COMPREHENSIVE ANALYSIS OF COMPLICATIONS AND OUTCOME OF LAPAROSCOPIC CHOLECYSTECTOMY IN STANLEY HOSPITAL

Dissertation Submitted to

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

in partial fulfillment of the regulations

for the award of the degree of

M.S. BRANCH – I
GENERAL SURGERY

GOVT. STANLEY MEDICAL COLLEGE & HOSPITAL
THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI, INDIA.

SEPTEMBER 2006

CERTIFICATE

This is to certify that the dissertation titled "**COMPREHENSIVE ANALYSIS OF COMPLICATIONS AND OUTCOME OF LAPAROSCOPIC CHOLECYSTECTOMY IN STANLEY HOSPITAL"** of **Dr. N. SENTHIL KUMAR** in partial fulfilment of the requirements for **M.S. Branch – I (General Surgery)** Examination of the Tamilnadu Dr. M.G.R. Medical University to be held in September 2006. The period of study was from March 2004 to February 2006.

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DECLARATION

I, **Dr. N. SENTHIL KUMAR** solemnly declare that dissertation titled, "**COMPREHENSIVE ANALYSIS OF COMPLICATIONS AND OUTCOME OF LAPAROSCOPIC CHOLECYSTECTOMY IN STANLEY HOSPITAL"** is a bonafide work done by me at Govt. Stanley Medical College & Hospital during 2004-2006 under the guidance and supervision of my Unit Chief

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The dissertation is submitted to Tamilnadu Dr. M.G.R. Medical University, towards partial fulfillment of requirement for the award of **M.S. Degree (Branch – I) in General Surgery.**

Place : Chennai.

Date :

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ACKNOWLEGEMENT

I owe my thanks to the Dean, Govt. Stanley Medical College and Hospital, **Dr. M. VASANTHA, M.D.** for allowing me to avail the facilities needed for my dissertation work.

I am grateful to **Prof. Dr. D.R. GUNASEKARAN, M.S, FICS,** Professor and Head of the Department of Surgery, Govt. Stanley Medical College Hospital for permitting me to do the study and for his constant encouragement.

I am so thankful to our former unit chief **Prof. Dr. M. AMARNATHAN, M.S.** for his valuable guidance and suggestions.

I am extremely thankful to my unit Chief **Prof. S. DEIVANAYAGAM, M.S.,** for his guidance and encouragement.

I sincerely thank **Dr. GUNASEELAN, M.S,** Surgical Registrar, Stanley Medical College Hospital who has been an Chief incharge in our unit for his valuable guidance.

I owe my sincere thanks to our Assistant Professors **Dr. ZAHIR HUSSAIN, M.S., Dr. MANIVANNAN, M.S. and Dr. MANOHARAN, M.S.,** for their valuable guidance and appropriate suggestions.

I thank my seniors colleagues, my fellow postgraduates and my junior colleagues, without whose help this study would not have been possible.

Last but not the least, my sincere thanks to all the patients who cooperated for this study, without whom this study could not have been possible.

CONTENTS

INTRODUCITON

In this modern era Laparoscopic surgery has evoked marked changes in approach to surgical diseases. The "Minimally invasive surgery "(MIS) , now turned into "Minimal Access Surgery" (MAS) has prompted us to scrutinize nearly all operations for possible conversion to Laparoscopic technique.

HISTORICAL ASPECTS

In the history of surgery few procedures have so rapidly changed the surgeon's way of thinking and acting as has Laparoscopic cholecystectomy . It has been the true detonator of the laparoscopic revolution in digestive surgery.

First Laparoscopic cholecystectomy was done by **Mahe** in 1985. **Mouret** a general surgeon performed a Laparoscopic cholecystectomy and few months later showed video tape of his technique in Paris 1987. In 1988 in Paris, **Dubois** and Co-workers – tried the laparoscopic method. During the same year, technique of internal lithotripsy for removing gallstones with a laparoscopic access was developed.

For the first time in the United States, a videotape of laparoscopic cholecystectomy using intra corporeal lithotripsy technique was

presented at the annual meeting of society of American Gastrointestinal Endoscopic Surgeons in Louisville, Kentucky in April 1989.

As early as 1992, laparoscopic cholecystectomy had become the procedure of choice to remove gallbladder with calculi for two main reasons,

1. Constant improvement of results.
2. Simplification of technique.

The explosive success of laparoscopic cholecystectomy initiated revolution within us. At present nearly all abdominal surgeries can be performed laparoscopically.

In our hospital we are doing the following laparoscopic procedures.

1. Laparoscopic Appendicectomy
2. Laparoscopic Cholecystectomy
3. Diagnostic Laparoscopy
4. Laparoscopic Ovariectomy

AIM OF THE STUDY

Our aim of the study is to analyse the complications and outcome of laparoscopic cholecystectomy and comparing with open cholecystectomy by the following factors.

1. Technique of surgery
2. Duration
3. Complications of surgery
4. Post operative morbidity
5. Analgesic and antibiotic requirements
6. Hospital stay
7. Return to work
8. Cost effectiveness
9. Cosmesis

REVIEW OF LITERATURE

1. ***Jeffery et al*** reported 1980 about the outcome of laparoscopic cholecystectomy in 100 patients. They found that CBD injury in 1%, bile leak in 2% cases and wound infection in 0.5% of cases. The conversion rate of about 4%, operating time of 85 minutes and post-operative hospital stay of about 1.5% days were also noted.

2. ***Hershman et al*** observed in 1991, in that study CBD injury, duodenal injury and bile leak each in 0.5% noted. The conversion rate of about 5%, operating time of about 75 minutes and hospital stay of about 1.5 days were also observed.

3. ***Georgia A.martin et al*** CEPRP study revealed the following observations.

    - Period of study between July 1990 to May 1992.

    - 5602 laparascopic cholecystectomy cases compared with 2918 open cases.

	Lap Methods	**Open Methods**
CBD Injuries	2.3%	1%
Others	4.1%	1.5%
Hospital Stay	3.7 days	8.2 days
Cost	$ 3959	$ 8774

4. ***Perez TE et al*** in 1996 published the results of this study conducted at Mexico General Hospital between July 1992 to October 1994. Totally 128 patients were studied. He noted complications in 2.5% of cases, the average operating time of 95.5 $\pm$ 10.3 minutes and hospital stay of 42.4 $\pm$ 10.3 hours.

5. ***Hannan EL et al*** did his study at Department of Health Policy, state University of Newyork in 1999. This is one of the retrospective Cohort study. He concluded his study by noting large difference among hospitals, hospital groups and various regions of the state in complication rate, operating time and duration of hospital stay.

6. ***Thompson MH et al*** reported his study in 2000. The study was conducted at Department of Surgery Bristol; UK. The following observations were made by the group. Totally 957 patients were studied. 573 cases of laparasocopic cholecystectomy compared with 384 open cases. Less complications rate was observed in laparoscopic cases and conversion rate of about 1.2% also noted.

7. ***Hjelmquist B et al*** did his study at Department of general surgery; Kalmar, Sweeden, in 2000. 11,164 patients underwent laparoscopic cholecystectomy during 1991-1993 of which 57 (0.5%) cases had

bile duct injuries. The average operating time was 104 minutes and hospital stay was about 3 days.

8. ***David P.VOGT et al*** compared laparoscopic cholecystectomy with open methods at Cleveland clinic for general and liver transplant surgery; US totally 8,000 cases were analysed.

	Lap Methods	**Open Methods**
Mortality Rate	0.06- 0.1%	0- 0.4%
BD injury	0.6%	0.1 – 0.25%
Hospital Stay	1.6 days	4.3 days
Return to work	15 days	31 days.

Conversion rate of 2 to 5% also noted.

9. ***Zvonimir et al*** did his study at sestre milosrdnice University Hospital; Crona between 1995 and 2001 and published his results as follows. 2657 cases were operated laparoscopically and 1873 by open methods in which 0.45% and 0.10% of BD injuries were noted in laparoscopic and open methods respectively.

10. ***Florian Bosch et al*** reported in October 2003 about various clinical aspects and cost of open and laparoscopic cholecystectomy methods. 22 cases operated laparoscopically and 153 patients by open methods.

	Lap Methods	Open Methods
Complication rate	06%	09%
Operating Time	92%	66%
Hospital Stay	3 days	8 days
Cost	$ 2808	$ 3434

Laparoscopic method were 18% less costlier than open method by taking account of less hospital stay.

11. ***John. H. Haynes et al*** published a report in the Journal of family practice in March 2004; France. Study conducted between June 1992 and June 2001 at North Medical Centre, France 108 cases of gallbladder disease who treated by laparoscopic method were studied.

    - 2 cases needed conversion
    - Average operating time was 130 minutes.
    - Hospital stay was 14 hours.
    - No CBD injuries and no post-operative complications noted.

OVERVIEW OF SURGICAL ANATOMY

Gallbladder is a pear shaped organ of size 7.5 – 12 cm , with a normal capacity of about 5 ml. It is located in the gallbladder fossa of inferior surface of right lobe of liver and covered by layer of peritoneum. It is anatomically divided into

- Fundus
- Body
- Neck (or) infundibulum through which bile drains into cystic duct which joins the common bile duct. Cystic artery, a branch of Right hepatic artery is usually given off behind the common hepatic duct supplies the gall bladder.

There are various anomalies of GB, cystic duct and cystic artery course that must be recognized to avoid inadverdent injury during Laparoscopic cholecystectomy.

Anatomy of calots triangle is very important either during open or Laparoscopic cholecystectomy. This is bounded above by the cystic artery, below by the cystic duct and medially by the common hepatic duct.

SPECTRUM OF GALL STONE DISEASE

Gallstones are the most common biliary pathology. More than 85% of patients are asymptomatic who needs expectant line of management.

They are classified into

1. Cholesterol stones – Most common
2. Pigment stones which again divided into
    a) Brown pigment stones.
    b) Black pigment stones

FACTORS IN GALLSTONE FORMATION

a. Supersaturated bile – Most important.
b. Impaired gall bladder function
c. Cholesterol nucleating factors
d. Absorption and enterohepatic circulation of bile acids.

GALLSTONE PATHOGENESIS

Bile facilitates intestinal absorption of lipids and fat soluble vitamins and represents the route of excretion for organis solids such as bilirubin and cholesterol. Bile salt solubilise lipids and facilitate their absorption. Phospholipids are synthesized in the liver in conjucation with bile salt. Cholesterol is highly non-polar and insoluble in water and

in bile. The normal volume of bile secreted by the liver is 500 to 100ml/day.

Gall stone represent a failure to maintain certain biliary solutes, primarily cholesterol and calcium salts in a solubilised state. An important biliary precipitate in gallstone pathogenesis is “biliary sludge”, which refers to a mixture of cholesterol crystals, calcium bilirubinate granules and a mucin gel matrix. Biliary sludge has been observed in prolonged fasting states or with the use of long term total parenteral nutrition. Both of these conditions are also associated with gallstone formation.

CHOLESTEROL GALLSTONES :

The pathogenesis of cholesterol gallstones is multifactorial but involves three stages.

- Cholesterol supersaturation
- Crystal nucleation
- Stone growth

Gall bladder mucosal and motor function also play key role in gallstone formation. The key to maintaining cholesterol in solution is the

formation of both micelles, a bile salt – phospholipid - cholesterol complex and cholesterol – phospholipid vesicles. Cholesterol solubility depends on the relative concentration of cholesterol, bile salts and phospholipid.

Cholesterol supersaturation is present in many normal humans without gallstones. Thus, cholesterol supersaturation results in metastable state in which cholesterol precipitation may or may not take place and additional factors in bile must be present to either enhance or inhibit nucleation of cholesterol leading to next stage in gallstone formation.

Nucleation refers to the process in which solid cholesterol monohydrate crystals form and conglomerate. As bile is concentrated in the gall bladder, a net transfer of phospholipids and chlolesterol from vesicle to micelles occurs. The phospholipids are transferred more efficiently than cholesterol, leading to cholesterol enrichment of the remaining vesicles. These cholesterol rich vesicles aggregate to form large multilamellar liquid vesicles that then precipitate cholesterol monohydrate crystals. The pornucleating factors like mucin glycoproteins, immunoglobulins and transferrin accelerate precipitation of cholesterols in bile.

For gallstones to cause clinical symptoms, they must attain a size sufficient to produce mechanical injury to gall bladder or obstruction of the biliary tree. Growth of stones may occur in two ways.

- Progressive enlargement of crystals or stones by deposition of insoluble precipitate at the bile – stone interface.
- Fusion of individual crystals or stones to form a larger conglomerate.

In addition defects in gal bladder motility increase the residence time of bile in the gall bladder thereby playing a role in stone formation. Gallstones formation occurs in clinical states with gallbladder stasis, as seen with prolonged fasting, use of long term parenteral nutrition, after vagotomy and in patients with somatostatin – producing tumors or in those receiving longterm somatostatin therapy.

PIGMENT GALLSTONES

The precipitation of calcium with the anions, bilirubin, carbonate, phosphate or palmitate forms insoluble calcium salts which serves as a nidus for cholesterol stone formation. Furthermore, calcium bilirubinate, and calcium palmitate also forms major components of pigment gallstones.

Pigment stones are either brown or black. Block pigment stones are typically tarry and associated with hemolytic conditions or cirrhosis. In hemolytic states, bilirubin load and concentration of unconjucated bilirubin increases.

Brown pigment stones are earthy in texture and typically found in the bile ducts, especially in Asian population. These stones often contain more cholesterol and calcium palmitate and occurs as primary common duct stones in Western Patients with disorders of biliary motility and associated bacterial infection.

COMPLICATIONS OF GALLSTONES

a) In the Gall Bladder

1. Chronic Cholecystitis
2. Acute Cholecystitis
3. Gangrene
4. Perforation
5. Empyema
6. Mucocele
7. Carcinoma

b) In the Bile Ducts

1.Obstructive Jaundice

2.Cholangitis

3.Acute Pancreatitis

c) In the Intestine

1.Acute intestinal Obstruction

(Gallstone ileus)

Silent stones are incidentally found stone during examination for other pathology or in routine check up, which do not produce symptoms. Proplylactic cholecystectomy is not indicated in all these patients except in the following high risk groups.

- Diabetic patients
- Patients on immunosuppressive therapy
- Candidates for renal transplant
- Large gall stone more than 2 cm
- Multiple small stones
- Patients living in high risk areas where there is increased incidence of GB carcinoma.
- Porcelain GB, Cholesterosis GB

- Patient undergoing for abdominal surgery with indicental finding of gall stones, if general condition of the patient permits – incidental cholecystectomy may be done.

In our study the following groups of patients were taken.

- Cholelithiasis
- Chronic calculous cholecystitis
- Patients with biliary colic
- Diabetic patients with silent stones.

INVESTIGATIONS

1. Complete hemogram – Hb%, TC, DC, ESR
2. Urine for routine examination
3. Blood for sugar, urea , creatinine and electrolytes
4. Bleeding time, clothing time and PTT
5. Liver function test
   - i. Sr. Bilirubin – Total / Direct
   - ii. ALT
   - iii. AST
   - iv. Alkaline Phosphatase
   - v. Proteins
6. Chest X-ray PA view
7. ECG
8. USG Abdomen

   Reliable investigation for evaluation of biliary tract diseases.

GB: Assess

- Size of GB
- Walls of GB
- Intraluminal Calculi

CBD : Any calculi and diameter

Liver : Any solid (or) cystic lesions

Intrahepatic biliary radicle dilatation

Pancreas : Any mass in the pancreas

Diameter of pancreatic duct

LAPAROSCOPIC INSTRUMENTS

The surgeons knowledge of instrumentation and ability to "trouble shoot" certainly help to allay anxiety and contribute to optimal patient care.

OPERATING ROOM SETUP

The operating room setup includes equipment which properly positions the patient. Operative laparoscopic and video equipment and well coordinated assistant and nursing team are all required. Anasthesiologist should be well versed with the potential problems and complications of laparoscopy.

ESSENTIAL EQUIPMENTS

a). Optic Equipments

- Laparoscope 5mm, 10mm – 10^0, 30^0
- Computed chip video camera
- Light source
- Video monitors and video recorder

b) Abdomen Access Equipments

- Veress needle
- Hasson cannula
- Gas cylinder ($C0_2$)
- Trocar and cannulas
- Insufflators

c). Laparoscopic Instruments

- Atraumatic grasping forceps
- Bipolar coagulation forceps
- Dissecting forceps – Maryland
- Scissors
- Clip applicators
- Staplers
- Endo pouches (or) Sacs
- Sutures and needles
- Needle holder
- Suction and irrigation system

LIGHT SOURCE

High intensity light source (Xenon) is necessary for adequate illumination of peritoneal cavity. The light source is connected to the laparoscope by either fibre optic cable (or) fluid filled cable. The fibre optic cables consist of an inner core of glass that has a high refractive index which absorbs much of the light input.

VIDEO CAMERA

The video camera is attached directly to the eye piece of the laparoscope and contains both manual focus mechanism and zoom capability.

The essential part of video camera is a solid-state chip sensor or charged coupled device (CCD). The degree of resolution determines resolving power required and should be 400 lines of resolution per inch.

VIDEO MONITOR

The resolution capability of the monitor should match that of video camera such that one-chip camera is best coupled with a monitor that provided at least 400 lines of resolution per inch. Three chip cameras require expensive monitors with 700 lines of resolution.

LAPAROSCOPES

Commonly used laparoscopes are rigid instruments that employ the Hopkins rod lens system of optics. It comes in sizes ranging

between 3mm to 10mm in diameter and variety of viewing angles. The 0 degree or end/ forward viewing is easy to use and results in least amount of image distortion. Angled scopes (30^o, 45^o) provide greater versatality by following the operator to looks around corners and solid organs but needs experience. Recently, flexible scopes have been developed.

INSUFFALATORS

Insuffalators used to create working space within the abdominal cavity by delivering $C0_2$ via an automatic high flow pressure – regulator system.

$C0_2$ is currently the agent of choice because of low toxicity, low risk of gas embolism, rapid reabsorption, low cost and ease of use. Ideal insuffalator should be able to deliver 8 to 10L/min with a minimum acceptable flow rate of 6L/min. It regulates flow rate, monitors intra abdominal pressure and stops delivering $C0_2$ whenever the pressure exceeds predetermined level of 12 to 15mm Hg.

PUNCTURE INSTRUMENTS

To gain access to the peritoneal cavity 2 types of instruments used,

1. Veress needle

2. Laparoscopic trocar – sheath assemblies

Veress needle achieve pneumoperitoneum in a “Closed” fashion. It has outer sharp cutting needle and inner blunt spring loaded obturator. Once cutting needle enter peritoneal cavity blunt stylet springs forward thereby reducing injury.

Hasson cannula is used to create pneumoperitoneum in a “opened” fashion. By using this we may avoid inadverdent injury to the bowel and vessels which may occur occasionally.

The basic laparoscopic port consists of an outer hollow sheath or cannula that has a valve to prevent $C0_2$ escape, side port for insuffalation of gas and a portal for instrument access. The commonly used trocars are 5 mm and 10 mm in diameter.

SURGICAL INSTRUMENTS

They are modification of standard surgical instruments, shaft of these may be insulated with non-conductive material and the working tips are metal to allow use with electrocautery.

i. Dissecting forceps

Equipped with atraumatic tips that can be used to dissect and spread tissues bluntly. Forceps with gentle curve for dissecting around cornersalso available.

ii. Grasping forceps

It comes with either atraumatic or toothed jaws and has ratchet for locking onto the tissues being grasped.

iii. Scissors

Scissors with Metzenbaum – type configuration of tip useful for procedures like adhesiolysis.

iv. Clip appliers

They are the primary modality for ligating blood vessels and tubular structures. The clips are made of titanium and range from 7mm to 1mm.

v. The Push rod and suture loop

They are inserted via a hollow reducing sleeve. The suture then looped around the structure and the knot slide down and closed.

THERMAL INSTRUMENTS

The two modalities used for coagulation and the hemostasis are the laser and electrocautery – monopolar or bipolar. The entire tip of the instrument must be well visualized to avoid contact with other structures there by avoiding thermal injuries.

LAPAROSCOPIC INTERVENTIONS

Currently the following procedures can be well performed laparoscopically.

1. Appendicectomy
2. Cholecystectomy
3. Diagnostic Laparoscopy
4. Adhesiolysis
5. Anti reflex procedures (Nissens fundoplication)
6. Inguinal Hernia Repair – TAPP, TEP
7. Lap. Assisted vaginal hysterectomy
8. Liver biopsies
9. Splenectomy
10. Highly selective vagotomy
11. Thoracoscopic esophageal myotomy
12. Pelvic lymphadenectomy
13. Lap. Asssited colo-rectal surgery
14. Lap. Assisted donor nephrectomy

FUTURE DEVELOPMENT

1. Gastric resection
2. Gastro jejunostomy
3. Pancreatic resection
4. Cholecysto jejunostomy
5. Choledocho jejunostomy, duodenostomy
6. CBD exploration
7. Adrenalectomy
8. Thyroid surgery
9. Pneumonectomy

COMPLICATIONS OF LAPAROSCOPY

a. Abdominal Wall

- Trocar site bleeding
- Trocar site infection – Rare
- Trocar site hernia. If 10 mm or larger trocars placed at extraumbilical site. These sites closed should be with sutures.

b. Fluid Overload

It occurs when using large amount of irrigation solution like ringer lactate or normal saline during a lengthy procedure. Loosely approximating umbilical and second-puncture incisions provide an easy exit of excess fluid. Pulmonary edema may occur which may be treated with frusemide and oxygen.

c. Subcutaneous and subfacial emphysema and edema.

Instrument manipulation loosens the parietal peritoneum, C02 then infiltrates the loose tissues of the body and crepitant areas can be palpated in the shoulder and fascial regions. It rapidly resolves within 2 to 4 hours post-operatively.

d. Vessel and Viscus Injury

Inadvertent traumatic perforation to the bowel or large vessel may occur during initial trocar placement. Shielded disposable trocars produce the same type of injury. It is essential to examine the course of the large vessels at the start and on end.

Gastrointestinal injuries can occur especially during adhesiolysis. Routine use of orogastric tube to reduce the possibility of stomach injuries.

f. Non-Trocar Injury

During adhesiolysis despite the application of traction and counteraction to each adhesion few bowel punctures are inevitable.

g. Un-recognized or delayed perforation.

It results from traumatic perforation not recognized during the procedures or from thermal damage from any source. With traumatic perforation symptoms of peritonitis occurs with in 24 to 48 hrs but in thermal injury persents between 4 to 10 days.

h. Bladder and Ureter Injury

It may occur from supraperitoneal thrusting of umbilical trocar which presents with hematuria and urine leak from umbilical incisions.

Thermal injury to the ureter results in narrowing and hydroureter formation.

i. Retained Foreign Bodies

Inorganic :	Clips
	Needle
	Suture material
Organic :	Lost gallstones
	Tissue fragments
	Blood clots

j. Pneumoperitoneum

- Cardiopulmonary distress
- Renal failure
- Venous thrombosis
- Hypothermia

LAPAROSCOPIC CHOLECYSTECTOMY

Laparoscopic cholecystectomy remains the Gold standard technique for Gallstone diseases.

INDICATIONS

- Symptomatic cholelithiasis
- Acute cholecystitis
- Acalculous cholecystitis
- Asymptomatis stones with certain indications
- Porcelin GB, cholesterosis
- GB polyp
- GB pancreatitis

ABSOLUTE CONTRAINDICATIONS

- Patient unfit for general anaesthesia
- Uncorrectable coagulopathy
- Significant portal hypertension
- GB carcinoma

RELATIVE CONTRAINDICATIONS

- Cirrhotic liver
- Unclear anatomy
- Acute pancreatitis

- Generalised peritonitis
- Multiple previous abdominal operations.

INSTRUMENTS REQUIRED

- 10 mm direct laparoscope
- Two 5 mm and two 10 mm trocars
- Two 5 mm forceps
- One 10 mm grasping 'Crocodile' forceps
- One 10 mm curved dissector
- One 5 mm irrigation – suction cannula
- One bipolar electrocautery forceps
- One dissecting hook with monopolar cautery
- One 100 mm clip applier

POSITIONING

The patient is firmly strapped on the table to permit rotation of the table with reverse trendelenburg position and table tilted towards the surgeon. The surgeon stands on the left side of the patient and with first assistant on the right side of the patient. Person handling camera stands adjacent and caudally to the surgeon.

PORTS

Umbilical 5 or 10mm	-	Camera port
Epigastric 10mm	-	Working port
Right subcostal 5 mm (Midclavicularline)	-	Infundibulam grasper
Right ant. axillary 5 mm	-	Cranial traction on fundus of GB.

OPERATIVE TECHNIQUE - American approach

There are 2 approaches French and American approach. American approach is detailed here. After creating pneumoperitoneum by veress needle, first umbilical trocar introduced then all other trocars introduced one by one.

The following steps are done,

- Exposure of porta hepatis
- Adhesion release
- Decompression
- Dissection of calot's triangle
- Cystic pedicle skeletonisation
- Clipping and division of cystic pedicle
- GB dissection from its bed
- Hemostasis and drain placement
- Extraction of GB.

- Peritoneal lavage.
- Closure of the ports.
- Conversion to laparotomy.
- Postoperative Care.

i. Adhesion Release

The first assistant grasp the GB at its fundus with a grasping forceps and directed anterosuperiorly, reflecting liver with it to reveal the porta hepatis and the peritoneum covering the cystic pedicle. If the omentum and duodenum are adherent to the GB, they are dissected free at this time, taking care to avoid burn injury to the duodenum if electro cautery is used.

ii. Decompression

In patients with acute cholecystitis and hydrops, it is helpful to decompress the GB using electrocautery and suction – irrigation system to properly grasp the GB.

iii. Dissection of calot's triangle

Once the cystic structures are evident the surgeon grasps the infundibulum of the GB with the grasping forceps and applies countertraction towards downward and outward direction. The surgeon starts the dissection to display the cystic duct, cystic artery and calot's triangle. Countertraction stretches the cystic duct towards the GB. So

that common duct can be tented into the area of dissection particularly with short cystic duct. So it is important to stay as close as possible to the GB.

Generally the cystic duct is oriented in an oblique direction from left to right. If the orientation and the exact identity of the structures are still unclear begin dissection of the GB from its fossa just above the cystic duct. This creates an inferior window, in which one can exclude any other ductal structure existing into the GB fossa or from the GB itself.

iv. Clipping and division of cystic pedicle.

Ligation and division of the cystic duct is performed with clips using a special clip applicator. The applicator is used to place two clips on the cystic duct stump and one on the GB side. The clips must be aligned to completely cross the cystic duct and do not overlap. The cystic artery is then identified, clipped and divided. The cystic duct is prominent and its division allows better access to the cystic artery.

The cystic artery is isolated with the right angle and doubly clipped proximally, singly clipped distally and divided.

v. GB dissection from its bed.

Further traction on the GB brings into view the proper plane for dissection between liver and gallbladder. The dissection can be done using disposable scissors which has a slight curve and when closed, it has a narrow tip so that electrocautery can be guided. It can also be done using hook scissors and a dissecting hook. The grasping forceps on the neck of the GB can be maneuvered into various positions, to maintain proper countertraction and display the plane between the GB and the liver. The GB fossa is best cauterized to achieve hemostasis.

vi. Hemostasis and drain placement.

Perfect hemostasis is achieved using electrocautery taking care not to injure CBD and duodenum.

The placement of subhepatic drain is needed in the following situations.

1. Infected or inflamed GB – where cystic stump is fragile and high risk of post-operative leakage.
2. Injury to the liver parenchyma

Drainage permits the exterior diversion of an early bile leak, transforming it into a biliary fistula, which spontaneously resolves in some patients thereby avoiding a biliary peritonitis and its complications.

vii. Extraction of the GB

Once the GB is free and it is solid, supple, not damaged by the dissection, if the stones are few and smaller than 5 mm and the bile is liquid, the GB is grasped at its neck using 10mm claw grasper and extracted through the epigastric port.

If the GB wall is supple and not damaged by the dissection, if the calculi are more than 10mm, if the bile is fluid and there is a long neck, Hartmann's pouch is directly exteriorized with the crocodile forceps, GB opened and the bile aspirated. Calculi that cannot pass through are either crushed with Kochers forceps or the facial defect is widened by spreading the fascia with the Kelly clamp or sharply with a scalpel.

If the GB wall is infected, thickned or damaged by the dissection, if the bile is thick, or if there is an empyema or a gangrenous GB, the "bag extractor" technique is used. The GB is widely opened inside the bag and the bile aspirated. The bag is then brought outside of the abdominal cavity and easily pulled outside of the abdomen.

viii. Peritoneal Larage

A peritoneal lavage is then performed if there is bile spillage, infected (or) gangrenous gall bladder. The laparoscope is placed through the umbilical port and the irrigation suction cannula is placed through epigastric port. The subhepatic and subdiaphragmatic spaces

are washed with abundance of warm saline. The table is rotated into the trendelenburg position and to the right, to collect all the fluids in the patient's right hypochondrium. In this position the laparoscope can be turned to check the right paracolic gutter and the pouch of Douglas. The lavage is continued until it runs clear.

ix. Closure of the ports

Each trocar is removed within direct view while retaining the pneumoperitoneum. The camera is then removed. The abdomen is defflated by keeping the umbilical trocar. The anaesthesiologist is then asked to perform a few valsalva maneuvers with ventilation bag to remove as much $C0_2$ as possible there by avoiding post-op shoulder pain.

10mm port facial defect is usually closed using 1-0 Vicryl, then skin closed using 3-0 silk stitches. In all other ports, skin is closed directly using 3-0 silk. All incisions are usually injected with local anaesthetic drug to minimize post-operative pain.

x. Conversion to Laparotomy

The indications for conversion fall into two categories.

- Conversion for necessity
- Conversion for prudence

CONVERSION FOR NECESSITY

A complication may occur at any step of the laparoscopic cholecystectomy. The bowel can be damaged, perforations, hematomas or electric burns can occur. The omentum and small and large vessels such as venacava or portal vein can be traumatized. Bleeding can occur from the liver after GB removal or from the liver pedicle. All of these complication can be repaired unless if they are major which needs an open procedure.

CONVERSION FOR PRUDENCE

Any event that endangers patients life requires conversion. Any mechanical or instrument failure like poor lighting, bad image transmission, defective insuffalator, malfunctioning electro cautery and insulation instrument defects.

If the surgeon, after his laparoscopic dissection cannot accurately identify the vascular and biliary component of calot's triangle, clip should never be applied and no structures divided. If available, intra operative cholangiography must be performed through a puncture of the GB if not conversion is needed.

Laparoscopic cholecystectomy is a safe procedure only when performed by a surgeon experienced in open biliary procedures.

xi. Care

Pre-operative :

The patients should have the following preoperative tests.

- USG of liver and biliary tree
- Liver function test
- Pre OP medical evaluation

Post Operative:

The post-op. routine is similar to that of open gallbladder surgery.

- Analgesics and antibiotics for first 24 hours.
- Oral fluids after 24 hours
- If there is appropriate surveillance at home the patients can be discharged on the next day.

i. Complication

a. Intra Operative :

- Bleeding - trocar site
  - Omental Vessels
  - Cystic A while dissecting at calots triangle
  - GB fossa
- Perforation of GB and contamination of peritoneal cavity with infected bile.

- Bile duct injuries
    - Partial or total transection of the CBD during difficult dissection at calot's triangle.
    - Narrowing or obstruction of the CBD by inadverdent placement of clip.

b. Post Operative

- Bile leak and fistula
- Bile peritonitis
- Biliary stricture
- Thermal injuries to bowel
- Port site hernia
- Port site metastasis in carcinoma GB

OPEN CHOLECYSTECTOMY

Incision:

Most commonly used incision – Kochers subcostal

Other incisions – short right upper transverse, right paramedian

Methods :

There are 2 methods

- Duct first method : If calot's anatomy is clear
- Fundus first method : If there is dense adhesions at calot's triangle and anatomy is not clear.

Procedure :

After opening the abdomen, the GB is appropriately exposed by keeping packs on the hepatic flexure of colon, the duodenum and the lesseromentum. An artery forceps is placed on the infundibulum of the GB and the peritoneum overlying calot's triangle is put on stretch. The peritoneum then divided close to the GB and calot's dissected to expose the cystic duct and cystic artery.

The cystic duct is cleared down to the CBD, the cystic artery is tied and divided. The cystic duct is then divided in between ligatures. The GB is then dissected away from the GB bed.

Some golden rules in difficulties.

1. If anatomy of the calot's unclear, don't dissect blindly.
2. Bleeding at calot's should be controlled by pressure, packing and patience but not by blind clipping (or) clamping.
3. When there is doubt about the anatomy, dissect the GB wall down to the cystic duct by "fundus-first" method.
4. If the cystic duct is densely adherent to the CBD and suspected Mirizzi syndrome, open the infundibulum, remove stones and suture it.

COMPLICATIONS

Intra – Operative

- Bleeding
- Bile duct injury
- Bowel injury

Post – Operative

- Wound infection
- Localized abscess
- Biliary fistula
- Incisional hernia
- Portal pyemia

DIFFICULT CHOLECYSTECTOMY

The application of a stopping rule to cholescystectomy for cholelithiasis is not as simple as that for a mechanical device such s an airplane or a nuclear power plant. The human body is much more complex than these mechanical systems; there are no “pop ups” on the video monitor during a laparoscopic cholecystectomy that signal the need to convert to open cholecystectomy. But what is important is the adoption of the mindset of the stopping rule in which safety is the chief consideration that governs decisions when danger is apparent. This is especially appropriate in a benign disease such as cholelithiasis, particularly because there are alternatives to pushing ahead with a difficult dissection.

When operative difficulty is encountered during laparoscopic cholescystectomy, the surgeon should pause to determine whether the operation should be continued laparoscopically. Local operative factors and operative experience of the surgeon are key considerations. Failure of progression of the dissection, anatomic disorientation, difficulty in visualization of the field, and inability of the laparoscopic equipment to carry out usual tasks such as grasping of the gallbladder or separation of tissues, are events that might be used as triggers of the stopping rule mentality in which subsequent actions are governed chiefly by

considerations of safety. In most cases these events are indicators for conversion. The negative effects of conversation are minor compared with the negative effect of a biliary injury, it is best to back off when the zone of serious danger is entered rather than to determine if the procedure can be completed under dangerous conditions.

The stopping rule mentality should not end after an incision has been made an applies equally to the difficult open cholecystectomy, in which the risk of completing an open cholecystectomy must be balanced against the risk of injury. Cholecystostomy is a good alternative in very difficult patients, and it is almost always possible. Partial cholecystectomy is another reasonable alternative in some cases of difficult open cholecystectomy. Because of variation in operative experience, what constitutes the zone of serious danger may differ somewhat among surgeons.

There is an outlet when laparoscopic cholecystectomy is very difficult and potentially hazardous : Conversion. There is an outlet when open cholecystectomy is very difficult and potentially hazardous : Cholecystostomy. It is not appropriate to proceed laparoscopically when conditions are patently hazardous. For instance, it is inappropriate to attempt to stop bleeding laparoscopically when one cannot see well

and there is a possibility that application of clips might also clip and injure bile ducts. In addition, the presence of clips on such a structure after operation, when it has been described that they have been used to arrest hemorrhage is likely to convince most experts that the action was practice below the standard of care. The mind set of surgeon should be directed to methods that result in completing a large number of cholecystectomies safely, even if that means that fewer cholecystectomies are completed laparoscopically and that more converted laparoscopic procedures are completed by cholecystostomy.

So if you are not a physician, not to mention a surgeon, what's the big deal? Part of it is the need to approach this procedure, as well s all others, with the idea of "Safety First". When explaining the procedure and the possibility of conversion to patients tell them that the goal is to remove the gallbladder in the safest way possible, and that the convenience of a laparoscopic procedure comes in a distant second.

Another concern is the volume of litigation related to this condition.

Based on information received from risk management sources, it seems that biliary injury is by far the most common cause for litigation in gastrointestinal surgery. Claims arising from laparoscopic surgery

represent 20% of all general surgery claims, and 50% of laparoscopic claims are for bile duct injury. In terms of indemnity, the situation is even more serious because 33% of general surgery indemnity arises from laparoscopic procedures, and half of that is for biliary injury. So, about 15% of all general surgery indemnity is from biliary injures. The percentage of biliary injures litigated is very high.

MATERIALS AND METHODS

We are doing both Laparoscopic and open cholecystectomy in our hospital.

This study was done between March 2004 to January 2006.

During the period about 67 cases of laparoscopic cholecystectomy have been performed. For comparison with open cholecystectomy 79 cases of open cholecystectomy have been selected in the same age group.

Table 1

DETAILS OF THE STUDIED GROUPS

	Male	Female
Laparoscopic cholecystectomy	25	42
Open cholecystectomy	21	58

All patients were pre operatively assessed by doing USG abdomen, liver function tests and other routine investigations for getting assessment for surgery.

INDICATIONS FOR SURGERY

1. Chronic cholecystitis
2. Symptomatic gall stone diseases
3. Biliary colic
4. Diabetic patients with silent stones

THE ASSOCIATED CONDITIONS FOUND

1. Diabetus mellitus in 12 patients
2. Hypertension in 14 patients
3. COPD in 3 patients
4. H/O previous abdominal surgery in 3 patients

The following factors were compared between laparoscopic cholecystectomy and open cholecystectomy groups.

1. Technique of surgery
2. Duration
3. Complication of surgery
4. Post – Operative morbidity
5. Analgesic and Antibiotic requirement
6. Hospital stay
7. Return to work
8. Cost effectiveness
9. Cosmesis

CONVERSION TO OPEN METHOD

The procedure was converted to open method in 4 out of 67 patients due to the following factors.

1. There were dense adhesions between the greater omentum and anterior abdominal wall with the previous operative scar in 1 case.

2. There were plenty of thick adhesion between the gallbladder and surrounding structures particularly hepatic flexure of colon and duodenum in 1 case.

3. The anatomy of the calot's was not clear because of adhesions and excessive fat in 1 case.

4. Because of excessive bleeding conversion was needed in 1 case.

OBSERVATION AND RESULTS

A study of **67** cases of laparoscopic cholecystectomy of which **42** female and **25** male patients wee compared with that of **79** cases of open cholecystectomy of which **58** female and **21** male patients.

1. TECHNIQUE

By techniquewise laparoscopic surgery provides better visualization and magnifications of surgical anatomy in contrast to open surgical methods.

2. DURATION OF SURGERY

The mean operative time taken for doing laparoscopic cholecystectomy was **112.23** minutes but in open group it was **75.06** minutes. This is **37.17** minutes longer in laparoscopic group in comparison with open group.

3. COMPLICATIONS OF SURGERY

During laparoscopic cholecystectomy partial clipping of CBD was done in **2** cases which were identified intra operatively the clips were removed immediately and the patients are on regular follow up for the past 6 months.

In open group, CBD was inadverdantly injured in **1** case, 'T' tube was inserted immediately and the tube was removed 2 weeks later and the patients is on regular follow up. **7** cases developed wound infection and **1** case had bile leak which subsided in 5 days in open group but in laparoscopic group **4** cases developed wound infection.

4. POST – OPERATIVE MORBIDITY

Both groups of patients were ambulated in early post operative period. The compliance in the laparoscopic group was better than open group. Better compliance in laparoscopic group from **2nd** post operative day itself than with open group which took **5** days post-operatively.

5. ANALGESIC AND ANTIBIOTIC REQUIREMENTS

Parenteral diclofence sodium was given post operatively to both the groups. The laparoscopic group did not need analgesia after **2nd** post operative day but open group the requirement was upto **6th** post – operative day.

Both the groups parenteral cefotaxime was given during induction but post – operatively laparoscopic group needed only **2.26** days of antibiotic in comparison with open group who needed **4.59** days of antibiotics.

6. HOSPITAL STAY

Nearly all the patients in laparoscopic group were discharged from the hospital on **3rd** post-operative day but in open group it was on **7th** post-operative day.

7. RETURN TO WORK

Nearly all the patients in laparoscopic group returned to their work by **10** days but in open group it took about **18.86** days.

8. COST – EFFECTIVENESS

Even though the laparoscopic surgery seems to be costlier in terms of instrument and equipment purchase and installation, the advantages like less hospital stay, early return to work and less analgesic, antibiotic requirement equals the cost effectiveness of open cholecystectomy and even less costlier than the open group.

9. COSMESIS

There is no doubt that laparoscopic surgery provides better cosmesis in terms of faster healing of small port incisions and small scar, obviously no scar in long run when compared with open cases which left lengthy and large scar which is major concern especially in females.

IN OUR STUDY THE FOLLOWING OBSERVATIONS NOTED

	Lap Methods	**Open Methods**
Overall Complication	8.9%	11.39%
BD injury	2.9%	1.26%
Infection	5.9%	8.86%
Others	-	1.2%
Duration of surgery	112.23 mts	75.06mts
Antibiotic requirements	02.26 days	04.59 days
Post –operative hospital stay	2.65 days	6.70 days
Return to work	10.01 days	18.86days

Conversion rate of 5.9 % also noted.

DISCUSSION

By observation of the results there is no doubt that laparoscopic cholecystectomy outscores in number of ways than open cholecystectomy.

- Comparing the technique laparoscopic surgery is the best in terms of magnifications and visualization of surgical anatomy and ease to deal.

- The mean operating time for laparoscopic method is **112.23** minutes which is **37.17** minutes longer than open method.

- Complications in laparoscopic surgery seems to be more only in the hands of inexperienced young surgeon but it is less in comparison with open cholecystectomy if done by surgeon well experienced in Laparoscopy.

- Post-operative morbidity in terms of pain, recovery from surgery and ambulance from bed, the laparoscopic group done better than open surgery group.

- Analgesic and antibiotic requirement is less in laparoscopic group if compared with open surgery group.

- The ambulance and return to normal work was early after laparoscopic method than with open surgery method.
- Post operative hospital stay also less in laparoscopic cases compared with open group.
- When factors like less hospital stay, early return to work and less antibiotic and analgesic requirements taken into discussion laparoscopic surgery is less costlier than open method.
- Definitely laparoscopic cholecystectomy surgery provides better cosmesis than open surgery.

CONCLUSION

Our study proves the laparoscopic cholecystecomy is the gold standard method for Gall Stone diseases by the following factors.

- Better visualization and magnification of surgical anatomy.
- Less post-operative morbidity.
- Short duration of analgesic and antibiotic requirement.
- Short post operative hospital stay
- Early return to work
- Cost-wise better than open method
- Best cosmesis.

The only disadvantage is the prolonged operative time.

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PROFORMA

1) Name :
2) Age / Sex :
3) Occupation :
4) IP No. :
5) Date of admission :
6) Date of Surgery
7) Date of Discharge :
8) Complaints :
9) Clinical examinations :
10) Investigations :
11) Diagnosis :
12) Procedure and details :
    - Anaesthesia Duration Co_2 used
    - No. of ports
    - Findings
        i. Spillage
        ii. Bleeding – Cause / Management
        iii. Others
        iv. Drain
    - Conversion : Yes / No
13) Post-operative period
        a) Pain
        b) Analgesic & Antibiotic used
            a. Drugs
            b. Dose
            c. Duration

c) Oral feeds
d) Drain removal
e) Ambulation

14) Complications – Post-operative
15) Hospital Stay
16) Condition at discharge
17) Follow -up