"STUDY OF PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY"

By

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ABSTRACT

Objective :

To assess the safety and efficacy of laparoscopic cholecystectomy in terms of duration of operation, hospital stay,post operative analgesia, post operative recovery,complication of each procedure, patient satisfaction.

Back ground Data:

Benign diseases of the biliary tract are one of the most common surgical problems in the world. Surgery plays an important part in the treatment and over half a million cholecystectomies are performed worldwide. Since its introduction in France, laparoscopic cholecystectomy has become the treatment of choice for symptomatic cholelithiasis. The postulated advantages of laparoscopic cholecystectomy are the avoidance of large incision, shortened hospital stay and earlier return to work.. Our purpose in this study was to assess the safety and efficacy of laparoscopic cholecystectomy.

Materials & Methods:

A prospective study, considering 20 patients treated with laparoscopic cholecystectomy in R.L.Jalappa hospital and research center attached to Sri Devaraj Urs medical college, Tamaka, Kolar, during the period of November 2008 to May 2010. All patients with acute cholecystitis, chronic cholecystitis, cholecystolithiasis, empyema of gallbladder, mucocele of gallbladder, nonperforated gangrenous gallbladder included in the study. Any patient with choledocholithiasis,,Perforated gallbladder were excluded. Cases that encounter difficulty during laparoscopic cholecystectomy and converted to open cholecystectomy are included in laparoscopic group.

Cases were reviewed after 7^{th} day and 21^{st} day of operation. Follow up ranges from minimum 3 months to maximum upto 6 months wherever possible. Laparoscopic cholecystectomies were described with respect to duration of surgery, complications, resumption of oral intake hospital stay, return to normal work patient satisfaction.

Results:

In our series of 20 patients there was a female preponderance and the peak age group affected was 3rd, 4th and 5th decade. The most common indication for cholecystectomy was cholelithiasis followed by acute cholecystitis. Dense adhesions was the most common cause of conversion to open cholecystectomy. The patients had less post operative pain, started oral intake earlier and were discharged early. They were also able to resume their normal work sooner.

Conclusion:

Laparoscopic cholecystectomy is a safe and justified replacement for open cholecystectomy. It should be an available option for all patients requiring elective cholecystectomy. With the increasing acceptance amongst the operating surgeons and the patients , very soon it will be accepted as the treatment of choice for gallstone disease.

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INTRODUCTION

INTRODUCTION

Benign diseases of the biliary tract are one of the most common surgical problems in the world. Gallstones especially, affect millions.[1] Surgery plays an important part in the treatment and over half a million cholecystectomies are performed worldwide.[2]

Cholecystectomy was the universal standard for the treatment of symptomatic cholelithiasis.[3] The first open cholecystectomy was performed in 1882. The operation became the most common surgical treatment performed for calculous biliary tract disease because it alone ensures permanent cure.

Since its introduction in France, laparoscopic cholecystectomy has become the treatment of choice for symptomatic cholelithiasis.[3] The postulated advantages of laparoscopic cholecystectomy are the avoidance of large incision, shortened hospital stay and earlier return to work.[4]

Our purpose in this study is to assess the safety and efficacy of laparoscopic cholecystectomy.

AIMS AND OBJECTIVES

AIMS AND OBJECTIVES

1. To assess safety and efficacy of laparoscopic cholecystectomy in terms of:
    - Duration of operation
    - Postoperative analgesia
    - Postoperative recovery
    - Complications of each procedure
    - Hospital stay
    - Patient satisfaction

REVIEW OF LITERATURE

REVIEW OF LITERATURE

ANATOMY

Gallbladder is a pear-shaped sac of 9cm long with a capacity of 50 ml, lying on the visceral surface of the right lobe of the liver in a fossa between the right and quadrate lobe.[5] It has:

- A rounded end (fundus of the gallbladder), which might project from the inferior surface of the liver.
- A major part in the fossa (body of gallbladder), which may be against the transverse colon and the superior part of the duodenum.
- A narrow part (neck of gallbladder) with mucosal folds forming the spiral folds or valves of the Heister.
- Hartmann's pouch is a sacculation at the neck of the gallbladder; this is a common site for a gallstone to lodge.

The wall consists of a musculo-elastic network without definite layers, the muscle being particularly well developed in the neck and fundus. The mucous membrane is in delicate closely woven folds; instead of glands there are deep indentations of mucosa, the *crypts of Luschka,* which penetrate into the muscular layer. There are no submucosa or muscularis mucosae.

Anatomy of biliary tract

The *right and left hepatic ducts* emerge from the liver and unite in the porta hepatic to form the *common hepatic duct.* This is soon joined by the *cystic duct* from the gallbladder to form the common bile duct.

The *common bile duct* runs between the layers of the lesser omentum, lying anterior to the portal vein and to the right of the hepatic artery. Passing behind the first part of the duodenum in a groove on the back of the head of the pancreas, it enters the second

part of the duodenum. The duct runs obliquely through the posterior-medial wall, usually joining the main pancreatic duct to form the *ampulla of Vater*. The ampulla makes the mucous membrane bulge inwards to form an eminence: the *duodenal papilla.* In about 10-15% of subjects the bile and pancreatic ducts open separately into the duodenum.

The dimensions of the common bile duct depend on the technique used. At operation it is about 0.5-1.5 cm in diameter. Using endoscopic cholangiography, it is usually less than 11 mm and values greater than 18 mm are pathological. By ultrasound the values are less, the common bile duct being 2-5 mm and values greater than this are abnormal.[6]

The duodenal portion of the common bile duct is surrounded by a thickening of both longitudinal and circular muscle fibres derived from the intestine. This is called **sphincter of Oddi**. [7]

Calot's Triangle

Calot's triangle is formed by the common hepatic duct to the left and the cystic duct below. Although the original description of the area gave the cystic artery as the superior border, the inferior surface of the liver is now accepted as this border. The cystic artery usually arises from the right hepatic artery behind the common hepatic duct and runs behind the right hepatic duct and through Calot's triangle to the gallbladder.

Blood supply

The gallbladder receives blood from the *cystic artery.* This branch of the hepatic artery is large, tortuous and variable in its anatomical relationships. Smaller blood vessels enter from the liver through the gallbladder fossa. The venous drainage is into the *cystic vein* and hence into the portal venous system.

The arterial blood supply to the supra-duodenal bile duct is generally by two main (axial) vessels, which run beside the bile duct in the 3'o' clock and 9'o' clock position.[8] These are supplied predominantly by the retro-duodenal artery from below, and the right hepatic artery from above, although many other vessels contribute. This pattern of arterial supply would explain why vascular damage results in bile duct stricturing.

Lymphatics

There are many lymphatic vessels in the sub mucous and sub peritoneal layers. These drain through the cystic gland at the neck of the gallbladder to glands along the common bile duct, where they anastomose with lymphatic from the head of the pancreas.

Nerve supply

The gallbladder and bile ducts are liberally supplied with nerves, from both the parasympathetic and sympathetic system. [9]

Laparoscopic anatomy[10]

The advent and popularity of laparoscopic cholecystectomy has led to a new look and insights into the biliary anatomy especially of the Calot's triangle area and the term "laparoscopic anatomy" has actually found a place even in anatomy texts.

The different anatomical 'laparoscopic view' of the area around the gallbladder especially the Calot's triangle does contribute to misidentification of structures. The method of retraction during the laparoscopic procedure tends to distort the Calot's triangle by actually flattening it rather than opening it out. Also the reluctance to (or difficulty) performing a fundus first cholecystectomy during the laparoscopic procedure as approved to open procedure also contributes to the some lack of exposure of the Calot's triangle. Finally the 'posterior' or 'reverse' dissection of the Calot's

triangle, which is popular during laparoscopic cholecystectomy again gives a different view of the area and since gallbladder is flipped over during the method, it may lead to further anatomical distortion. The Rouviers sulcus is fissure on the liver between the right lobe and caudate process and is clearly seen during a laparoscopic cholecystectomy during a posterior dissection in majority of patients.

It corresponds to the level of the porta hepatic where the right pedicle enters the liver. It has been recommended that all dissection be kept to a level above (or anterior) to this sulcus to avoid injury to the bile duct.

Also, this being an "extrabiliary" reference point it does not get affected by distortion due to pathology. Similarly, a clear delineation of the junction of cystic duct with the gallbladder along with the demonstration of a space between the gallbladder and the liver clear of any structure other than the cystic artery (safety window or critical window) is also recommended as an essential step to prevent bile duct injury.

ANOMALIES OF EXTRA HEPATIC BILIARY PASSAGES AND THEIR ARTERIES

Anomalies of gallbladder

- The gallbladder may be septate, transversely or longitudinally.
- The gallbladder may be double with a single cystic duct.
- The gallbladder may be double with separate ducts opening into hepatic or common or both ducts. The serosa may be separate or common.
- Small ducts may connect gallbladder with liver. Usually these become obliterated. They may persist, which is one of the reasons why drainage is advisable after cholecystectomy.

- The folded fundus (Phyrygian cap) deformity is the commonest congenital abnormality of the gallbladder. It has no pathological significance, but when present it can be seen on cholecystectomy.
- The gallbladder may have a mesentery; it may be on the left of the falciform ligament, or it may be intrahepatic.

Variations of the cystic duct

1. The cystic duct usually joins the common hepatic duct to form the common bile duct within 2-5 cm of the upper border of the duodenum.
2. Frequently the common hepatic and cystic ducts lie parallel, being joined by connective tissue for some distance before becoming one duct.
3. The union of the cystic and common hepatic ducts is frequently behind the duodenum or the pancreas, and may only occur just before the duct pierces the wall of the duodenum.
4. Usually the cystic duct joins the common hepatic duct on its right side. It may, however, join the front, back, or even the left side of the common hepatic duct by taking a spiral course behind it.
5. An accessory bile duct is not uncommon. It is sometimes an accessory right hepatic duct which leaves the right extremity of the porta hepatis runs down parallel to the cystic duct and behind it, in front of the right hepatic artery, and joins the common hepatic duct anywhere between the site for its formation and the entrance of the cystic duct into the common duct. It is more common to find ducts of varying size going directly from the liver into the gallbladder.
6. The cystic duct may be absent, the common hepatic duct entering gallbladder and the common bile duct leaving it. It is perhaps no accurate to describe the

gallbladder in these cases as being sessile. This condition is important, as gall stones can readily enter the common duct.

7. A rare anomaly shows the right hepatic duct entering the gallbladder near its junction with cystic duct. Its surgical importance is considerable. Should it be ligatures, jaundice would result as their little communication of bile channels between the two parts of the drained by right and left hepatic ducts.
8. In congenital absence of the common bile duct hepatic bile enters the gallbladder via cholecystohepatic ducts and reaches the duodenum through the cystic dict. To prevent discontinuity of biliary drainage into the duodenum, therefore it is necessary to recognise this anomaly at operation and not to remove the gallbladder in its entirety

Anomalies of the hepatic artery and the cystic artery

Present in 50% of cases a large accessory let hepatic artery originating from left gastric artery occur in 5%. Right hepatic artery originates from superior mesenteric artery in 20%. Two hepatic arteries – 5%.

A "Caterpillar hump" is right hepatic artery parallels the cyst duct and may be mistaken for cystic artery.

In 10% cases cystic artery originates from left hepatic artery or from junction of left or right hepatic artery.

In about 15% cases, cystic artery passes in front of common hepatic duct, rather than to right or posterior to this duct double cystic arteries occur in 25% cases.

Physiology

Bile

The prime function of the biliary tract is to convey bile from the liver, where it is formed, to the duodenum. Along the way, bile is stored and concentrated in the

gallbladder until it is required. Between 250 – 1000 ml of bile is secreted by human hepatocytes everyday. The main constituent is water, along with bile acids, bile pigments, cholesterol, phospholipids and all other inorganic ions found in plasma. The pH of bile duct bile is generally greater than 7 and the inorganic ions are normally present in concentrations slightly higher than in plasma, with the exception of chloride, which is usually lower.

The bile acids, cholic and chenodeoxycholic acid are synthesized in the liver from cholesterol and is major pathway of cholesterol excretion. In the colon they are metabolized by bacterial to deoxycholic and lithocholic acid, respectively, all of them except lithocholic acid are absorbed back into the portal circulation and are then re-excreted into the bile salts takes place several times each day. Because of this continuous circulation, there is always a pool of bile acids in the body. A small amount is lost from the pool each day in the stools and is made up by hepatic synthesis.

The main function of the bile acids in bile is to maintain cholesterols in solution, which they do by forming micelles. Hydrophobic cholesterol is encased in hydrophilic phospholipids and bile salts. Ingestion of food increases bile flow, probably mediated by vagal and hormonal stimuli, although bile salts themselves have a powerful choleretic effect.

Bilirubin, the major degradation product of haemoglobin, is conjugated with glucuronide by the hepatocyte and actively secreted into bile. Conjugated bilirubin is converted by the action of bacteria in the bowel into urobilinogen, which is reabsorbed into the portal circulation and re-excreted. Some urobilinogen reaches the systemic circulation and is then excreted in the urine, where it can be detected.

Biliary pain

At endoscopic retrograde cholangiopancreatography, distension of the bile duct with contrast causes pain and it is probable that a similar effect occurs from distension in normal life. While a rapid increase in intraductal pressure causes pain, slower increase lead to discomfort. Pain form stones in either the bile duct or the gallbladder probably results from acute obstruction to flow. Pain nerve endings are widely distributed throughout the biliary tract. Most pain fibres return to the central nervous system via the splanchnic nerves but a significant minority runs with the vagus, right phrenic, and intercostals nerves. This wide distribution probably explains some of the clinical variations in the perception of biliary pain.

Gallbladder function

The gallbladder provides storage and concentration of bile. The selective absorption of sodium chloride and water results in a concentration of bile salts, bile pigments, and cholesterol ten times higher than in liver bile. The gallbladder mucosa has the greatest absorptive power per unit area of any structure in the body. This rapid absorption prevents a rise in pressure within the biliary system and normal circumstances. The absorption of fluid by the gallbladder is driven by an energy dependent active transport of sodium and a consequent passive transport of water.

Secretion of mucus, approximately at the rate of 20 ml/hr, protects the mucosa from the lytic action of bile and facilitates the passage of bile through the cystic duct. This mucus makes up the colorless, “white bile” present in hydrops of gallbladder resulting from obstruction of cystic duct. The gallbladder also secretes calcium in the presence of inflammation or obstruction of the cystic duct.

Motor activity

The passage of bile into the duodenum involves the coordinated contraction of the gallbladder and relaxation of the sphincter of Oddi. Some bile flows from the gallbladder continuously and there are rhythmic contractions occurring 2-6 times per minute and mediating pressure less than 30cm H_2O. The gallbladder's emptying, however, is mainly a response to the ingestion of food and release of cholecystokinin (CCK) by the duodenum. CCK also relaxes the terminal bile duct; the sphincter of Oddi, the gallbladder is two thirds evacuated within 30 minutes. CCK exerts its contractile effects mainly through action directly on gallbladder smooth muscle cells, but also via interaction with cholinergic nerves. There is a feedback inhibition of CCK secretion bile acids and proteases. Somatostatin has a direct inhibitory action against CCK induced gallbladder contraction.

The vagus nerve stimulates contraction of the gallbladder and splanchnic sympathetic stimulation is inhibitory to its motor activity. Parasympathetic drugs contract the gallbladder, whereas atropine leads to relaxation. Magnesium sulphate is a potent evacuator of the gallbladder. Emptying of the gallbladder takes place 30 min after ingestion of a fatty meal. There is an increased risk of gallbladder disease in patients on prolonged total parental nutrition (TPN) because of the lack of intestinal stimulus and consequent stasis of bile within the organ.

The common bile duct can be shown to have wave of peristalsis. During starvation, the sphincter of Oddi maintains an intraductal pressure that approximates the maximal expulsive pressure of gallbladder, i.e. 30 cm H_2O, thereby preventing emptying. During the interdigestive periods, the hormone motilin regulates sphinceteric pressure to allow continuous flow of small amounts of bile into the duodenum, after the ingestion of food; the sphincteric pressure is reduced to 10 cm H_2O. When pressure

within the extra hepatic bile ducts is greater than 36 cm H_2O secretion of bile is suppressed.

Gallstones

Incidence: Gallstones are the most common biliary pathology. The incidence of biliary calculous disease varies widely throughout the world. Around 10% of population in the United States has documented cholelithiasis. The incidence of gallstone disease in Asia is considerable and constitutes a problem of enormous magnitude. The incidence of cholesterol gallstones is increasing in Asia for the reasons that may be related to environmental and dietary considerations.

Gallstones are composed predominantly of cholesterol, bilirubin and calcium salts with lesser amounts of other constituents. The most popular classification system uses the relative amount of cholesterol as the main criterion and designates gallstones as being either cholesterol or non-cholesterol. The latter are further classified as black or brown pigment stones. The centre of a cholesterol gallstone is frequently pigmented because of a concentration of calcium bilirubinate salts in this area higher than that in the outer portions.

Cholesterol gallstones

Three major factors determine the formation of cholesterol gallstones. These are altered hepatic bile, which becomes supersaturated with cholesterol, nucleation of cholesterol monohydrate crystals and impaired function of gallbladder.

Classification of gallstones

	Cholesterol	**Black**	**Brown**
Location	Gallbladder, ducts	Gallbladder, ducts	Ducts
Major constituents	Cholesterol	Bilirubin pigment polymer	Calcium bilirubinate
Consistency	Crystalline with nucleus	Hard	Soft, friable
% Radio-opaque	15%	60%	0%
Associations			
Infection	**Rare**	**Rare**	**Usual**
Other diseases		Haemolysis, Cirrhosis	Chronic partial biliary obstruction

Altered hepatic bile composition

Bile is 85-95% water. Cholesterol, which is insoluble in water and must be maintained in solution, is secreted from the canalicular membrane in unilamellar phospholipid vesicles. In hepatic bile unsaturated with cholesterol and containing sufficient bile acid, the vesicles are solubilised into mixed lipid micelles. These have a hydrophilic external surface and a hydrophobic interior. Cholesterol is incorporated into the hydrophobic interior. Phospholipids are inserted into the walls of the micelles so that they grow. These 'mixed micelles' are thus able to hold more cholesterol in a stable thermodynamic state. This represents the situation with a low cholesterol saturation index (derived from the molar ratios of cholesterol, bile acids and phospholipids).

When bile is supersaturated with cholesterol, or bile acid concentrations are low (a high cholesterol saturation index), the excess cholesterol cannot be transported in

mixed micelles and unilamellar phospholipids vesicles remain. These are not stable and can aggregate. They fuse to form large multilamellar vesicles from which cholesterol monohydrate crystals may nucleate.

In most gallstone sufferers, the gallstone formation can be related to supersaturating of bile with cholesterol due to an increased proportion of cholesterol to bile acids. In the majority of patients a diminished hepatic secretion of bile acids is the primary defect, and this is related to a reduced totally body pool of bile acids. The bile acids circulate more frequently within the entero hepatic circulation, thereby suppressing synthesis.

FIGURE-1: CHOLESTEROL STONES

Cholesterol nucleation

Nucleation of cholesterol monohydrate crystals from multilamellar vesicles is a crucial step in the process leading to gallstone formation. The distinguishing feature between those who from gallstones and those who do not is the ability of the bile to promote or inhibit nucleation rather than the degree of cholesterol supersaturation. The time taken for this process (nucleation time) is significantly shorter in those with gallstones than in those without and in those with multiple as opposed to solitary stones.

Ursodeoxycholic acid, as well as decreasing cholesterol saturation, also prolongs the nucleating time, which may have implications in the prevention of gallstones recurrence.

The gallbladder fills with hepatic bile during fasting, concentrates the bile and injects the concentrated bile into the duodenum during a meal. It must be capable of emptying to clear itself of sludge and debris that might initiate stone formation, particularly in the patient with bile supersaturated with cholesterol and a short nucleation time. Hepatic bile is stored in the gallbladder and concentrated by the absorption of Na, Cl and HCO_3 with a nearly isotonic amount of water. The biliary concentration of bile salts, bilirubin and cholesterol, for which the gallbladder wall is essentially impermeable, may rise 10 fold or more.

Gallbladder contraction is under cholinergic and hormonal control. Cholecystokinin (CCK), derived from the intestine, contracts and empties the gallbladder and increases fluid secretion with dilution of gallbladder contents. Other hormones found to have an influence on the gallbladder include *motilin* (stimulatory) and *somatostatin* (inhibitory).

The relationship between impaired gallbladder emptying and the increased incidence of gallstones in patients on long term parenteral nutrition and in pregnant women has suggested that the gallbladder stasis has a role in the formation of gallstones.

Biliary sludge

This consists of calcium, bilirubin and cholesterol. It occurs in the presence or absence of gallbladder stones. Alone, it can cause biliary-type pain.

Role of infection

Infection is of little importance in cholesterol gallstone formation. The bile is usually sterile and culture of the gallstone yields no growth. Biliary infection plays a role in brown-pigment stone formation, the majority containing bacteria on electron microscopy.

Age

There is a steady increase in gallstone prevalence with advancing years, probably due to the increased cholesterol content in bile. Gallstones of pigment and cholesterol type are reported in childhood.

Genetics

Families of patients with gallstones have an increased frequency of gallstones, irrespective of their age and weight.

Sex and oestrogens

Gallstones are twice as common in women as in men.

The incidence is higher in multiparous than in nulliparous women. Incomplete emptying of the gallbladder in late pregnancy leaves a residual volume and this retention of cholesterol crystals; this favours gallstone formation.

In women younger than 30 years, gallstones are usually associated with pregnancy and obesity. The bile becomes more lithogenic, when women are placed on birth control pills. Women on long term oral contraceptives have a two-fold increased incidence of gallbladder disease over controls. Post menopausal women taking oestrogen-containing drugs have highly significant (2.5 times) increase in gallbladder disease.

Obesity

This seems to be more common among gallstone sufferers than in the general population and is particular risk factor in women less than 50 years old (fat, fertile, female of forty). Obesity is associated with increased cholesterol synthesis and excretion. 50% of markedly obese patients were found to have gallstones at surgery.

Dietary factors

Gallstones have been linked to dietary fibre deficiency. This would increase the secondary bile acids, such as deoxycholic acid, in bile and render it more lithogenic,

carbohydrate in refined form increases biliary cholesterol saturation. A moderate amount of alcohol seems to protect against gallstones. Vegetarians get fewer gallstones irrespective of their tendency to be slim anyway.

Serum factors

The highest risk of gallstones (both cholesterol and pigment) is associated with low HDL levels and high triglyceride levels.

Pigment gallstones

This term is used for stones containing less than 25% cholesterol. They are irregular or smooth and amorphous or crystalline on cross-section. They represent quarter of gallstones removed at cholecystectomy. There are two types: black and brown.

Black pigment stones are largely composed of an insoluble black pigment polymer mixed with calcium phosphate and carbonate. They are usually limited to the gallbladder. They accompany chronic haemolysis, usually hereditary spherocytosis or sickle cell disease, and mechanical prostheses in the circulation.

Brown pigment stones have calcium bilirubinate as their major component but calcium palmitate and cholesterol are other major constituents. They are usually radiolucent. They are found in the intra-hepatic and extra-hepatic bile ducts and in the gallbladder. They are virtually 10% associated with stricture, sclerosing cholangitis and Caroli's syndrome. Recurrent bile duct stones are usually of this type.

In Oriental countries, they are associated with parasitic infestations of the biliary tract such as Clonorchis sinensis or Ascaris lumbricoides.

Shaffer and Small proposed six categories of pathophysiologic abnormalities that could lead to lithogenic bile formation.

- Excessive bile salt loss.
- Oversensitive bile acid feedback.
- Excessive cholesterol secretion.
- Mixed defects
- Rapid bile salt circulation with decreased pool size
- Primary disorders of the gallbladder, duct or sphincter.

In Western countries, cholesterol gallstones predominate. Pigment stones, particularly brown stones are very common in Asia.

Effects and complications of gallstones

In gallbladder

- Silent stones
- Chronic cholecystitis
- Acute cholecystitis
- Gangrene
- Perforation
- Emphysema
- Mucocele
- Carcinoma

In bile ducts

- Obstructive jaundice
- Cholangitis
- Acute pancreatitis

In the intestine

- Acute intestinal obstruction (gallstones ileus)

PATHOLOGY

Acute cholecystitis

Acute cholecystitis is clinically defined as an episode of acute biliary pain accompanied fever and right hypochondrial tenderness and guarding, with persistence of the symptoms beyond 24 hours.

It is usually due to persistent impaction of a stone in the neck of the gallbladder. The result is initially a chemical inflammation of the gallbladder wall, perhaps due to the mucosal toxin, lysolecithin, produced by the action of phospholipase on biliary lecithin. This is soon followed by bacterial infection. Because the cystic duct is occluded the inflammatory process is particularly aggressive and the gallbladder becomes acutely distended with accompanying lymphatic and venous obstruction. The serosa may be covered by a fibrous exudates and subserosal haemorrhage gives the appearance of patchy gangrene. The gallbladder wall itself grossly thickened and oedematous, and the underlying mucosa may show hyperemia or patchy necrosis. Histologically, three grades of inflammation are recognized; acute cholecystitis, acute suppurative cholecystitis and acute gangrenous cholecystitis.

Acute acalculous cholecystitis

Acute acalculous cholecystitis is found in approximately 5% of all patients undergoing cholecystectomy (Babb RR, 1992). It predominantly affects individuals with other conditions including trauma, non-biliary surgical procedures, sepsis, burns, TPN, mechanical ventilation, blood transfusions and use of narcotics or antibiotics. Increased bile viscosity from stasis with obstruction of the cystic duct has been suggested as a contributing factor. Mucosal ischemia is a major culprit due to thrombosis of arteriolar and venules. Bile cultures are generally negative. USG is the

most useful investigation and may show biliary sludge in a tender thickened gallbladder but fails to demonstrate stones.

Acute emphysematous cholecystitis

An uncommon variant characterized by the production of gas by the infecting bacterial organism. It occurs mostly in men between 50-60 years of age and in diabetics. As there is a high incidence of complications such as gangrene and perforation, the overall morality is high. About half of bile cultures are positive for Clostridia organisms. (Lee BY et al, 1992) and the diagnostic sign is gas within the wall or the lumen of the gallbladder seen on plain radiograph.

Chronic cholecystitis

Chronic cholecystitis develops as a result of recurrent attacks of mild acute cholecystitis.

Pathology

The pathological changes, which often do not correlate well with symptoms, vary from those of an apparently normal gallbladder with minor chronic inflammation in the mucosa to a shrunken organ with gross transmural fibrosis and organized adhesions. The mucosa is initially hypertrophied but later become atrophied; the epithelium protrudes into the muscle coat, leading to the formation of Ashoff – Rokitansky sinuses. The most severe form is represented by cholecystitis glandularis proliferans in which there are buried areas of hyperproliferative epithelium within the wall of the gallbladder. Rarely, dystrophic calcification may occur, resulting in the formation of a porcelain gallbladder. Calcification is said to predispose o malignant change.

Chronic acalculous cholecystitis

About 12-13% of patients with chronic cholecystitis do not have gallstones. (Raptopoulos V et al, 1986; Singha SN et al, 1977) found an incidence of 14.7% of

acalculous gallbladder disease. In children the incidence has been quoted as 32%. In US the generally accepted incidence has been 5-10%. Post inflammatory stenosis or anatomic abnormalities of the cystic duct might impede normal emptying of the gallbladder. Mucosal hyperplasic has been stated as a potent cause of biliary symptoms without stones (Gunn A et al, 1973).

The symptoms of acalculous gallbladder disease do not differ in any significant way from those of calculous disease but quite a high proportion of patients complain of severe pain and it is these who benefit most from cholecystectomy (Gunn A et al, 1973).

Mucocele

Distention of the gallbladder by a clear and watery or mucoid material has been called hydrops or mucocele respectively, and accounts for 3% of the pathologic gallbladders in adults. The most common cause is an impacted stone in the neck of the gallbladder or cystic duct. Thin wall is the rule. Microscopy reveals flattened mucosa lined by low columnar or cuboidal cells. Rokitansky – Aschoff sinuses may be plentiful. Once diagnosed, patients should be advised to have a cholecystectomy.

Cholesterolosis

This is caused by the deposition of cholesterol in the mucosa and sub mucosa of the gallbladder wall and produces the classic macroscopic appearance of a strawberry gallbladder. Microscopy shows macrophages loaded with cholesterol. Ultrasound identifies the cholesterol in the wall as bright shiny spots and there may also be a cholesterol stones with the lumen. Cholesterolosis may cause pancreatitis, perhaps as a result of small cholesterols crystals passing down the bile duct and briefly occluding the ampulla, soothe at symptomatic patients should be advised to undergo cholecystectomy.

Adenomyomatosis

Adenomyomatosis or cholecystitis glandularis proliferans is characterized on microscopy by hypertrophic smooth muscle bundles and epithelial sinus formation. Granulomatous polyps develop in the lumen at the fundus. Inflammation develops later and gallstones are sometimes present. Symptomatic patients require a cholecystectomy.

Differential diagnosis of cholecystitis

Common

- Appendicitis
- Perforated peptic ulcer
- Acute pancreatitis

Rare

- Acute pyelonephritis
- Myocardial defarction
- Pneumonia – right lower lobe

CLINICAL FEATURES

The classical presentation of acute cholecystitis is an acute pain in the right hypochondrium or epigastrium along with fever, vomiting and a palpable tender gallbladder mass in the right hypochondrium. The tenderness is characteristically described as the Murphy's sign (inspiratory arrest during sub costal palpation). However, a mass may not be evident when recurrent acute cholecystitis is imposed on an already severely diseased small contracted gallbladder. The frequency of finding a palpable mass as has been noted by different workers ranges from 30-42% (Tyagi SP et al, 1992).

The characteristic symptoms of chronic cholecystitis are that of a right upper abdominal pain, dyspepsia, fat intolerance and nausea or vomiting. The pain is most frequently located in the right upper quadrant and is usually radiating to the back or right shoulder. The frequency of the pain has been described as about 90% in most of the literatures (Colcock BP et al, 1955; Pal V et al, 1980). Fever and chills are occasionally noted. Anorexia and weight loss are the nonspecific symptoms of the disease.

INVESTIGATION

Abdominal radiography

Visualization of gallstones on plain abdominal radiographs is possible only in that 20% of patients whose stones are grossly calcified. More the less, gallstones are so common that they are the most frequent cause of discrete right upper quadrant calcifications. The smaller numbers of calcified gallstones that will be seen on plain films are indicative that the majority of stones are cholesterol based and contain little calcium. Despite the overall limited utility of plain abdominal films in the diagnosis of gallstone disease, such radiographic examinations may be very helpful in eliminating other causes of acute abdominal pain.

Oral Cholecystography

In 1924, Graham and Cole introduced the concept of oral cholecystography. For many years, this test was considered the main stay and gold standard for the diagnosis of gallstone disease.

The technique introduced more than 70 years ago was based on two physiologic principles; halogenated dyes are excreted in bile and the gallbladder is capable of concentrating bile 8 to 10 fold. In a normally functioning gallbladder, dye is

concentrated as a result or the absorptive function of the gallbladder and it will appear opacified. The presence of gallstones is suggested by the appearance of filling defects in an otherwise opacified gallbladder or by non-visualization. The latter is indicative of reduced absorption, which is consistent with chromic cholecystitis.

The accuracy of oral cholecystography is between 95 - 99%. One of the major criteria for establishing oral cholecystography evidence of gallstone disease has been non-opacification of the gallbladder after two successive doses of oral contrast medium. However, there are a number of other factors that may account for non-opacification, including failure to ingest the contrast agent, failure of the agent to reach the small bowel, hepatic parenchymal disease or biliary obstruction, prolonged fasting, pancreatitis, hyper alimentation, and prior cholecystectomy.

All of these above factors, plus overall patient's compliance have been quite limiting in the efficacy and utility of oral cholecystography.

Cholangiography

Routine cholangiography during laparoscopic cholecystectomy has been advocated to confirm anatomy and thus prevent ductal injury. Although its utility has been questioned by some, routine cholangiography assures facility with the technique and appears to be a skill that can be mastered (84% of attempted intra operative cholangiography were successful).

One disadvantage of videoscopic surgery is the inherent loss of depth perception with the two-dimensional image played on the video monitor. An intra operative cholangiography provides a "road map" of entire biliary system and aids in the dissection of the function between cystic and common bile ducts which is of great value in cases where anatomic land marks are not clearly identified or where variation to the normal ductal anatomy are present.

Ultrasonography

It is the investigation of choice for diagnosing cholelithiasis. It helps to know the status of the gallbladder regarding the size, shape, wall thickness and number of stones and whether stone is impacted or mobile and the size of stone.

Preliminary success in evaluation of gallstones was done using 'A' mode ultrasonography. Ludwig et al reported this in 1950. Weill (1970) reported gallbladder examination for stones using ultrasonic 2 – dimensional 'B' mode examination. He showed that using 'B' mode ultrasonography calculi as small as 9.5 can be detected. Goldberg et al (1972) reported examination of gallbladder by 'B' mode examination using gray scale. He compared the findings of USG with operative findings and showed on accuracy of 72% in detection of stones.

The confidence of the radiologist in making a diagnosis of a gallbladder packed with stones is enhanced if the double are sign or WES triad (W – the wall, E – the echogenic focus from the stone and S – the shadow). It consists of two parallel accurate echogenic focus separated by a thin anechoic space with distal acoustic shadowing. The proximal represents the near wall of the gallbladder, the anechoic space is bile and the distal arc is due to stones.

The ultrasound report aids in predicting difficulty at laparoscopic cholecystectomy. A report suggesting a contracted gallbladder is highly predictive of failure. 50% of patients with this report will be converted to open cholecystectomy.

J.O. Jorgensen and D.R. Hunt in 1993 reported that a thick walled gallbladder (>3mm) on ultrasound was not a significant predictor of failure at laparoscopic cholecystectomy. In this study, if the definition of a thick walled gallbladder was that it measures more than 4 mm, this parameter was still not able to predict failure at laparoscopic cholecystectomy. This finding reflects the ability to remove inflamed

edematous gallbladder laparoscopically. Frequently, the histology report showed that the thickening was caused by muscle hypertrophy or glandular proliferation, not by chronic fibrosis.

Computed Tomography

Computed tomography (CT) scans are not a first-line test for the diagnosis of cholelithiasis. Obvious gallstones frequently are missed by routine CT, although they may be seen as incidental finding, if they are densely calcified. In addition to failing to demonstrate calculi that might be seen more easily in ultrasonography or oral cholecystography, CT has the additional disadvantage, compared to cholecystonsonography, of relying on ionizing radiation for images. Utilizing x-rays striking a series of sensitive detectors, images are created by computers, based on different sections and individual levels, ant the entire body can be visualized. Although this test is not particularly sensitive for identifying gallstones, it does not provide important information regarding the nature, extent, and the location of biliary dilatation and masses in and around the biliary tract and for pancreas. In general, this test provides more useful information than ultrasonography when the concern is extra hepatic obstruction owing to cause other than choldocholithiasis. Limiting factors for CT scanning include patient exposure to ionizing radiation and cost.

Magnetic resonance imaging

Magnetic resonance imaging (MRI) provides images that may appear similar to CT. the images however result from the different magnetic properties of the tissues and rely on the use of contrast material, gadolinium. Gallstones, when sufficiently large, may be visualized with MRI as low-intensity filling defects within the gallbladder bile. The majority of gallstones, however produce no signal whatsoever with this modality.

Therefore, its role in the evaluation of patients with cholelithiasis remains unclear at this time.

Hepatobilliary scintigraphy

In the late 1970s, the introduction of technetium 99m (99mTC) – labeled iminodiacetic acid (IDA) agents facilitated the development of Radionuclide imaging as a diagnostic modality for suspected acute cholecystitis. This family of radio nuclides provides direct imaging of the gallbladder and the biliary tract. These agents, administered intravenously, are cleared from the blood by hepatocytes and excreted in an unconjugated form directly into the biliary ductal system. Currently, two commercially available IDA agents are in common use disofenin and mebrofenin. These agents are superior to those we used in earlier years and make possible the evaluation of patients despite elevated bilirubin levels. In addition, these isotopes have a relatively short half-life and this provides for improved visualization with less radiation exposure of the patient. This test provides information on the potency of the bile ducts and cystic duct. Recognition that cystic duct obstruction is present represents the hallmark of the diagnosis of acute cholecystitis. Cystic duct obstruction, and by implication acute cholecystitis, is diagnosed when there is normal imaging of the liver and common bile duct with prompt visualization of the duodenum but absence of label within the gallbladder. Failure to visualize the gallbladder after 60 minutes is diagnostic of cystic duct obstruction, and highly suggestive of acute cholecystitis. Delayed visualization of the cystic duct and gallbladder after 4 hours even in patients with altered hepatocellular function, is also highly suggestive of cholecystitis. Most large series suggest that biliary scintigraphy has a diagnostic accuracy for acute cholecystitis of 98%. Although this test is extremely sensitive in diagnosing acute cholecystitis, it is often superfluous in the clinical evaluation of patients suspected of having this

diagnosis. Biliary scintigraphy does not demonstrate the presence of gallstones. Often, the diagnosis of acute cholecystitis is made based on clinical criteria and ultrasonographic demonstration of the presence of stones.

CHOLELITHIASIS AND CHOLECYSTECTOMY

History

Archaeological excavations demonstrating the presence of gallstones in young Egyptian women have confirmed that cholelithiasis has plagued mankind for over 2000 years.[11]

Gordon Taylor (1937) suggested that the first clinical description of gallstone disease was recorded in the 4th century BC. Despite description of liver and gallbladder, recognition of the gallstones was not recorded until 5th century. Credit is given to Greek Physician Alexandra. His description of concretions within bile ducts is almost certainly that of gallstones.

Vesalius gave an accurate description of human gallstones, concluding that they represented a disease and describing some of their consequences.

During the last several centuries, numerous innovative and creative techniques have been introduced in an effort to manage patients with symptomatic gallstone disease.

Joenisius was credited for the first successful cholecystolithotomy in 1676, but the apparently extracted gallstones from a biliary fistula of the abdominal wall following spontaneous drainage of the abscess.

Jean Louis Petit reported puncture of the enlarged gallbladder by trocar and cannula as early as 1743.

Nonetheless, the treatment for symptomatic gallstone disease remained relatively primitive and ineffective until the late 1800s. As surgical techniques began to evolve, John Bobbs, a surgeon and others attempted to perform cholecystolithotomy, removing the stone from the gallbladder and leaving the organ in situ. [12] While this proved to be effective in ameliorating acute symptoms, physicians were disappointed by the recurrence of symptoms in many of these patients.

In 1882, Karl Langenbunch, a noted German surgeon performed the first successful cholecystectomy. [13] He believed that gallbladder would reform stones after their removal and that cholecystectomy was therefore not a curative procedure. [14]

During the last 100 years, open cholecystectomy has remained the gold standard for the definitive management of patients with symptomatic cholelithiasis.

Despite the efficacy and safety of cholecystectomy, physicians have long pursued and investigated other less invasive options. The earliest attempts at medical dissolution for cholesterol gallstones were reported in the mid 1920s.

The development of potent cholesterol solvent, methyl terbutyl ether provided the opportunity for the introduction of a form of gallstone dissolution in which a catheter is placed percutaneously in the gallbladder and the agent is directly instilled. This technique while theoretically attractive, has found limited utility because of its invasive nature, as well as problems with gallstone recurrence. [15]

The management of patients with gallstone disease has been revolutionized during the last seven years with the introduction and evolution of laparoscopic cholecystectomy.

LAPAROSCOPIC SURGERY

Laparoscopy had its beginnings in the interest to examine human internal structures. Credit for the first attempt to examine internal structures should be given to Abulkasi, an Arabic physician (936-1013 AD), who first used reflected light to inspect the cervix. [16] The first real interest in developing technology to examine internal human viscera is recorded by Bozzani of Frankfort in 1805 when he reported an attempt to visualize the urethra and bladder of a patient. His apparatus, called “Litch Leiter”, was a crude attempt at a urethroscope using a candle as a light source.

By 1826 Segalas had developed the urethroscope and the development of modern urologic endoscopic equipment was well on its way. The problem of then early instruments remained the light sources. Desormeaux, in 1853 developed a urethroscope that used a kerosene lamp and a system of mirrors. This was rapidly improved and in 1867 Andrews introduced the idea of burning a piece of magnesium were in a kerosene flame to provide a brighter light which was more easily reflected down the long urethroscopy tubes. In 1867, Bruck developed a light source consisting of a loop of platinum wire, which he heated by electric current. This adaptation of a heated platinum wire light source was adapted to cystoscopes by Nitze in 1877.

Thomas Edison provided a new technologic breakthrough in 1879 with the invention of electric light bulb. This allowed Maximilian Nitze and Josef Leiter, in the same year, to introduce a rigid endoscope with a built-in-light source formed from an electrically heated platinum wire, a multilens system, and a separate water circulation system of cooling.

In 1901, Dimitri Oskarovich Ott of Petrograd, Russia, performed the first endoscopic examination of the abdominal cavity through a posterior vaginal incision using a head mirror and speculum. [17] In the same year, although reported in 1902, George Kelling of Dresden, Germany, is credited with performing the first true laparoscopy of the abdominal cavity. [18]

Jacobeus performed the first endoscopic examination of the abdominal and thoracic cavities in humans and is credited with coining the terms laparoscopy and thoracoscopy.

Bertram Bernheim at Johns Hopkins University Hospital performed the first laparoscopic procedure in the United States in 1911. [19] This organoscopy allowed him

to inspect the peritoneal cavity, the liver and the stomach after inserting a 12 mm proctoscope through an epigastric incision without pneumoperitoneum.

Practical improvements in laparoscopy occurred over the next two decades. Peritoneal abscess was facilitated by the use of the pyramidal shaped, sharp-tipped trocars introduced by Orndoff in 1920.

A Swiss gynecologist, Zollikofer, popularized carbon dioxide for pneumoperitoneum in 1924 because it was absorbed faster and minimized the risk for explosion.

In 1929, Kalk was the first to advocate dual trocar technique.

A major advance in establishing pneumoperitoneum occurred in 1938 when James Veress, a Hungarian physician, introduced a new needle. This sharp-edged needle combined with a spring-loaded central blunt tip, which was recognized as a method to introduce pneumoperitoneum safely and minimize intra abdominal organ injury. The Veress needle still is used today.

Therapeutic applications of laparoscopy began in the 1930s. Fervers, a gynecologist initiated this process with the laparoscopic adhesiolysis using electrocautery in 1933.

In 1950, Ruddock reported his series of 500 cases using a peritoneoscope, which increased his diagnostic accuracy. [20]

Royer in 1947, described techniques of puncturing the gallbladder and injecting x-ray contrast material under laparoscopic guidance to allow for cholangiography. [21]

An English optics expert, Professor Harold H. Hopkins of the University of Reading, devised a rod lens system, which would theoretically deliver the maximum total light that could be transmitted to the tip of the endoscope. [22] The system was developed to change the method of light transmission dramatically.

The last technological improvement necessary to development of laparoscopic cholecystectomy was the development of a miniaturized high-resolution video camera.

By the early 1980s, the small "three-chip" color, high resolution camera became available and these cameras could be readily modified to adapt to laparoscopic equipments.

Laparoscopic Cholecystectomy

Although these advances had widespread rise of laparoscopy for diagnostic and stabilization procedures in gynecological surgery, few general surgeons used it on their surgical practice. The exceptions were pioneering individuals such as George Berci and Alfred Cushicri who used diagnostic laparoscopy for everlasting and staging patients with abdominal malignancies.

In 1987, Philippe Mouret performed the first laparoscopic cholecystectomy in a human. [23, 24] Almost simultaneously Mc Kernan and Saye performed the first laparoscopic cholecystectomy in the United States in 1988. [25]

Less than 50 years after Kelling's experiment, Dr. F.P. Antia, then physician at KEM Hospital, Mumbai performed a diagnostic laparoscopy on a patient with cirrhosis using a Nitze-type telescope and a feeble filament light bulb and atmospheric air instilled with the help of sigmoidoscope pump for induction of pneumoperitoneum. [26]

The first laparoscopic cholecystectomy in India was performed in 1990 at the JJ Hospital, Mumbai by Dr Tehemton Udwadia, followed by few months later in Pune by Dr. Jyotsna Kulkarni. [26]

Within a short span of five years laparoscopic cholecystectomy has surpassed conventional cholecystectomy as procedure of choice for diseases of gallbladder. [27]

MANAGEMENT OF GALLSTONE DISEASES

Medical therapy

The non-operative therapy for the management of gallstones has long fascinated physicians.

In the 1920s the recognition that excess biliary cholesterol was critical to the formation of cholesterol gallstones paved the way for a series of studies that attempted to identify agents that could reduce bile lithogenicity and dissolve cholesterol stones.

Years of intense investigation result in the identification and subsequent commercial release of chenodeoxycholic acid (CDCA). This agent desaturates bile and dissolves cholesterol gallstones by a mechanism that is independent of simple expansion of the bile salt pool. CDCA is the specific inhibitor of HMG-COA reductase, and the rate-limiting enzyme for cholesterol biosynthesis.

Initial enthusiasm for CDCA was tempered by the realization that many patients experienced diarrhea and few developed reversible hepatic toxicity. Patient selection is absolutely critical for success of CDCA. Factors for success relate to gallbladder function, stone size and stone composition. Ideal candidates are young, thin females who have thin (<5mm) radiolucent, floating stones. Ninety percent of such selected patients will undergo total dissolution. But will require 6-12 months of intense therapy. Unfortunately, <5% of patients with gallstones meet these criteria. In addition, most patients will require a lifetime of maintenance therapy to prevent recurrence of stones.

Cost analysis studies have suggested that bile acid therapy is not cost effective, as compared to cholecystectomy for younger patients, but may in fact be appropriate from a fiscal and economic prospective in patients more than 65 years of age.

Ursodeoxycholic acid (UCDA) is now commercially available. Similar to CDCA, UCDA, when taken orally, can dissolve cholesterol gallstones in selected patients. Neither CDCA nor UCDA has any efficacy for patients with pigment stones. These two bile acids are similar in structure, differing only in the orientation of a hydroxyl group. Initial data suggested that UDCA was in fact, a better safer and more UDCA facilitates conversion of hepatic cholesterol to bile acid and in addition, reduces cholesterol absorption in the intestine. A number of large studies would suggest that the administration of UDCA result in approximately 40% rate of complete gallstone dissolution. The criteria for patient selection in predicting success with UDCA are identical to that which has been discussed above CDCA. Unfortunately similarly small number of patients is candidates for this type of therapy, based on selection criteria. This disappointing slow rate of complete dissolution with CDCA and UDCA, coupled with the recurrence rate and the need for maintenance therapy, have severely limited the indications and use of these drugs in clinical medicine. The ultimate role of oral bile dissolution therapy remains to be more clearly defined. To date, medical dissolution of gallstones has only been accomplished for cholesterol gallstones. Limited information is available regarding the dissolution of non-cholesterol, calcium bilirubinate stones.

Direct contact dissolution

The development and refinement of percutaneous transhepatic cholangiography and catheter placement has facilitated a technique for gallstone dissolution based on instillation of solvents directly into the gallbladder. Pioneered by Thistle and his colleagues at the Mayo Clinic in the late 1980s, percutaneous transhepatic cholecystolitholysis (direct contact dissolution) has been utilized in only a small number of centres. The procedure involved the percutaneous placement of a pigtail

catheter through the liver and directly into the gallbladder with rapid alternating infusion and aspiration of a specific agent that dissolves cholesterol. Gallbladder puncture and intubation can be accomplished using local anesthesia with fluoroscopic or ultrasonographic guidance. Methyl tert-butyl either (MTBE) is aliphatic ether that is liquid at body temperature and rapidly dissolves cholesterol. This agent is potentially explosive, and can be toxic when allowed to enter the bile duct and / or duodenum. Patient selection is critical, and current criteria include high-risk patients with symptomatic stones or who refuse operation, and who have a patent cystic duct, as demonstrated by oral cholecystography or biliary scintigraphy. This procedure is invasive and associated with potential side effects and risk including hemorrhage, catheter displacement, transient abdominal pain, nausea, emesis, duodenitis, and sedation. Stones have been documented to re-occur in approximately 10% of patients who have been followed up for 36 months. The use of contact dissolution with MTBE should probably be limited to a few specific centers with specific interest and expertise in the area.

Extracorporeal shock wave lithotripsy (ESWL)

The success of ESWL for genitourinary (GU) stones lead to a number of trials examining the role of this technology for patients with biliary tract stones. Potential advantages of biliary lithotripsy include shortened hospitalization, avoidance of surgical intervention and associated complications and high rate of acceptance by patients. Preliminary studies performed in Germany suggested stone-free rates of up to 90% could be realized by the combination of ESWL and litholytic therapy with CDCA or UDCA.

Unfortunately, more recent prospective studies performed in the United States and other countries have been disappointing. Data from the Dornier National Biliary

Lithotripsy study indicated that only 22% of patients treated with ESWL and litholytic therapy were stone free at 6 months. A number of selection criteria have been proposed based on the collective experience with ESWL. History of biliary tract pain, one to three radiolucent gallbladder stones with diameters <30 mm, and a functioning gallbladder, as demonstrated by oral cholangiography. Patients who should be excluded specifically from consideration for ESWL therapy include patients with more than three stones; very large calcifies stones, non-functioning gallbladder or presence of acute cholecystitis, cholangitis, jaundice or pancreatitis. Cost-effectiveness analyses also have been disappointing and raised concern about the value of ESWL as a first line of therapy for gallstone patients.

The major problem with ESWL for gallstone continues to be the high rate of stone recurrence. Patients undergoing ESWL can expect a recurrence rate of 10% per year for the first 5 years. Nonetheless, this observation, coupled with limitations based on selection criteria, and the development laparoscopic techniques have caused a reevaluation of its role in the treatment strategy of gallstone patients.

OPERATIVE MANAGEMENT

Cholecystectomy is one of the most common major abdominal operations in the Western world. Cholecystectomy can be performed by open and laparoscopic methods.

The indications for cholecystectomy are the same for both techniques: [28]

- Gallbladder and biliary symptoms are most common symptoms
- Gallstone pancreatitis
- Symptomatic gallbladder polyp
- Non-functioning of gallbladder

- Gallstones in patients with sickle-cell disease
- Large gallstones (>3cms)
- Calcified gallbladder wall
- Chronic cholecystitis

Traditionally, open cholecystectomy has been the gold standard for all patients with symptomatic gallstone disease.[29]

OPEN CHOLECYSTECTOMY

Although laparoscopic techniques have largely supplanted traditional methods of performing open cholecystectomy for most patients with chronic, uncomplicated cholecystitis and cholelithiasis, the open approach continues to be safe and effective therapy for the treatment of complicated gallstone disease. The most common indication for surgical removal of the gallbladder is recurrent biliary colic.

There are a number of clinical situations that, when present, make the laparoscopic approach more difficult and should prompt consideration of the open approach. Morbid obesity, cirrhosis, portal hypertension, severe obstructive lung disease, previous surgery, and pregnancy are all factors for which laparoscopic cholecystectomy may be difficult and associated, with increased risk.[30]

In addition, open cholecystectomy should be considered the procedure of choice in patients with severe cholecystitis, empyema of gallbladder, acute cholangitis, gallbladder perforation, cholecystenteric fistulae, or a suspected gallbladder neoplasm.[30]

A number of technical and anatomic considerations may preclude laparoscopic cholecystectomy or make its performance unwise. Control of hemorrhage and

difficulty in identifying ductal and vascular anatomy are important considerations in deciding the most appropriate way of removing the gallbladder. [30]

Despite the advent of minimally invasive technology, open cholecystectomy continues to be a perfectly acceptable method for removal of the gallbladder under any circumstances and should certainly be considered if proper facilities for performance of laparoscopic surgery are not available or if the surgeon is not, adequately trained in this technology. [31-34]

Mini cholecystectomy

Mini cholecystectomy is performed via a subcostal incision no more than 5 cm long placed right over the gallbladder, which is then dissected out fundus first. There is postoperative pain or systemic upset and patients can be discharged earlier their surgery. Controlled trial shave claimed that the results of mini cholecystectomy are as good as those of the laparoscopic operation. [35]

Acute cholecystectomy

This is usually an open operation from the outset, either because the diagnosis is only made at laparotomy or because it has been immediately obvious on laparoscopy that conversion to an open operation would be wise. It is a difficult operation that should only be undertaken by an experienced surgeon. The operation is always done fundus first and mostly with the fingers.

Cholecystectomy

Most patients with acute cholecystitis respond to conservative measures. A few do not and then go on to develop empyema of the gallbladder that requires drainage. Ultrasound guided percutaneous drainage with a pigtail catheter is the procedure of choice. It is best to allow the inflammation to settle whichever method of drainage is

employed and to remove the gallbladder sometime later when a laparoscopic operation is often possible.

Partial cholecystectomy

Sometimes during a cholecystectomy it becomes obvious that it is too dangerous to remove all the gallbladder. It is then wisest to excise as much of the gallbladder as possible and to remove any remaining stones from the lumen. The gallbladder lumen is closed with a suture and a drain is left in the wound. If necessary a further operation to remove the residual gallbladder tissue can be undertaken, usually with some difficulty, sometimes later when an acute inflammation has subsided.

LAPAROSCOPIC CHOLECYSTECTOMY

During the last several years, this minimally invasive procedure has emerged worldwide as the preferred treatment for patients with uncomplicated cholelithiasis and cholecystitis. Theoretical benefits of this approach include reduced hospitalization and associated costs, decreased pain, avoidance of a large incidence with improved costs, avoidance of large incision with improved cosmetic outcome, and reduced postoperative recovery with quicker return to work. The indication for laparoscopic cholecystectomy (LC) is analogous to open cholecystectomy and include the presence of symptomatic gallstones.

Successful laparoscopic surgery requires specific and often unique instrumentation. Optical and electronic interfaces serve as the surgeon's eyes and sensors. A laparoscopic surgeon can be only as good as the quality of his or her imaging system and tissue manipulators. [36]

Equipment and Instrumentation

Laparoscopes

Modern laparoscopes come in a variety of sizes and configurations. The most commonly used laparoscopes are rigid instruments that employ the Hopkins rod lens system of optics. The basic components of the rod lens system include a series of quartz rod lenses and image reversal system, optical fibers for the transmission of light, an objective lens, and an eyepiece. These features allow enhanced light transmission and image resolution, as well as superior color reproduction. Rigid laparoscopes come in sizes ranging from 3 to 10 in diameter and a variety of viewing angles. The 0^0 or end/forward viewing laparoscope is the easiest to use, and its use results in the least amount of image distortion, as well as the brightest image. Angled (30^0 ,45^0) scopes provide greater versatility by allowing the operator to look around corners and over the surfaces of solid structures (e.g. the liver). Although oblique viewing scopes are more difficult to operate because the orientation axis of both the telescopic lens and video camera must be maintained, they are preferred by most experienced laparoscopists for performing advanced procedures. Recently, flexible laparoscopes have been developed that use fibreoptic bundles for visualization and that provide even greater flexibility in the viewing angle.

Video Imaging Systems

The single most important technologic advance in the field of laparoscopic surgery has been the development of high quality video imaging systems that allow surgeons to work together while watching a video monitor. The basic components required for video laparoscopy include the laparoscope, a light source, a video camera, a camera control unit, and a video monitor. A high-intensity light source (usually xenon) is

necessary to provide adequate illumination of the peritoneal cavity. The light source is connected to the laparoscope by either fibreoptic cable or a fluid-filled cable.

Two separate video monitors, placed on each side of the operating table, are commonly used for most laparoscopic cases, allowing all members of the surgical team an unobstructed view pf the operation.

Insufflators

The creation of a working space for laparoscopic surgery within the abdominal cavity generally is accomplished using CO_2 delivered to the patient via an automatic, high-flow, pressure-regulated insufflators.

Carbon dioxide is used because of the low risk of gas embolism, lack of toxicity to peritoneal tissues, rapid rate of reabsorption, low cost and ease of use. It also suppresses combustion, making it safe for use with the electrocautery or laser

Ideally, the insufflator should be able to deliver CO_2 at a flow rate of up to 8 to 10 L/min with a minimum acceptable flow rate of 6 L/min. In addition to regulating gas flow, the insufflator monitors intra-abdominal pressure and stops delivery of CO_2 whenever the pressure exceeds a predetermined level. This pressure limit usually is set at 12 to 15 mmHg because of the risk if hypercarbia, acidosis, acidosis, and adverse haemodynamic and pulmonary effects at higher pressure.

Trocars and Insufflation needles

Two types of instruments are used to gain access to the peritoneal cavity for laparoscopic surgery: the Veress needle and the laparoscopic trocar-sheath assemblies (laparoscopic ports). The Veress needle is designed to achieve pneumoperitoneum prior to inserting laparoscopic trocars in a “closed” fashion.

The basic laparoscopic port consists of an outer hollow sheath or cannula that has a valve to prevent CO_2 gas from escaping, a side port for instillation of gas, and a portal

for instrument access. An inner removable trocar fits through the outer sheath and is used only while inserting the port through the abdominal wall. The most commonly used trocars are 5 mm and 10 mm in diameter, although ports ranging from 3 to 18 mm in diameter are available for specialized procedures. The principle choice of trocars is between reusable versus disposable. Reusable trocars are radiopaque and equipped with rotational trumpet valves and gaskets to prevent air leaks. They have the advantage of lower costs, but they require careful maintenance to keep the trocar tips sharp and the unit airtight. A variety of disposable trocars are available commercially from a number of different manufacturers. The single use trocar tip guarantees sharpness with each insertion.

The Hasson cannula is used for gaining initial access to the abdominal cavity with an open cut down technique. It has a conical blunt tip, which is fitted into the cut down site and buttressed, in place with fascial sutures attached to the wings of the cannula.

Surgical Instruments

Many instruments have been designed specifically for laparoscopic surgery. These instruments are modifications of standard open-surgical instruments and are 30 to 40 cm in length with shaft diameters of 3 to 10 mm. The shafts of these instruments may be insulated with non-conductive material, and the working tips are metal to allow use with electrocautery and to provide durability.

A variety of graspers, scissors, dissectors and tissue manipulators are currently available, in both disposable and reusable forms.[37]

Clip appliers are the primary modality for ligating blood vessels and other tubular structures.

The clips are made of titanium and range from 7 to 11 mm in length. Irrigation / aspiration probes are essential for most laparoscopic procedures in order to maintain a clear operative field.

Laparoscope cautery probes came with a variety of tips, including spatula, hook, and right angle configurations. Several precautions must be taken when using electrocautery during laparoscopic surgery. The shafts and handles of the cautery instrument must be well insulated to avoid inadvertent burns to the patient or operating surgeon. The entire tip of the cautery instrument must be well visualized endoscopically to avoid contact with other structures that could be cauterized or injured. Concerns have been expressed that possible injury to remote sites could occur owing to capacitative coupling effects from the laparoscopic trocars and other laparoscopic instruments present within the abdominal cavity.

In the modern era of laparoscopic surgery, it is acknowledged that most laparoscopic cautery injuries are the result of direct burns from the cautery probe up. Several types of lasers (argon, CO_2, KTP = Potassium thionyl chloride, YAG = Yttrium aluminium garnet) are available for use in laparoscopic surgery. A major disadvantage associated with the use of lasers in laparoscopic surgery is cost. Electrocautery units are available in all operating rooms, and cautery probes and scissors are standard components of laparoscopic instrument sets.

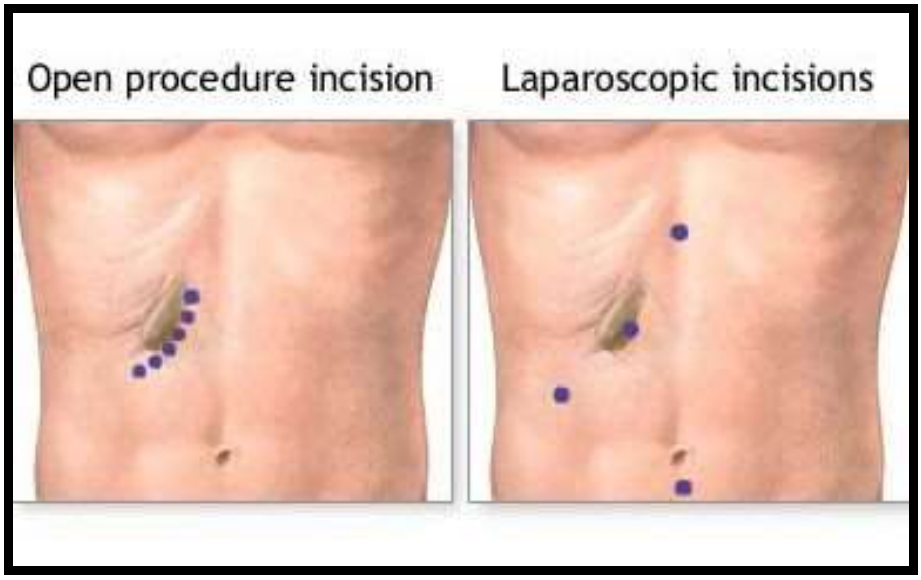
Operating room design

Laparoscopic cholecystectomy is performed in a fully equipped operating room under sterile conditions with general anesthesia. Instruments for conversion to an open technique should be readily available.

Relative and absolute contraindications are becoming less applicable and must be evaluated on an individual basis.

Laparoscopic cholecystectomy is a team effort. The surgeon who works with the same assistants on a day-to-day basis will find that operating time and technical difficulties are kept to a minimum. The surgeon operates from the left side of the table. He or she uses both hands. The first assistant stands on the patient's left side and is responsible for retraction of the gallbladder with instruments passed through the lateral subcostal cannula. Finally, the camera operator stands below the surgeon. Video monitors on each side of the operating table make it easy for all involved to view the operation and provide the best help. While the standard laparoscopic cholecystectomy team is composed of three people, specially designed retractor systems make single surgeon procedures possible. The lateral most grasper and the camera can be mounted on retractors allowing the surgeon to manipulate instruments and the gallbladder through the remaining two ports.

FIGURE-1A: INCISIONS



TECHNIQUE OF LAPAROSCOPIC CHOLECYSTECTOMY[40]

Laparoscopic cholecystectomy can be performed with the patient lying supine in either the classical or leg abduction position.

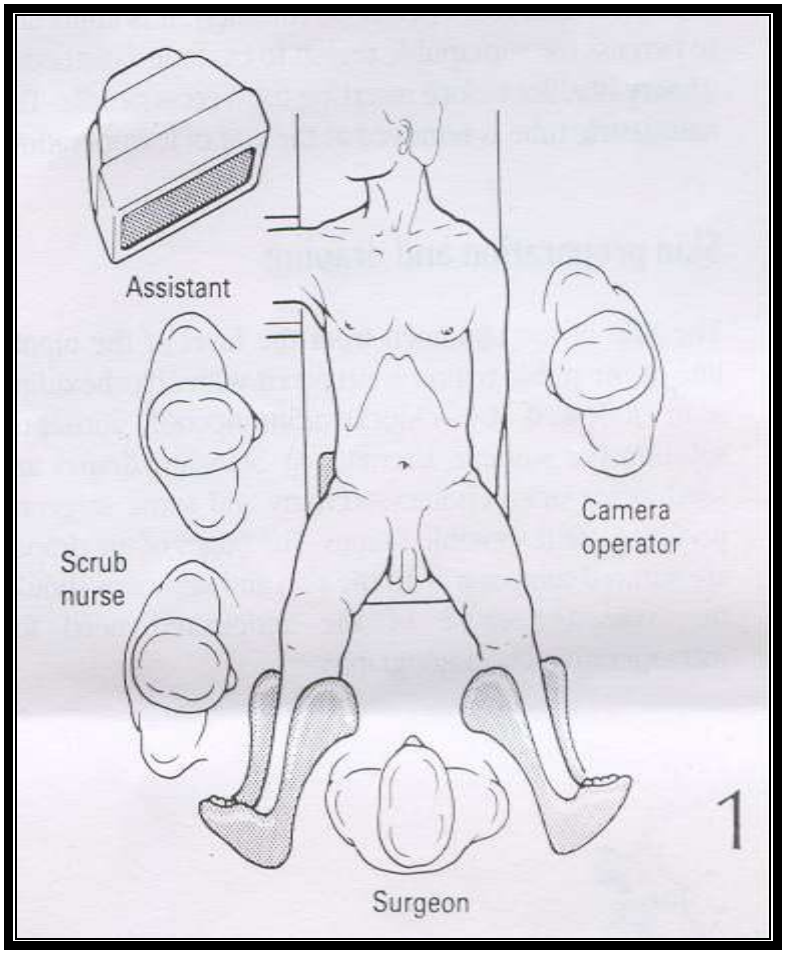


FIGURE- 1B : LEG ABDUCTION POSITION:-

1. The patient is positioned supine on the operating table and the legs are abducted, preferably in the limb extension position and without the use of Lloyd-Davies stirrups. Surgeon stands between the patient`s legs and patient is given 30o. head up (Reverse Trendelenburg position). The neutral electrosurgical generator, the assistant and the scrub nurse stand on the patient's right. Insufflator, suction / irrigation system, telescope heater, electro-cautery unit and xenon light source are positioned on the left of the surgeon between him and scrub nurse. Television monitor is placed on the right

side of the patient, such that the assistant and scrub nurse can all clearly see the progress of the operation.

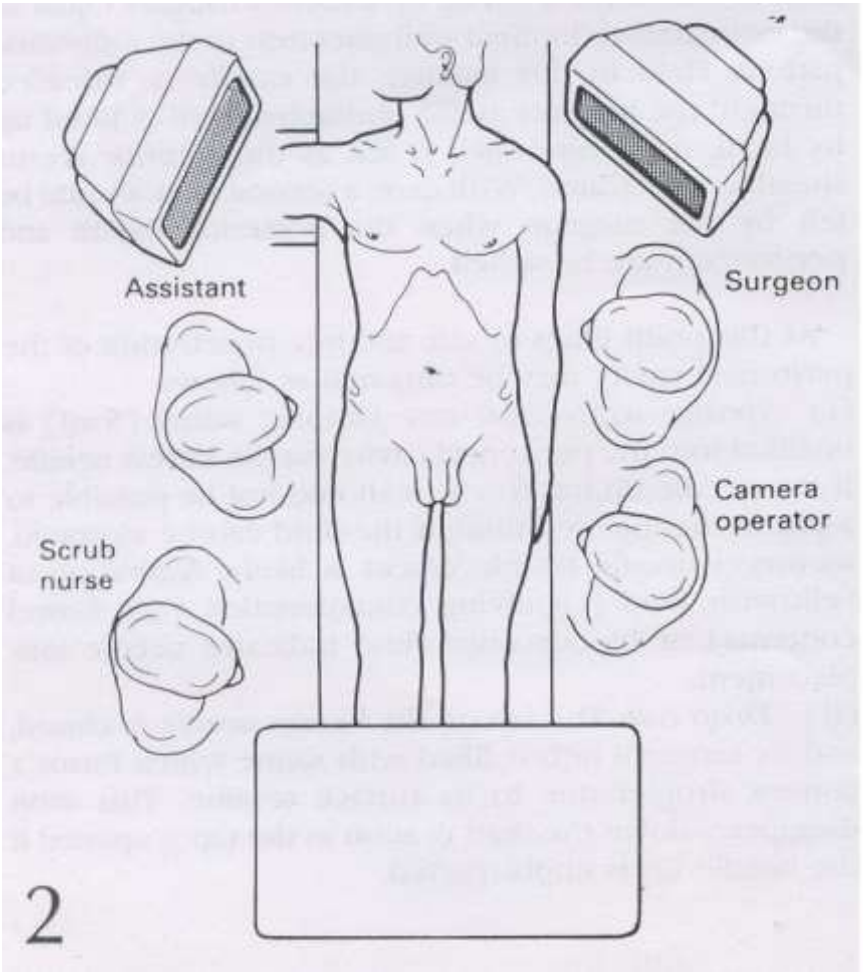


FIGURE-2: CLASSICAL SUPINE POSITION

2. In this position, the patient is placed in the ordinary supine position with the table given a 30o Reverse Trendelenburg tilt. The surgeon and the camera operator stand on the left of the patient with the assistant and the scrub nurse on the right side.This position is less likely to cause compression trauma to the calf veins but two television monitors are required, one facing the surgeon and the other facing his assistant.

A nasogastric tube is placed to decompress the stomach, and a urinary catheter is used to decompress the bladder. Compression stockings and/or sequential compression devices should be placed on the lower extremities for deep venous thrombosis prophylaxis. This is especially important because the patient will be in the reverse

Trendelenburg position, which produces venous stasis and pooling. The entire abdomen is prepped and draped for a formal laparotomy. Special care should be taken in cleaning the umbilicus, as it is the most common site for wound infection following laparoscopic surgery.

Pneumoperitoneum and Trocar insertion

The first step in performing laparoscopic surgery is to create a pneumoperitoneum. The pneumoperitoneum may be achieved using either a closed technique with the Veress needle or by an open mini laparotomy technique. The preferred site for insertion of the Veress needle is at the umbilicus, where the abdominal wall is thinnest and is well away from fixed internal organs. If the patient has had less prior abdominal surgery in the vicinity of the umbilicus, an alternative site for insertion of the Veress needle may be chosen, or an open insertion technique may be used.

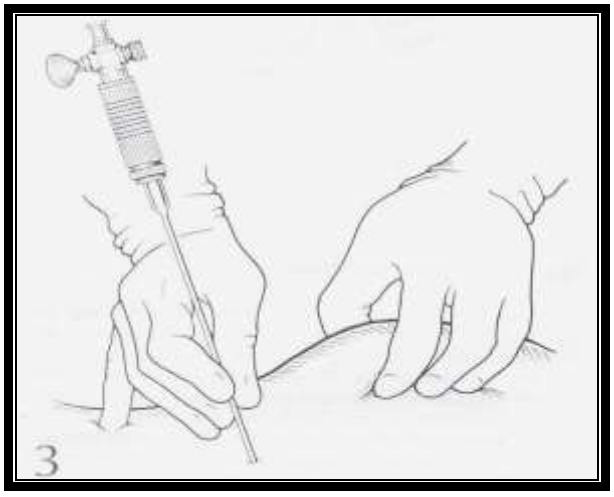


FIGURE 3: INSERTION OF VERESS NEEDLE

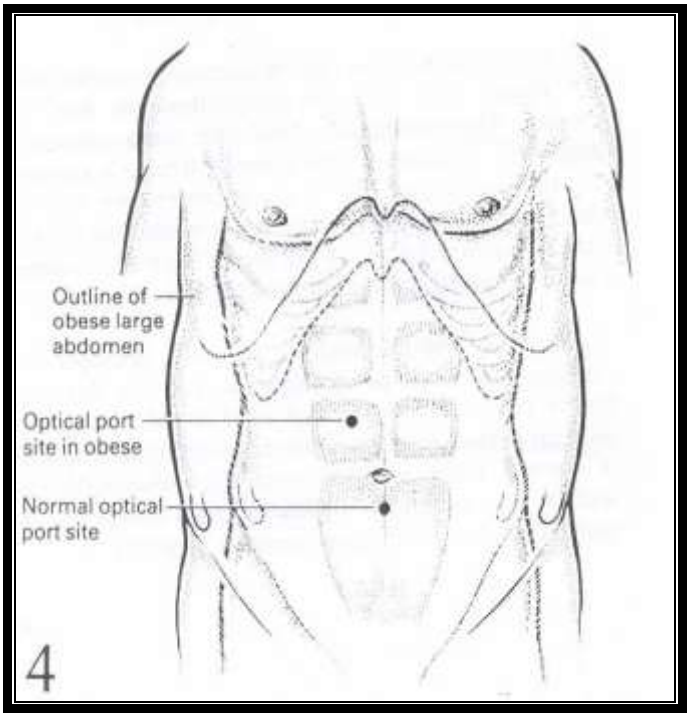


FIGURE-4 : SITES OF INSERTION.

Regardless of the method of initial access to the peritoneal cavity, the patient should be in the supine position on the operating room table and strapped securely in place. This is done to avoid patient movement during the frequent repositioning that is necessary for laparoscopic surgery. A Foley catheter usually is inserted to drain the urinary bladder and to reduce the risk of bladder injury by the Veress needle to trocar. Decompression of the stomach with an oral gastric tube also is advisable, both to avoid inadvertent puncture of a distended stomach and to provide better exposure and access to the upper abdomen.

The patient is placed in the Trendelenburg position to allow bowel loops to ascend into the upper abdomen. A small incision (vertical or horizontal) is made at the

inferior aspect of the umbilicus. The incision should be just large enough to accommodate the desired trocar; if the incision is too large, the trocar is more likely to slip out of the puncture site while the laparoscope repeatedly is moved. The subcutaneous tissue is bluntly dissected away until the umbilical fascia is palpable.

The abdominal wall inferior to the umbilicus then is lifted with one hand, while the Veress needle is inserted through the fascia at the base of the umbilicus. The needle (and subsequent trocar) should be inserted at a 45^0 angle towards the pelvis and away from the aorta and inferior venacava.

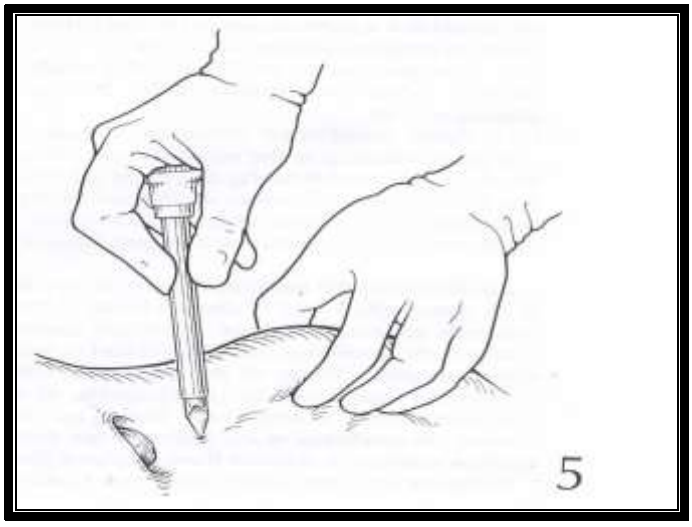


FIGURE-5 : METHODOLOGY OF INSERTION.

One can frequently appreciate two clicks of the spring-loaded Veress needle as it penetrates first the fascia and then the peritoneum. Several maneuvers should be carried out to confirm the free intraperitoneal position of the needle. First, the needle is aspirated and irrigated to demonstrate the absence of return of blood or bowel contents and a free flow of fluid. Second, a saline drop test is performed in which the needle is filled with saline and fluid is demonstrated to flow freely by gravity into the peritoneal cavity as negative pressure is generated by lifting the abdominal wall. Finally, the needle is moved back and forth, which indicates that the tip is free within the peritoneal cavity.

The needle is connected to the insufflator and CO_2 is instilled at a rate of 1 L/min. The opening pressure recorded on the insufflator should be about 10 mmHg. Initial pressures of 10 mmHg or higher may indicate the placement of the needle in the

preperitoneal or other closed space. A flow rate for CO_2 should be used initially to avoid gas embolism or vagal stimulation from sudden stretching of the peritoneum. Upon insufflating approximately 1L of CO_2, increased tympany in all four quadrants of the abdomen is confirmed, and the flow rate may be increased. Although high flow insufflators are designed to deliver flow rates of up to 8 to 10 L/min, the maximum flow rate through the small caliber Veress needle is approximately 2.5 L/min. Once the intra-abdominal pressure has reached 15 mmHg, generally requiring 3 to 6 L of CO_2, the Veress needle is removed, and the trocar is inserted through the same site.

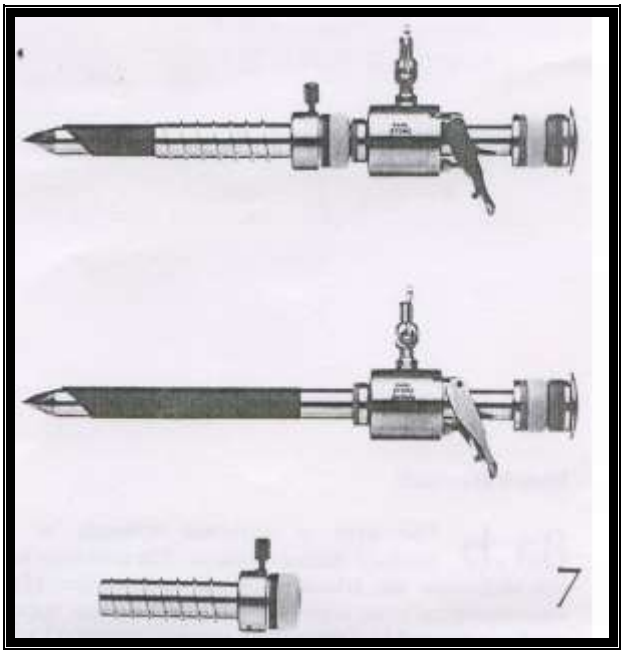


FIGURE 6: TROCAR AND PORTS

The trocar is grasped firmly in the palm of one hand and inserted using gently firm pressure while elevating the abdominal wall with the other hand or with towel clips. Once the port is in, the inner trocar is removed, leaving the outer cannula and sheath in place. Return of CO_2 gas is confirmed by opening either the stopcock or flapper valve on the port and then connecting the insufflation line to the sheath. The video telescope is inserted and a general inspection of the peritoneal cavity, including underlying

viscera and retroperitoneum, is carried out to assess for visceral injury. Additional trocars then are inserted under the direct endoscopic vision as shown in the figure.

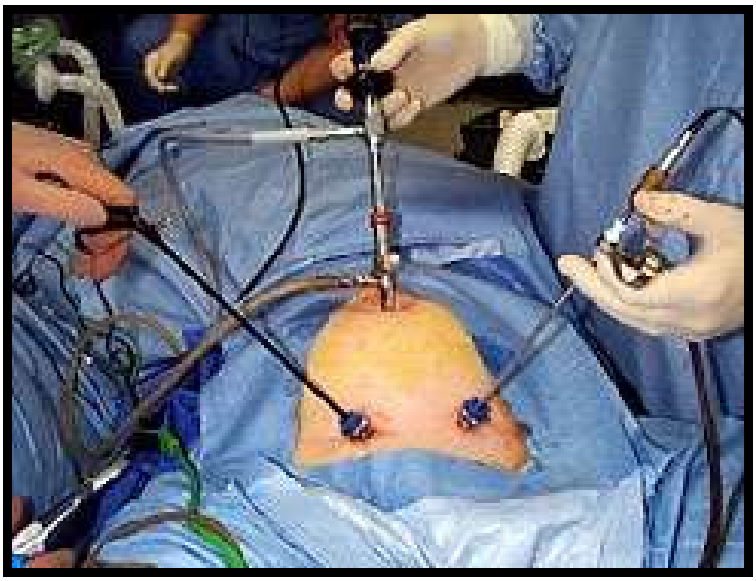


Fig. 7: Trocar insertion

In the open approach to insertion of the laparoscope, the umbilical fascia and peritoneum are incised under direct vision. The dissection should be kept close to the umbilicus, where there is less tissue between the fascia and peritoneum cavity and where all layers of the abdominal wall are fused.

Once the peritoneum has been opened, digital palpation confirms that the adjacent peritoneal space is free. The laparoscopic port must be secured at the fascial site of entry in an airtight manner to prevent escape of CO_2 gas and loss of pneumoperitoneum. An alternative approach uses the Hasson trocar/cannula, which was designed specifically for an open insertion method. The Hasson cannula requires placement of simple sutures in either side of the fascia. The cannula tip then is inserted through the fascial/peritoneal opening, and the nose of the conical sleeve is fitted into the umbilical opening and locked onto the cannula. The fascial sutures are pulled up tightly around the suture wings if the cannula, wedging it into the umbilical fascia and providing an airtight seal.

Following open insertion of the initial trocar, the port is connected to the CO_2 insufflator and the abdomen is inflated to 15 mmHg pressures. Insufflation may be carried out at a higher flow rate with the open method than with the Veress needle because the risk of the trocar insertion into the blood vessel or closed space has been eliminated. However, rapid expansion of the peritoneum in some patients may be associated with an increased vagal response, bradycardia and postoperative shoulder pain.

The potential for trocar-related complications exists with both closed and open methods for establishing pneumoperitoneum.

The incidence of such complications should be reduced, if not eliminated, using as open insertion technique. Liberal use of an open insertion technique is also advisable in patients with previous abdominal surgery who have an incision near the umbilicus.

In addition advantage of the open technique is that it produces a larger incision for removal of tissue at the conclusion of the case. Disadvantages of the open method include problems with CO_2 leak and loss of pneumoperitoneum from an incomplete seal.

Anaesthesia

General anaesthesia is the preferred anaesthetic method for patients undergoing most therapeutic laparoscopic surgical procedures. Two advantages of general anaesthesia as compared to other types of anaesthesia are two folds:

1. It allows for complete control of the patient's ventilation, which might otherwise be compromised by systemic absorption of CO_2 and increased diaphragmatic pressure form the pneumoperitoneum.

2. It enables complete relaxation of the abdominal wall muscles necessary for adequately maintaining pneumoperitoneum.

The CO_2 pneumoperitoneum causes an increase in total resistance and central venous pressure. An increase in entidal Pa CO_2 may occur due to increased intra-abdominal pressure and absorption of CO_2. The reverse Trendelenburg position may further decrease venous return and lower cardiac output and blood pressure. These changes are insignificant in most individuals but could lead to serious haemodynamic consequences in patients with depleted intravascular volume, underlying cardiac disease, or compromised pulmonary function (e.g. chronic obstructive pulmonary disease).

All patients should have continuous monitoring of EKG, blood pressure and oxygen saturation. Pulmonary atelectasis decreased functional residual capacity and high peak airway pressures may also be seen.

CO_2 embolism is a potentially lethal complication of laparoscopic surgery that should be detected by careful intraoperative monitoring. Gas embolism may occur as a result of trocar or needle penetration of a blood vessel or from gas embolism into venous channels cut during laparoscopic surgery. Gas embolism may be heralded by the sudden haemodynamic collapse of the patient. There may be associated dysarrhythmias, a mill wheel-type heart murmur, cyanosis and pulmonary edema. Prompt recognition and management of CO_2 embolism is critical for patient survival. The pneumoperitoneum should be deflated immediately, and the patient should be placed in the left lateral decubitus position with the head down (Durant position).

Patient selection

The success of any laparoscopic operation depends on both proper patient selection and the technical skill and experience of the laparoscopists. As surgeons have gained

experience and techniques have become more advanced, the number of absolute contraindications to laparoscopy has decreased.

Contraindications to laparoscopic surgery[38]

Relative		Absolute	
•	Inability to tolerate general anesthesia	•	Uncorrectable coagulopathy
•	Abdominal sepsis/peritonitis	•	"Frozen" abdomen from adhesions
•	[a]Intra-abdominal malignancy	•	Intestinal obstruction with massive abdominal distention
•	Pregnancy	•	Haemorrhagic shock
•	Morbid obesity	•	Severe cardiac dysfunction
•	Multiple previous abdominal operations	•	Concomitant disease requiring laparotomy
•	Severe COPD[b]		
•	Diaphragmatic hernia		

a – Excluding colon carcinoma

b – Chronic obstructive pulmonary disease

Operative Technique

Open cholecystectomy has been performed in its present fashion for more than 100 years with acceptably low morbidity and mortality. Laparoscopic cholecystectomy exploded onto the scene in the late 1980s. While initially reviewed with skepticism and even disdain, laparoscopic cholecystectomy has proven itself to be a safe and effective approach to gallbladder disease. Initial reports were encouraging, but the

rapid rise in popularity has been paid for with an increased incidence of bile duct injuries.

With more than 90% of cholecystectomy being performed via the laparoscope in many institutions, it appears that laparoscopic cholecystectomy has now become the new gold standard in management of symptomatic cholelithiasis.

Initial laparoscopic exploration through the umbilical cannula may reveal adhesions in patients with previous surgery. In this case, placement of a second cannula in a safe, open area may allow for adhesiolysis and subsequent safe placement of the needed cannulas.

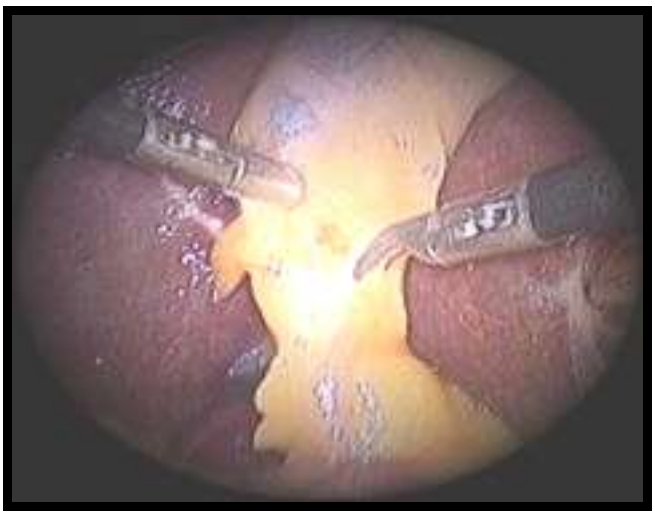


Fig 8: Initial exploration

After exploration, operation can begin. The patient is now placed in a 20 to 30 degree reverse Trendelenburg position and rotated slightly to the left. These maneuvers shift the stomach, omentum, intestines, and colon out of the right upper quadrant and help expose the neck of the gallbladder and cystic duct.

The first assistant grasps the fundus of the gallbladder with an atraumatic clamp placed through the lateral most 5 mm cannula and lifts the gallbladder up and pushes it towards the diaphragm. A second grasper is then placed through the midclavicular cannula. This instrument is used to grasp the neck of the gallbladder retracting it

laterally exposing the cystic duct. This second grasper is controlled with the surgeon's left hand. With these two graspers, the gallbladder is retracted up and away from the hepatoduodenal ligament, thus exposing the critical anatomy.

With the electrocautery, open the peritoneum over the cystic duct. Using an angled dissector passed through the subxiphoid cannula, the surgeon begins blunt dissection in the triangle of Calot's. Dissection should be taking place in the vicinity of the cystic duct-gallbladder junction.

It is neither desirable nor safe to routinely identify or dissect the cystic-common duct junction. Once the cystic duct is isolated, it is ligated with a clip distally near the gallbladder wall. Ligate the proximal duct with two clips and divide it with the scissors, leaving two clips on the proximal duct. By this point the cystic artery is often visible in the triangle of Calot's. Once isolated doubly ligate it proximally and distally with clips and divide it with scissors.

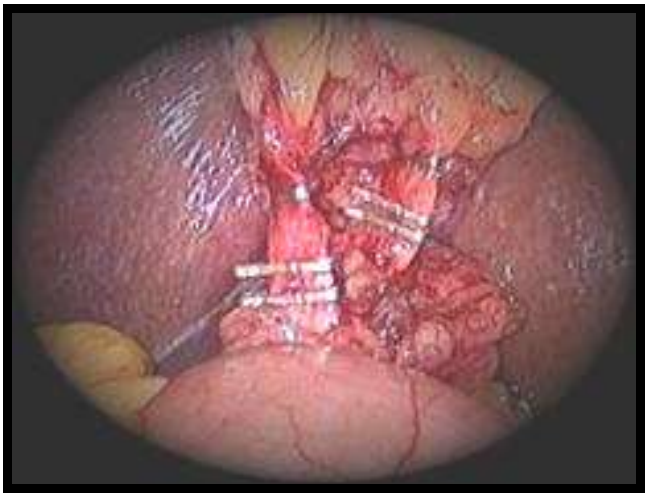


Fig 9: Ligation of cystic duct and artery

Dissect the gallbladder from the underlying liver bed using electrocautery or laser dissection. The dissection begins at the neck of the gallbladder and proceeds superiorly along the liver.

Fig 10: SEPARATION OF GB FROM LIVER BED AND HEMOSTASIS

Occasionally, a posterior branch of the cystic artery is encountered and will require clipping. Before the gallbladder is completely removed from the liver, it is used to retract liver upwards exposing the gallbladder bed and subhepatic space. Irrigate this area thoroughly and confirm adequate haemostasis. The gallbladder is then removed from the liver and it is ready for extraction. Hold the gallbladder by graspers placed through the 5 mm cannulas. Move the video-laparoscope to the subxiphoid cannula and transfer the gallbladder to the toothed grasper placed through the umbilical port. The gallbladder should be grasped at its neck. Pull it up to the umbilical cannula and remove the specimen and cannula together through the fascial opening. If the gallbladder is too distended with bile and/or small, multiple stones to pass easily through the umbilical fascial opening, withdraw the neck of the gallbladder to just above the skin.

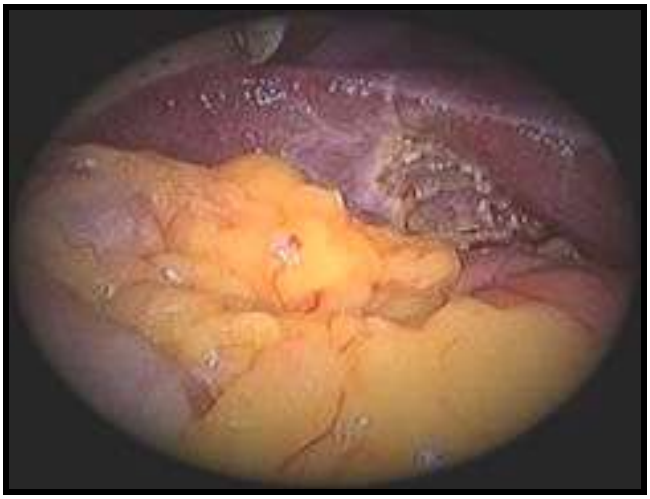


FIGURE 11: POST CHOLECYSTECTOMY STATUS

Use Kelly clamps to grasp and secure the gallbladder. Make a small incision in the neck of the gallbladder can then be extracted. If extraction is impeded by one or two large stones, a Kelly clamp can be passed through an incision in the gallbladder neck and the stones can be crushed. Furthermore, the umbilical fascial opening can always be enlarged to allow for removal of the gallbladder.

After the gallbladder is removed, pneumoperitoneum is released through the cannulas, which are then withdrawn. The fascial opening at the umbilicus is closed with three non-absorbable interrupted stitches and the skin incisions are closed with subcuticular sutures or skin tapes.

COMPLICATIONS AND MORBIDITY

Pain in laparoscopic cholecystectomy

Pain experienced after laparoscopic cholecystectomy was of 2 types:

- Deep seated upper abdominal pain
- Shoulder pain

Shoulder pain is not related to the surgical procedure, as it is well known phenomenon also following gynecologic laparoscopy. It is thought to be the result of direct irrigation of the diaphragm by CO_2 or the stretching of diaphragm associated with insufflations and may be reduced by careful and complete exsufflation by the end of the laparoscopic procedure. Also a slow insufflation rate when establishing the pneumoperitoneum may decrease postoperative shoulder pain.

According to Mogens Rorback Madscn et al (1992) postoperative pain intensity was moderate as 20% of the patients were managed without any opiates post operatively and 88% did not require any opiates after discharge from the hospital. A single dose of ondansetron at the end of the operation seems to reduce postoperative nausea effectively. 2/3rd patients had no complaints of nausea and the majority of remainder experienced only mild and transient nausea. Mugene Rorbaek Madsen recommends that swab wound sites be infiltrated with local anaesthetics and that anti-emetics are administered at the end of the operation.

Postoperative analgesic

Postoperative analgesic requirements were limited to oral or no medication in more than 70% of patients in a study by Jeffrey after laparoscopic cholecystectomy.

Bile duct injury

Single and multi institutional experiences have cited bile duct injury rates of 0% to 2% during laparoscopic cholecystectomy compared with historical rates of 0-0.4%

during open cholecystectomy. (A national survey of 4292 hospitals and analysis of 77604 cases Damin et al, Jan 1993).

The time at which major duct injuries were diagnosed was 48% of these injuries were recognized at time of laparoscopic cholecystectomy where 51.2% were diagnosed at sometime postoperatively. The method of initial repair were hepaticojejunostomy or choledochojejunostomy in 40.8% tube or operative stent placement in 30.4% suture repair alone in 10.4%, choledochoduodenostomy in 5.6% primary end to end anatomists in 6 patients (4/8%) clip removed alone in (4%) and endoscopic dilation and stent placement in 4% (Damin et al, Jan 1993).

A prospective analysis of 1518 laparoscopic cholecystectomy by Southern Surgery Club had bile duct injury rate of 0.5%.

Operative time

The mean duration of operative procedures in Deshow et al Israel Medical Centre New York was 93 minutes.

In comparison with above Sopeh et al Feb 1992, the mean operative time was 95 minutes; the mean morphine requirement was 2.5 mg and the average postoperative hospitalization period was one day with return to full activity at 8.4 days.

Drainage

Drainage following simple cholecystectomy has been blamed for an increase in complication by Melior et al who found a 28% complication in drained group compared to 10% in undermined group. Romaghan et al, 1986 also found an increase in postoperative pain maximum postoperative temperature elevation and the number of postoperative analgesics in the drained group.

Meeyes (1962) also found that postoperative temperature is higher in the drainage group. A question arises as to whether temperature is due to drainage fever or to atelectasis. Both temperature elevation and atelectasis were higher in drainage group. On the other hand, Playforth et al (1985) found no increase in temperature with drainage. In addition, Lewise et al (1990) found that short-term drains did not increase morbidity in simple elective cholecystectomy despite the controversies regarding drainage. Cahill and Paul in 1988 in a questionnaire to consultant general surgeons in England found that 75% routinely place a peritoneal drain after cholecystectomy.

Placement of a closed suction drain after laparoscopic cholecystectomy can prevent reoperation providing an egress for the collected bile and also can be used to help monitor postoperative bleeding and evacuate collected irrigation fluid. In addition a closed suction drain may have a role in decreasing postoperative shoulder pain by allowing the remaining CO_2 gas to escape. (Abdelkader 1992).

Conversion Rate

Most experienced laparoscopic units suggest a rate of conversion to open cholecystectomy of about 5%. J.O. Jorgensen and D.R. Hunt in 1992 concluded that laparoscopic cholecystectomy is technically feasible in most patients, but those having a thick gallbladder wall on ultrasound, gallstone pancreatitis, morbid obesity or acute cholecystitis should be warned of a higher than usual chance of conversion to open cholecystectomy.

According to Teizo Kimura Japan (1993) the conversion rate to open surgery (2.7%) was lower than the rates reported from Europe and United States. Conversion to open cholecystectomy is more often necessary when patient with acute cholecystitis are treated by laparoscope.

Most authors agree that a 5% to 10% conversing rate is acceptable and refracts the good judgment of surgeon. T.R. Scott et al reported 4% conversion rate for elective cases but 20% conversions to open cholecystectomy in case of acute cholecystitis.

A prospective analysis of 1518 laparoscopic cholecystectomy by Southern Surgery Club showed a conversion rate of 4%.

Most common reason for conversion to open cholecystectomy was inability to identify the anatomy of the Calot's triangle as a result of inflammation, adhesion and fibrosis in the region of dissection.

Learning Curve

The idea of a learning curve in laparoscopic cholecystectomy has often been discussed. A review of 250 cases of laparoscopic cholecystectomy by T.R. Scott et al. 67% of total bile duct injuries occurred in first 25 cases 19% in next 25 cases and remaining 14% in next 200 cases. Author concluded that the incidence of bile duct injury should decrease as the surgeons experience with laparoscopic cholecystectomy increases.

Regarding safety and efficacy of laparoscopic cholecystectomy – a study of 100 initial patients by Jeffrey mean operative time improved significantly form 1st month to 6th month (122.4 minutes versus 78.5 min respectively) indicating a rapid learning curve. Author concluded that although there is a significant learning curve, laparoscopic cholecystectomy is a safe and effective procedure that can be performed with minimal risk.

The question whether laparoscopic cholecystectomy can be a day surgery procedure – A study by Giampiero. In his series 93.5% patients reported normal postoperative function within 24 hours. 90.2% patients, which were able to take oral fluid on same day of operation and have normal bowel peristalsis within first postoperative day.

Respiratory changes

A study David Johnson et al on postoperative respiratory function after laparoscopic cholecystectomy showed that vital capacity deceased by 13% and functional residual capacity by 17%. The PO_2 decreased from 89 mm to 82 mmHg.

Finally he concluded that the respiratory changes after laparoscopic surgery are small in comparison to those expected after open cholecystectomy.

Resumption of diet

A regular diet was tolerated by 83% of patients by the morning following the laparoscopic cholecystectomy in a study by Jeffrey et al. Leon Morgensten reported that only 42% of patients could tolerate a regular diet following open cholecystectomy next morning.

Length of hospital stay

A study of 1200 open cholecystectomy by Icon Morganatic et al showed the mean length of hospital stay for the uncomplicated cholecystectomy was 5 to 7 days and 10 to 14 days in complicated cases.

A study of 1000 lap cholecystectomy by Jeffrey et al. mean hospital stay 27.6 hours.

A prospective analysis of 1518 laparoscopic cholecystectomy by Southern Surgery Club showed mean hospital stay of 1.2 days.

Mean hospital stay was 27.6 hours, reflecting a policy of overnight stay. A regular diet was tolerated by 83% of patients by the morning; following the procedure median time of return to full activity was 6.8 days after operation.

Return to work office after laparoscopic cholecystectomy

In traditional open cholecystectomy return to work after 4-6 weeks of operation but a study by Gary C et al showed that after laparoscopic cholecystectomy return to work

by 2 weeks after surgery. These data suggest that early return to work is possible and that pain resolves quickly after laparoscopic cholecystectomy.

MATERIALS AND METHODS

METHODOLOGY

This was a prospective study. This study consisted of 20 patients treated with laparoscopic cholecystectomy in R.L.Jalappa hospital and research centre attached to Sri Devaraj Urs Medical college, Tamaka, Kolar from November 2008 to May 2010.

Inclusion Criteria

All patients with acute cholecystitis, chronic cholecystitis, cholelithiasis, empyema, mucocele and non perforated gangrenous gallbladder.

Exclusion Criteria

Patients with choledocholithiasis, perforated gallbladder will be excluded from the study.

All the patients were admitted and a detailed history and clinical examination was carried out as per written proforma.

The choice of operation in each case is decided by:

- Patient's choice by explaining the procedures.
- The preference of the surgeon in each case.

Patients opting for laparoscopic cholecystectomy were explained the possibility of conversion to open cholecystectomy.

Preoperatively patient's history was assessed with special reference to pain, fever, nausea, vomiting, dyspepsia, jaundice, lump abdomen, weight loss and decreased appetite. A careful emphasis was given to record the physical findings particularly icterus, tenderness in right hypochondrium and gallbladder lump. Laboratory testing and USG of gallbladder and CBD was done. CBD stone was ruled out by USG.

A thorough preoperative anaesthetic evaluation was done and patient fitness for general anaesthesia assessed. A dose of antibiotics (usually a cephalosporin with

Metronidazole) was given pre operatively. A nasogastric tube and Foley's catheter were inserted routinely.

Injectable antibiotics and analgesics were given for 2-3 days postoperatively. Then they were given orally for another 3 days. Patient was started orally between 24-48 hours post surgery in most cases. Sutures were removed usually by the 7^{th} or 8^{th} day.

The patient was reviewed on the 7^{th} day and 21^{st} day after discharge. Follow up was done for a period of 3-6 months whenever possible.

METHOD OF COLLECTION OF DATA

- Operative step, duration, intra and postoperative complication were noted in detail and tabulated.
- Postoperative assessment with respect to postoperative hospital stay, complications including postoperative pain will be included as per protocol attached.
- Conversion rate – cases that had encountered difficulty during laparoscopic cholecystectomy were converted to open but were included into laparoscopic group.
- At the end of the study an assessment of laparoscopic cholecystectomy was done regarding:
    - Criteria for selection and indication for surgery
    - Duration of surgery
    - Complication
    - Resumption of oral intake
    - Hospital stay
    - Return to normal work
    - Patient satisfaction

  The results were analyzed and conclusions were drawn.

OBSERVATION AND RESULTS

RESULTS

This prospective study comprised of 20 patients with biliary tract symptoms who were admitted to the surgical inpatient ward in R.L.Jalappa hospital and research centre attached to Sri Devaraj Urs Medical college, Tamaka, Kolar and underwent laparoscopic cholecystectomy from November 2008 to May 2010.

Total no. of cases – 20

All cases underwent detailed preoperative assessment; their preoperative findings and postoperative complications were meticulously recorded as per protocol. The findings were tabulated and the following observations were made.

Study design

A comparative clinical study consisting of 20 patients undergoing laparoscopic cholecystectomy is undertaken to study efficacy, safety and patients' satisfaction.

Table 1

Age distribution of study groups

Age in years	(n=20)
≤ 20	1 (5%)
21-30	1 (5%)
31-40	4 (20%)
41-50	8 (40%)
51-60	4 (20%)
61-70	1 (5%)
> 70	1 (5%)

Table 2

Sex distribution

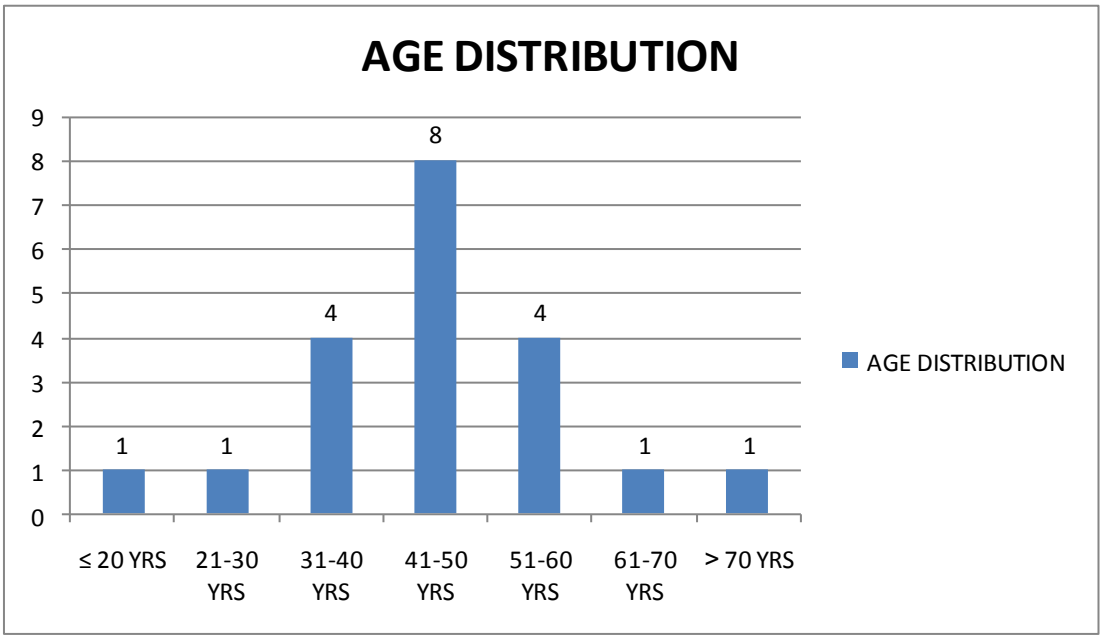
Sex	(n=20)
Male	2 (10%)
Female	18 (90%)

There was a preponderance of cases in the 3rd, 4th and 5th decades of life in the study group accounting for nearly 80% of the cases. The mean age of patients in the study groups was around 46 years.

There was a female preponderance in the study group with 90% of patients being females .

Graph : 1

Age Distribution



Graph : 2

Sex Distribution

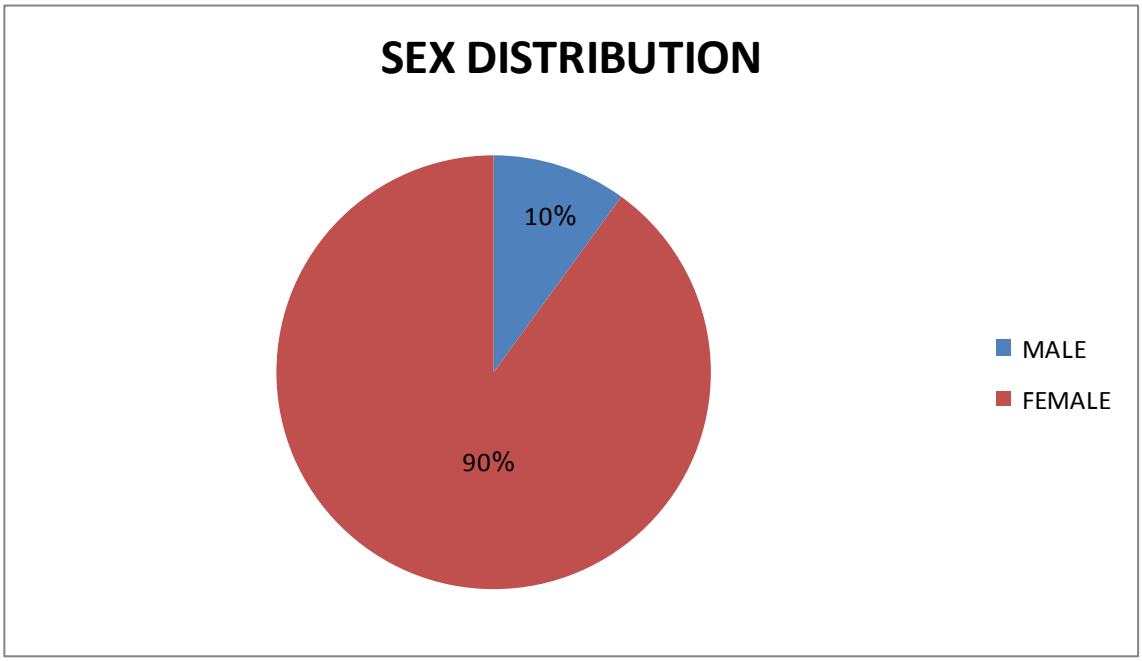


Table 3
Indication for Cholecystectomy

Diagnosis	(n=20)
A. Acute cholecystitis	8 (40%)
B. Chronic cholecystitis	2 (10%)
C. Cholelithiasis	10 (50%)
D. Empyema GB	-
E. Mucocele	-
F. Gangrenous GB	-

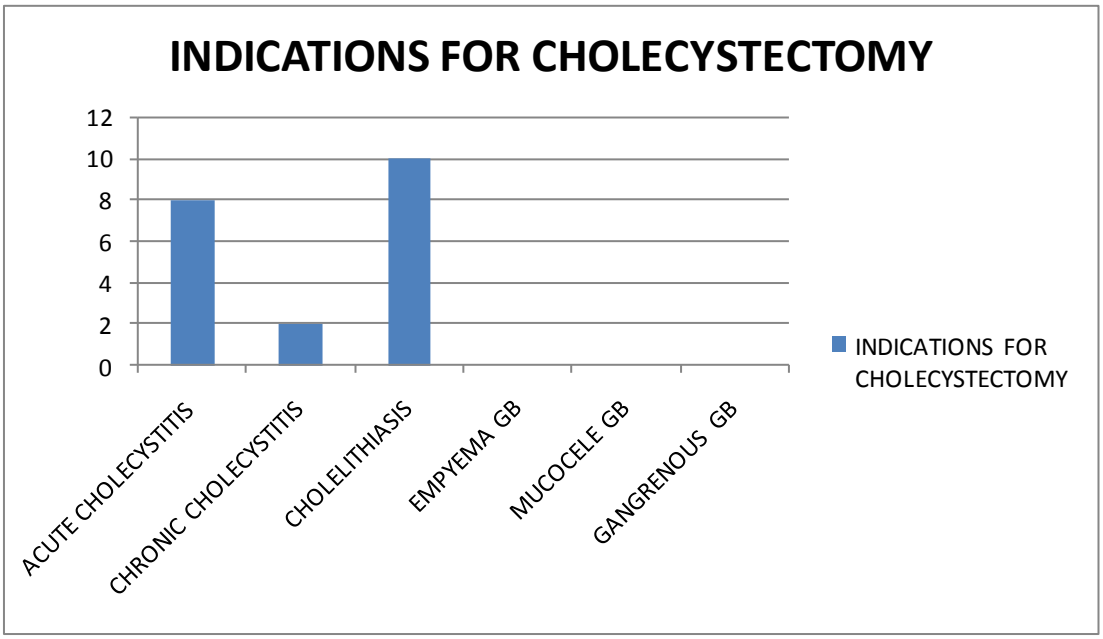
The most common indication for laparoscopic cholecystectomy was cholelithiasis (50%). In the study group both cholelithiasis and acute cholecystitis were the most common causes.

Table 4
Duration of surgery

Duration of surgery (in minutes)	(n=20)
≤ 60	6(30%)
60-120	11(55%)
>120	3(15%)

The duration of procedure in study group is counted from insertion of Veress needle to the port site suturing . The duration of procedure ranged from 30-180 mins in the study with a mean duration of 88 mins.

Graph : 3.



Graph : 4

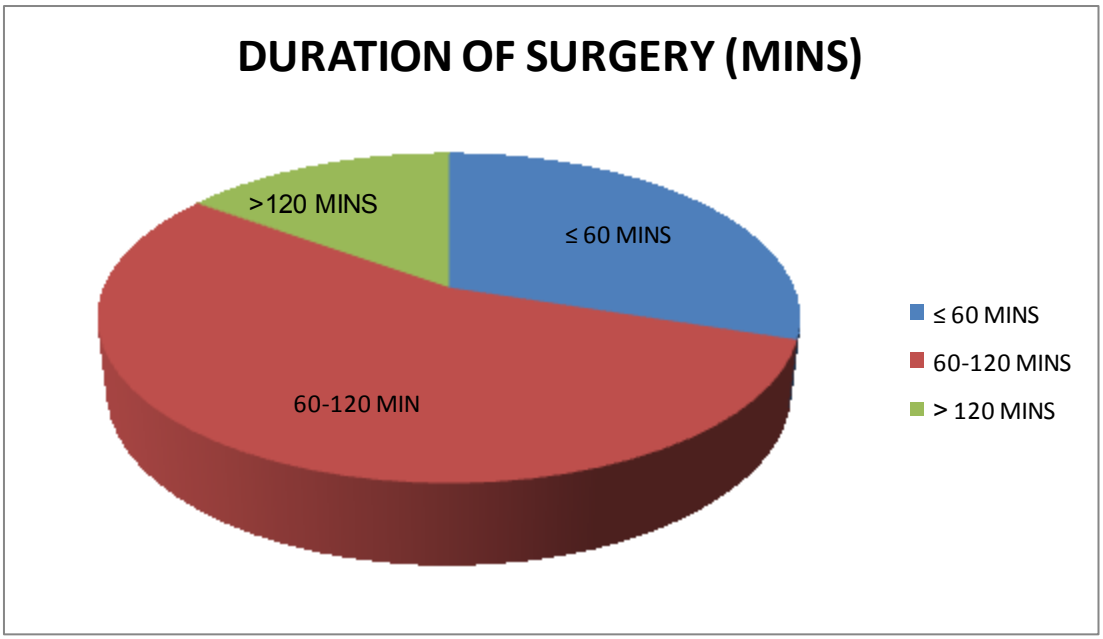


Table 5

Complications

Complications	**(n=20)**
Absent	16 (80%)
Present	4 (20%)
Major complications	
• Bile duct injuries	-
• Major bleeding	-
Minor complications	
• Chest infection	1(5%)
• Gallstone spillage	1(5%)
• Wound infection	2 (10%)

There were 4 cases with complications in the study group. Wound infection was the most common complication (2 cases).

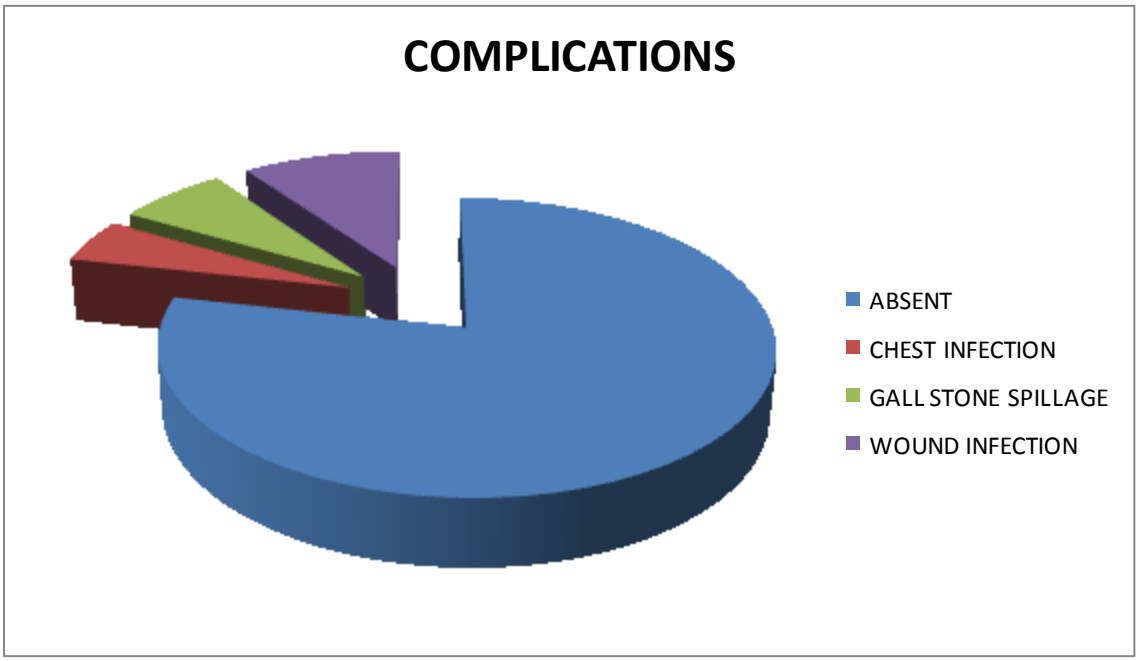
Table 6

Post operative pain

Post-op pain	(n=20)
Tolerable	15 (75%)
Moderate	3 (15%)
Severe	2 (10%)

Most of the patients in the study group had tolerable pain (75%), where as 10% of the patients complained of severe post operative pain.

Graph 5



Graph : 6

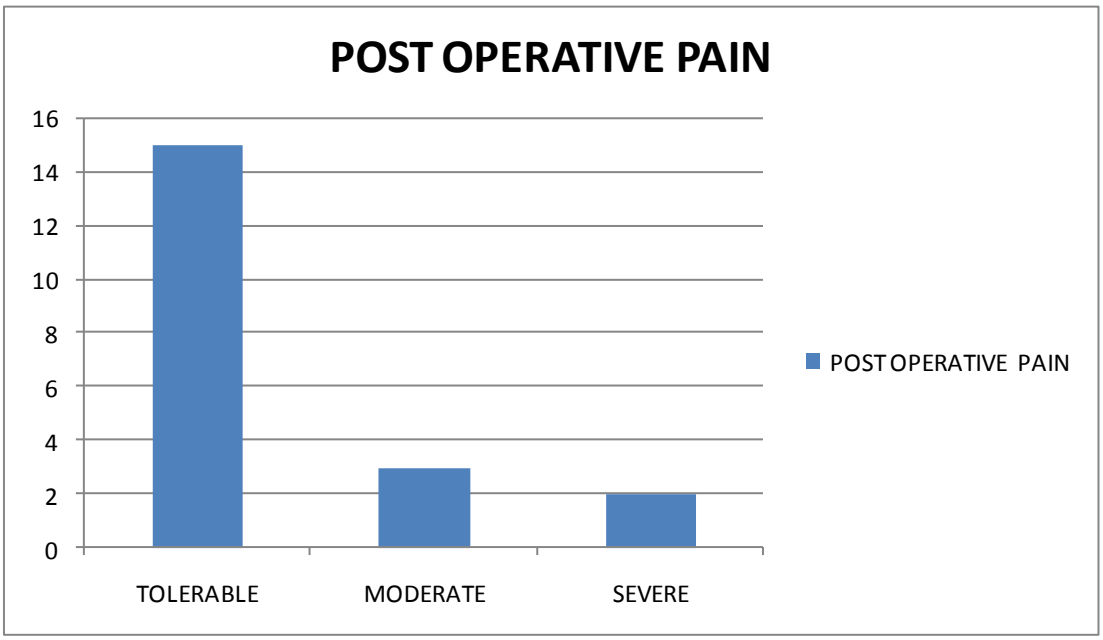


Table 7

Resumption of oral intake

Resumption of oral intake in hours	(n=20)
≤ 24 Hrs	18 (90%)
> 24 Hrs	2 (10%)

Resumption of oral intake was significantly earlier in most of the cases (90%) .

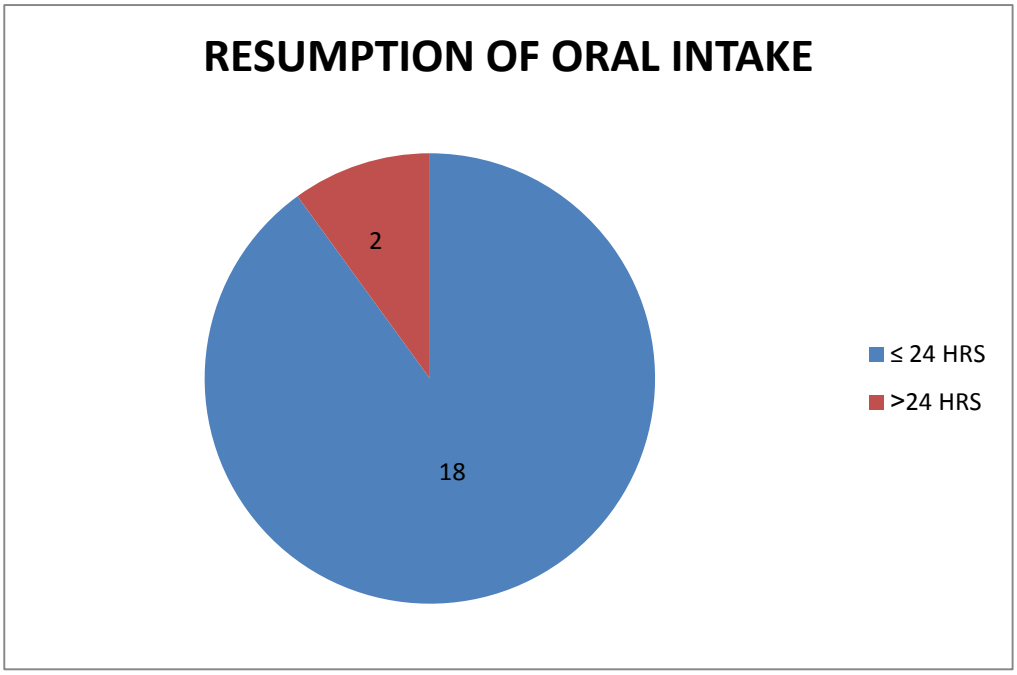
Table 8

Hospital stay and return to normal work

	Post op Hospital stay	Return to normal work
≤ 5 days	11 (55%)	4 (20%)
5-10 days	3 (15%)	15 (75%)
>10 days	6 (30%)	1 (5%)

The total duration of hospital stay was less than 5 days in 55% of the cases. Majority of the patients were able to get back to normal work within 5-10 days.

Graph : 7



Graph : 8

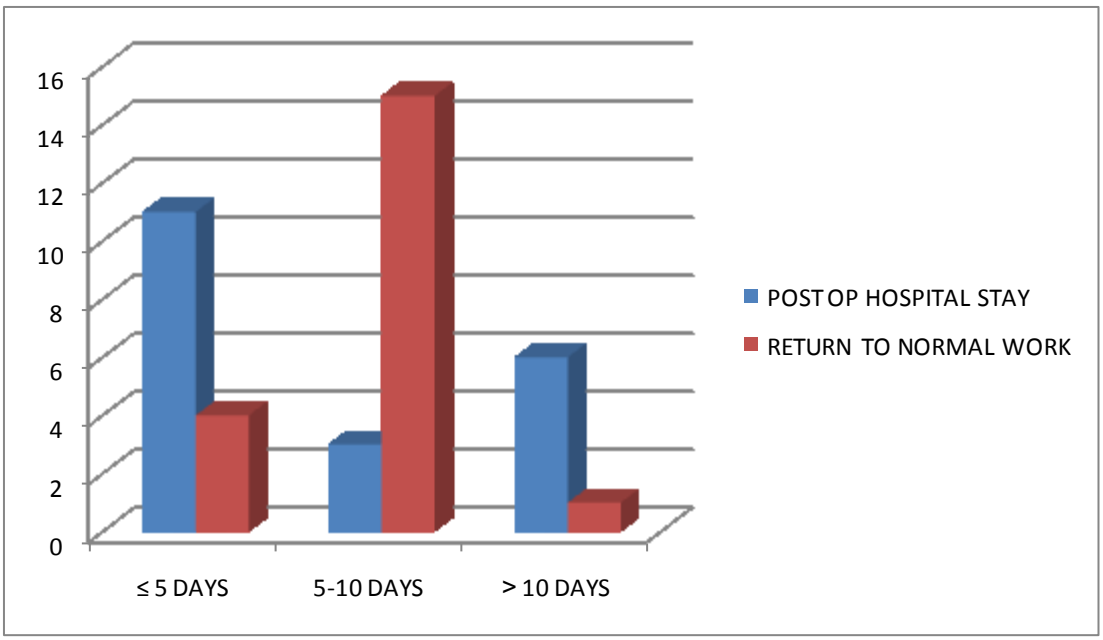


Table 9

Patient satisfaction

	(n=20)
Excellent	-
Good	16 (80%)
Average	4 (20%)
Poor	-

Significant number of patients responded with good grading (80%) .

Graph : 9

DISCUSSION

DISCUSSION

Cholelithiasis is a common disease entity. Frequent occurrence and serious complications of cholelithiasis have made this one of the most important surgically correctable diseases.

Laparoscopic cholecystectomy has significantly changed the treatment of gallstone disease. Although this new technique has been adopted by many practicing surgeons, concern about the incidence of major complications still exists. The morbidity and mortality associated with laparoscopic cholecystectomy should be comparable to open cholecystectomy before it is accepted as the treatment of choice for gallstone disease. Several large published series have reported their experience with laparoscopic cholecystectomy.

This was a clinical study consisting of 20 patients undergoing laparoscopic cholecystectomy conducted in our institute, R.L.Jalappa hospital and research centre attached to Sri Devaraj Urs Medical college, Tamaka, Kolar from November 2008 to May 2010.

The study was undertaken to study the efficacy, safety and patients' satisfaction regarding laparoscopic cholecystectomy.

A study was made on:

- Duration of surgery
- Complications
- Postoperative pain
- Resumption of oral intake
- Period of hospital stay
- Return to normal work
- Patient satisfaction

The observations were analysed and tabulated accordingly.

Age and sex

The main sufferers of gallbladder disease in our study were females as compared to males. Out of total 20 cases, 2 cases were males, which are very much similar to those observed by Fraze and others[29] and U. Berggren and others[39.] The reason for the high incidence among females could be that pregnancy and child birth have a definitive influence on biliary tract disease, acting by casual stasis as well as weight gain and consequent hypercholesteremia.

Age

No age is said to be immune to gallbladder disease, however they were more common in the third, fourth and fifth decades of life as 80% of the cases belonged to these decades. Workers like Thomas B Hugh et al[40] , R Schmitz et al[41] have reported a similar peak incidence in the 4th and 5th decade.

Duration of surgery

The duration of surgery was about 88.25 minutes in the study group . Other studies quoted Sooper et al [42] 95 minutes for laparoscopic cholecystectomy .

	Group A
AJ Karayiannakis et al[43]	105 minutes
Ravimohan SM et al[33]	46.8 minutes
Bart M Redemaker[44]	78 minutes
Sooper et al[42]	95 minutes
Axe ROS et al[45]	93 minutes

Complications

The most common complication found was wound infection. But major complication like bile duct injury was not seen in the study group. There were one case each of chest infection and gall stone spillage.

There was no mortality in this study.

Comparison of complications with other studies

	Bile duct injuries	Major bleeding	Chest infection	Wound infection	Vomiting	Fever
Our Study			5%	10%		
Alfred Cuschieri et al[46]	10.1%	4%				
Hieronymos PJD et al[47]			1%			
Luster F Williams et al[48]	3%		0.5%	1%		
Jerry M Gilliland et al[49]			0.5%	1%		
Bruce M Wolfe[50]	2%	1%				

Postoperative pain

Patients undergoing laparoscopic cholecystectomy had less pain (tolerable to moderate) .In a similar study conducted by Hieronymus PJD et al[10] similar findings were seen.

Resumption of oral intake

Most of the patients in the laparoscopic group were able to take orally within the first 24-48 hours

Period of post operative hospital stay

The period of post operative hospital stay was taken from day of surgery to discharge. The total period of hospital stay in our study was around 8 days .

Compared to our series, the study conducted by U. Bergen et al and Sooper et al showed a postoperative hospital stay of 1.8 days and 1 day respectively which is much shorter than seen in our study. Studies by Jeffrey S Berken[51,] Ahmed Assalea[52] , A W Majeed et al[35] and Tuula Kivilvoto et al[53] also showed a much shorter stay in both groups.

The reason for longer hospital stay in our hospital could be that even though many of our patients could have been suggested discharge earlier, because most of our patients were from rural background they insisted on staying till sutures were removed and hence majority of cases discharged after a week. Another important reason could be postoperative wound infection.

Return to work

The mean time for return to normal work after surgery was 8.2 days in the study group.

Conversion

Three cases were converted into open surgery making it more than with the conversion rate in other studies. The main reason for this could be that while some surgeons doing laparoscopic surgeries in our hospital were already well experienced and been doing it for the past 3-5 years, some were still in the learning curve.

Patient satisfaction

Patients were much more pleased with the outcome especially cosmesis after laparoscopic cholecystectomy giving and good to excellent grading.

CONCLUSION

CONCLUSION

The results support the view that laparoscopic cholecystectomy is a safe and justified replacement for open cholecystectomy.

There is a definite learning curve for surgeons who are newly exposed. The complication rate reduces as the surgeons become more experienced in this procedure. Laparoscopic cholecystectomy is safe with less postoperative morbidity associated with faster patient recovery and satisfaction as documented by less postoperative pain, earlier resumption of oral feeds, earlier full mobilization and discharge home, as well as early return to work.

In conclusion, the study supports the view that laparoscopic cholecystectomy is safe and efficacious and should be an available option for all patients requiring elective cholecystectomy.

SUMMARY

SUMMARY

The purpose of present study was to evaluate the safety and efficacy of laparoscopic cholecystectomy .

The present study comprised of 20 patients who underwent laparoscopic cholecystectomy.

All cases underwent detailed preoperative assessment, their preoperative findings and postoperative complications were meticulously recorded as per protocol.

The observations in our study are summarized below:

- The age and sex distribution of the whole series corresponds fairly well with the usual age and sex affection of gallbladder disease. There was a female preponderance and the peak age group affected was 3rd, 4th and 5th decades.
- The most common indication for cholecystectomy was cholelithiasis followed by acute cholecystitis.
- Three case were converted from laparoscopic to open cholecystectomy. The reason for conversion was because of dense adhesions.
- The mean operative time in laparoscopic study group was 88.25 mins.
- **Complication**

  Major complications like major bleed or bile duct injuries were absent. This indicates that as surgeons become experienced the rate of bile duct injury decreases. The study group had 2 cases of wound infection .

- The patients in the study group had less pain, started oral intake earlier and were discharged early. They were also able to resume their normal work sooner.

- No mortality was seen in our study .

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ANNEXURES

PROFORMA

Name: Age: Sex: IP No:

Address: DOA: DOD:

Occupation: Duration of stay:

HISTORY

Pain	**Pain location**		**Fever**	**Jaundice history**
None	Epigastric	Diffuse	None	None
Mild	RHC	Going to back	Low-grade	Past
Severe	Central	Going to back	High-grade	Current

Hypertension Diabetes Other medical condition

On the following previous medicines Allergies

Drug 1: _____ Smoking

Diet

Drug 2: _____

Drug 3: _____ Alcohol intake Previous operations

Drug 4: _____

EXAMINATION

Built Pulse: _____ / min Blood pressure: ____ / ___ mmHg

Cachectic

Normal

Obese

Temperature	**Lump**
None	None
Low-grade	Gallbladder
High-grade	Pancreatic
	Other

Tenderness Non-tenderness

RH:

Murphy's sign:

LABORATORY INVESTIGATIONS

Hb: _____ FBS: _____ SGPT: _____

TLC: _____ PPBS: _____ Alkaline phosphatase: _____

DLC: _____ RBS: _____ Amylase: _____

ESR: _____ Bilirubin (T): _____ PT: _____

BUN: _____ Bilirubin (D): _____ APTT: _____

Creatinine: _____ SGOT: _____ Urine routine:

ULTRASOUND FINDINGS

Gallstone	**Cholecystitis**	**CBD diameter**	**Other findings**
None	Chronic	Normal ≤ 7 mm	
None	Acute	Dilated > 7 mm	
Single			
Multiple			

CBD stones

Present

Not present

CT scan: _____ MRCP: _____

Other test reports:

OPERATION DETAILS

Date of operation: Operation: _____

Subtotal: _____

Conversion to open cholecystectomy_____

Reason for conversion	**Port sizes**	**Gallbladder**	
Not converted	Umbilical	Normal (with stones)	Empyema
Difficult dissection	Epigastric	Contracted	Gangrenous
Bleeding	RHC	Tense with bile	Sessile
Mirizzi's syn	Lumbar	Mucocele	Mirizzi's
CBD injury	Extra cannula used		
Other organ injury			

GB wall thickness	**GB adhesions**	**Fistula**	
Thick-walled	None	Duodenum	Colon
Thin-walled	Flimsy		
	Dense	Abnormal cystic artery	

Cystic duct	**Cystic duct length**	**Gallstones**
Normal width	Short	None
Wide	Normal	Sludge
Long single		
Multiple		

Difficulty in operation	**Drain**
Normal	If yes, 1. Intraoprative spillage
Slightly difficult	2. Bleed increased
Very difficult	3. Others
CBD injury?	Duration of operation:

Anaesthesia used:

Analgesia used: 1. Narcotic

2. Non-narcotic

Frequency used

Oral feeds after surgery

1. 8 hours
2. 24 hours
3. 48 hours
4. Beyond 48 hours

First bowel movement Vomiting Duration

Expenditure incurred	**Postoperative pain**	**Acceptance**	**Scar size**
1. Hospital stay	Tolerable		
2. Medicines	Moderate		
3. Surgery	Severe		

Rehabilitation	**Postoperative complication**		
Back to normal routine	Haemorrhage	Chest infection	Bowel injury
(at home)			
Back to normal	Wound dehiscence	Wound infection	Jaundice
If late cause for delay	Intestinal obstruction	Bile leak	Shoulder pain
	Others		

OPERATION REMARKS

ANY ADDITIONAL INFORMATION

KEY TO MASTER CHART

1. SL.NO : SERIAL NUMBER
2. I.P NO : IN PATIENT NUMBER
3. RUQ : RIGHT UPPER QUADRANT
4. EP : EPIGASTRIC
5. USG : ULTRASOUND
6. PRO : PROCEDURE
7. LC : LAPAROSCOPIC CHOLECYSTECTOMY
8. COC : CONVERTED TO OPEN CHOLECYSTECTOMY
9. DUR : DURATION
10. GB : GALL BLADDER
11. MINS : MINUTES
12. T : TOLERABLE
13. M : MODERATE
14. S : SEVERE
15. ADL : ACTIVITIES OF DAILY LIVING
16. E : EXCELLENT
17. G : GOOD
18. A : AVERAGE
19. P : POOR
20. Rs : RUPEES
21. WKS : WEEKS
22. MTH : MONTHS
23. POP : POST OPERATIVE PAIN

24. F&C : FINDINGS AND COMPLICATIONS
25. RO : RESUMPTION OF ORAL INTAKE
26. HS : HOSPITAL STAY (DAYS)
27. DPS : DURATION OF STAY IN HOSPITAL POST SURGERY
28. RTW : RETURN TO WORK (DAYS)
29. PS : PATIENT SATISFACTION
30. COMP : COMPLICATIONS
31. WI : WOUND INFECTION
32. CI : CHEST INFECTION

MASTER CHART

SL.No	I.P No	NAME	AGE IN YEARS	SEX	COMPLAINTS	USG FINDINGS	PRO	DUR (MINS)	F & C	DR & DUR (DAYS)	POP	RO (HRS)	HS (DAYS)	DPS (DAYS)	RTW(DAYS)		PS	COMPLICATIONS	COST (RUPEES)
															ADL	ROUTINE			
1	586180	AYESHA	20	F	PAIN RUQ 2 WKS	MULTIPLE STONES	L	45	THICKENED GB WITH STONES	NO	T	24	5	3	7	10	G	NIL	8600
2	525331	VENKATRAVANAPPA	45	M	PAIN RUQ 6 MTHS	MULTIPLE STONES	L	90	GB STONES	YES 3	T	24	7	6	2	4	G	NIL	8700
3	560918	PARVATHAMMA	51	F	PAIN RUQ,EP 3MTHS	MULTIPLE STONES WITH SLUDGE	COC	75	ADHESIONS,DISTENDED GB	NO	M	24	14	12	3	7	G	NIL	7100
4	541374	NIRMALA	42	F	PAIN RUQ 7 DAYS	MULTIPLE STONES+FIBROIDS	COC	80	DENSE ADHESIONS	YES 4	T	24	31	14	4	9	G	WI	8500
5	535692	NARAYANAMMA	45	F	PAIN RUQ 1MTH,VOMITING	MULTIPLE STONES	L	90	INFLAMMED GB	NO	T	24	6	3	2	7	G	NIL	5800
6	557257	SABINA BANU	35	F	PAIN EP 2DAYS	MULTIPLE STONES WITH SLUDGE	L	70	DISTENDED GB	NO	T	24	6	5	4	8	G	NIL	5800
7	575299	LAKSHMAMMA	45	F	PAIN RUQ,FEVER 2DAYS	INFLAMMED GB	L	85	INFLAMMED GB	NO	T	24	9	7	3	4	G	NIL	5700
8	488673	BHAGARATHA	44	F	PAIN RUQ 5 MTHS	MULTIPLE STONES	L	70	NO ADHESIONS,INFLAMMED GB	NO	T	24	7	4	3	7	G	NIL	5800
9	576508	UMA	58	F	PAIN RUQ 4MTHS,VOMITING	BILIARY SLUDGE	COC	150	DENSE ADHESIONS	YES 4	S	48	22	20	7	10	A	NIL	7400
10	461973	MAHABOOB BEE	45	F	PAIN RUQ,EP 3DAYS	SINGLE STONE	L	105	INFLAMMED GB	NO	T	24	7	5	4	8	G	NIL	5800
11	468407	RABIYA BASRI	72	F	PAIN EP 3DAYS FEVER 2DAYS	INFLAMMED GB	L	80	DISTENDED GB	NO	S	24	17	15	7	14	A	NIL	7800
12	418010	AKKAYAMMA	56	F	PAIN RUQ 4DAYS FEVER 2DAYS	SINGLE STONE	L	150	DENSE ADHESIONS	YES 4	M	48	20	16	5	10	A	WI	10900
13	596151	LALITHAMMA	60	F	PAIN RUQ,FEVER 2DAYS	MULTIPLE STONES INFLAMMED GB	L	60	FLIMSY OMENTAL ADHESIONS	NO	T	24	16	4	3	6	G	NIL	9200
14	484051	ADIYAMMA	70	F	PAIN RUQ 4MTHS	MULTIPLE STONES CONTRACTED GB	L	30	THICKENED GB WALL	YES 3	T	24	11	5	5	10	G	NIL	9300
15	501044	PUSHPA	34	F	PAIN RUQ EP 1DAY	MULTIPLE STONES	L	120	THICKENED GB WALL	YES 4	T	24	7	4	4	8	G	NIL	6800
16	512770	LEELAMMA	48	F	PAIN RUQ 2MTHS	CONTRACTED GB MULTIPLE STONES	L	45	FLIMSY ADHESIONS	NO	T	24	6	3	3	4	G	NIL	6800
17	516423	ANITHA	25	F	PAIN RUQ 1DAY,VOMITING	DISTENDED GB WITH STONES	L	120	DENSE ADHESIONS	YES 3	T	24	18	15	5	14	A	CI	7600
18	478607	NIRMALAMMA	33	F	PAIN RUQ,EP 3DAYS,VOMITING	DISTENDED GB WITH STONES	L	60	FLIMSY OMENTAL ADHESIONS	NO	T	24	7	3	4	9	G	NIL	6900
19	466331	RATNAMMA	45	F	PAIN RUQ 2 DAYS	MULTIPLE STONES	L	180	ADHESIONS,STONE SPILLAGE	YES 4	M	24	8	5	5	9	G	NIL	6000
20	481932	GIRIYAPPA	40	M	PAIN EP 2DAYS	DISTENDED GB	L	60	INFLAMMED GB	NO	T	24	9	6	3	5	G	NIL	77OO