of Technolog  
Vellore - 632 014  
(Deemed to be University under section 3 of the UGC Act, 1956)



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# **INTRODUCTION**

## INTRODUCTION

The first open cholecystectomy was performed in Berlin by Carl Langenbuch in 1882. The first two laparoscopic cholecystectomies were performed by Eric Muhe and Philippe Mouret in 1985 and 1987 respectively.

Symptomatic cholelithiasis remains the main indication for elective laparoscopic cholecystectomy. By 1990, 10% of the cholecystectomies were performed which have raised to 90.5% by 2010. LC in acute cholecystitis may be significantly more difficult with conversion rate of 5-10% depending on experience of the surgeon. Early surgeries has been associated with reduced risk of mortality, fewer bile duct injuries and lesser conversion rates when compared to delayed cholecystectomy. Preferably surgery should be performed 72 hrs after onset of surgery. Non operative management with a plan for delayed surgery often fails in about 15% patients due to recurrence, pancreatitis or cholangitis.(1)

Complications of laparoscopic cholecystectomy includes trocar/veress needle injury, haemorrhage, wound infection/ abscess, ileus, bile

leak, gall stone spillage, deep vein thrombosis, retained common bile duct stone, CBD injury/stricture, pancreatitis and conversion to open.

The major advantages of laparoscopic cholecystectomy was improved recovery, less pain, better cosmesis and faster recovery which allowed patients to have better quality of life in the immediate postoperative time.

However, some cases are converted to open cholecystectomy, the most frequent indications being dense upper abdominal adhesions, necrotic gallbladder that preclude grasping and elevation with a grasper, lack of adequate exposure, or difficult dissection. Risk factor for conversion include male gender, obesity, cholecystitis (especially after 48 to 72 hrs after the onset of symptoms), and choledocholithiasis. Conversion to open cholecystectomy is associated with increased risk of morbidity, pulmonary and surgical site infections, pain, slower recovery, longer hospital stay and longer time in resuming the normal daily activities.

Ultrasound abdomen is a non-invasive screening test for cholelithiasis with the accuracy of 96% in detecting gallbladder calculi. Hence, few ultrasonographic parameters along with clinical parameters may be taken into consideration to predict the difficult laparoscopic cholecystectomy. This will help in appropriate planning, avoid prolonged surgeries or even

conversion to open cholecystectomy and its complications for the benefits of the patient and surgeon.

“this study aims to predict difficult laparoscopic cholecystectomy using clinico-sonographic parameters.”

# **AIMS AND OBJECTIVES**

## AIMS AND OBJECTIVES

1. The aim of this study is to preoperatively predict difficult laparoscopic cholecystectomy by using clinico-sonographic parameters.

(a) Ultrasound scoring for the following factors:

1. Gall bladder status
2. Pericholecystic collections
3. Number of gallbladder stones
4. Size of gallbladder stones
4. Impacted stones
5. Gall bladder wall thickness

(b) Age, sex, BMI, palpable gallbladder, previous surgery.

2. To correlate the clinico-sonographic scoring with intraoperative findings

# **REVIEW OF LITERATURES**



## **REVIEW OF LITERATURE**

### **EMBRYOLOGY OF GALLBLADDER AND BILE DUCTS:**

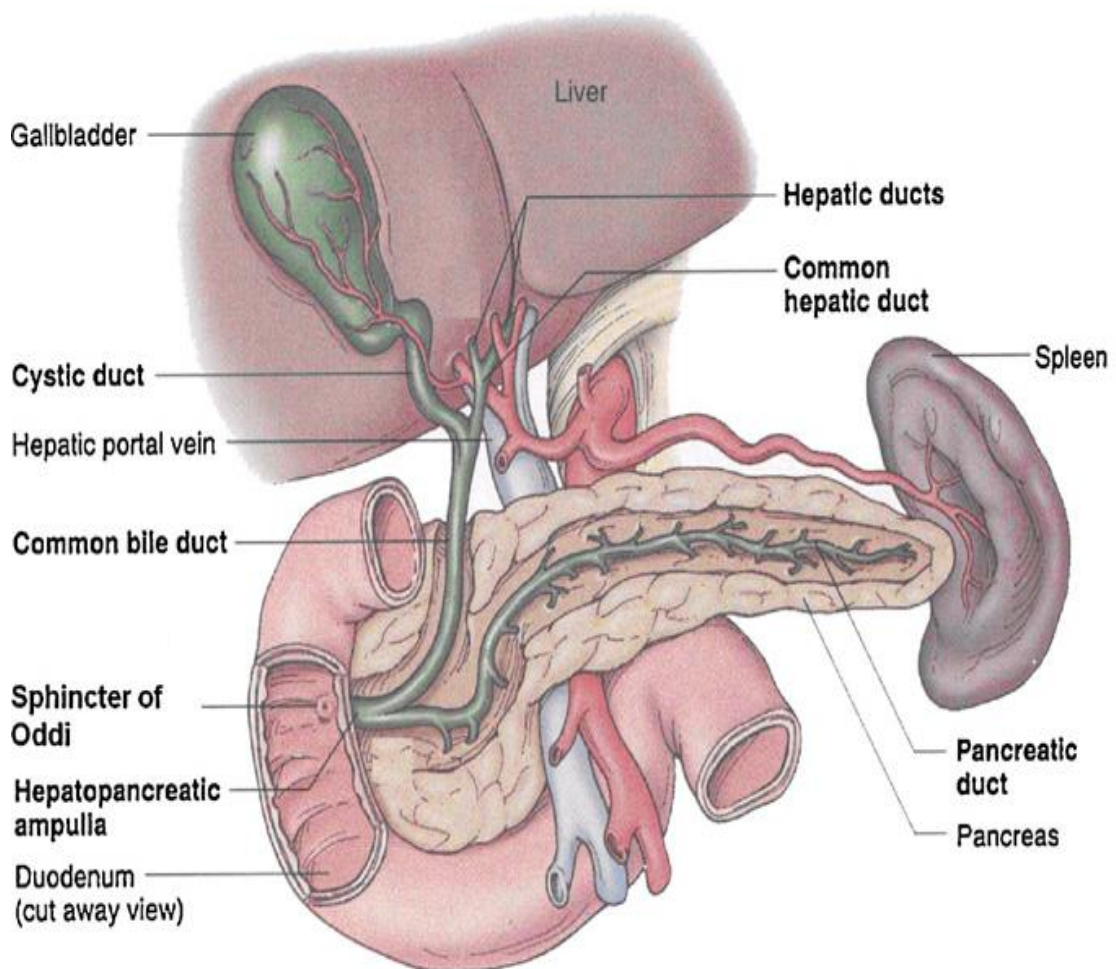
By 4<sup>th</sup> week of gestation, the ventral wall of the foregut gives rise to the hepatic diverticulum which then elongates to form choledocus. Gallbladder and cystic duct develops from the lateral wall of choledocus. The embryonic hepatic duct forms the canaliculi between the liver cells. Hyperplasia of these embryonic cells causes obliteration of lumina normally which the recanalizes subsequently to conduct biliary flow by the end of 5<sup>th</sup> week. Failure to recanalize contributes to the pathophysiology of biliary atresia.

### **ANATOMY OF GALL BLADDER:**

Gallbladder is a pear-shaped organ, which lies on the inferior surface of liver, beneath the main scissura of the liver. Gall bladder lies on the cystic plate which is the part of perihilar system which arises from Glisson's capsule. This plate is in continuity with the hilar plate of segment IV, separates gallbladder from liver(2). There is a variation in relationship

between the liver and GB. It is a peritoneal organ which is sometimes embedded within the liver or suspended in the mesentery.

Gall bladder has normal capacity of about 25ml to 30ml. It is about 7.5 to 12cm long.(2)



Anatomically, Gallbladder is divided into:

- Fundus
- Body
- Infundibulum with Hartmann pouch
- Neck

In the wall of gallbladder, muscle fibres are arranged in criss-cross manner, which are well developed in the neck region.

The mucosal surface contains indentations, which are called crypts of Luschka.

#### CYSTIC DUCT:

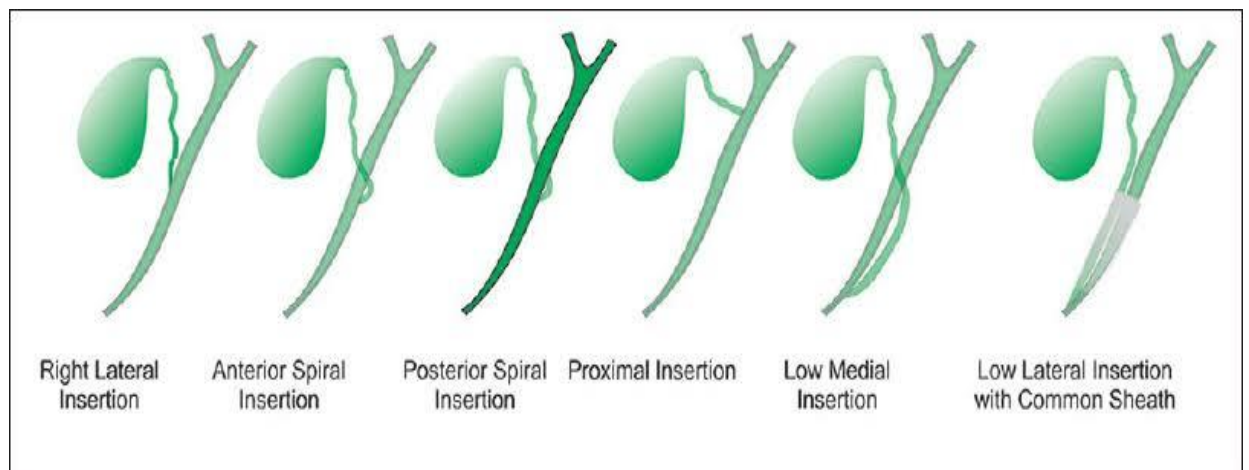
Cystic duct drains the Gallbladder, arises from the infundibular part, which then joins the common hepatic duct to form common bile duct. It is about 3 cm in length with the luminal diameter of about 1-3mm.

Variation in length ranges from 1-5cm. Its drains at an acute angle into the CBD. There are anatomical variations in the insertion of cystic duct.

Within the cystic duct and neck of gallbladder, the mucosa is oriented in

5-12 spiral folds. These are known as valves of Heister, which prevents gallstones from reaching into the CBD. The wall is surrounded by the sphincter known as 'sphincter of Lutkens'.

Variations in the anatomy of cystic duct:(2)



*fig: Anatomical variations of Cystic duct*

#### HEPATIC DUCT:

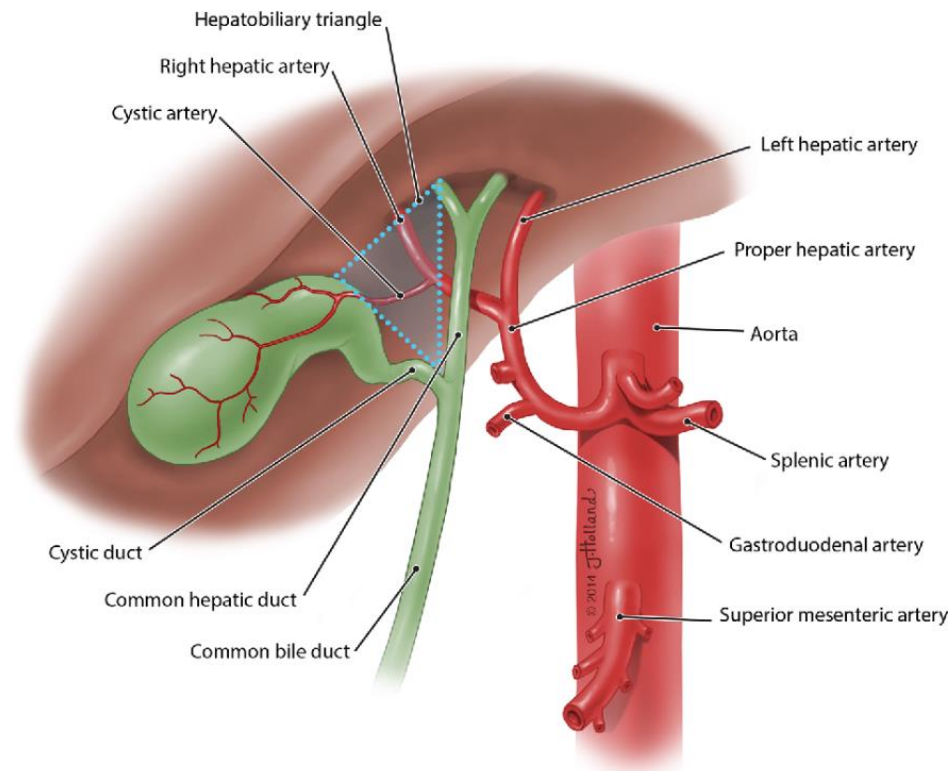
Right and left hepatic ducts joins to form common hepatic duct, the confluence of which lies above the hilar plate. Common hepatic duct measures less than 2.5 cm long, joined by cystic duct supra duodenal in 80% of cases.

## COMMON BILE DUCT:

Formed by common hepatic duct and cystic duct. Measure about 7.5cm long. It runs anterolateral to the portal vein and hepatic artery. Then it descends posterior to the first part of duodenum along with gastroduodenal artery on its left, to lie in the groove on the superolateral aspect of the head of pancreas to finally enter the second part of duodenum. Intraduodenally, it is surrounded by the sphincter of Oddi, which opens at the summit of the ampulla of Vater.

## CALOT'S TRIANGLE

Described by Jean Francois Calot(2) , also known as hepatobiliary triangle, is a triangular space bordered inferiorly by cystic duct, superiorly by inferior surface of liver and medially by common hepatic duct. It is an important surgical landmark during cholecystectomy, since it contains branching of cystic artery from right hepatic artery which is at great risk during surgery. Most of the aberrant form of right hepatic ducts and arteries are usually encountered in this triangle, the most dangerous anomaly being the tortuous course of hepatic artery known as 'caterpillar turn' or 'Moynihan's hump'(3) which cause many problems during cholecystectomies.



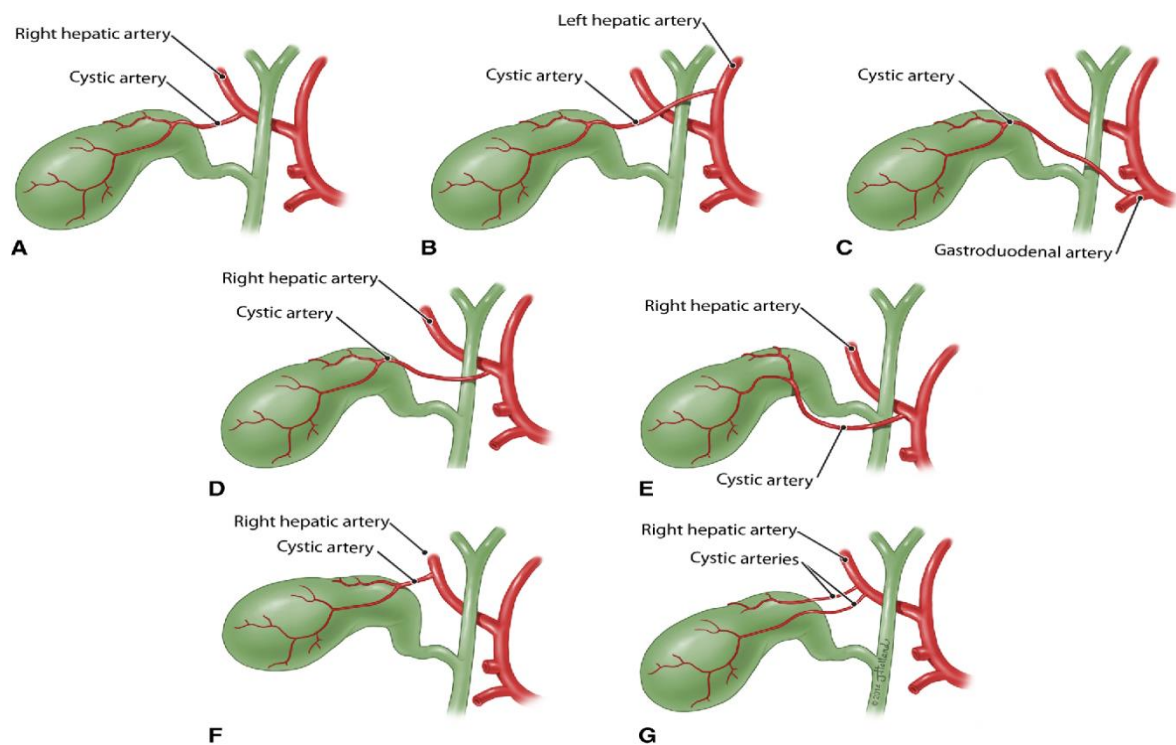
*fig: Calot's triangle*

Contents of Calot's triangle:(4)

- Cystic artery
- Right hepatic artery
- Calot node- cystic lymph node of Lund
- Lymphatics from GB

## BLOOD SUPPLY OF GALLBLADDER:

Cystic artery supplies the gallbladder. It is a branch of right hepatic artery and traverse superior to the cystic duct. However, like cystic duct there are variations from which the cystic artery arises and its course. It may arise from right hepatic artery, left hepatic artery, common hepatic artery, proper hepatic artery, gastroduodenal artery or directly from superior mesenteric artery. Sometimes, an accessory cystic artery may supply GB which may arise from common hepatic artery. Cystic artery often bifurcates close to its origin to supply the GB. Besides cystic artery, GB is additionally supplied by multiple fine branches from liver parenchyma.



*fig: anatomical variation of cystic artery*

### VENOUS DRAINAGE:

Cystic veins drains Gallbladder. They drain into the segmental portal veins or directly into the liver parenchyma.

### LYMPHATICS:

Gallbladder drains into the cystic lymph node of Lund which is the sentinel node and lies in the confluence of cystic and common hepatic ducts. The node drains into the hilum of the liver then to the coeliac nodes.

### INNERVATION:

The gallbladder along with extra-hepatic biliary tree are innervated by hepatic plexus. Pyloric branch of vagus innervates some part of the retro duodenal common bile duct and the smooth muscles of the ampulla.

### SURGICAL PHYSIOLOGY:

Liver produce bile which is store in the gall bladder and release to duodenum. Bile is excreted at the rate of 40ml/hour (800-1200ml/day). It



is made up of bile salts, phospholipids, cholesterol, bilirubin and 97% water.

#### **FUNCTIONS OF GALLBLADDER:**

1. Reservoir for bile
2. Bile concentration by active absorption of water, NaCl, HCO<sub>3</sub> by mucous membrane of GB.
3. Mucus secretion of about 20ml/day.(5)

#### **CHOLELITHIASIS (GALLSTONES)**

is the most common biliary pathology affecting about 10-15% of the western population. More than 80% cases are asymptomatic. 1-2% patients are symptomatic requiring cholecystectomy.(6)

#### **PATGOPHYSIOLOGY OF GALLSTONES:**

Gallstones are subclassified into: ( depending on the solute that precipitate into stones)

- Cholesterol stone

- Pigment stone
- Mixed stones(6)

In United states and European countries, 70-80% are cholesterol or mixed stones. In Asian countries, pigment stones accounts for more than 80%.

Cholesterol or mixed stones are formed by pure cholesterol with/ without admixture of calcium stones, bile pigments, bile acids and phospholipids.

Pigment stones, on the other hand, are classified into black or brown stones, are formed by precipitation of concentrated bile pigments.

Factors which explains the formation of gallstones:

- Supersaturation of the secreted bile
- Crystal nucleation
- Bile concentration in GB
- Dysmotility of gallbladder

Precipitating factors includes

- Hypercholesterolaemia, with high concentration of cholesterol and lipid in bile secretions. This predisposes to formation of cholesterol stones.
- Increased processing of haemoglobin and its breakdown products causes pigment stones.

Bile salts helps in solubility of cholesterol. The normal ratio of bile salts to cholesterol is 25:1. Ratio below 13:1 leads to inadequate bile salts for maintaining the solubility of cholesterols. This leads to precipitation and crystallisation of insoluble cholesterols, hence forming cholesterol stones.

When crystallisation is accelerated by glycoproteins and immunoglobulins, it is called nucleation.

Abnormal GB motility further leads to stasis which enables more time for solutes to precipitate, leading to supersaturation and crystallisation and stone formation. Abnormal GB motility is seen in prolonged fasting, parenteral nutrition, and vagotomy.

Pigment stones- black stones are associated with haemolytic conditions and cirrhosis, brown stones are made up of calcium

bilirubinate, palmitate and stearate and cholesterol. They are formed due to bile stasis and more commonly associated with luminal foreign bodies, endoprosthesis and infections-most common infections being E.coli, Salmonella and parasites like *Ascaris lumbricoides*, *Clonorchis sinensis*.(7)

#### CLINICAL PRESENTATION OF GALLSTONES:

They are most commonly asymptomatic and their identifications are coincidence during abdominal imaging. Symptoms usually appears once there is obstruction to the biliary outflow from the gallbladder like cystic duct obstruction. This produce biliary colic which tend to occur mostly after meals due to cholecystokinin secretion stimulating gallbladder contraction. Manifestation is usually right upper quadrant or epigastric pain with or without radiation to back usually describes as colicky associated with nausea and vomiting, dyspepsia, flatulence and intolerance to fatty food. Patients, may at times, present with jaundice if there is common bile duct obstruction. Rarely, gallstone ileus can cause bowel obstruction.

## EFFECTS AND COMPLICATIONS:

- Biliary colic
- Acute and chronic cholecystitis
- Gallbladder empyema, mucocele
- Gallbladder perforation
- Common bile duct obstruction,
- Acute cholangitis
- Acute pancreatitis
- Intestinal obstruction due to gallstone ileus,
- Cholecysto duodenal fistula
- Gallbladder malignancy
- Mirizzi syndrome due compression of CBD by stone in cystic duct

## DIAGNOSIS:

Diagnosis is made based on history, clinical examination and confirmatory radiological imagings.

## Radiological Investigations:

### Plain Xrays:

Radio opaque gallstones are visible in 10% of patients. The centre of the stone may contain air in triradiate or biradiate fissure giving rise to Mercedes-Benz or seagull sign. GB wall calcification or porcelain gallbladder are detected in plain Xrays, and are associated with high risk of malignancies. Emphysematous cholecystitis may be detected in plain radiographs as gas in wall of gallbladder.



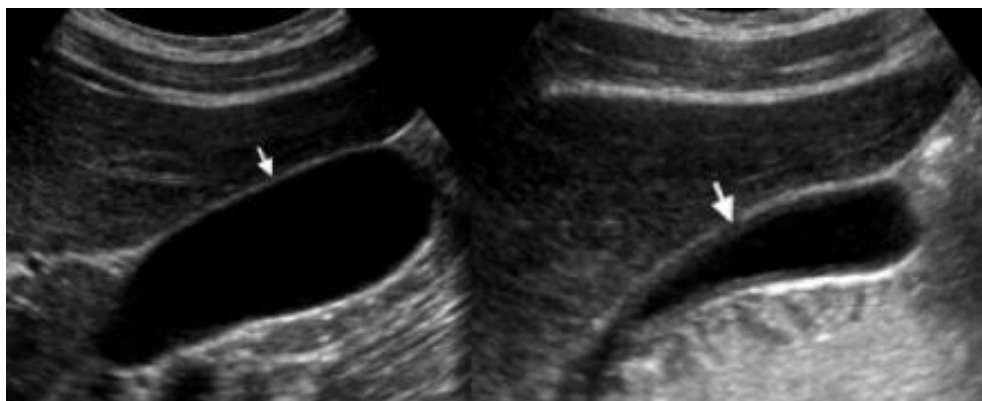
*Fig: multiple radio opaque gall stones sacked in Gallbladder.*

### Transabdominal ultrasound:

It is sensitive, reliable, cheap and reproducible test and is the modality of choice to initially evaluate the hepatobiliary tree. However it is operator dependent. Biliary calculi, gallbladder dimensions, its wall thickness, any pericholecystic collections, dimensions of biliary tree and occasionally choledocholithiasis can be demonstrated by transabdominal Ultrasound due to its relatively superficial location with no overlying bowel gas. Gallstone density produce reverberation of the sound waves, which produce posterior acoustic shadowing behind. Non-impacted GB stones moves freely with positional change, hence can be rule out from other masses like fixed polyp, sludge which also do not produce same echogenicity like GB stones. Ultrasound also helps in delineating between medical and surgical (obstructive) jaundice. Colour doppler can demonstrate twinkling artifact and is useful in identifying small stones. In transabdominal grey scale ultrasound, posterior acoustic shadowing are better demonstrated when stone size is  $>3\text{mm}$ , with higher transducer frequency; paradoxically, gallbladder full of stones may be hard to visualised- this is known as wall echo sign.(8)



*Fig: ultrasonographic demonstration of Gallstone with posterior acoustic shadowing.*



*Fig: gall bladder wall normal vs. thickening*





*Fig: pericholecystic fluid collection*

### COMPUTED TOMOGRAPHY:

Allows visualisation of whole hepato-biliary system, and important in demonstrating hepatic and pancreatic lesions. It is the modality of choice in staging of hepatic malignancies, gall bladder malignancies, cholangiocarcinoma and pancreatic malignancies. It allows 3D reconstruction of whole hepato-biliary system and helps in accuracy of diagnosis. In non-contrast CT abdomen, pure cholesterol stones are hypoattenuating to bile while calcified stones are hyperattenuating.

However some stones maybe isodense to bile and are difficult in detection.

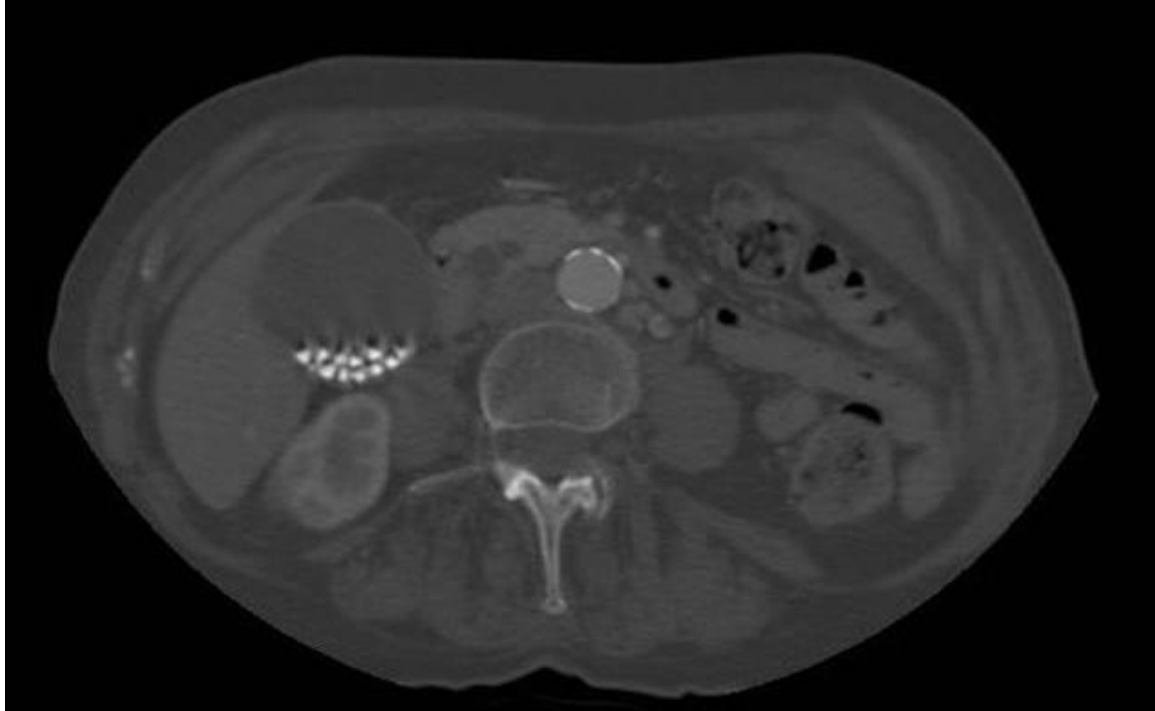


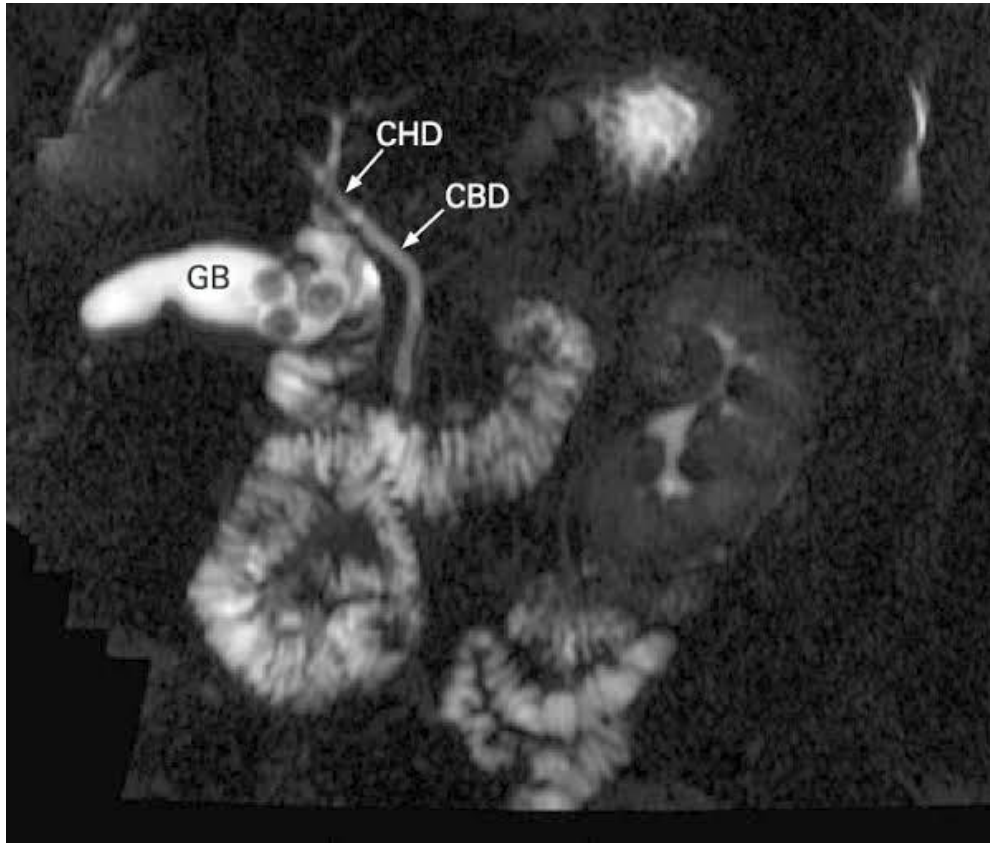
Fig: multiple hyperintense gallstones within gallbladder

Magnetic Resonance Imaging:

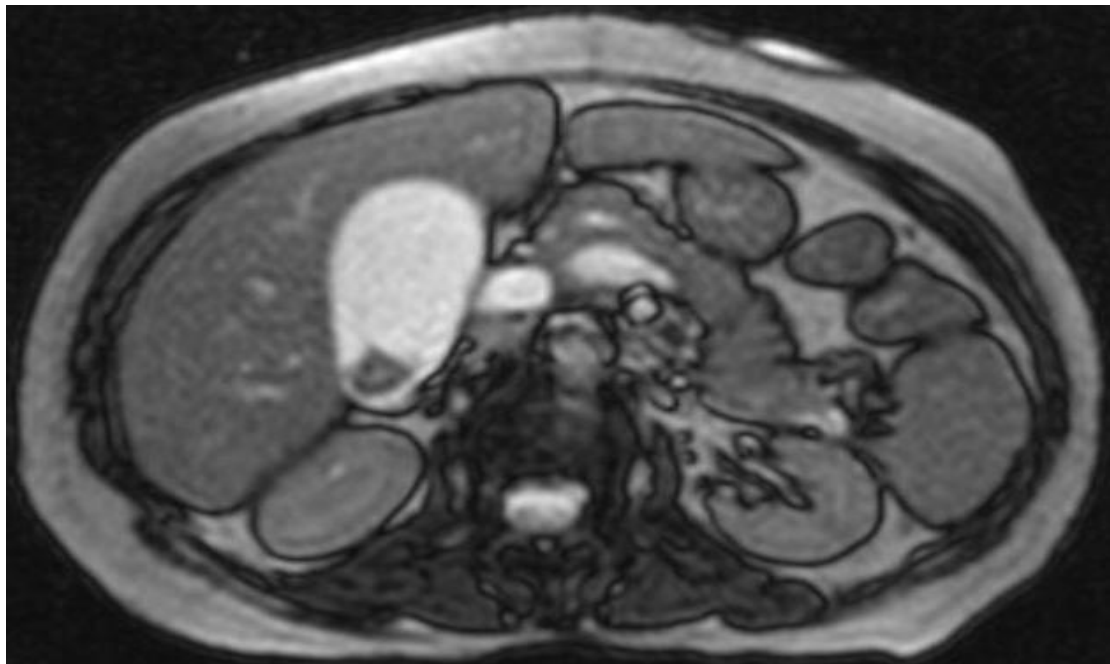
T2 sequence: stones are demonstrated as voids surrounded by hyperintense bile within the gallbladder.

Magnetic Resonance Cholangiopancreatography: it can demonstrate whole biliary tree, any obstruction by stones, strictures or malignancies.

Gallstones or CBD stones are seen as void surrounded by hyperintense bile



*fig: MRCP with multiple GB Calculi*



*fig: gallstone demonstrated as void with hyperintense bile. (T2 sequence)*

## **MANAGEMENT OF CHOLELITHIASIS:**

Asymptomatic cholelithiasis are identified during abdominal imaging and only 1% of them went complications of their stones. Hence prophylactic cholecystectomy is not advisable in asymptomatic cases.

Non operative management of gallstones is unsuccessful and rarely used. Options are dissolution stone with bile salt therapy, extracorporeal shockwave lithotripsy.

## **SURGICAL MANAGEMENT OF CHOLELITHIASIS:**

### **LAPAROSCOPIC CHOLECYSTECTOMY:**

With advancement in laparoscopic surgery, laparoscopic cholecystectomy has become the procedure of choice in the management of cholelithiasis owing to its smaller incision, minimal pain, faster recovery, better cosmesis and shorter hospitalisation.

#### Indications of cholecystectomy:

- Symptomatic cholelithiasis:

Biliary colic is the most common indication for laparoscopic cholecystectomy, with 80% chance for having persistent symptoms

throughout the life. It also increases the risk of acute cholecystitis, choledocholithiasis, gallstone pancreatitis.

- Asymptomatic cholelithiasis

Less than 1% of asymptomatic cases have chances of developing symptoms and complications. The prophylactic laparoscopic cholecystectomy is indicated in haemolytic diseases, patients on total parenteral nutrition, biliary dyskinesia, immunosuppression, gallbladder polyp, porcelain gallbladder.

### CONTRAINDICATIONS OF LAPAROSCOPIC

#### CHOLECYSTECTOMY:

Absolute contraindications in

- Inability to tolerate general anaesthesia
- Gallbladder malignancy
- Coagulopathies

Relative contraindications in

- Peritonitis
- Previous upper abdominal surgeries
- Cholangitis

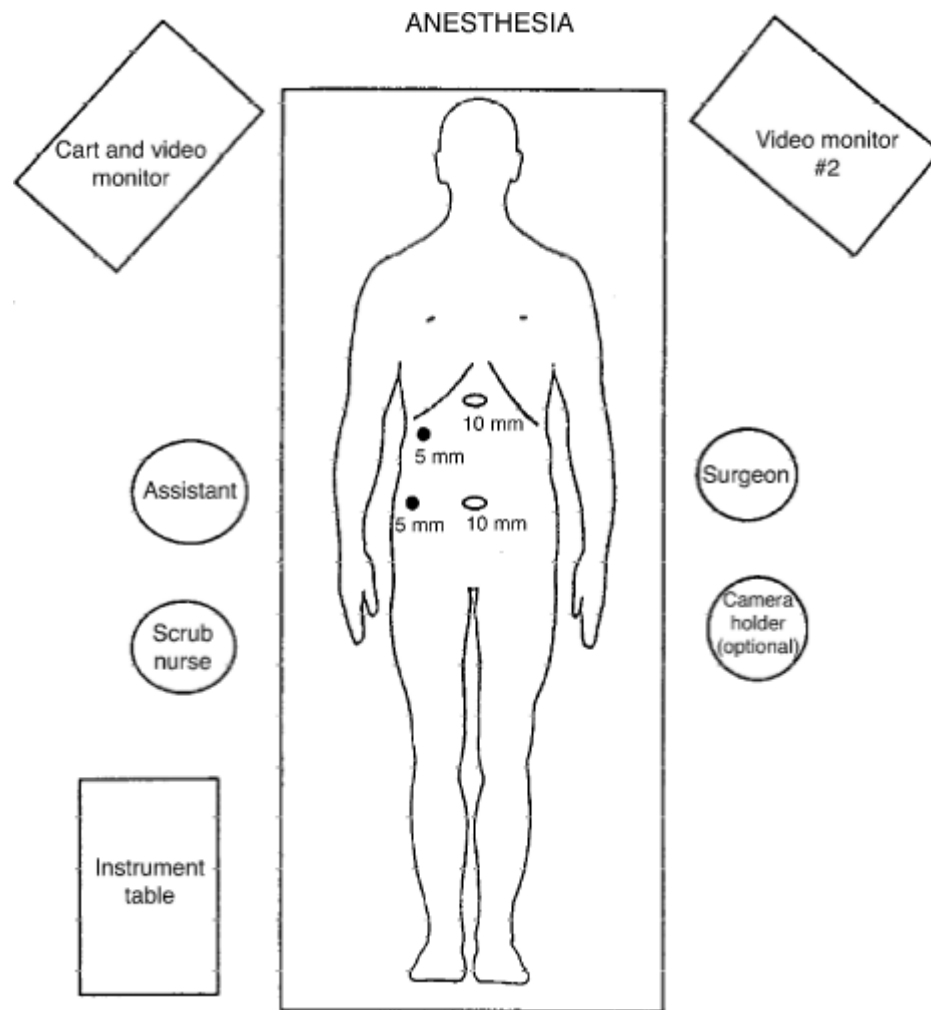
- COPD
- Morbid obesity

### **LAPAROSCOPIC CHOLECYSTECTOMY PROCEDURE:**

Recruitment of good operating team is important and first step to successful surgery.

The good team includes:(4)

- well-trained laparoscopic surgeon
- A first assistant with equivalent skills
- A skilled camera operator



*fig:Room set up for laparoscopic cholecystectomy*

Equipments for laparoscopic cholecystectomy:

- Videolaparoscope with a 300W light source coupled to high resolution monitor.
- High flow CO<sub>2</sub> insufflator
- Four trochars- 10mm or 12mm trochars and 5mm trochars

- Laparoscopic hand instruments:
  - Monopolar electrode L-hook
  - Fine tipped Maryland dissector
  - Graspers
  - Scissor
  - Clip applicators

Surgery is performed under general anaesthesia. Nitrous oxide are avoided to minimize bowel distension.

### **Surgical technique:**

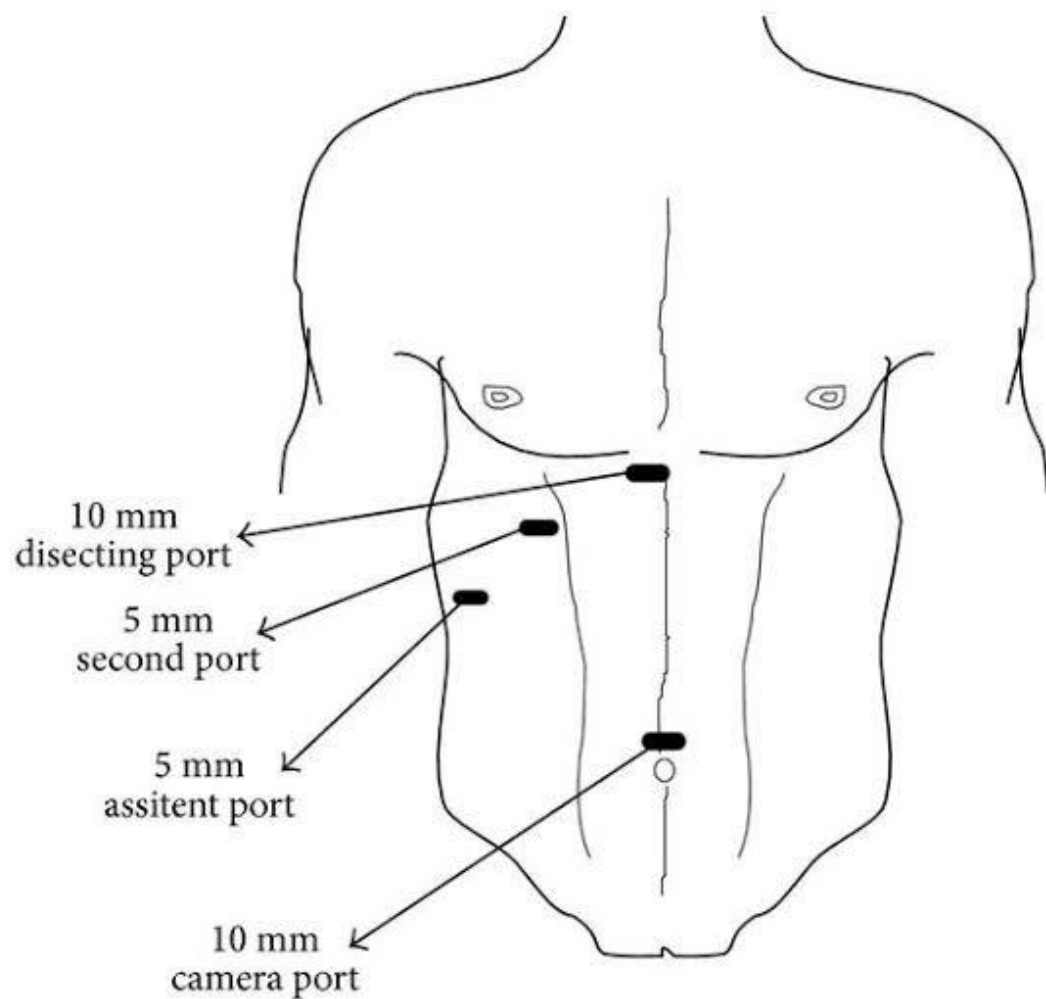
Pneumoperitoneum is created with carbondioxide at 15mmHg pressure (9) via Veress needle through umbilical incision. Flow rate is maintained at 2-3L/min. Intraabdominal position of Veress needle is confirmed by uniform distension of abdomen, tympanic note.



Another method for creating pneumoperitoneum is by Hasson cut down technique., which is an open technique where the abdominal cavity is entered under vision.

#### Trocar placement:

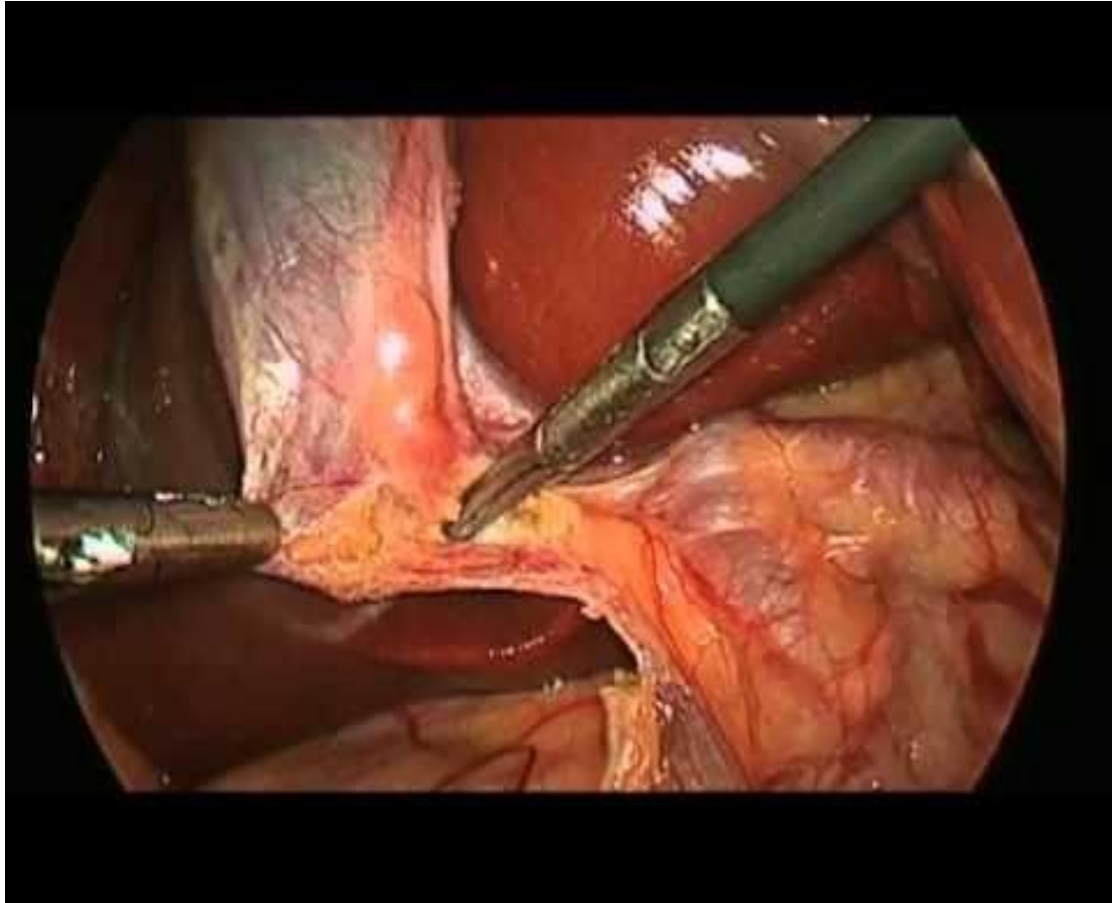
After establishing pneumoperitoneum, first trocar (10mm or 12mm) is placed supra umbilically. Trocars are placed with controlled twisting movement. Plunging movements should be avoided to prevent injury to intraperitoneal structures. 5-10mm telescope is passed through the primary trocar. 30<sup>0</sup> scope provides a better view of the Calot's triangle(4), posterior wall of gallbladder and common bile duct. Another 10mm trocar is placed at epigastrium angled towards the gallbladder. Next 5mm trocar is inserted at 2-3cm below costal margin at midclavicular line. Last 5mm trocar is usually place at anterior axillary line below the fundus of gallbladder.



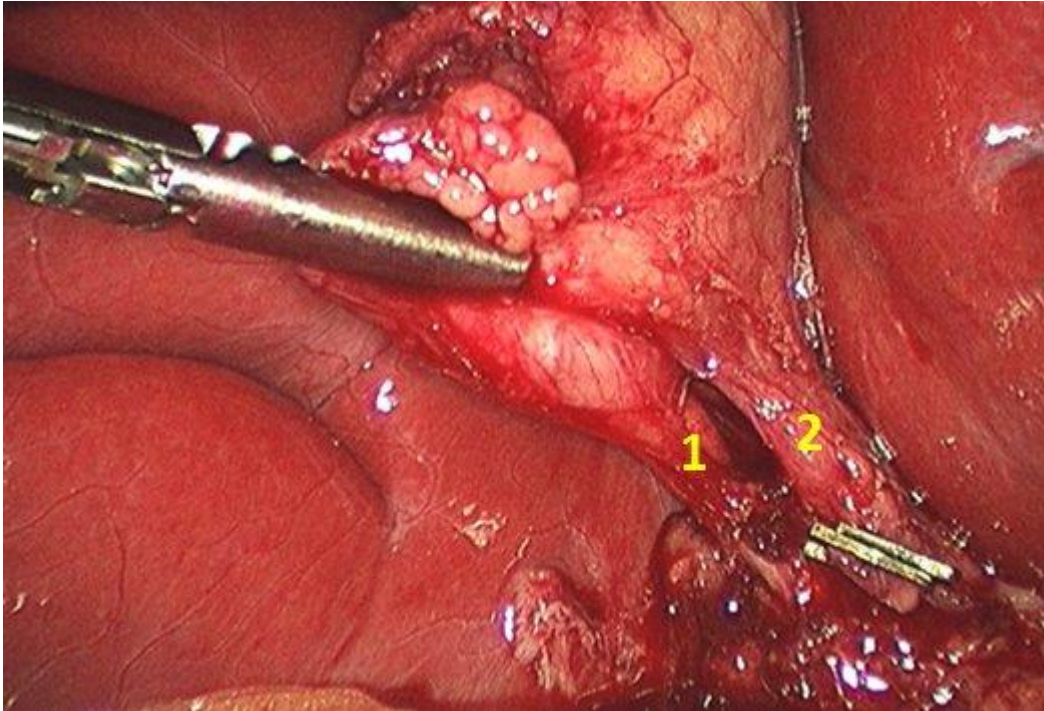
Porta Hepatis exposure:

Porta hepatis is exposed by maximal elevation of the edge of liver and fundus of gallbladder. This is achieved by using ratcheted clamp on the fundus of the gallbladder and lateral most trocar and cephalad displacement.

The gallbladder is then grasped at its infundibulum and retracted laterally. Peritoneum is dissected from the interface between GB and periportal fat. Dissection is carefully carried out until Calot's triangle(4) and its contents are identifiable.

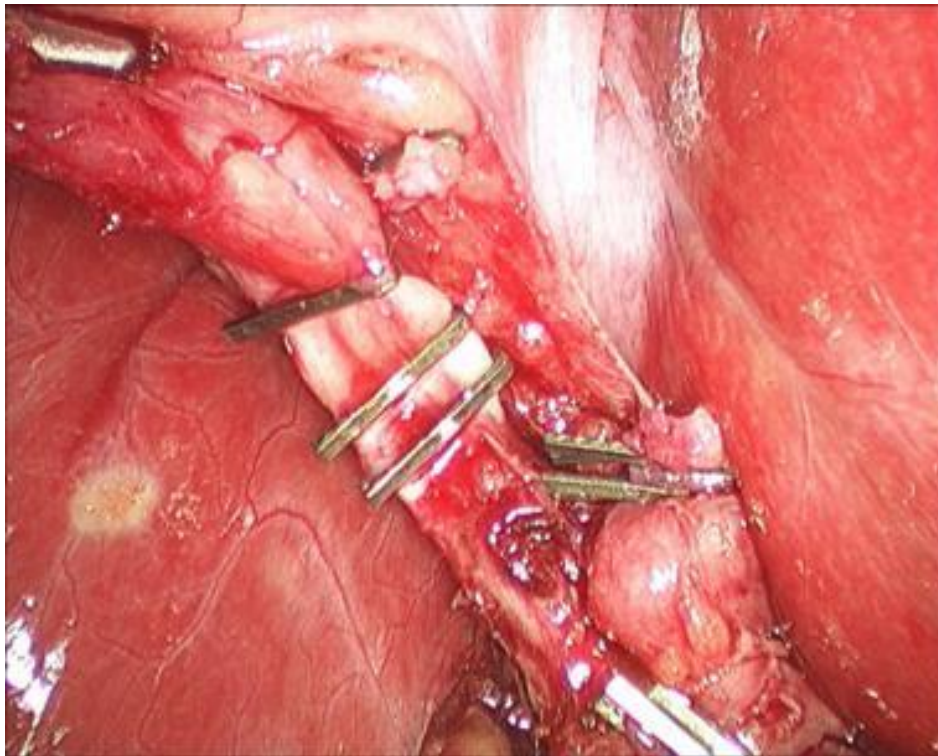
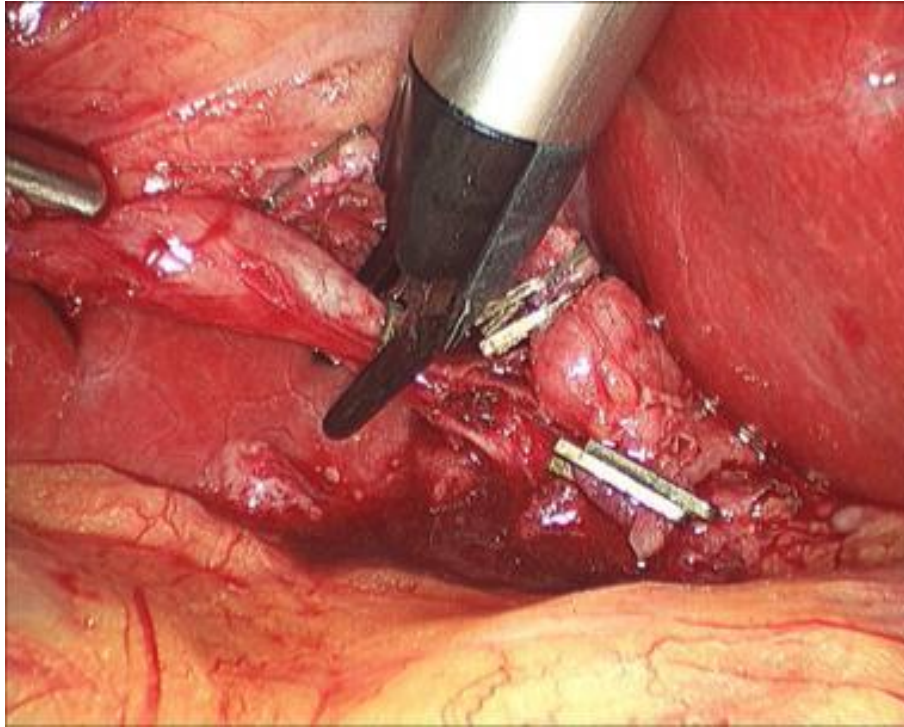


This dissection helps in revealing the cystic duct insertion into the gallbladder. Careful dissection should be made until gallbladder is pendunculated and cystic artery is exposed well.



#### Division of cystic artery and cystic duct:

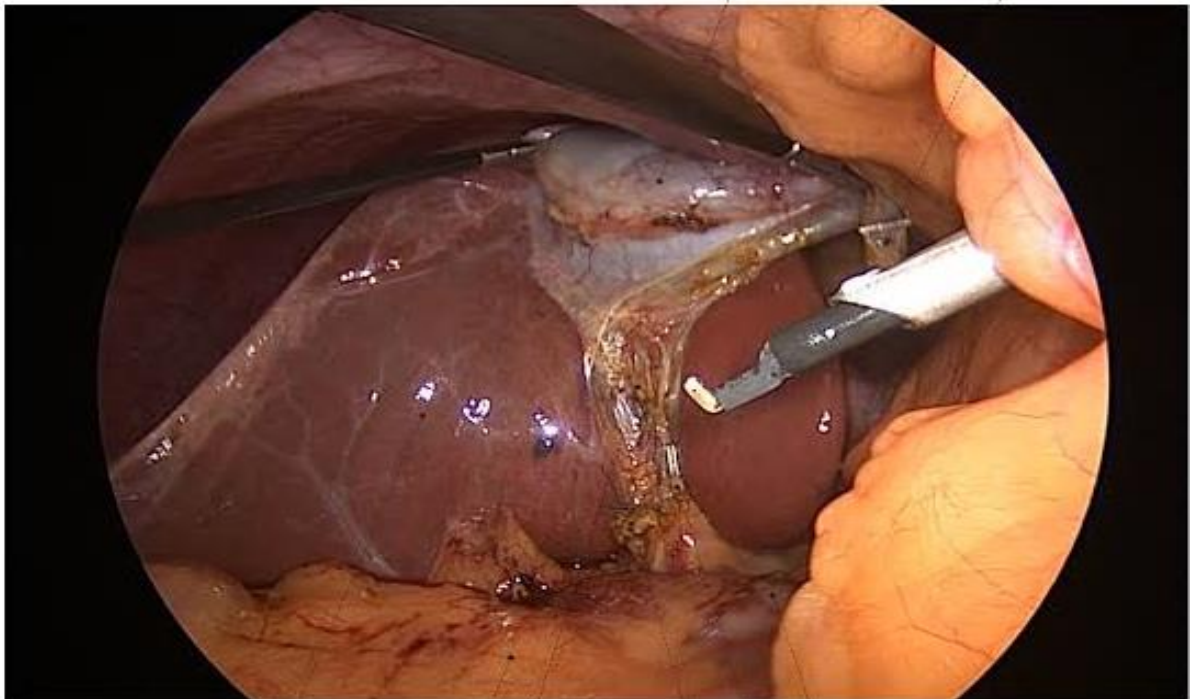
Cystic duct is narrow measuring about 8mm in diameter. Medium to large clips can be applied upto the infundibulum of the gallbladder. Two clips are applied at below its junction with gallbladder. After ensuring clip at its proper position , cystic duct id divided. Two clips are applied at cystic artery and divided.





### Dissection of Gallbladder:

Gallbladder resection is achieved by traction of the gallbladder from the surface of the liver, where monopolar electrode is used to cauterise the bridging veins. Haemorrhage during this dissection is due to dissection at the wrong plane. As the dissection approaches the fundus, gallbladder is flipped to the anterior surface of liver and completely dissected off the liver.(10)



### Retrieval of gallbladder:

Sterile retrieval bag can be used to retrieve the specimen. This helps in preventing spillage and contamination. Specimen is retrieved either

through the umbilical port or epigastric port. If the specimen retrieval is difficult, bile can be sucked out to reduce the size. If presence of stones hinders the retrieval, the port size can be dilated.

After retrieval, the gallbladder is thoroughly irrigated, and all fluids drained pneumoperitoneum is reduced. All the trocars are removed under the vision. The port sites are closed in layers. Sterile dressings should be applied.

#### CONVERSION TO OPEN CHOLECYSTECTOMY:

The most common factors responsible for conversion are dense upper abdominal adhesions, frozen Calot's triangle, necrotic gallbladder and inadequate exposure.(11)

#### COMPLICATIONS OF LAPAROSCOPIC CHOLECYSTECTOMY:

Complications are seen in less than 2% of all cases. Intestinal injuries may be encountered during establishment of trocars, adhesiolysis and gallbladder dissection from duodenum and colon.(12)

Complications includes:

- Haemorrhage
- Trocar/ Veress needle related injuries
- Infections/ abscess
- Paralytic ileus
- Biliary leak
- Stone or biliary contamination
- Deep vein thrombosis
- CBD injury and stricture
- Pancreatitis
- Conversion to open cholecystectomy
- Umbilical hernia

**Post-cholecystectomy syndrome:**

It is a group of symptoms occurring after the cholecystectomy. Onset may vary from early postoperative period to years after surgery.

Manifestations are right upper quadrant pain, nausea, vomiting, dyspepsia



or diarrhoea. The symptoms are usually related to the bile duct injury/ strictures, retained stones, primary biliary dyskinesia. In some patients, the symptoms are due to irritable bowel syndrome, peptic ulcer disease, diverticulitis or pancreatitis while the rest have psychosomatic disorders, coronary artery disease, neuritis.

In general, laparoscopic cholecystectomy has replaced open cholecystectomy with its minimal invasive incisions, faster recovery, good cosmesis, lesser complications and lesser hospital stay.

# **MATERIALS AND METHODOLOGY**

## **TOOLS AND TECHNIQUE:**

### Site of study

The study was conducted in Government Vellore Medical College and Hospital, Adukkamparai, tertiary care hospital.

### Type and duration of study

The study was prospective analysis of laparoscopic cholecystectomy by predicting its difficulty using ultrasonographic parameters and its correlation with intraoperative findings.

The duration of study was 9 months from January 2019 to September 2019.

### Sample size and study population:

Total number of sample size=39

## METHODOLOGY:

All patients under the study were preoperatively evaluated by ultrasound abdomen, clinical examinations as per clinico-sonographic parameters given below. Each parameters are given scoring values in numerical.

These patients underwent laparoscopic cholecystectomy after routine investigations and informed consent. The intraoperative events are noted as per intraoperative parameters given below.

The clinico-sonographic parameters were compared against the intraoperative parameters.

Each parameters are compared and p-values were calculated for each parameters.

<b>Ultrasound abdomen parameters</b>			
	0	1	2
Gallbladder status	normal	distended	Contracte d
Gallbladder wall thickness	≤3mm	>3mm-4mm	>4mm
Number of stone(s)	single	multiple	

Impacted stone	No	Yes	
Stone size	<5mm	5mm-1cm	>1cm
Pericholecystic collections	Absent		Present
Maximum score=10			

<b>Clinical parameters</b>			
	0	1	2
Age	<50yrs	>50yrs	
Sex	Female	Male	
Body Mass Index	$\leq 25$	$> 25$	

Previous abdominal surgery		infraumbilical	supraumbilical
Palpable gallbladder	No	Yes	
Maximum score=6			

Grading of scores:

Easy=0-5

Difficult=6-10

Very Difficult=11-16



<b>Intraoperative parameters</b>			
	Easy	Difficult	Very Difficult
Duration of surgery	<60mins	60-120mins	>120mins
Bile/stone spillage	No	Yes	Yes
Injury to duct/artery	No	Duct only	Both
Frozen Calot's triangle	No	yes	Yes
Conversion to open	No	No	Yes

#### INCLUSION CRITERIA:

1. Patients presenting with cholelithiasis diagnosed by ultrasound abdomen or other imaging modalities.
2. Patients undergoing laparoscopic cholecystectomy for Gallbladder calculus.

#### EXCLUSION CRITERIA:

1. Patients with CBD calculus who needs CBD exploration
2. Patients with features of obstructive jaundice
3. Gallbladder malignancy
4. Patient unfit for laparoscopic surgery.

#### EQUIPMENTS:

Laparoscopic instruments(1)

- ◆ Atraumatic grasper
- ◆ Locking tooth jaw grasper

- ◆ Dissectors- curved, right angle, straight
- ◆ Scissor
- ◆ L-hook
- ◆ Clip applicator
- ◆ Stone retrieval grasper
- ◆ Light source
- ◆ Veress needle
- ◆ Trocar cannula
- ◆ Insufflator

Camera processing unit and monitor

Energy source- diathermy unit (monopolar/ bipolar)

Conventional instruments for wound closure

#### PREOPERATIVE EVALUATION:

A detailed clinical history were obtained. These included chief complains, duration of illness, recurrence, aggravating and relieving factors, previous history of abdominal surgeries, comorbidities.

Detailed physical examinations of each patient were done and recorded in proforma.

Laboratory investigations were done for each patient preoperatively:

- ◆ Complete blood count
- ◆ Random blood sugar
- ◆ Liver function test
- ◆ Renal function test
- ◆ Serum amylase
- ◆ HIV, Hbs Ag, Anti HCV
- ◆ Electrocardiogram
- ◆ Coagulation profile
- ◆ Chest X ray PA view
- ◆ X ray Abdomen Erect AP
- ◆ ECHO

## LAPAROSCOPIC CHOLECYSTECTOMY STEPS:

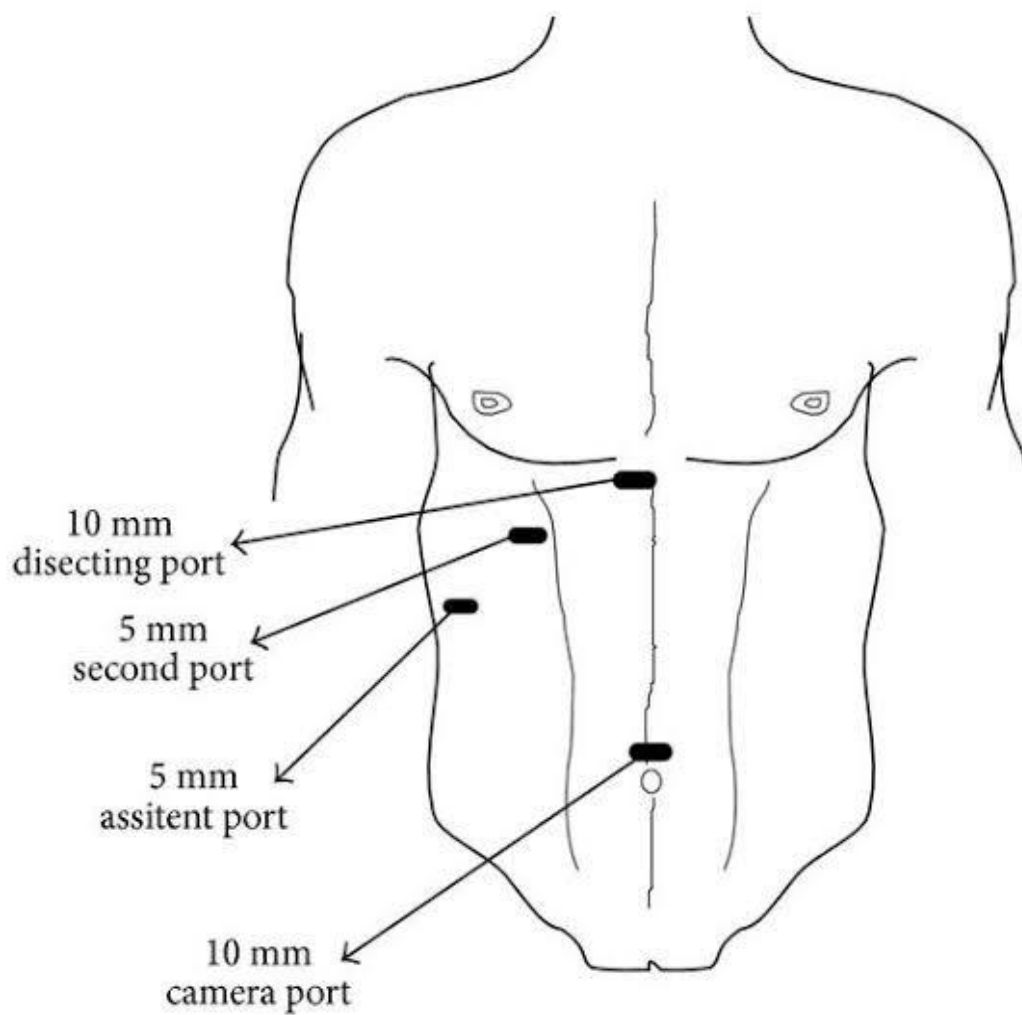
Patient is put under general anaesthesia with controlled ventilation.

Patient is positioned with 15 degrees head tilt and right up position.

Urinary bladder is catheterised and nasogastric tube is inserted.

Parts painted and draped.

Using Veress needle through supraumbilical incision ,  
pneumoperitoneum created, and ports inserted as below:



Gallbladder is identified and any adhesions are separated.(10)

Calot's triangle is identified and cystic duct and artery defined, divided and clipped.

Gallbladder is the dissected off the liver and specimen is retrieved through 10mm port.

Haemostasis is ensured, pneumoperitoneum is reduced. Sheath is closed at 10mm port. Wound closed. Sterile dressing applied.

## **RESULTS**

## RESULTS

A total of 39 patients with gallbladder calculi who underwent laparoscopic cholecystectomy were included in the study. The mean age of the patients was 47 years (SD 13)..The age range of patient was between 24 and 75 years. 53% were female patients.

### **Clinical features:**

Of these 39 patients, 17 patients had undergone previous abdominal surgeries. Of which 13 had infra-umbilical, and 4 had supraumbilical surgeries.

Obesity was present in 33.3% (95% CI 19-50).

None of the patients had palpable gallbladder.

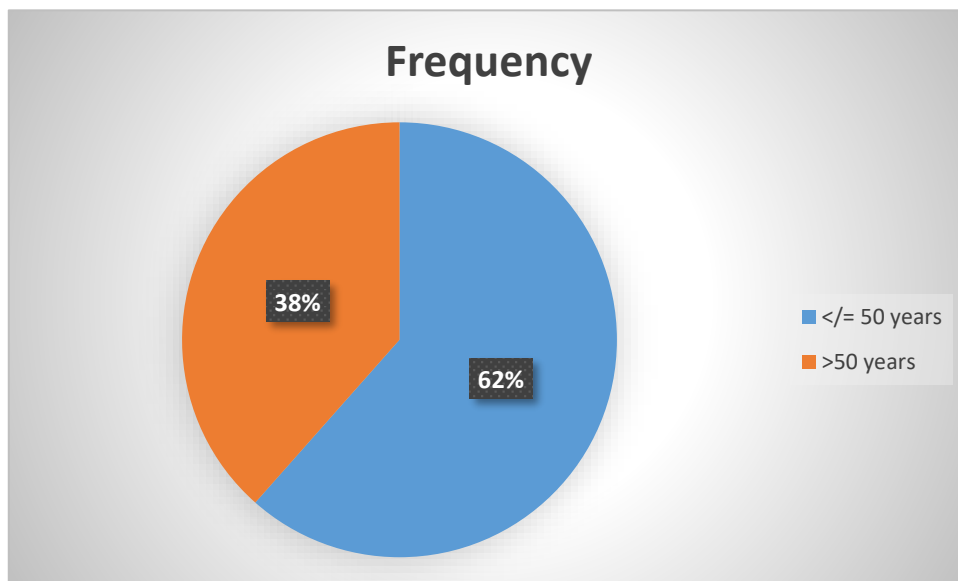
None of the patients had any comorbidities.



**AGE FREQUENCY:**

Out of 39 patients included in the study, 24 patients (61.54%) were below 50 years, while 15 patients were above 50 years (38.46%) as shown in the table below:

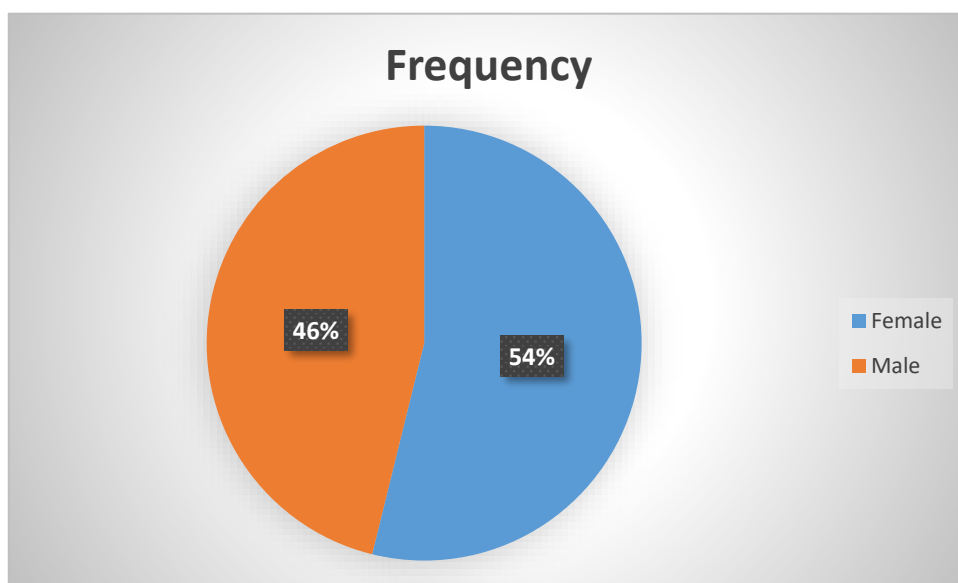
Age	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
<= 50 years	24	61.54%	44.62%	76.64%
>50 years	15	38.46%	23.36%	55.38%
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



**GENDER FREQUENCY:**

21 patients out of 39 were females (53.85%) and 18 (46.15%) were males as shown in table below:

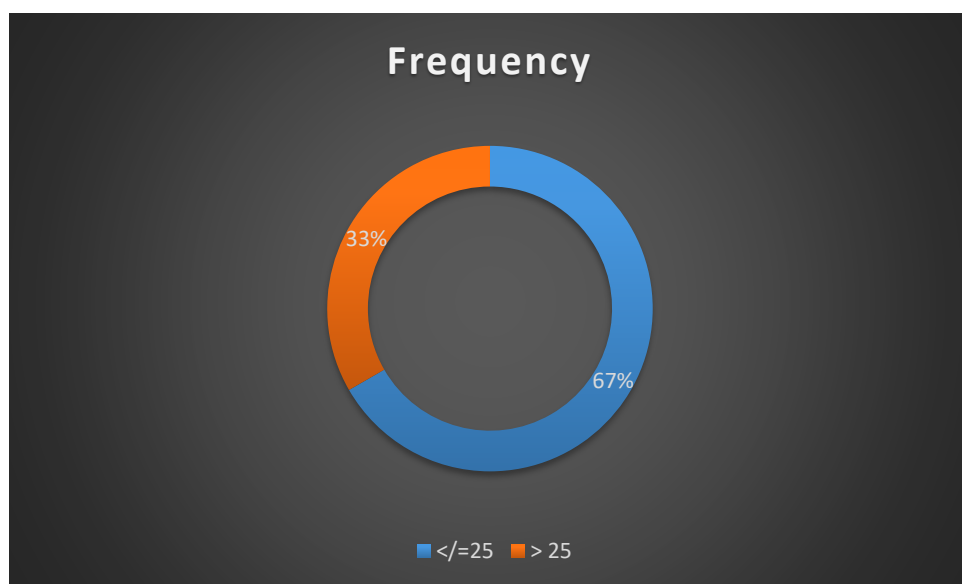
Gender of patient	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
<b>Female</b>	<b>21</b>	<b>53.85%</b>	<b>37.18%</b>	<b>69.91%</b>
<b>Male</b>	<b>18</b>	<b>46.15%</b>	<b>30.09%</b>	<b>62.82%</b>
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



BMI frequency:

26 patients (66.67%) had BMI equal or lower than 25, while other 13 (33.33%) patients had BMI of more than 25 as shown in table below:

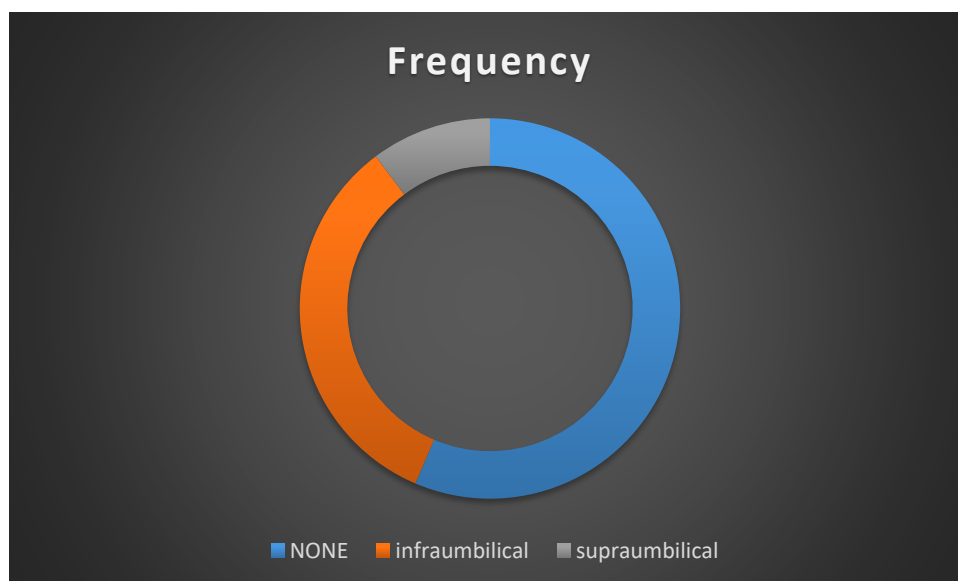
BMI	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
$\leq 25$	26	66.67%	49.78%	80.91%
$> 25$	13	33.33%	19.09%	50.22%
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



## PREVIOUS ABDOMINAL SURGERY:

Previous infra-umbilical surgeries were found in 13 patients (33.33%) and supraumbilical surgeries in 4 patients (10.26%) as tabulated below:

Previous abdominal surgery	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
<b>Absent</b>	<b>22</b>	<b>56.41%</b>	<b>39.62%</b>	<b>72.19%</b>
<b>Infra-umbilical</b>	<b>13</b>	<b>33.33%</b>	<b>19.09%</b>	<b>50.22%</b>
<b>Supraumbilical</b>	<b>4</b>	<b>10.26%</b>	<b>2.87%</b>	<b>24.22%</b>
<b>TOTAL</b>	<b>39</b>	<b>10.00%</b>		



### **Ultrasound features:**

Of 39 patients who had undergone laparoscopic cholecystectomy,

25 patients had distended gallbladder, 7 had contracted gallbladder and 7 had normal gallbladder.

11 patients had normal GB wall thickness, 20 had 3-4mm GB wall thickness and 8 patients had >4mm thickness.

Of 39 patients, 3 patients had impacted Gall bladder stones ( most of them in the neck of the GB).

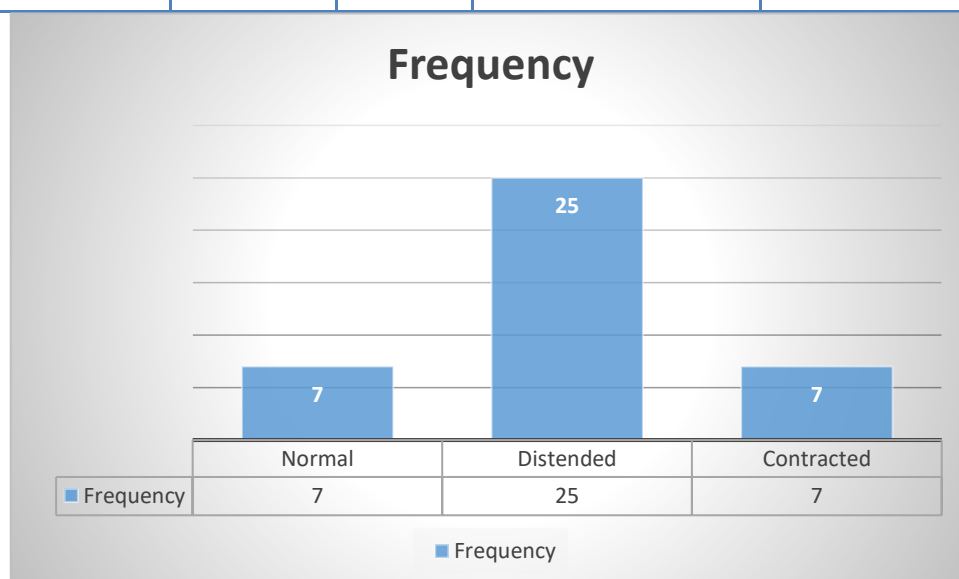
31 patients had multiple gallbladder calculi.

Pericholecystic collections were found in 8 patients.

**Gallbladder status:**

27 patients out of 39 had distended gallbladder though none of them are clinically palpable. 7 patients(17.95%) patients had contracted gallbladder as shown in the table below:

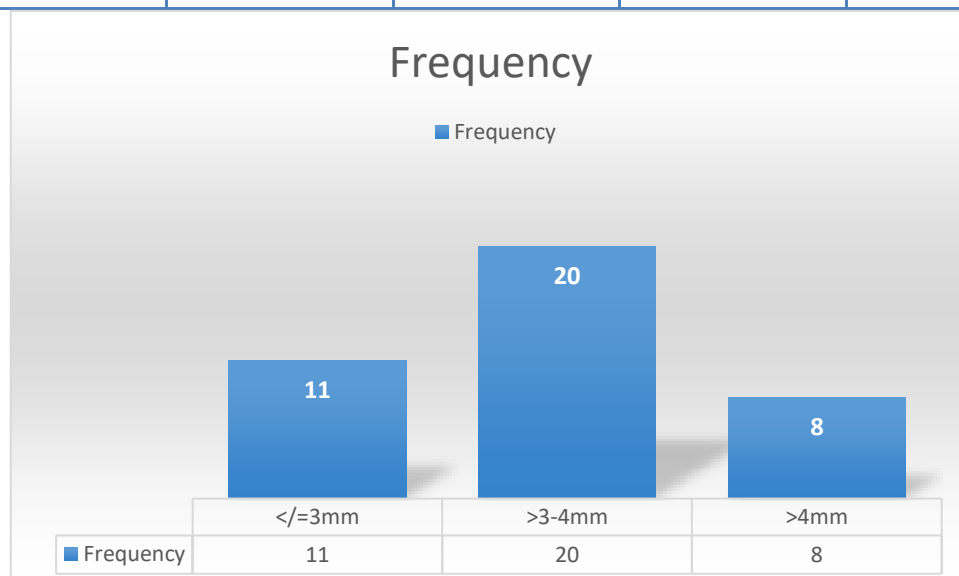
Gall bladder status	Frequency	95% lower Percent confidence limit	95% upper confidence limit
<b>Normal</b>	<b>7</b>	<b>17.95%</b>	<b>7.54%</b> <b>33.53%</b>
<b>Distended</b>	<b>25</b>	<b>64.10%</b>	<b>47.18%</b> <b>78.80%</b>
<b>Contracted</b>	<b>7</b>	<b>17.95%</b>	<b>7.54%</b> <b>33.53%</b>
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>	



### Gallbladder wall thickness:

Of 39 patients, 11 patients have normal gallbladder wall thickness, 20 patients have wall thickness ranging from >3mm to 4 mm, and 8 patients have thickened wall of more than 8mm.

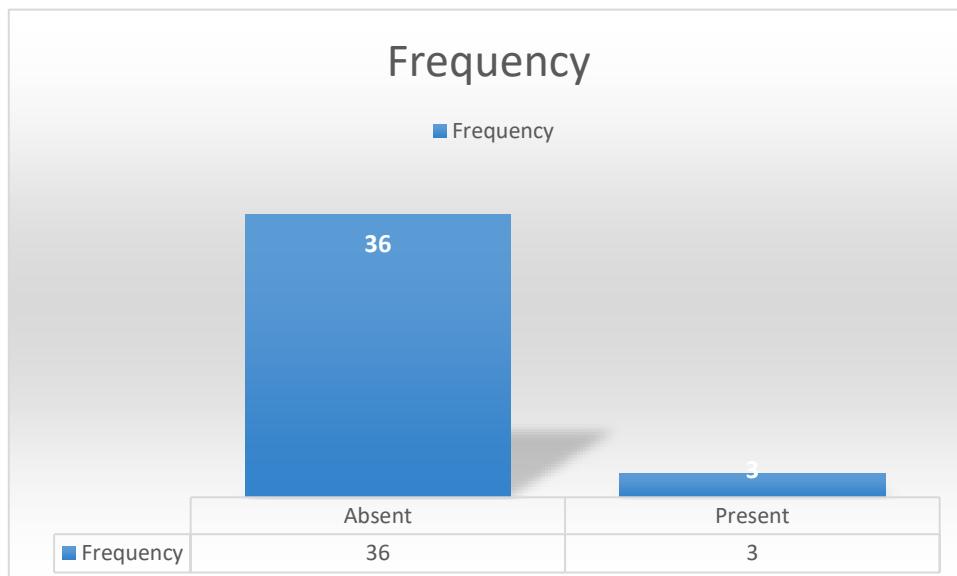
Gall bladder wall thickness	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
<b>3mm</b>	<b>11</b>	<b>28.21%</b>	<b>15.00%</b>	<b>44.87%</b>
<b>&gt;3-4mm</b>	<b>20</b>	<b>51.28%</b>	<b>34.78%</b>	<b>67.58%</b>
<b>&gt;4mm</b>	<b>8</b>	<b>20.51%</b>	<b>9.30%</b>	<b>36.46%</b>
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



### Impacted stones:

Out of 39 patients, impacted stones were sonographically noted in 3 patients (7.69%) in the region of neck of gallbladder.

Impacted gall bladder calculus	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
Absent	36	92.31%	79.13%	98.38%
Present	3	7.69%	1.62%	20.87%
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		

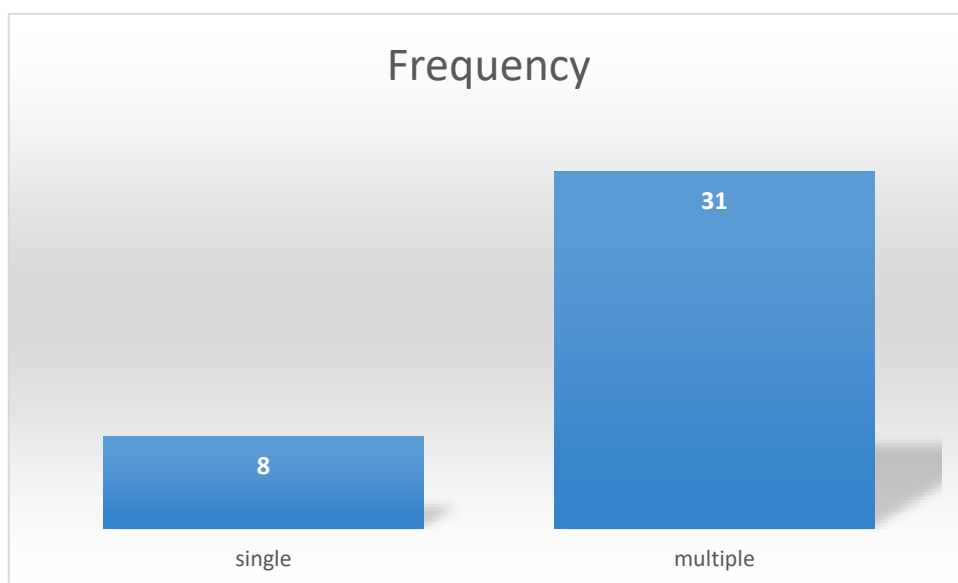




**Number of stone(s):**

Single stone were noted in 8 patients, whereas 31 patients have multiple calculi as tabulated below:

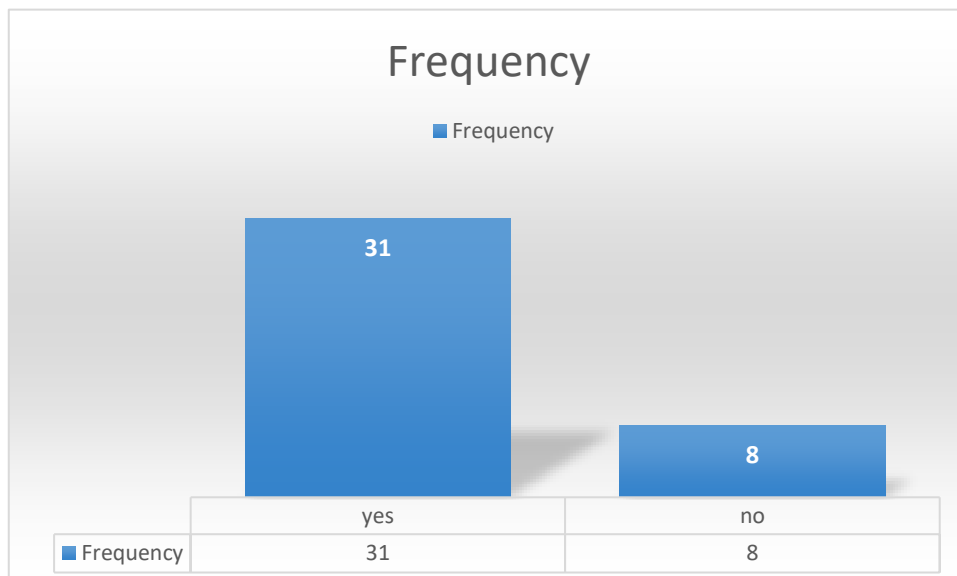
Number of calculi	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
<b>Single</b>	<b>8</b>	<b>20.51%</b>	<b>9.30%</b>	<b>36.46%</b>
<b>Multiple</b>	<b>31</b>	<b>79.49%</b>	<b>63.54%</b>	<b>90.70%</b>
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



### Pericholecystic collections:

8 patients (20.51%) out 39 patients had pericholecystic collections as shown below:

Pericholecystic collection	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
<b>Absent</b>	<b>31</b>	<b>79.49%</b>	<b>63.54%</b>	<b>90.70%</b>
<b>Present</b>	<b>8</b>	<b>20.51%</b>	<b>9.30%</b>	<b>36.46%</b>
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



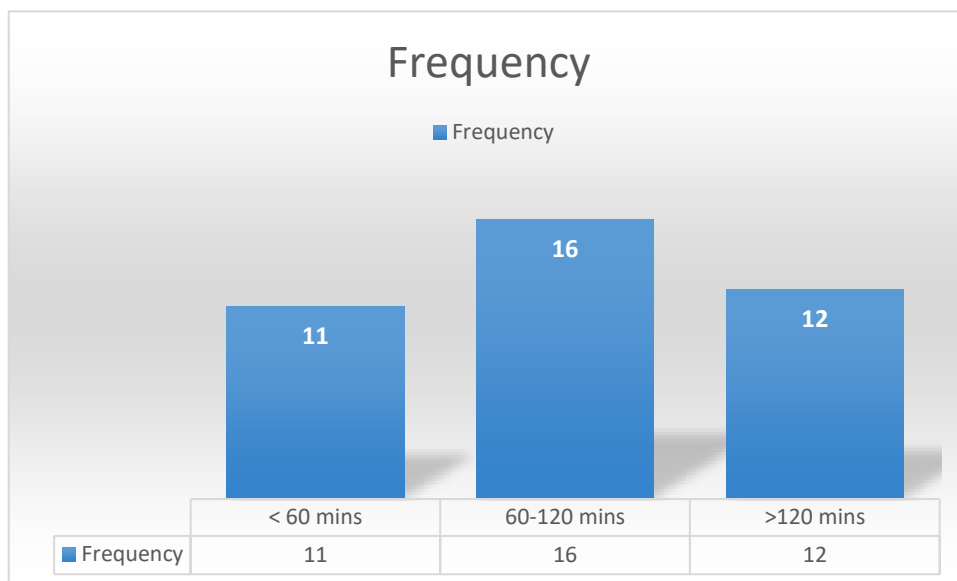
**Intraoperative features:**

Of all the 39 patients who had undergone laparoscopic cholecystectomy, 11 patients were completed within 60 minutes( from insertion of ports to the closure of skin). 16 patients were completed within 60-120mins. 12 patients underwent a prolonged surgery of >120mins. Biliary leakage were noted in 5 (mostly during GB dissection from its bed), 3 patients had both biliary and stone leakage( 2 during GB dissection from its bed and 1 while retrieving specimen due to slippage of metal clip). 4 patients had frozen Calot's triangle. Of 39 laparoscopic cholecystectomy, 5 patients were converted to open cholecystectomy. None of the patients had injury to bile duct or cystic artery.

Of 39 patients, 18 patients were considered as Easy, 17 patients as difficult and 4 were very difficult by operating surgeon based on intraoperative events and durations. Of 39 patients, 5 patients underwent conversion to open cholecystectomy.

**Duration of surgery:**

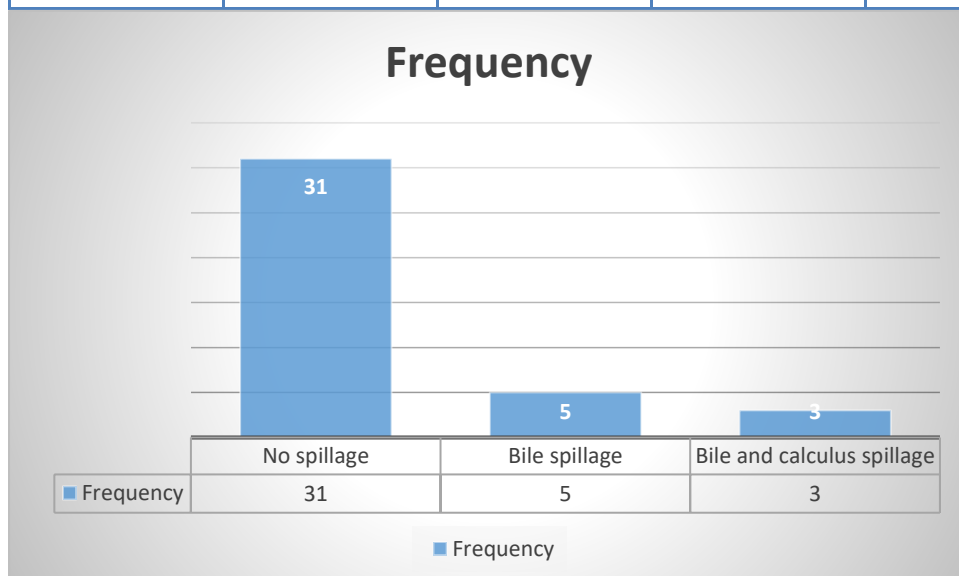
Duration of surgery	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
< 60 mins	11	28.21%	15.00%	44.87%
60-120 mins	16	41.03%	25.57%	57.90%
>120 mins	12	30.77%	17.02%	47.57%
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



### Spillage during surgery:

Of 39 patients, bile spillage was noted in 5 patients (12.82%), while both bile and stone spillage were noted in 3 patients(7.69%) as shown in table below:

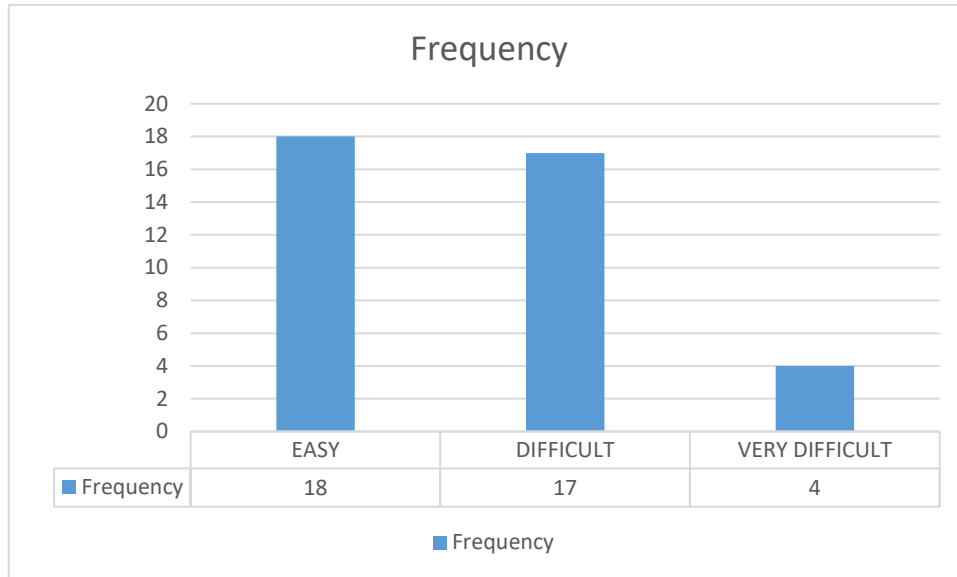
Spillage during surgery	Frequency	Percent	95% lower confidence limit	95% upper confidence limit
No spillage	31	79.49%	63.54%	90.70%
Bile spillage	5	12.82%	4.30%	27.43%
Bile + stone spillage	3	7.69%	1.62%	20.87%
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



### **Clinico-sonographic scoring Vs. Graded operation time:**

Of 39 patients, 18 patients (46.15%) had easy surgery, 17 (43.52%) had difficult surgery, whereas 4 patients had very difficult surgery as shown in table below.

<b>Final score</b>	<b>Frequency</b>	<b>Percent</b>	<b>95% lower confidence limit</b>	<b>95% upper confidence limit</b>
<b>Easy</b>	<b>18</b>	<b>46.15%</b>	<b>30.09%</b>	<b>62.82%</b>
<b>Difficult</b>	<b>17</b>	<b>43.52%</b>	<b>27.81%</b>	<b>60.38%</b>
<b>Very difficult</b>	<b>4</b>	<b>10.26%</b>	<b>2.87%</b>	<b>24.22%</b>
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



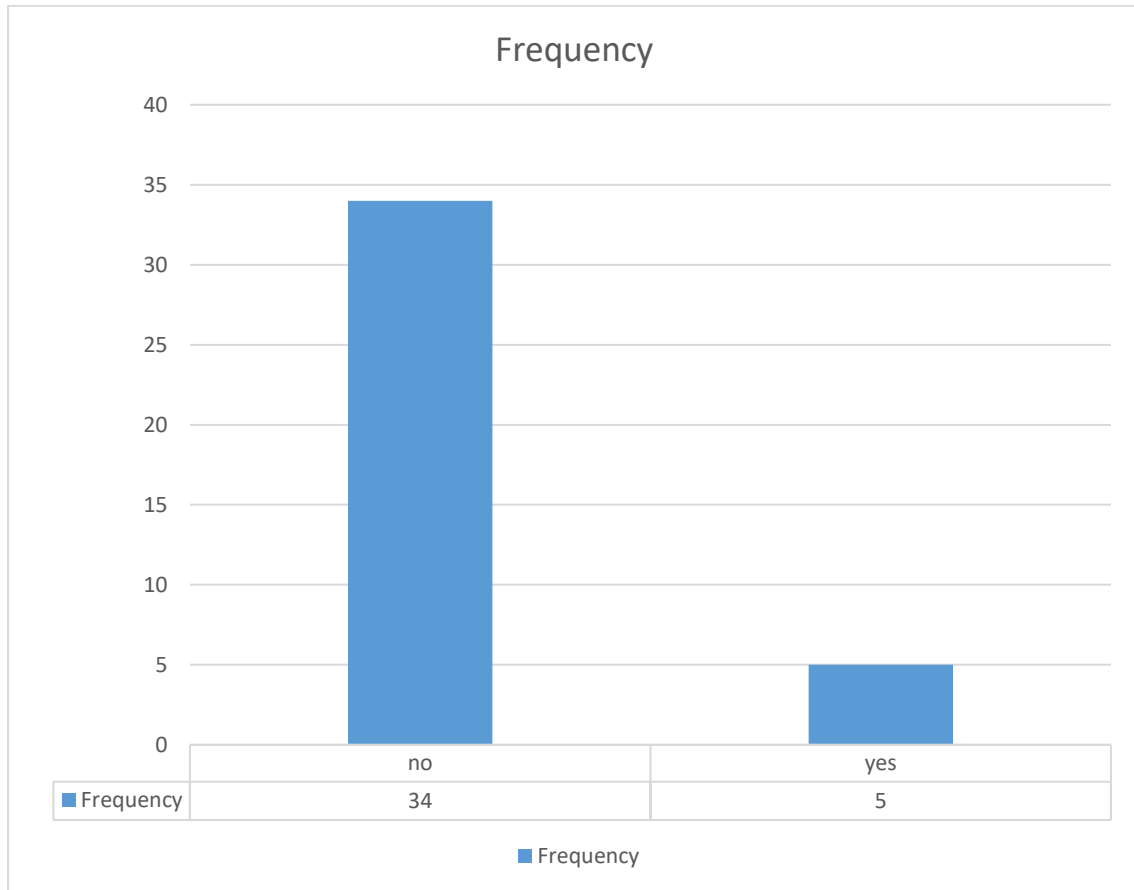
### **Laparoscopic conversion to open cholecystectomy:**

Of 39 patients, 5 patients were converted into open cholecystectomy, owing to dense adhesion in the Calot's triangle in 4 patients. One patient out of 4 had previous supraumbilical surgery with extensive intraperitoneal adhesions.

*Table: frequency of conversion to open cholecystectomy*

COC	Frequency	Percent	Exact 95%	Exact 95%
			LCL	UCL
NO	34	87.18%	72.57%	95.70%
YES	5	12.82%	4.30%	27.43%
<b>TOTAL</b>	<b>39</b>	<b>100.00%</b>		



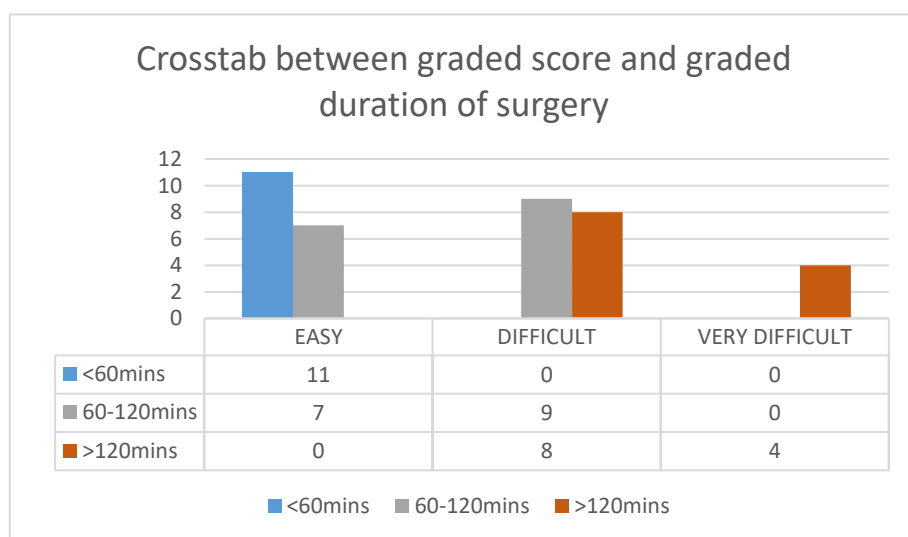


### CROSSTABULATION:

Chi-square test for independence between graded duration of operation and graded total score shows very significant p-value of  $<0.00$  and Pearson Chi-square value of 28.318 and degrees of freedom=4 as shown in table below:

Clino-sonographic score	<60mins	60-120mins	>120mins	TOTAL
EASY	11	7	0	18
DIFFICULT	0	9	8	17
VERY DIFFICULT	0	0	4	4
<b>TOTAL</b>	<b>11</b>	<b>16</b>	<b>12</b>	<b>39</b>

Chi-square	df	Probability
28.318	4	0



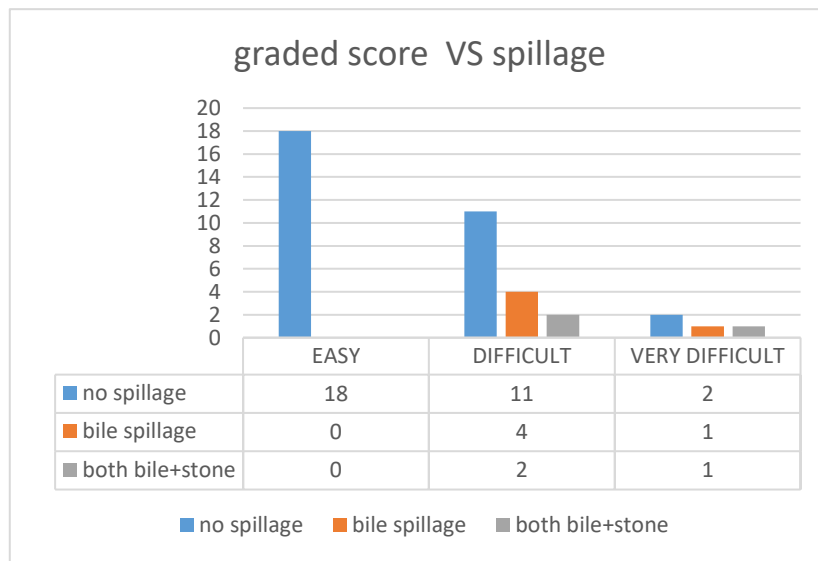
Out of 39 patients who were graded as Easy in 18 patients, 11 was easy while 7 was difficult as operative grading. Of 17 patients who were graded as difficult, 9 patients were difficult while 8 patients were very difficult. 4 patients were clinico-sonographically graded as very difficult and yielded the same operative results.

#### CROSSTABULATION:

Chi-square test for independence between intraoperative biliary and stone leakage and graded total score shows very significant p-value of  $<0.05$  and Pearson Chi- square value of 9.4577 and degrees of freedom=4.

SCORE VS SPILLAGE	No spillage	Bile only	Both bile+stone	TOTAL
EASY	18	0	0	18
DIFFICULT	11	4	2	17
VERY DIFFICULT	2	1	1	4
<b>TOTAL</b>	<b>31</b>	<b>5</b>	<b>3</b>	<b>39</b>

Chi-square	df	Probability
9.4577	4	0.0506



### CROSSTABULATION:

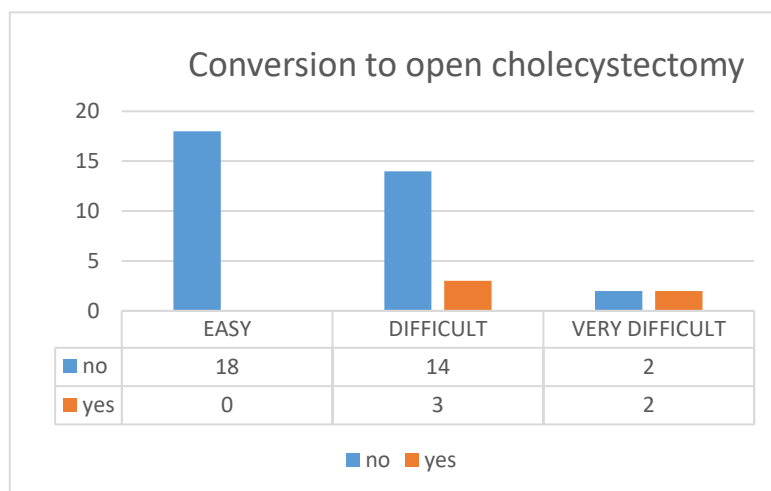
Chi-square test for independence between conversion to open

cholecystectomy and graded total score shows very significant p-value

of  $<0.018$  and Pearson Chi- square value of 7.9484 and degrees of freedom=2.

Conversion to open	no	yes	TOTAL
EASY	18	0	18
DIFFICULT	14	3	17
VERY DIFFICULT	2	2	4
<b>TOTAL</b>	<b>34</b>	<b>5</b>	<b>39</b>

Chi-square	df	Probability
7.9484	2	0.0188



# DISCUSSION

## DISCUSSION:

Laparoscopic cholecystectomy is the treatment of choice for cholelithiasis owing to its smaller incision, less pain, better cosmesis, faster recovery and lesser hospital stay.

These study was initiated after obtaining approval from the Ethical Committee of Government Vellore Medical College. Only consented patients and those eligible as per inclusion and exclusion criteria were included in the study. The total number of patients included in the study was 39.

The study was conducted at Government Vellore Medical College & Hospital with the aim to pre operatively predict difficult laparoscopic cholecystectomy using the transabdominal ultrasound and clinical parameters and comparing them with intraoperative findings. The clinico-sonographic parameters were given certain scores which were graded to correlate with the difficulty level of surgery.

A total of 39 patients with cholelithiasis who underwent laparoscopic cholecystectomy were included in the study. The mean age of the patients

was 47 years (SD 13)..The age range of patient was between 24 and 75 years. 53% were female patients. Of these 39 patients, 17 had undergone previous abdominal surgeries. Of which 13 had infra umbilical, and 4 had supraumbilical surgeries. Obesity was present in 33.3% (95% CI 19-50). None of the patients had palpable gallbladder. None of the patients had any comorbidities. Out of 39 patients included in the study, 24 patients (61.54%) were below 50years, while 15 patients were above 50 years (38.46%).

Of 39 patients who had undergone laparoscopic cholecystectomy, 25 patients had distended gallbladder, 7 had contracted gallbladder and 7 had normal gallbladder. 11 patients had normal GB wall thickness, 20 had 3-4mm GB wall thickness and 8 patients had >4mm thickness. Of 39 patients, 3 patients had impacted Gall bladder stones ( most of them in the neck of the GB). 31 patients had multiple gallbladder calculi. Pericholecystic collections were found in 8 patients.





The clinico-sonographic parameters were given scoring and graded as Easy (0-5), Difficult (6-10) and very difficult (11-15). The patients were preoperatively given scores and graded accordingly. The

intraoperative findings were compared against the preoperative parameters and whether preoperative grades were predicting well.

Of all the 39 patients who had undergone laparoscopic cholecystectomy, 11 patients were completed within 60 minutes( from insertion of ports to the closure of skin). 16 patients were completed within 60-120mins. 12 patients underwent a prolonged surgery of >120mins. Biliary leakage were noted in 5 (mostly during GB dissection from its bed), 3 patients had both biliary and stone leakage( 2 during GB dissection from its bed and 1 while retrieving specimen due to slippage of metal clip). 4 patients had frozen Calot's triangle. Of 39 laparoscopic cholecystectomy, 5 patients were converted to open cholecystectomy. None of the patients had injury to bile duct or cystic artery.

Of 39 patients, 18 patients were considered as Easy, 17 patients as difficult and 4 were very difficult by operating surgeon based on intraoperative events and durations. Of 39 patients, 5 patients underwent conversion to open cholecystectomy.

Out of 39 patients who were graded as Easy in 18 patients, 11 was easy while 7 was difficult as operative grading. Of 17 patients who were graded as difficult, 9 patients were difficult while 8 patients were very

difficult. 4 patients were clinico-sonographically graded as very difficult and yielded the same operative results.

The operations were performed by different surgeons, which was a limitation to our study. 5 patients underwent conversion to open cholecystectomy, 4 out of which was due to frozen Calot's triangle and one due to extensive intraperitoneal adhesions due to previous supraumbilical surgery. There was no injury to the cystic duct or artery in our subjects. Mean postoperative stay was 2 days for our study group in laparoscopic cholecystectomy group and 7 days for converted group. None of the patients from both groups had post-operative complications.

There was a significant value at  $p < 0.00$  between the operating duration and the graded clinico-sonographic scores, and  $p < 0.018$  for conversion to open cholecystectomy and clinico-sonographic score, implying strong association between graded score and the outcome. The most important factor leading to open cholecystectomies was frozen Calot's triangle. The percentage of conversion was 12.82%. The conversion rates according to Waseem et al was 4%, Ishizaki et al was 10.6%, Lim et al was 11.5%, and Rosita et al was 9%.

# CONCLUSION

To conclude this study, laparoscopic cholecystectomy is treatment of choice for cholelithiasis. Preoperative prediction with clinical and ultrasonographic parameters has a positive prediction for difficult laparoscopy. It can help us in predicting difficult surgery, prevent complications, obtain adequate and proper consent from patient, as well as proper planning of surgery. Gallbladder wall thickness, distended GB, impacted stones, pericholecystic collections, previous supraumbilical surgeries and Calot's triangle are of importance in prediction.

Intraoperative difficulties were noted with thickened gallbladder wall, distended gallbladder, pericholecystic collections, frozen Calot's triangle and presence of previous supraumbilical surgery.

There were several drawbacks in our study. Operating procedures were performed by different surgeons with different experience. The study population was small, which a larger sample size could have yielded a better outcome.

#### RECOMMENDATIONS:

Similar study on larger sample size could yield a better outcomes.

Single experienced laparoscopic surgeon may help to erase the bias encountered by multiple hands and experience.

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1	VARASI	0																	y
12	SELVARAJ	49	M	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	Easy
13	SERALATHAN	54	M	1	1	1	0	1	0	1	1	0	2	0	0	0	1	0	Difficult
14	SAKHUNTHALA	43	F	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	Easy
15	RANI	44	F	1	1	1	0	2	0	0	0	1	1	0	0	0	1	0	Difficult
16	JEEVA	39	F	1	1	1	0	1	0	0	0	1	1	0	0	0	1	0	Difficult
17	NATHARAJAN	70	M	1	2	1	0	2	2	1	1	0	0	0	0	2	1	0	very difficult
18	ANJALI	55	F	2	1	0	0	2	0	1	0	1	1	0	0	0	1	0	Difficult
19	RAJENDRAN	60	M	1	1	1	0	1	0	1	1	0	2	0	0	1	2	1	very difficult
20	DEVARAJA	47	M	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	Easy
21	SRINIVASAN	33	M	2	2	1	1	2	2	0	1	0	0	0	0	2	0	0	very difficult
22	KARPAGAM	45	F	1	1	1	0	1	0	0	0	1	1	0	0	0	1	0	Difficult
23	JARINABEGUM	59	F	1	2	0	0	1	0	1	0	1	1	0	0	0	1	0	Difficult
24	SETTU	49	M	1	0	1	0	0	0	0	1	0	0	0	0	0	1	0	Difficult
25	SHANKARAN	57	M	1	1	1	0	2	2	1	1	1	0	0	1	1	2	2	very difficult

																			t	
26	BALARAMAN	65	M	2	2	1	0	2	0	1	1	1	2	0	0	0	2	0	0	very difficult
27	MALATHI	24	F	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	Easy	
28	JAYARAMAN	62	M	1	1	1	0	2	2	1	1	0	1	0	0	0	2	0	0	very difficult
29	ARULDOSS	37	M	1	1	1	0	1	0	0	1	1	0	0	0	0	1	0	0	Difficult
30	RAMESH	38	M	2	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	Difficult
31	PANJALAI	75	F	1	1	1	1	2	0	1	0	0	1	0	1	1	2	1	0	very difficult
32	KRISHNAMOORTHY	65	M	0	1	0	0	2	0	1	1	0	0	0	0	0	1	0	0	Difficult
33	LAKSHMIK	51	F	1	1	1	0	1	0	1	0	1	1	0	0	0	2	0	0	very difficult
34	ABHINAV	45	M	2	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	Difficult
35	GOVINDHAMMAL	50	F	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	Easy
36	CHINAMA	38	F	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	Easy
37	KANNAN	52	F	1	1	1	0	1	0	1	0	1	1	0	0	0	1	0	0	Difficult
38	SATHYA	27	F	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	Easy
39	SUGANT	67	F	1	1	1	0	2	2	1	0	1	1	0	0	0	2	1	0	Difficult



## PROFORMA:

Name:

Age:

Sex:

IP No.:

DOA

DOS:

DOD:

Body weight:

Body height:

Consented: yes/no

Chief complain:

Duration of illness:

Recurrence:

USG Scoring: \_\_\_date of Sonography:

	0	1	2
Gallbladder status	Normal	Distended	contracted
Gallbladder wall thickness	≤3mm	>3mm-4mm	>4mm
Number of stone(s)	Single	Multiple	
Impacted stone	No	Yes	
Stone size	<5mm	5mm-1cm	>1cm
Pericholecystic collections	Absent		present

Total score = \_\_\_/10

Clinical score:

	0	1	2
Age	<50yrs	>50yrs	
Sex	Female	Male	
Body Mass Index	≤25	>25	
Previous abdominal surgery		Infraumbilical	supraumbilical
Palpable gallbladder	No	Yes	

Total score: \_\_/6

Intraoperative parameters:

	Easy	Difficult	Very Difficult
Duration of surgery	<60mins	60-120mins	>120mins
Bile/stone spillage	No	Yes	Yes
Injury to duct/artery	No	Duct only	Both
Conversion to open	No	No	Yes

Others:

Post-operative Complications:

Duration of Post-Operative hospital Stay:

