"COMPARISION BETWEEN CAMERA LENS FOGGING DUE TO CARBON DIOXIDE INSUFFLATION WHILE USING THE INSUFFLATOR PORT VS THE NON-INSUFFLATOR PORT IN A PATIENT UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY"

BY

REG NO.BH0122012

Dissertation

Submitted to the KLE Academy of Higher Education and Research, Belagavi, Karnataka

In Partial Fulfilment

of the Requirements for the Degree of

MASTER OF SURGERY (M.S)

IN

GENERAL SURGERY

DEPARTMENT OF GENERAL SURGERY

JAWAHARLAL NEHRU MEDICAL COLLEGE,

BELAGAVI, KARNATAKA

SEPTEMBER /OCTOBER 2025

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Dr. S. C. METGUD MS

Professor and Head, Department of Surgery,

J. N. Medical College,

Nehru Nagar, Belgaum – 10

Date: 21/3/25

Place: Belgaum

Dr. N. S. Mahantshetti MD (PAED)

PRINCIPAL
Jawaharlal Nehru Medical College
BELAGAVI

Principal,

J. N. Medical College,

Nehru Nagar, Belgaum – 10

Date: 21/3/25

Place: Belgaum

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Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA
0831 - 2471350 0831 - 2470759 www.jnmc.edu incipal@jnmc.edu

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Principal,
J. N. Medical College, Belagavi.

To,
Reg. No. BH0122012
Postgraduate Student,
2022-23 Batch,
Department of General Surgery
J. N. Medical College, Belagavi.

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JNMC INSTITUTIONAL ETHICS COMMITTEE
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)
Website: http//www.jnmc.edu
E-Mail : dome@jnmc.edu
Phone: (+ 91-(0)831 Office : 2472550
Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref No.MDC/JNMCIEC/ 291 **Date: 24/06/2023**

To.

REG NO.BH0122012
PG Student in General Surgery
J. N. Medical College,
BELAGAVI.

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(Dr. Smita Sonoli)
Member Secretary
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi.

(Dr. Harsha Hegde)
Chairman,
JNMC Institutional Ethics Committee
J.N.Medical College, Belagavi

LIST OF ABBREVIATIONS

ACR	-	American College of Radiology
ALT	-	Alanine aminotransferase
AST	-	Aspartate aminotransferase
BP	-	Blood pressure
CA	-	Cystic Artery
CBD	-	Common bile duct
CD	-	Cystic Duct
CHD	-	Common Hepatic duct
cm	-	Centimeters
CT	-	Computed tomography
ERCP	-	Endoscopic retrograde cholangiopancreatography
$ETCO_2$	-	Partial pressure concentration of carbon dioxide
EUS	-	Endoscopic Ultrasound
HA	-	Hepatic Artery
HBS	-	Hepatobiliary scintigraphy
HIDA	-	Hepatobiliary iminodiacetic acid scan
i.e.,	-	That is,
ICU	-	Intensive care unit
Kg	-	Kilogram
LC	-	Laparoscopic cholecystectomy
LFT	-	Liver function tests
LLF	-	Laparoscopic Lens Fogging
min.	-	Minute
MIS	-	Minimally Invasive Surgery
RHA	-	Right Hepatic Artery
SILS	-	Single incision laparoscopic cholecystectomy

ABSTRACT

Introduction: To execute minimally invasive treatments and replicate the vision that would often be provided with open surgery, laparoscopic surgery uses a high-definition camera to give the Surgeon a clear and precise viewing field. Laparoscopic Lens fogging (LLF) has been one of the most persistent problems with laparoscopic visibility. The human intraperitoneal cavity is over 37°C (and more than 85% relative humidity), in contrast to surgical rooms, which are typically maintained at a dry temperature between 20°C and 24°C. The moisture in the pneumoperitoneum around the laparoscope rises to its dew point—the temperature at which moisture from the air will condense and turn into a liquid—due to the scope's temperature fluctuation when it is positioned inside the intraperitoneal cavity. Condensation forms on the lens and the scope shaft as a result of this temperature, which is influenced by air pressure and relative humidity. Additionally, during an operation, modifications to the intraperitoneal environment, like tissue cauterization, result in changes in heat and moisture that could still have an impact on the scope's lens.

Aim of the Study: To compare camera lens fogging due to carbon dioxide insufflation between the insufflator port and non-insufflator port in a patient undergoing Laparoscopic Cholecystectomy (LC).

Methods: Patients in Dr. Prabhakar Kore Hospital undergoing Laparoscopic Cholecystectomy. The number of times the camera lens had to be removed from the port to clean using a gauze piece during the surgery while using the Insufflator Port v/s the Non-Insufflator Port when all the parameters of CO2 Flow, Pressure are kept constant and on using both Monopolar and Bipolar Cautery. CO2 Pressure at 15 mm Hg and CO2 Flow -> 5 L/min.

Results: The time taken to remove the scope after placing the insufflator in the Epigastric port was far more than the time taken to remove the scope after connecting it to the umbilical port during Laparoscopic Cholecystectomy.

Conclusion: In a patient having laparoscopic cholecystectomy, camera lens fogging from carbon dioxide (CO_2) insufflation is significantly less in the non-insufflator port (epigastric) than when linked to the insufflator port (umbilical).

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INTRODUCTION

Laparoscopic cholecystectomy has been the gold standard for treating symptomatic cholelithiasis for over 25 years, replacing open cholecystectomy in the treatment of benign gallbladder disorders. Cholecystectomy has become the preferred procedure for most patients who are referred for it. In 1985, Muhe performed the first LC. (1) (2) and Dubois continue to refine this approach.

The primary benefits of laparoscopic cholecystectomy are a decrease in adhesion formation and tissue damage from the skin incisions. The growing body of research indicating a lower rate of patient morbidity, a shorter length of time in the hospital, and an earlier return to normal activity is primarily responsible for the growing interest in laparoscopy.

The technique, extent of tissue injury, and CO2 pneumoperitoneum are the main distinctions between open and laparoscopic cholecystectomy. Pneumoperitoneum must be established before laparoscopy can give sufficient surgical exposure and preserve operative freedom. The peritoneal cavity's gas is inhaled during the laparoscopic cholecystectomy procedure. The preferred gas for the formation of pneumoperitoneum is carbon dioxide due to its low cost, high solubility, chemical stability, quick elimination, physical alertness, ability to suppress combustion, and ability to produce good illumination. As a typical byproduct of human metabolism, carbon dioxide is harmless at physiological concentrations. (3) Peritoneal absorption, it is easily expelled through the lungs. It has been shown that CO_2 is 20 times more soluble in serum and 32 times more absorbed than in oxygen or ambient air.

Compared to an open cholecystectomy, a laparoscopic procedure has numerous benefits. The surgeon's skill level and the level of difficulty encountered during the procedure determine the conversion rate and problems related to laparoscopic procedures. Several centers have reported wildly different rates of conversion to open operation (ranging from 1.5% to 6%). Bile duct injury (BDI) in LC is reported to occur in 0% to 1% of cases. These clear benefits have led to the procedure's global rise in popularity and current ranking among the most often done operations in general surgical practice. In essence, LC is a low-risk technique with minimal rates of morbidity and death.

During laparoscopic procedures, carbon dioxide is infused into the abdominal cavity to facilitate simpler instrument manipulation and organ vision. This procedure is known as CO2 pneumoperitoneum. The pressure being used is higher than the pressure in the portal system, which is between 7 and 10mmHG, and ranges from 12 to 20 mmHg, however, it is often 14 mmHG. (4) Increased intraabdominal pressure and CO2 pneumoperitoneum can cause a variety of pathophysiologic abnormalities. Depending on the thickness and muscle strength of the front abdominal wall, most procedures call for an abdominal pressure of 12 to 20 mmHg, which necessitates delivering about 5 liters of gas into the belly. There are two categories of CO2 pneumoperitoneum effects:

1. The physiological effects of CO2 absorption and
2. Chemo-dynamic effects from increased intraabdominal pressure

Since the video camera was introduced in 1987 to assist with the first laparoscopic cholecystectomy (5) (6)c surgical procedures have rapidly gained popularity in a wide range of specializations.(7) During these procedures, LLF

reduces vision, lengthens the operating time, and may raise the risk of intraoperative problems.(8) Since repetitive camera withdrawal can impair eyesight, take time, and hinder operative efficiency, intra-surgical LLF may have serious consequences. Similar problems arise when doing surgeries with robotic assistance.

Nevertheless, despite these challenges, little is known about the etiology of LLF and possible treatments. There are currently few methods for managing fogging that have been documented, and most of them are laborious and need the removal and reinsertion of laparoscopic equipment on multiple occasions. (9,10)

LLF is thought to be caused by an imbalance between the abdominal cavity's humidity and the laparoscope's front lens's temperature. As a result, several techniques for warming up scopes have been documented, including the use of laparoscopic scope warmers, humidified carbon dioxide insufflation, and warmed normal saline from a thermos. (7,9,11)

To save time while removing the scope and cleaning the lens of fog, several surgeons have chosen to use the non-insufflator port location for CO2 insufflation.

AIMS AND OBJECTIVES

The aim of the study was to investigate:

- To compare camera lens fogging due to carbon dioxide insufflation between the insufflator port (Umbilical) and non-insufflator port (Epigastric) in a patient undergoing Laparoscopic Cholecystectomy.

REVIEW OF LITERATURE

Laparoscopic surgery, sometimes referred to as "keyhole" or minimally invasive surgery (MIS), is a contemporary surgical method that uses cannulae (or Ports), or tiny incisions that create channels into the body, to perform procedures in the belly. (12)

More than two millennia ago in biblical history, laparoscopy was first mentioned. The idea of preserving homeostasis by balancing the production and excretion of physiological wastes was the cornerstone of the ancient Galenic medical tradition at the time. Obstacles gave rise to illnesses. The traditional method of returning the body to equilibrium involved using purgatives and cathartics. Alternatively, according to Ezekiel and Celsus (25 BC – AD 50), medically draining the abdomen of "bad humours" through trocar insertion was acceptable. (13)

In “1882, Carl Langebuch (1846–1901) of Germany performed the first cholecystectomy. (13) In 1985, 103 years later, Prof. Dr. Erich Mühe performed the first LC. He performed 94 identical procedures before another surgeon, Phillipe Moret of Lyon, France, performed his first LC in 1987, and Francois Dubois of Paris, France, followed in” 1988.

Dresden, Germany-based surgeon George Kelling recorded the first laparoscopy on a live dog. In September 1901, this was presented at the 73rd Congress of German Naturalists and Physicians. By employing filtered air to create pneumoperitoneum and utilizing trocar and cystoscopy, he performed laparoscopy and established many of the fundamental concepts of laparoscopy that are still in use today. Sweden's Hans Christian Jacobaeus published a report on the first laparoscopic procedure performed on a human in 1910.

The development of the computer chip television camera greatly facilitated the advancement of laparoscopy by improving the view of internal structures and enabling the process to be carried out while observing a projected image of the abdomen's contents. Additionally, it gave the surgeon unrestricted hand movement, which made it simpler to carry out more difficult procedures. This method was only used for diagnostics and a few straightforward gynecologic surgical operations prior to the development of the camera.

The three most important and basic instruments utilized in the first LC were the hemoclip, the pistol grip scissors, and the laparoscope. (1)

Before general surgeons, gynecologists had been using the laparoscope for years for diagnostic purposes. Mühe carried out the first LC in 1985. (1)

The “Weck-Reynolds pistol grip clip applier and the Weck-Reynolds pistol grip scissors were two more essential tools utilized at that time for the hemoclip's ligation and cutting of the cystic duct (CD) and artery during laparoscopic cholecystectomy. Hemoclips caught Walker Reynolds Jr.'s” attention when they were first employed in 1970 to hemostasis blood arteries in conjunction with staple surgery. (1)

To perform laparoscopic procedures, the abdominal cavity is gas-inflated to create pneumoperitoneum. The abdominal wall and its contents are separated by the distension of the abdomen. For surgical treatment to be safe and effective, it must have clear vision, enough room for diagnostic and therapeutic processes, and the ability to maintain a normal physiological condition. Richard Zollikofer from Switzerland proposed using CO2 to create a PP. Electrocoagulation was made possible by the lack of oxygen in the abdominal cavity.

For laparoscopic surgery, a spring-loaded Veress needle is utilized to generate pneumoperitoneum. The Hungarian János Veress surgeons created the Veress needle in 1932 with the intention of developing a secure piercing method for inducing a therapeutic pneumothorax, or collapsed lung, for the treatment of pulmonary tuberculosis.

More than 500,000 laparoscopic cholecystectomy procedures are carried out yearly, making it one of the most popular general surgery procedures today. When opposed to open cholecystectomy, LC has numerous advantages. The surgeon's skill level and the level of difficulty encountered during the procedure determine the conversion rate and problems related to laparoscopic procedures. Widely disparate conversion rates (ranging from 1.5% to 6%) to open operation have been reported by several centers. Bile duct injury is reported to occur in LC at a rate of 0% to 1%. These clear benefits have led to the procedure's global rise in popularity and current ranking among the most often done operations in general surgical practice. In essence, LC is a low-risk technique with minimal rates of morbidity and death.

SURGICAL ANATOMY

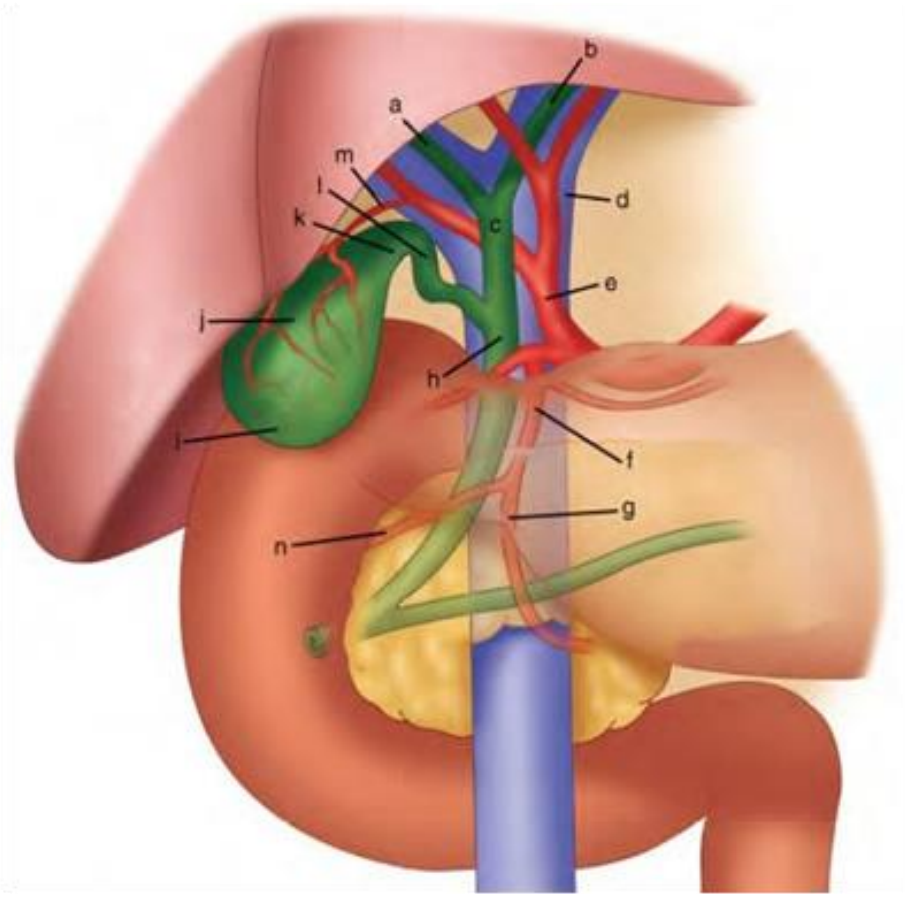
The “gallbladder is where bile is stored. In the gall bladder fossa, it is a pyriform structure situated on the inferior surface of the right hepatic lobe. In close proximity to the right end of the porta hepatic, it stretches forward to the inferior hepatic border. (14) Connective tissue connects its upper surface to the liver whenever the peritoneum completely covers it, and a short mesentery connects it to the liver.

It is 7–10 cm long and 3 cm wide at its widest” point, with a 30–50 ml capacity. Its parts are the neck, body, and fundus. The narrow, restricted part at the neck curls forward and upward before abruptly decreasing and reversing to form the

cystic duct. The neck and gallbladder are connected by areolar tissue that contains the cystic artery (CA). The obliquely rigid mucosa creates a spiral valve when the neck enlarges, giving the surface a spiral groove.

Known as Hartmann's pouch (first reported by Broca), a tiny depression may protrude from the right side of the neck and extend back towards the duodenum.

The 3 to “4 cm-long cystic duct travels back, down, and to the left from the neck of the gall bladder before connecting the common hepatic duct (CHD) to form the common bile duct (CBD). The cystic duct runs along the right border of the lesser omentum, generally around the porta hepatis but sometimes below. The five to ten concentric folds that emerge obliquely in a regular” succession from the mucosa like spiral valves and are called the Valves of Heister. (14)(15) (16)(17)



a = "right hepatic duct ; b = left hepatic duct; c = common hepatic duct; d = portal vein; e = hepatic artery; f = gastroduodenal artery; g = left gastric artery; h = common bile duct; i = fundus of the gallbladder; j = body of gallbladder; k = infundibulum; l = cystic duct; m = cystic artery; n = superior pancreatico-duodenal artery. Note: the situation of the hepatic bile duct confluence anterior to the right branch of the portal vein, the posterior course of the right hepatic artery behind the common hepatic" duct. (17)

Figure 1. Anterior aspect of the biliary anatomy

Arterial Supply of the Gallbladder:(14)

The CA, a branch of the RHA, serves as the primary conduit to the gall bladder. Tiny capillaries from the hepatic bed also supply the gall bladder. On the upper side of the gall bladder's neck, the CA normally passes beneath the CHD and CD before dividing into superficial and deep branches. The hepatic ducts and the upper part of the common bile duct get branches from the cystic artery. In the bottom part of the bile duct, the posterior superior pancreatico-duodenal artery receives several branches. The RHA supplies branches to the BD's center part.

In order to perform surgery without causing damage, there may be abnormalities in the artery's origin that are of surgical relevance. Anson (1963) noted the following incidences in 800 specimens: i) “superior pancreatico-duodenal (0.3%), ii) right gastric (0.1%), iii) coelic trunk (0.3%), iv) superior mesenteric (0.8%), v) left hepatic (5.5%), vi) gastroduodenal (2.6%), vii) right hepatic artery (63.9%). The hepatic ducts and upper portion of the CBD are supplied by the auxiliary cystic artery, which might emerge from the common hepatic or one of its branches. The gall bladder gangrene follows the closure of the cystic artery, which is an end” artery. (18)

Venous Drainage of the Gallbladder:(14)

There are significant differences in the veins that drain the gall bladder. They are in the areolar tissue, which is present between the liver and gallbladder on its upper side. These connect the hepatic veins by passing straight through the gallbladder's fossa and into the liver. One or more cystic veins on the gall bladder's neck are formed by the veins joining from the rest of the bladder. These often “enter the liver either directly or through the veins that empty the bile duct's upper section and the hepatic ducts. Rarely, a single or double cystic vein can empty directly into

the right branch of the portal vein. The cystic artery is not accompanied by them.

Lymphatic Drainage:(14)

Both inflammatory and malignant gall bladder diseases are significantly impacted by the lymphatics that drain the gall bladder. The lymphatics from the subserosal and submucosal plexus are received by the cystic lymph node of Lund. This sentinel lymph node is located in the fork formed when the common and cystic hepatic ducts" converge. Additionally, lymph drains to a node located at the epiploic foramen's anterior edge. Efferent vessels are received by the celiac group of preaortic nodes through the free margin of the smaller omentum.

An enlarged sentinel node may disrupt the normal anatomy in patients with malignancy or AC. The relationship between the liver's subcapsular lymphatic channels and the gallbladder's subserosal lymphatic capillaries explains why gallbladder cancer frequently spreads to the liver.

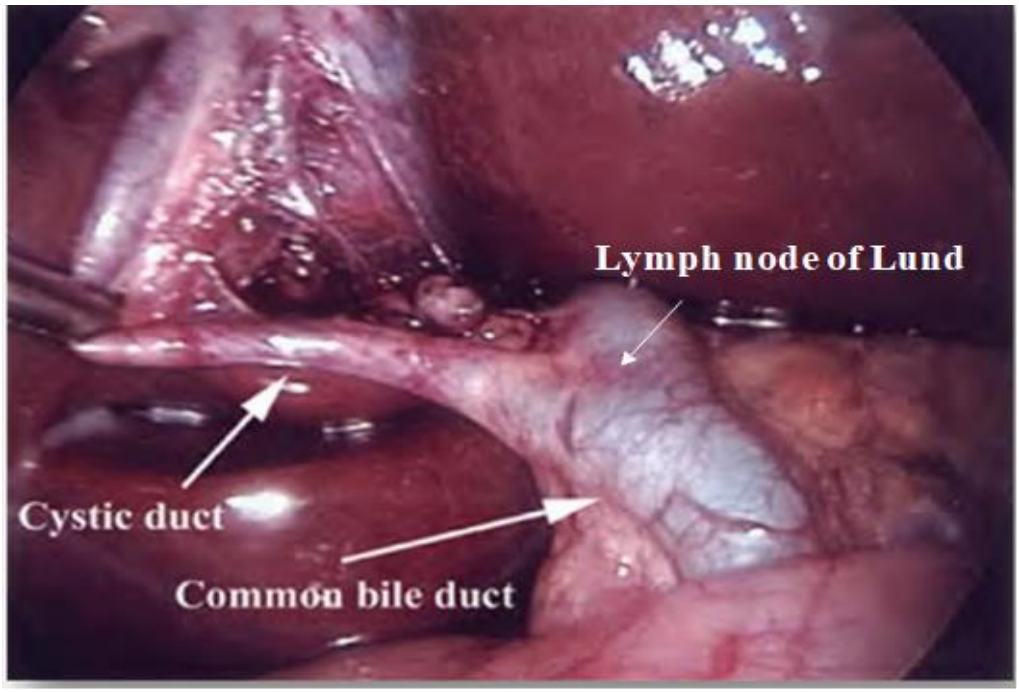


Figure 2. Calot's triangle

Innervation:(14)

There are several innervated “sympathetic and parasympathetic nerve fibers. They pass through the hepatic artery's branches. The hepatic branch of the anterior vagal trunk is the primary source of parasympathetic fibers that relax the ampullary sphincter to promote gall bladder contraction. Contraction is inhibited by sympathetic fibers from the cell bodies of the celiac ganglia and the preganglionic cells in the lateral horn of spinal cord segments” T7–T9. The muscle and submucosal layers contain the nerve's autonomic plexus. It appears that the phrenic and celiac plexus carry fibers from the right phrenic nerve to the gallbladder via the hepatic plexus. In gall bladder pathology, this explains the symptom of transferred "shoulder pain." The right hypochondrium and epigastrium are typically where biliary tract pain is felt, and it can also radiate to the back in the infrascapular region, which is where spinal nerves T7 and T9 are distributed.

Triangles of Cholecystectomy:

Jean-François Calot described an anatomical triangle in 1891 that was made up of the CD laterally, the CHD medially, and the CA superiorly. The previous “concept of the triangle of cholecystectomy had the inferior surface of the liver, now called the hepatocystic triangle, as the upper limit instead of the CA”. ((19) Due to the fact that several significant structures run through it, this triangle has surgical significance. Therefore, it is essential to identify each element within the triangle in order to prevent complications during cholecystectomy. ((20)

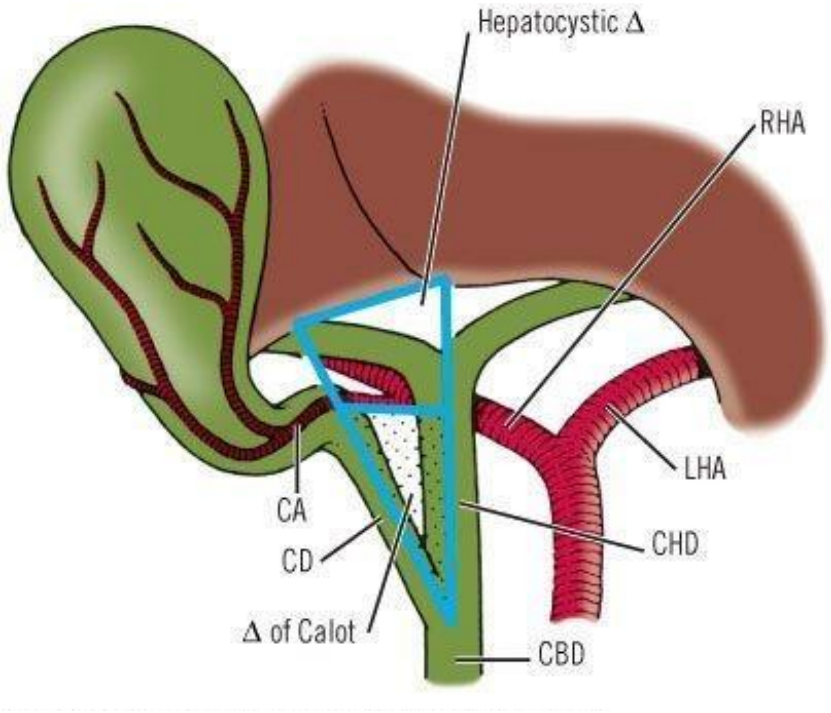


Figure 3. Triangles of cholecystectomy

Common anomalies and variations

1) Absent gall bladder: a very uncommon condition with a documented autopsy frequency of 0.03%. (14)
2) Gall bladder variation "in size and shape.

   Bilobed Gallbladder.

   Fundal Diverticulum.

   Phrygian cap.

   Hourglass Gall" bladder.
3) Positional "variation: floating gall bladder, left-sided gall bladder.
4) Double gall bladder: A double gall bladder, which is a duplication of the gall bladder with two separate chambers and two separates" CDs, will occur in around 1 in 4000 persons.

   Cholelithiasis and cholecystitis are examples of pathological processes that might affect one organ while protecting the other. (21)

5) Other “anomalies -

   a. Persistence of intrahepatic gall bladder
   b. Diverticula of body or neck of gall bladder
   c. Accessory peritoneal fold because of congenital” adhesions.

An increase in peritoneal investment causes the gall bladder to float; this disorder affects 5% of individuals and predisposes them to torsion, which can lead to gangrene or viscus perforation. (14)

In rare cases, the CD might not exist. It is possible for two or more cystic ducts to merge. CD and CHD junctions can “vary in level from the porta hepatis to behind or even below the first segment of the duodenum. When the junction between the two ducts is low, fibrous tissue might join” them. Rarely, the gall bladder itself may give rise to accessory hepatic ducts, which often arise from the right lobe to join the major hepatic ducts. (15)

Physiology of gall bladder (15,17,20)

The gall bladder absorbs water and sodium to concentrate bile, increasing its strength and ability to digest. The bile ducts and gallbladder are ideal for “storing and releasing bile into the duodenum during digestion. The gallbladder's concentrating ability allows for small-scale storage, while the contraction and relaxation of the sphincter of Oddi” controls the flow of bile into and out of the gallbladder.

A healthy gallbladder is rarely static since it is constantly in a state of partly emptying and refilling. The intestine migratory myoelectric complex controls this in between meals. It contracts sporadically during relaxation and refilling, releasing bile pulses into the duodenum. Stone formation is prevented by this continuous oscillation.

Epidemiology

Gallbladder inflammation is known as cholecystitis. Cholelithiasis is the frequent cause of this. Acalculous cholecystitis accounts for 10% of instances, while calculous cholecystitis, or stones in the CD, accounts for 90% of cases. (22)

The five F's—fat, female, fertility, forty, and family history—are typical risk factors. In affluent countries, gallstones are a major health issue that affects 10% to 15% of adults, which means that 20-25million Americans currently have or may eventually have gallstones. An anticipated 1.8 million ambulatory care visits are attributed to gallstone disease each year, making it a major cause of hospitalization for gastrointestinal issues. (23)

There are dangers associated with gallstone disease itself. Americans and Pima Indians with cholelithiasis have greater overall mortality rates, specifically from cancer and cardiovascular disease, according to prospective population-based surveys. (23)

Complications, including gallstone-associated pancreatitis, also increase with the rise in gallstone disease. (24)

Age distribution in cholecystitis

It's unknown what physiological factors contribute to the rising incidence of gallstone disease in the senior population. Gallstones affect at least 10% of adults. After the age of 60, the prevalence increases. Gallstones affect between 10 to 15% of men and 20 to 40% of women. (25)

Sex distribution for cholecystitis

Gallstones are two to three times more common in women than in men, which makes calculous cholecystitis more likely in women. Biliary stasis, which increases the risk of gallbladder disease, can occur in pregnant women with high progesterone levels. In elderly males, acalculous cholecystitis is more common. (26)

Prevalence of cholecystitis by race and ethnicity

People from sub-Saharan Africa and Asia are less likely than those of Scandinavian lineage, Pima Indian, and Hispanic ethnic backgrounds to develop cholelithiasis, the primary risk factor for cholecystitis. Caucasians are more common than African Americans in the United States. (27) (28)

Gallstones are particularly common in Chile and the Scandinavian nations. According to reports, the Pima tribe is more likely than other Mexican Americans, Native Americans, and American Indians to have gallstones. ((27)

The epidemiology of gallstone disease in India

Indian authors have conducted research. India is said to have a low incidence of gallstones in Western medical and gastrointestinal literature. Gallstone disease is common in different regions of India. (29) Gallstones were 7 times more common in North Indians than in South Indians, as per epidemiological research conducted in 1966 among Indian Railway workers. In Kashmir, good epidemiological investigations have been conducted. According to reports, the frequency is extremely high and rising. 30–34). Khuroo from Kashmir reported that the frequency was 6.12%, with women constituting 9.6% and men 3.07%. It increased gradually, peaking in the sixth decade. (35) The frequency is higher among women who are

multiparous. (33) There was no association with socioeconomic status, diet, or obesity.

Data from South India paints a different picture. According to Jayanthi et al.., mixed and pigment stones were more prevalent in Tamil Nadu than cholesterol stones. (35) They discovered no association with social norms or demographic characteristics. Although there is now no scientific explanation for this data, it is an intriguing finding that there is a correlation with high tamarind consumption. Compared to the Northern states, Tamil Nadu seems to have a lower overall gallstone prevalence. Cholecystectomy, which was historically a very rare surgery in south India, has grown more common, which may indicate a true rise in the disease's frequency or an earlier diagnosis because of the ease with which abdominal ultrasonography may find stones. (29)

Clinical Manifestations of Gallstones

Types “of gallbladder diseases:

1. Asymptomatic gallstone disease.
2. Symptomatic gallstone disease
3. Pain abdomen from another etiology that include peptic ulcer, with asymptomatic gallstones
4. Cholecystitis with no gallstones

The decision to surgery is based” on

1) Asymptomatic gallstone disease - Even after up to 20 years of follow-up, the majority do not exhibit any symptoms. By the age of 15, about 20% of people may start to exhibit symptoms. There are some exceptions, but in many

Western nations, asymptomatic gallstone disease does not require surgery. Many new articles emphasize the importance of preventative cholecystectomy for young patients from different parts of India, although one paper criticizes it. ((36)

2) Symptomatic gallstone disease -

   a. *Biliary colic* - A common description is upper abdominal right side postprandial pain. In contrast to what is generally accepted, it can occur following any mixed diet, not simply fatty meals. (29)

   b. *acute cholecystitis* - Patients often describe a history of biliary discomfort, which is characterized by fever and tenderness in the right upper quadrant (Murphy's sign) and lasts for more than three hours. (29)

   c. Chronic cholecystitis - Episodes of epigastric and upper right quadrant pain will last longer than thirty minutes for patients. Gallstones can cause cholangitis, choledocholithiasis, and pancreatitis in patients. (29)

   d. Choledocholithiasis - Patients may appear with acute cholangitis, pancreatitis, or biliary colic, or they may be asymptomatic. (29)

   e. Acute cholangitis - There is a medical emergency. Patients might have Charcot's triad, which consists of fever, jaundice, and pain in the upper right quadrant. The diagnosis can be made before the traditional trio develops because of advancements in clinical chemistry and imaging techniques. (29)

Diagnosis

Diagnostic tests ((29)

- Abdominal Ultrasonography: The most effective test for assessing gallstones, stones, and CBD size.

  Endoscopic Ultrasound (EUS): Excellent for assessing the size of the CBD stone.

  Nevertheless, it is costly and not widely available.
- ERCP: It is no longer useful as a diagnostic test. Can perform sphincterotomy in a therapeutic setting.
- HIDA, DIDA, Radioisotope Scans: Acute cholecystitis is diagnosed, and cystic duct obstruction is identified.
- CT scan of the Abdomen: Not recommended during pregnancy and not recommended owing to excessive radiation levels
- MRI/MRCP: MRCP is safe to use in the 2^{nd} and 3^{rd} trimesters of pregnancy and doesn't require contrast.

Delays in diagnosis increase the frequency of morbidity and mortality from acute cholecystitis. For individuals who have acalculous cholecystitis while in the ICU ("Intensive Care Unit"), this is especially true. To avoid negative consequences, the diagnosis should be taken into consideration and investigated right away. (25)

Differential diagnosis (15,17)

- Cholelithiasis
- Choledocholithiasis
- Biliary Colic
- Biliary Disease
- Cholangitis
- Gallbladder Mucocele
- Gallbladder Cancer
- Gallbladder Tumours
- Acute Mesenteric Ischemia
- Abdominal Aortic Aneurysm
- Gastric Ulcers
- Gastritis, Acute
- Cholangiocarcinoma
- Appendicitis

Approach

Radiography, ultrasound, CT ("Computed Tomography"), MRI ("Magnetic Resonance Imaging"), HBS ("Hepatobiliary Scintigraphy"), endoscopy, and laboratory tests (although unreliable ones) may all be part of the workup for cholecystitis.

Laboratory investigations ((37)

Although the following results may be useful in diagnosing cholecystitis, laboratory criteria are not always reliable in identifying every patient with the condition:

- Cholecystitis can cause leucocytosis.
- The hepatitis-detecting enzymes ALT ("Alanine Aminotransferase") and AST ("Aspartate Aminotransferase") can be elevated in cholecystitis and common bile duct blockage.
- Common duct blockage is assessed using bilirubin and alkaline phosphatase tests.
- Assays for amylase and lipase are performed to determine whether pancreatitis is present.
- Cholecystitis can also cause a little increase in amylase.
- A quarter of cholecystitis patients had an increased alkaline phosphatase level.

Imaging

The following imaging guidelines are provided by the 2010 "American College of Radiology (ACR)" Appropriateness Criteria: (38)

- The recommended and most reliable imaging test for diagnosing acute cholecystitis and cholelithiasis is sonography.
- A secondary imaging test called CT can detect extra biliary diseases and cholecystitis consequences such perforation, gas formation, and gangrene.
- When a patient has vague stomach pain, CT with intravenous contrast can be used to diagnose cholecystitis.
- MRI, which is commonly carried out "with intravenous gadolinium-based contrast material, is another possible secondary imaging method that might be useful in confirming a diagnosis of AC.
- For pregnant women whose sonograms have not clearly shown a diagnosis, MRI without contrast is" helpful in removing radiation exposure.

Radiography

In 10–15% of instances, gallstones can be seen on non-contrast radiography. With or without active cholecystitis, this finding simply suggests cholelithiasis.

Ultrasonography (USG)

Ultrasonography has a 90–95% sensitivity and a 78–80% specificity for detecting cholecystitis. It has approximately 95% sensitivity and specificity in diagnosing gallstones larger than 2mm in diameter. Research shows that emergency physicians with less training can use right upper quadrant USG in their practice. (39,40)

Ultrasonographic markers of AC consist pericholecystic fluid, gallbladder wall thickness >4mm, sonographic Murphy sign. Gallstones are another factor that supports the diagnosis. (41)

Ultrasonography is ideally performed after a minimum of eight hours of fasting since gallstones are most visible in a large gallbladder filled with bile. (42)

Computed tomography and magnetic resonance imaging

It has been observed that MRI and CT scans had a sensitivity and specificity of over 95% in predicting acute cholecystitis. 61 Unlike endoscopic retrograde cholangiopancreatography [ERCP], spiral CT scans and MRIs are non-invasive, but they are best suited for situations where stones are unlikely and have no therapeutic value.

Cholecystitis is characterized by "wall thickening (>4mm), pericholecystic fluid, subserosal oedema (without ascites), intramural gas, and sloughed mucosa". If the diagnosis is unclear, an MRI or CT scan might also be used to assess nearby structures.

Hepatobiliary scintigraphy (37)

It has been discovered that HBS can diagnose acute cholecystitis with up to 95% accuracy. Biliary scintigraphy has been found to have sensitivities and specificities between 90 and 100 percent and 85 and 95 percent, respectively.

On average, it takes 30 to 45 minutes for the gallbladder, small bowel, and common bile duct to fill. Intravenous morphine increases sphincter of Oddi flow resistance, improving HBS accuracy if the gallbladder cannot be visualized. When the CD is patent, the gallbladder fills. Critically ill patients immobilized by viscous bile have fewer false-positive scan results when morphine is administered.

Endoscopic "retrograde cholangiopancreatography

ERCP can be useful in visualizing the architecture if individuals at high risk for gallstones exhibit symptoms of CBD obstruction. Research by Sahai et al. found that ERCP was superior to intraoperative cholangiography and endoscopic ultrasonography for patients at high risk for CBD stones having LC. (43)

The need for a skilled operator, the high cost, as well as complications including pancreatitis, that occurs in 3" to 5% of patients, are some of the disadvantages of ERCP.

Histologic findings

Early acute alterations include venous congestion and oedema. Acute cholecystitis typically appears on top of a chronic cholecystitis histologic image. Fibrosis, mucosal flatness, and persistent inflammatory cells are among the specific findings. In 56% of instances, there are mucosal herniations called Rokitansky-Aschoff sinuses, which are linked to elevated hydrostatic pressure. There may also be neutrophil infiltration and focal necrosis. In more advanced cases, gangrene or perforation may be visible. (44)

Treatment

The degree of cholecystitis and whether or not complications are present determine how it should be treated. While complex instances may require surgery, simple ones can frequently be handled as outpatients. To treat an infection, antibiotics may be used.

Surgical Treatment

If surgery is necessary, cholecystectomy—ideally laparoscopic—is the usual procedure. Patients who are at high risk for surgery can be candidates for percutaneous drainage. (45)

LAPAROSCOPIC CHOLECYSTECTOMY

In symptomatic cholelithiasis, LC is the gold standard and widely recognized. Many facilities worldwide offer special "short-stay" or "24-hour admissions" for post-operative monitoring following this procedure. (46)

The most effective surgical procedure for treating cholecystitis is laparoscopic cholecystectomy. According to studies, early laparoscopic cholecystectomy reduced overall hospital stays without appreciably altering conversion rates or complications. (47) According to the ACR 2010 criteria, the main treatment for cholecystitis is LC. (48)

In 2010, the SAGES ("Society of American Gastrointestinal and Endoscopic Surgeons") published regulations for the clinical use of laparoscopic bile tract surgery. With the patient's safety as the top priority, the guidelines offer comprehensive advice for choosing to operate, carrying out the treatment, and overseeing post-operative care. The following are suggestions: (49)

- Preoperative antibiotics should only be used as a single preoperative dosage to lower the likelihood "of wound infection in high-risk patients.
- Intraoperative cholangiography may improve injury diagnosis and lower the risk of" BDI.
- Before any repairs are performed, a patient with BDI must be referred to a qualified hepatobiliary specialist unless the primary surgeon has ability to do biliary reconstruction.

Due to its medical and financial advantages, early surgery within 72 hours after admission is the recommended course of action for patients treated by surgeons with enough laparoscopic cholecystectomy experience. (50) When a patient develops gangrene or a perforation, immediate cholecystectomy or cholecystostomy is typically saved for more complex cases.

According to one study, CT scanning may be able to detect acute gangrenous cholecystitis more accurately if it is done up to 72 hours before surgery. Acute

gangrenous cholecystitis was significantly linked to non-gallstone problems, pericholecystic stranding, and gallbladder wall perfusion defects, all of which were more easily detected by CT scanning than by ultrasonography. (51)

Approximately 5% of elective laparoscopic cholecystectomy procedures end up being converted to open surgical procedures. When gangrene or perforation is present, the conversion rate for emergency cholecystectomy might reach 30%. (47)

Laparoscopic cholecystectomy has been successfully carried out in all trimesters of pregnancy, but it is thought to be the safest procedure in the second trimester.

Among the most prevalent surgical procedures in the world, LC is performed in over 500,000 instances each year. When opposed to open cholecystectomy, LC has numerous benefits. The conversion rate and LC-related problems “are determined by the surgeon's experience and the degree of difficulty encountered during surgery. Rates of conversion to open operation have” been recorded by several centers, ranging from 1.5% to 6%. In LC, bile duct damage is reported to occur between 0% and 1% of the time.

These clear benefits have made the procedure popular all around the world and have made it one of the most prevalent surgeries in general surgery practice. In essence, LC is a low-morbidity, low-mortality procedure.

One benefit of LC over open cholecystectomy is that the scar is smaller. Reduced morbidity and emergency procedures, fewer CBD explorations, shorter hospital stays, lower overall expenses under skilled care, and cosmetic use are all benefits of laparoscopic surgery.

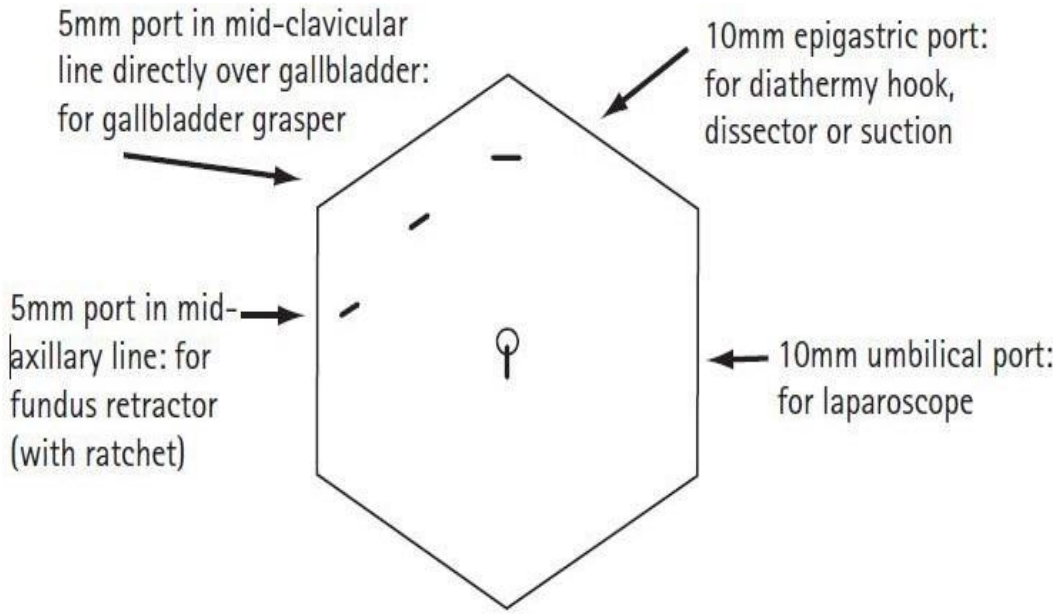


Figure 4. Common port placement in laparoscopic cholecystectomy

EQUIPMENT AND INSTRUMENTATION

EQUIPMENT -

1. Telescope
2. Video Camera
3. Light Sources
4. Insufflators
5. Video Monitors

Telescope

The typical laparoscope is made of a 24 cm long metal shaft with several quartz rod lenses within that project the picture all the way to the eyepiece. Parallel optical fibers within the telescope carry light from the light source into the belly through a cable connected to the side of the telescope. Telescopes can be tilted or provide a 0-degree straight-on view.

The 30° telescope has a total field of view of 152°, whereas the 0° telescope only provides a field of vision of 76°.

With a 10 mm diameter, the most often used telescope offers the best light and optical clarity. The 5-mm laparoscope, which can be inserted via one of the functioning ports for an alternate view, is the second most often used telescope. For processing, the camera is fastened to the laparoscope's eyepiece.

Video Camera

The image that will be seen on the monitor is captured by a high-definition video camera that is fixed to the telescope's eyepiece. A video unit receives the video image through a connection and processes it into an analog or digital format. An electrical signal that is continuously changing in waveform, strength, or voltage frequency is called analog. A computer interprets digital data signals, which are data signals with ones and zeros to represent the information. These are the techniques used to send the image to the video monitor. The cable and camera are made in a way that allows for glutaraldehyde sterilization.

Light Sources

Bulb types that produce high-intensity light include xenon, mercury, and halogen vapor. The type of surgery being conducted should be taken into consideration while selecting the bulbs, as they come in varying wattages. Blood absorbs light, therefore, additional illumination may be needed during any process that involves bleeding. A fiberoptic cable transports the light to the laparoscope's fiberoptic bundles. It is ideal to have a 225cm length, 5mm thick fiber optic light

guide wire. More light is carried by thick cables. Longer cables are more practical and less prone to break or stretch. The cable needs to be handled very carefully.

Insufflators

With the help of an insufflator, a patient receives gas at a high pace and precisely controlled pressure from a high-pressure cylinder.

Video Monitors

The image is displayed using high-resolution video monitors. Placement near the operational field can make smaller monitors more useful. Beyond the display setting, larger monitors don't offer many advantages.

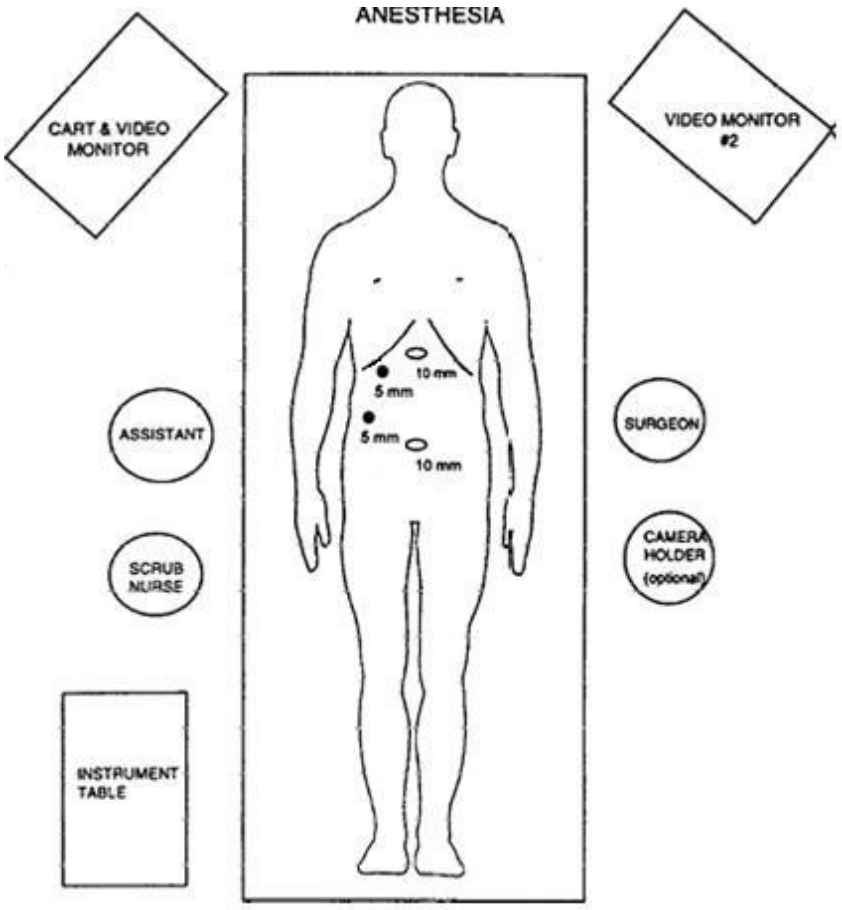


Figure 5. Laparoscopic Cholecystectomy Trocar Placement & OT Setup

Procedure -

Three ports, two ports, and SILS (single incision laparoscopic cholecystectomy) have replaced the traditional 4 ports used in LC procedures. The gall bladder is sutured to the abdominal wall in the right hypochondrial region during a two-port laparoscopic cholecystectomy. Less scarring results from these 3 and 2-port laparoscopic cholecystectomy procedures than from the traditional 4-port laparoscopic procedure. The benefits of laparoscopic procedures include fewer emergency procedures, lower morbidity, less CBD exploration, shorter hospital stays, lower overall expenses when performed by professionals, and cosmetic benefits.

A) After general anesthesia is administered, a Foley catheter is used to empty the bladder, and an oral-gastric tube is set to decompress the stomach.
B) The procedure involves making a tiny incision close to "the umbilicus and inserting a needle (Veress) blindly into the peritoneal cavity.
C) The Veress needle is used for injecting carbon dioxide into the peritoneal cavity; it is currently insufflated to 14mm mercury pressure.
D) Laparoscopy is the endoscopic view of the peritoneal cavity. This operation is typically made possible by a pneumoperitoneum, which expands and separates the abdominal wall from its" contents.
E) Three more trocar ports—two measuring 5 mm in diameter and one measuring 10 mm in diameter—have been added to the right upper quadrant under direct vision. Laparoscopic devices such as graspers, dissectors, scissors, and so on are inserted through these ports in order to extract the gallbladder from the liver bed and biliary tree. This is carried out in the manner described below:

1) Gripping the tip of the gallbladder, one pushes it upward toward the diaphragm. This allows for the essential separation of the cystic dust and cystic arteries before they are ligated. It also puts these structures on stretch. However, the gall bladder can tent up the CBD, which connects it, if its end is stretched.

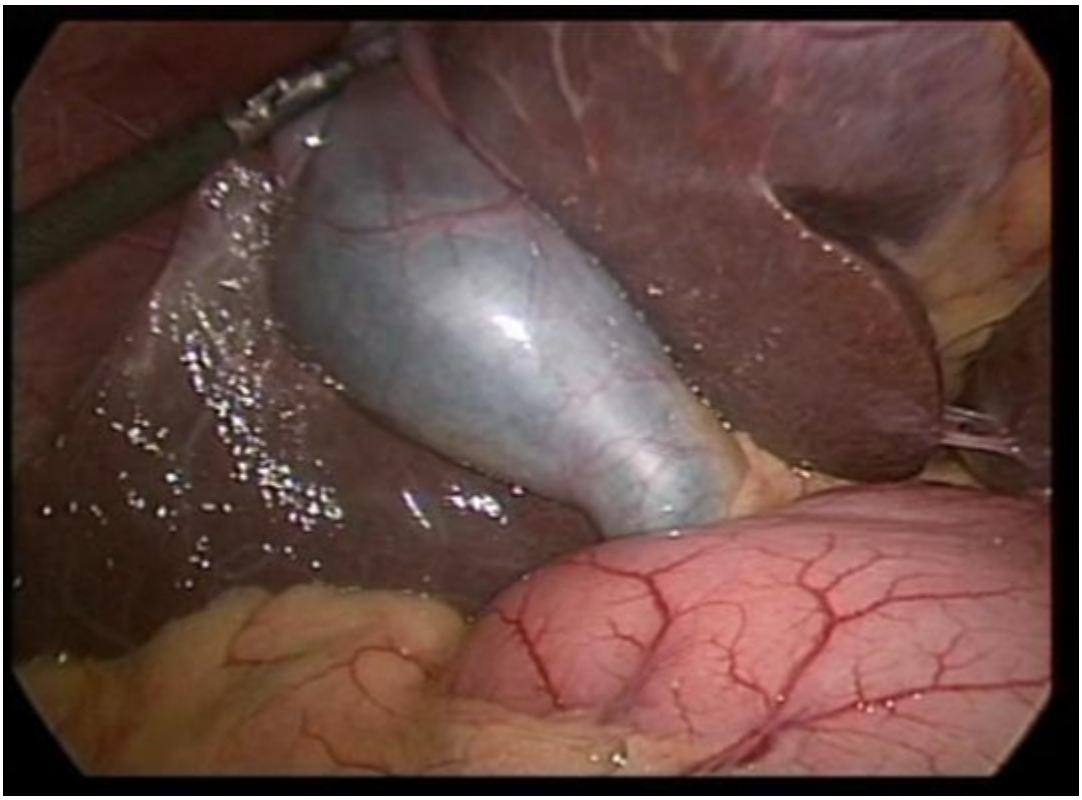


Figure 6. Gall Bladder retracted towards the Right Shoulder

2) To prevent the CBD from tenting up and to improve visibility of the CD, common duct, and cystic artery region (the Triangle of Calot), the proximal part of the gall bladder (known as Hartmann's pouch) is now grasped and retracted inferiorly using a second grasping device. This now makes it possible to safely identify and dissect the cystic duct- common duct junction.

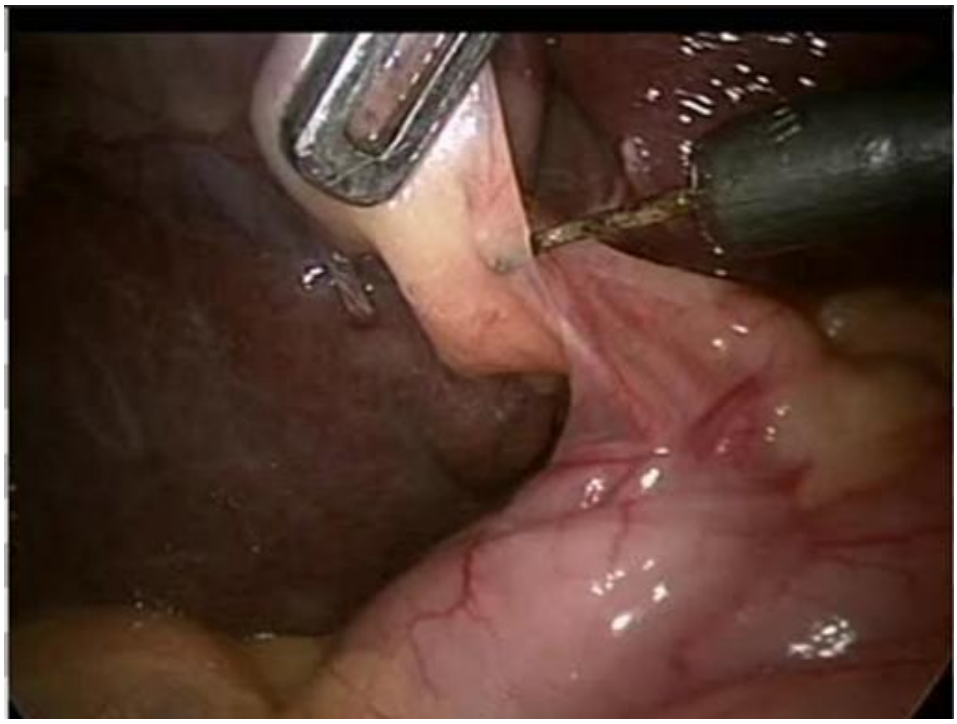


Figure 7. Dissection of peritoneum around CBD

3) Once the CD and CA have been identified, dissected, and cleaned of extra fibrous and fatty tissue, it is safe to ligate and divide them. This includes the common bile duct. To accomplish this, place two clips proximally and distally through the 10mm port on a clipping instrument, then cut in between the clips. Once this is done, the gall bladder and liver are separated by electrocautery, which involves splitting the peritoneum between the two organs. You can attach the electrocautery to any variety of dissecting tools that are made specifically for this use. Either electrocautery or laser light dissection works well for precisely dividing the gall bladder from the liver bed and halting

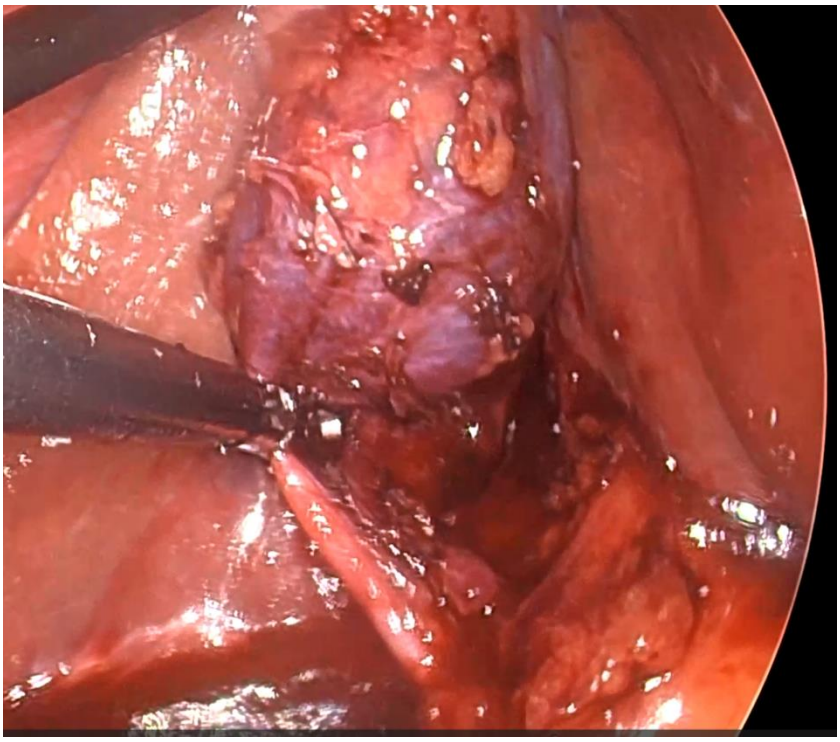


Figure 8. Critical View of Safety

4) The gall bladder is grabbed and extracted through a 10mm port once it has been securely detached from the CD, CA, and liver bed.

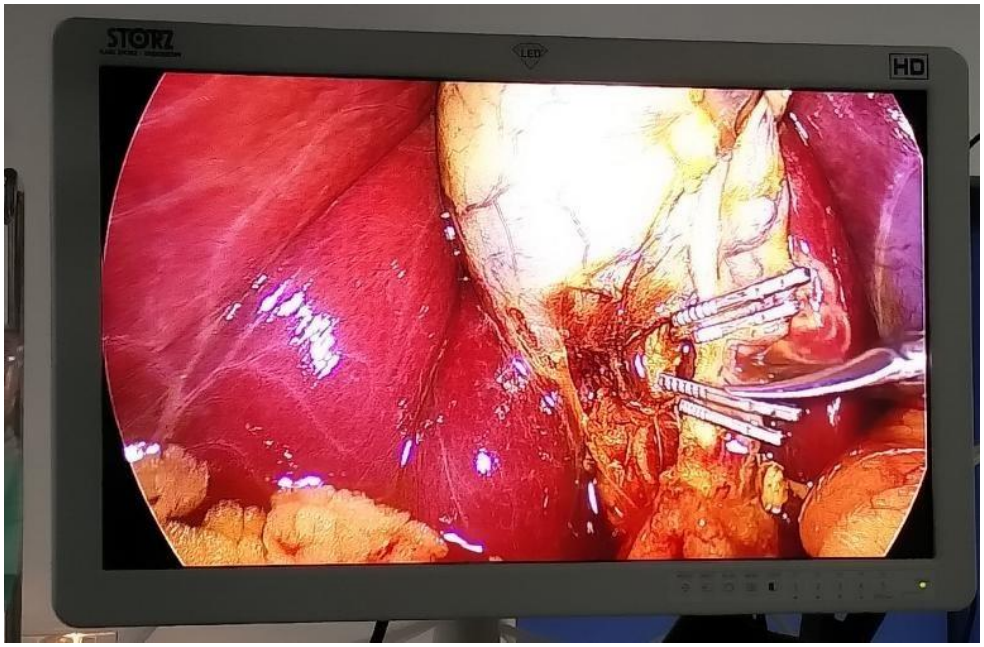


Figure 9. Cystic Duct Transected In between Clips

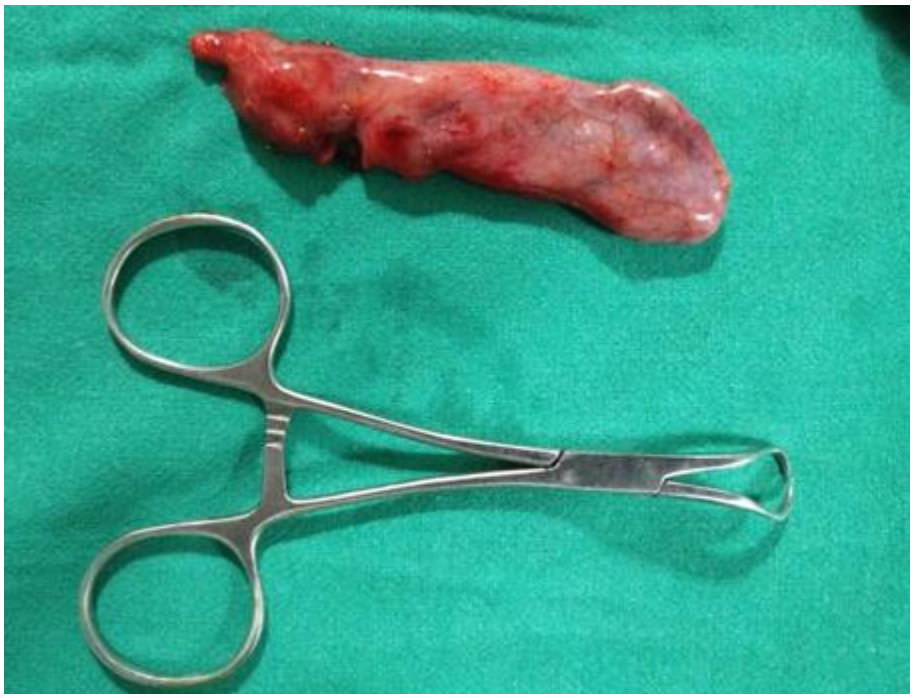


Figure 10. Typical Gall Bladder Specimen

PNEUMOPERITONEUM-

Laparoscopy "is the endoscopic view of the peritoneal cavity. This operation is typically made possible by a pneumoperitoneum, which expands and separates the abdominal wall from its contents. To conduct therapeutic and diagnostic treatments in a safe and efficient manner, it is necessary to maintain normal physiological conditions and visual acuity. To perform laparoscopic process, the abdominal cavity is gas-inflated to" generate a pneumoperitoneum.

The ideal gas for pneumoperitoneum depends on a number of factors: i) kind of anesthesia, ii) non-combustibility, iii). physiologic compatibility, iv) toxicity, distribution method, v) ease of use, vi) safety, and vii) cost. The gases utilized in pneumoperitoneum involve "CO2, air, oxygen, nitrous oxide (N2O), argon, helium, and mixtures of such gases.

The use of CO2 gas insufflation is" recommended due to its

- One common metabolic waste that the body rapidly removes is a high diffusion coefficient.
- In blood and tissues, CO2 is extremely soluble and inhibits combustion.
- The risk of formation of gas embolism is least

Typically, a trocar device or Veress or Tuohy needle is used to create a pneumoperitoneum. Ever since laparoscopic cholecystectomy became available in clinical practice in the late 1980s, pneumoperitoneum with CO2 has been utilized.

Pneumoperitoneum's physiological impacts include-

- Systemic absorption of CO2 and
- Increased intraabdominal pressure causes changes in organs' physiology and hemodynamics.
- Abdominal wall retraction is another technique for creating a working space; it can be done with or without gas insufflation and at low pressure (5-7 mmHg).

Creating Pneumoperitoneum -

- Closed method: Veress or Tuohy needle
- Open method: Hasson method

The rate of infusion of CO2 is 1 liter per minute. If the initial pressure is 10mmHg or more, the needle may need to be inserted preperitoneally or into another confined region. It is preferable to start with a low CO2 flow rate to prevent "gas embolism or vagal stimulation from abrupt peritoneal stretching. Increased tympani in all four quadrants are confirmed" with insufflating about 1 liter of CO2, and the flow rate may increase.

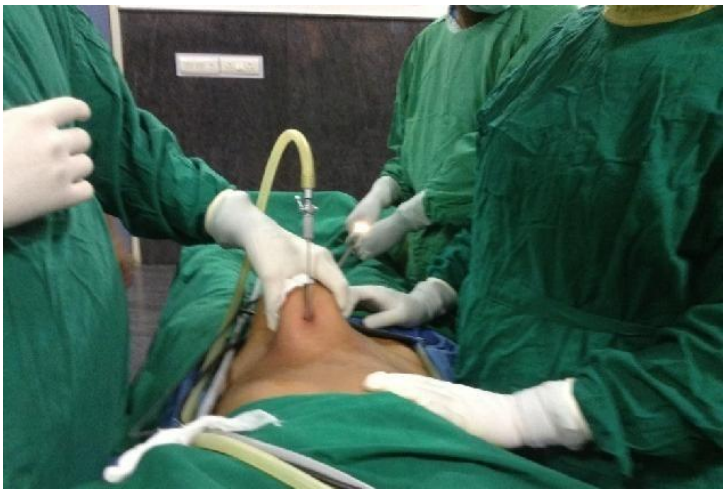


Figure 11. Creating Pneumoperitoneum using Veress Needle

IMPLICATIONS OF LAPAROSCOPIC CAMERA LENS FOGGING

According to a "World Health Organization" report, problems with the laparoscope's lens might result in surgical errors such as improper use of the equipment or positioning instruments in places they weren't intended for. (5,52) Even though the effects of a poor visual field during a laparoscopy can seem apparent, they shouldn't be ignored. While this is not the probable outcome, lens fogging frequently results in prolonged operative time, compromised visibility due to impaired vision, and consequently delays in procedural advancement, which may increase the risk of adverse events. Additionally, it causes irritation from the repeated necessity of removing the laparoscope to address the issue. Furthermore, even though the best vision is paradoxically required, there are a number of situations where vision is likely to be compromised: "close-up viewing (where lens fogging is more likely to occur), diathermy to control bleeding (with increased smoke), accidental bleeding (with blood on the lens), and sudden pneumoperitoneal decompression (particulate debris, e.g., fat, blood, eschar"). (5,7,53) Additionally, it must be emphasized that in laparoscopy, little to no haptic feedback guarantees that eyesight and visual cues become crucial. (5,54)

CAUSES OF LAPAROSCOPIC CAMERA LENS FOGGING -

According to the most widely recognized theory, fogging arises when there is an imbalance between the temperature of the abdominal cavity and the front lens of the laparoscope. This seems to be the case based on a review of the literature. (5,55–57) Vision fogging is caused by condensation on the front of the lens because of this difference in temperature. Furthermore, the humidity in a pneumoperitoneum is typically higher than 85%, which is significantly greater than the ambient air in operating room. (5,56), the intraperitoneal area is frequently much warmer than the operating room, which is normally between 218 and 248 degrees Celsius. (58) Schurr et al. concluded that keeping the lens temperature around 378C is the most crucial need for preserving a crisp visual field. (56)

PRINCIPLES TO ASSIST CLEAR VISION DURING LAPAROSCOPY

A consistent supply of insufflation gas, a method to exsufflate smoke "burst" “evacuation during electrocautery, a technique to rinse and dry the lens, and a way to warm the laparoscopic front optical lens to 378C are all essential. Among the ideas they proposed that have been disputed is the concept that the insufflation gas must be heated to 378°C to 458°C and humidified to 50% to 80%”. According to a meta-analysis comprising seven trials, neither was a factor in lowering LLF. (59)

MATERIALS AND METHODS

This study was done at the Department of General Surgery, "KLES Dr. Prabhakar Kore Hospital and Medical Research Centre", "Belagavi, Karnataka.

Study Design

The study design was an Observational Study.

Study Period and Duration

This study was conducted over the course of a year, from September 1, 2023, to August" 31, 2024 (12 months).

Place

The "Department of General Surgery at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belagavi, a tertiary care teaching hospital associated with Jawaharlal Nehru Medical College, Belagavi, KLE University, carried out this" study.

Source of Data

Patients undergoing elective laparoscopic cholecystectomy for cholelithiasis during the study period were enlisted.

Sample Size

The study comprised 68 patients with cholelithiasis who were categorised into two groups of 34 patients each.

Sampling Procedure

With "effect size=0.70, alpha=0.05, beta=0.80, and allocation ratio 1:1, the sample size had been determined using G-Power software under the t-test for difference between two" independent means. The total sample size is 68, 34 in each group.

Sampling technique

All Patients in Dr. Prabhakar Kore Hospital undergoing Laparoscopic Cholecystectomy. The number of times the camera lens had to be removed from the port to clean using a gauze piece during the surgery while using the Insufflator Port v/s the Non-Insufflator Port when all the parameters of CO2 Flow, Pressure are kept constant and on using both Monopolar and Bipolar Cautery.

CO2 Pressure -> 15 mm Hg

CO2 Flow -> 5 L/min

- Group A: Laparoscopic Cholecystectomy with pneumoperitoneum created using the Insufflator port (Umbilical)
- Group B: Laparoscopic Cholecystectomy with pneumoperitoneum created using the Non-Insufflator port (Epigastric)

Selection Criteria

Inclusion

- Patients aged 18 years to 65 years.
- Elective surgery for gallstone disease.
- Patients who give written and informed consent for participation.

Exclusion

- Conversion to open cholecystectomy.
- Any gallstone disease consequence, including acute inflammation.
- Choledocholithiasis.
- Co-existent liver disease.
- Any problem that occurs during or after surgery, including infection, high temperature, bile duct injury, bile duct obstruction, or the identification of bile duct abnormalities during surgery.
- Medical conditions that are out of control, that include diabetes mellitus, asthma, COPD, hypertension, and coronary artery disease.
- Individuals with cirrhosis, coagulopathies, probable gallbladder cancer, severe portal hypertension, or widespread peritonitis.
- Patients undergoing any additional surgical procedure in the same sitting.
- Failure to obtain consent

Ethical Clearance

The study was approved by "Jawaharlal Nehru Medical College's Institutional Ethical Committee" before it started.

Informed Consent

The goal of this research project was explained to the patients who met the selection criteria. Before the procedure, the patient and/or next of kin provided written informed consent. (Annexure I).

Method of Collection of Data

Demographic data, including age and gender, were noted. Patients were questioned about their presenting complaints, past history regarding comorbid conditions, treatment history, and surgical history. Clinical presentation and symptoms of abdominal pain, vomiting, and fever were recorded. These patients also had systemic examinations, including abdomen examinations and clinical examinations for vital signs. These results were documented on a pro forma that had been prepared previously. (Annexure II).

Investigations

The following tests were performed on the patients.

- Coagulation “profile
- Complete blood count
- Urine routine & microscopy
- Liver function tests (LFT”)
- Serum Urea & Serum Creatinine
- USG Abdomen and Pelvis

Radiological assessment

Patients underwent an ultrasound of abdomen and CT scan (as & when required) to conclude the diagnosis.

Procedure

Pre-operative work-up

Every patient has a pre-operative evaluation from the moment of admission. These consist of standard tests such as coagulation profiles, liver function tests, renal and urine profiles, and complete hemograms. Additionally, a pre-operative abdominal ultrasound was performed to verify the diagnosis, examine the location of calculi, measure the gall bladder wall's thickness, and search for signs of inflammation. Physicians and anesthetists evaluated each patient before surgery in order to record surgical fitness and assess co-morbidities.

Procedure of laparoscopic cholecystectomy

Position: Classical supine position with the patient in 30^0 reverse Trendelenburg tilt.

Throughout the treatment, a nasogastric tube was utilized to guarantee full gastric deflation. This is due to the fact that an enlarged stomach and duodenal cap may make it difficult to see the operating field. In order to avoid potential Veress needle injuries to a swollen bladder, the bladder was catheterized.

The normal procedure was followed for part-preparation and draping.

Access to peritoneal cavity

1. Closed peritoneal insufflation
2. Open laparoscopy using the modified Hasson's cannula.

Closed pneumoperitoneum

This method involves first creating a carbon dioxide pneumoperitoneum with electronic insufflators and a Veress needle. The infra-umbilical location is where veress needles are most frequently placed.

A 10mm port at the infra-umbilical area is used to introduce the camera (300). After that, the abdomen is examined. Three more ports were implanted under observation following "examination. 10mm left upper paramedian or epigastric, 5mm right upper midclavicular, and 5mm right lower axillary, placed 3 cm below the left costal border and 1 cm lateral to the" linea alba (to avoid the Falciform ligament). Co2 insufflation is connected to the Umbilical(Group B) and Epigastric(Group A) ports.

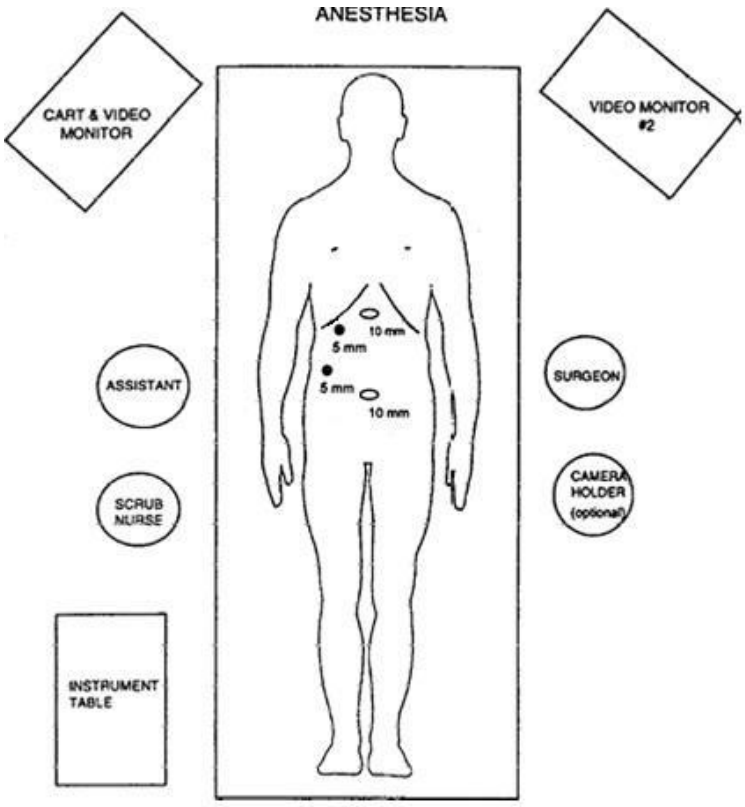


Figure 12. Laparoscopic Cholecystectomy Trocar Placement & OT Setup

Intervention

Group A

The above group of patients had LC with a pneumoperitoneum made using the umbilical insufflator port.

Group B

This group's patients had LC with pneumoperitoneum made with the epigastric non-insufflator port.

Surgical Procedure:

Grasping the gallbladder's fundus revealed the cystic pedicle. The sub-hepatic anatomy could then be seen once this was retracted toward the right shoulder. The neck was held in place with an atraumatic grasper before being moved anteriorly and upward. After skeletonizing the cystic duct, which typically runs anteriorly, the CA, which runs above and behind the duct, and the lymph node of Lund, which is located adjacent to the gallbladder's neck between the duct and artery, the Calot's triangle was seen.

Monopolar or bipolar forceps, scissors, or J-hook tools were used to dissect the pedicle. The critical perspective of safety was formed once the CD and CA were sufficiently exposed and the point where the CD and CHD met was determined. Examining the Calot's triangle reveals the base of the liver bed, and the CD and CA are the only two structures that might enter the gall bladder.

The CD was milked toward the gall bladder to ensure that no calculi remained in the duct. The duct was cut in between titanium clips that were placed closer to the

gallbladder end. The process was the same for the CA. To remove the gallbladder from the liver bed, the dissection was performed in the cystohepatic plate's loose fibrous layer. After the gallbladder had completely separated, it was grabbed with claw forceps and removed through the 10 mm epigastric port in an endo-bag.

The contents were carefully kept from spilling into the peritoneal cavity. A last examination was then conducted to check for any oozing, which includes bile and blood. After the abdominal cavity was decompressed to release the carbon dioxide, all ports were withdrawn under observation. For the rectus sheath, ports were sealed with VicylTM, and EthilonTM was used to stitch the skin. A sterile dressing was used. After being extubated, the patient was observed during the OT recovery.

Assessment during OT:

After the initial entry, the time needed to clean the lens fogging in groups A and B is noted.

Statistical analysis

Statistical methods:

For quantitative variables, descriptive analysis was done by employing mean and standard deviation (SD); for categorical variables, it was done using frequency and proportion. Additionally, appropriate diagrams, such as box plots, pie diagrams, and bar graphs, were used to illustrate the data.

The independent sample t-test had been for the comparison of mean values in order to evaluate the relationship between the quantitative outcome and the categorical explanatory variables.

It was deemed statistically significant when the P value < 0.05. The statistical analysis was performed by employing “IBM SPSS version 22. (1)

1. IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp”.

RESULTS

This one-year observational study was performed from September 1, 2023, to August 31, 2024, in the general surgery department of "KLES Dr. Prabhakar Kore Hospital and Medical Research Centre", Belagavi. G-Power software was used to determine the sample size, which came out to be 68 patients undergoing elective LC, with 34 in every group. Patients in Group A had laparoscopic cholecystectomy under pneumoperitoneum made with the umbilical insufflator port, whereas patients in Group B had laparoscopic cholecystectomy under pneumoperitoneum made with the epigastric non-insufflator port.

Following data analysis, the following tabulations were made of the findings and observations:

Table 1: Descriptive analysis of age in study population (N=68)

Parameter	Mean ± SD	Median	Minimum	Maximum	95% C. I	
					Lower	Upper
Age (years")	46 ± 14.06	45.00	21.00	78.00	42.60	49.40

Table 2: Descriptive analysis of gender in the study population (N=68)

Gender	Frequency	Percentages
Male	26	38.24%
Female"	42	61.76%

Graph 1: Pie chart of gender in the study population (N=68)

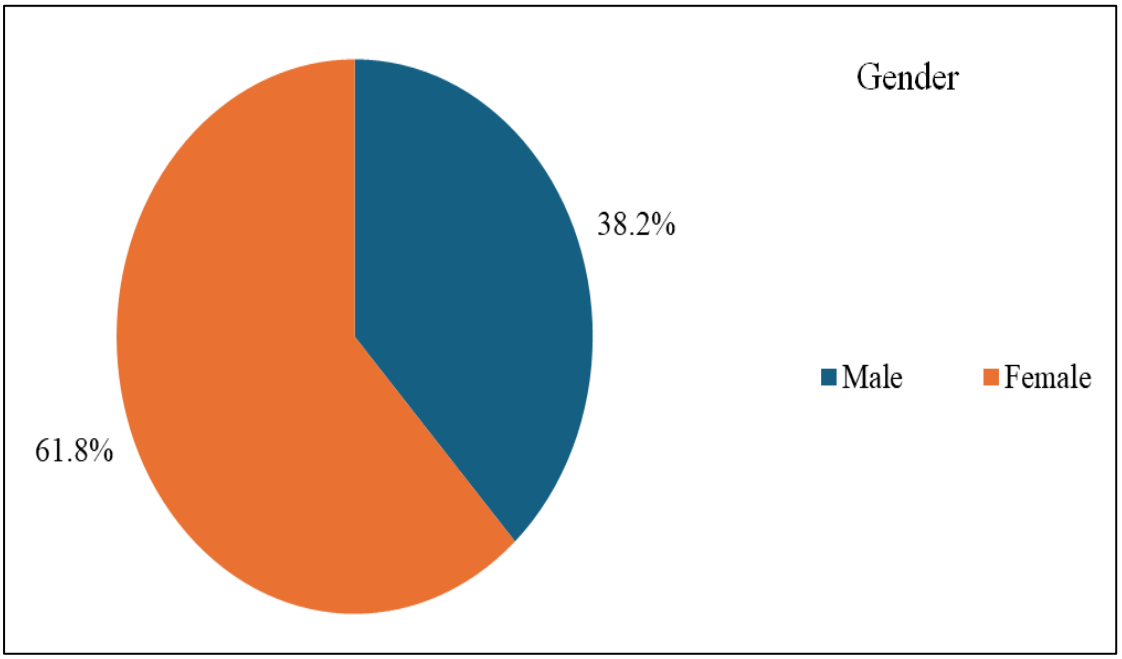


Table 3: Descriptive analysis of Diagnosis in the study population (N=68)

Diagnosis	Frequency	Percentages
Cholelithiasis	68	100.00%”

Table “4: Descriptive analysis of Surgery in the study population (N=68)

Diagnosis	Frequency	Percentages
Laparoscopic Cholecystectomy	68	100.00%”

Table “5: Descriptive analysis of Surgery in the study population (N=68)

Diagnosis	Frequency	Percentages
Afebrile	68	100.00%”

Table "6: Descriptive analysis of lab parameter in study population (N=68)

Parameter	Mean ± SD	Median	Minimum	Maximum	95% C.I"	
					Lower	Upper
Pulse Rate	78.65 ± 9.68	79.0	60.0	98.0	76.3	81.0
SBP	127.35 ± 6.66	127.0	116.0	146.0	125.7	129.0
DBP	80.29 ± 7.36	80.0	68.0	98.0	78.5	82.1
Hb	12.31 ± 1.2	12.8	9.4	14.5	12.0	12.6
WBC	8058.09 ± 1113.71	8200.0	5600.0	10000.0	7788.5	8327.7
Total Bilirubin	3.28 ± 0.37	3.2	2.9	4.1	3.2	3.4
SGOT	8.14 ± 0.15	8.1	7.9	8.6	8.1	8.2
SGPT	9.09 ± 0.13	9.0	8.9	9.4	9.1	9.1
Alk. Phosphate	115.04 ± 3.47	114.0	110.0	121.0	114.2	115.9
Sr. Creatinine	0.9 ± 0.14	0.9	0.7	1.1	0.9	0.9

Table 7: Descriptive analysis of insufflator connected to port in the study population (N=68)

Insufflator Connected to Port	Frequency	Percentages
Epigastric	34	50.00%
Umbilical	34	50.00%

Graph 2: Bar chart of insufflator connected to port in the study population (N=68)

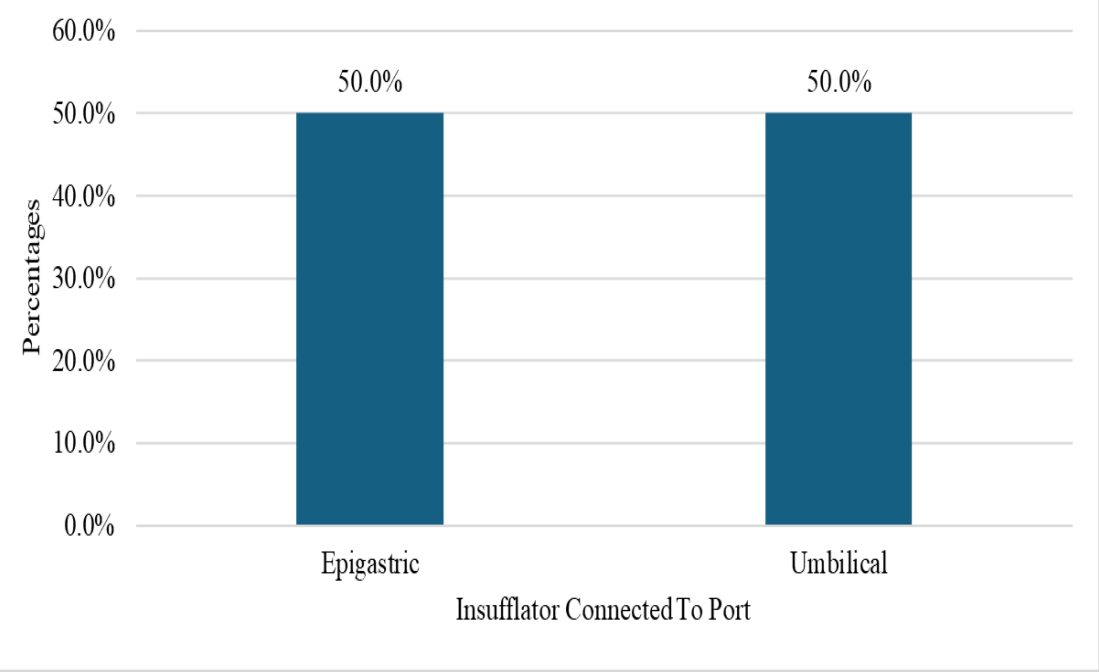


Table 8: Descriptive analysis of preset pressure(mm/hg) and flow rate (l/min) in study population (N=68)

Parameter	Median	Minimum	Maximum	95% C.I	
				Lower	Upper
Preset Pressure(Mm/Hg)	15.0	15.0	15.0	15.0	15.0
Flow Rate (L/Min)	7.0	7.0	7.0	7.0	7.0

Table 9: Descriptive analysis of duration of surgery (hours) and time after which scope was removed (mins) in study population (N=68)

Parameter	Mean ± SD	Median	Minimum	Maximum	95% C.I	
					Lower	Upper
Duration Of Surgery (Hours)	1.91 ± 0.39	2.0	1.0	2.5	1.8	2.0
Time After Which Scope Was Removed (Mins)	16.25 ± 6.34	17.0	2.0	28.0	14.7	17.8

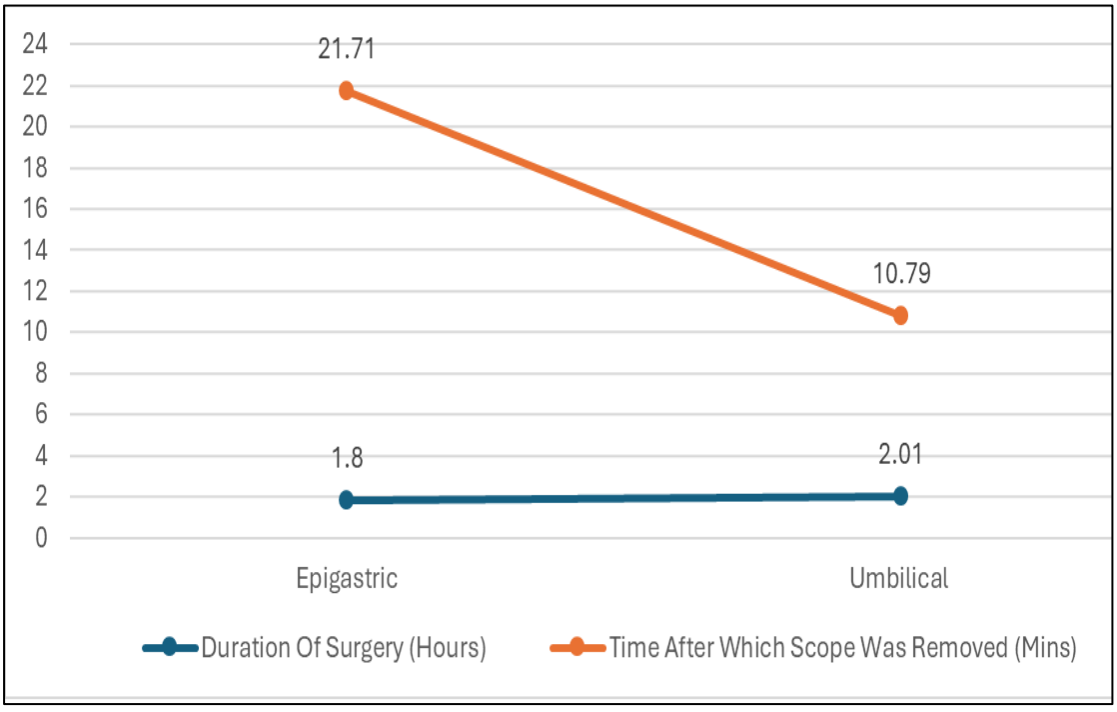
Table 10: Descriptive analysis of Intra-Op Complications in the study population (N=68)

Intra-Op Complications	Frequency	Percentages
Nil	68	100.00%

Table 11: Comparison of mean of duration of surgery (hours) between insufflator connected to port(N=68)

Parameter	Insufflator Connected to Port (Mean± SD)		P value
	Group B (Epigastric) (N=34)	Group A (Umbilical) (N=34)	
Duration Of Surgery (Hours)	1.8 ± 0.43	2.01 ± 0.31	**0.022**
Time After Which Scope Was Removed (Mins)	21.71 ± 3.59	10.79 ± 2.72	**<0.001**

Graph 3: Line chart for comparison of mean of duration of surgery (hours) between insufflator connected to port(N=68)



DISCUSSION

The most effective surgical treatment for benign gallstone disease in the management of cholecystolithiasis is laparoscopic cholecystectomy, which has supplanted open cholecystectomy.110 Laparoscopic surgery requires clarity of the scope for adequate visualisation and operative manipulation. Lens fogging during laparoscopy frequently results in reduced vision. Extensive experiments defining the effect of temperature and humidity have led to a thorough understanding of the physiology underlying lens fogging.

According to research by E. Flemming “et al., Principles determining optical clarity in endoscopic surgery, vision impairment during laparoscopic procedures is often caused by condensation on the front lens of the endoscopic optic. An illustration of the generally poor vision quality brought on by moisture on the endoscope's front lens” is provided, along with suggestions for technological changes to the laparoscope's design that would preserve sharp vision in recognized circumstances. The front lens is typically cleaned extracorporeally to address this common issue. The laparoscope cools to room temperature during this pause in the surgical procedure, and the front lens cools even more after being cleaned with cold water. This study investigated how the physical condition of the laparoscope affects the image during endoscopic surgery. After analyzing the environmental conditions inside the insufflated belly, the quality of eyesight under these settings was assessed. The purpose of these studies was to offer suggestions for technological adjustments to the laparoscope's design that would preserve sharp eyesight in recognized circumstances. During such procedures, it is crucial to maintain a clean field of view in order to increase accuracy, decrease working time, and ensure safety by preventing unintentional harm. (7)

"Laparoscopic Lens Fogging: A Review of Etiology and Techniques to Maintain a Clear Visual Field", another paper by Nathan Lawrentschuk et al., makes the following recommendations. A significant obstacle to a clean visual field during laparoscopy is laparoscopic lens fogging (LLF), which is brought on by condensation and the buildup of smoke, blood, and particulate matter on the scope lens. Although there are numerous ways to enhance vision during laparoscopy, information about the actual cause and vision-improving therapies has seldom ever been collected in one place. Crucially, existing methods for managing LLF are frequently expensive and time-consuming, and their application is not well supported by data. This study' purpose was to give a summary of the literature on etiology of LLF and different causes of poor vision during laparoscopy, as well as to examine the current strategies for reducing or restricting such events. The "group additionally recommended that the insufflation gas be connected through the same port as the laparoscope since they consider temperature and humidity aid lower LLF. If we think that the insufflation gas's temperature and humidity are unimportant, then this assertion may" also be false. (5)

In their article "Elimination of Laparoscopic Lens Fogging Using Directional Flow of CO2", John Teague Calhoun et al. described developing a device that creates a microclimate of dry CO2 to separate the laparoscope's lens from the humid intraperitoneal cavity. This was achieved by constructing a connecting sleeve that encircled the scope's distal 2 to 3 cm with an open chamber. In order for the scope to monitor the intraperitoneal cavity, dry, cool CO2 was pumped into this cavity via an insufflator. The gas's path would ring the scope's lens and escape at a single output point. This chamber's function is to isolate the lens by having a greater percentage of dry CO2 and low humidity. To test the device's ability to retain the viewing field

without any noticeable obstructions, it was put through seven distinct adverse situations.(60)

In their study “A randomized Comparison of laparoscopic Lens defogging using Anti-fog solution, warm saline, and chlorhexidine solution (CLEAR)”, “Taejong Song and Dong Hee Lee found that the warm saline group significantly reduced lens fogging during the first three minutes and the amount of time needed for the rest of the procedure after the first three minutes (all, $P<0.001$) compared to the other three groups. Post hoc analysis revealed that the anti-fog solution group was clearer than the chlorhexidine and control groups but substantially foggier than the warm saline group. The” warm saline and anti-fog solution groups required significantly fewer lens cleanings and less time overall than the chlorhexidine and control groups (all, $P<0.05$). (9)

Hilco Theeuwes addresses the 10 to 12mm ports that are commonly employed as camera ports during laparoscopic procedures in his paper “Easy Cleaning of the Camera Port During Laparoscopic Surgery: Three Useful Techniques”. First, the port is cleaned with a 10mm sterile cotton swab; next, sterile gauze is wrapped tightly around a Pean clamp; and finally, sterile gauze is wrapped securely around an endoscopic dissecting clamp. Throughout the process, all methods can be reused by repeatedly entering and exiting the port. Lens contamination from a filthy camera port can be minimized by cleaning the port using one of the three methods mentioned above. All of the methods are inexpensive and reusable throughout the procedure. (61)

Condensation on the laparoscope lens can cause vision problems that can be inconvenient and time-consuming, according to “A. J. Runia et al.., in Easy cleaning of the scope's lens in a syringe to prevent condensation during laparoscopic surgery. Anti-lens condensation solutions are utilized in many centers” to try to avoid this issue. Nevertheless, putting this concept into practice can be challenging. As explained, a 10-ml syringe can be used to get around this issue. However, because anti-lens condensation treatments do not close the temperature differential between the intraabdominal and ambient temperatures, they are unable to address the issue of condensation on the lens. Using a thermos flask to heat the scope is an alternate technique for cleaning it during laparoscopic surgery. Because gas passage throughout the scope decreases the temperature, which causes lens condensation, it would also be advantageous to transfer the gas influx to another trocar. The development of a fogless scope could additionally enhance laparoscopic vision. (62)

In his work, M. Backlund demonstrated “that the temperature of the supplied CO2 in the peritoneal cavity was insufficient to adequately explain the final fluctuations in core temperature during pneumoperitoneum”. Impact of inhaled CO2 temperature both during and after extended laparoscopic procedures: the energy count needed to thaw the cold CO2 “in the peritoneal cavity (4.0 kcal) was nearly equal to the energy count lost during the 0.1°C decline in core temperature (5.6 kcal). Thus, it is evident that the core temperature decline during cold pneumoperitoneum was mostly caused by the cool gas. The 1.86 kcal energy loss that takes place during humidification and cooling of warm CO2 in the abdominal cavity to body temperature would result in a 0.03°C drop in core temperature. Consequently, the warming that the patients” experienced from the warm CO2 was not what the calculations had indicated. The elevation in core temperature was probably caused by additional

warming methods utilized in the operating room, such as a heated blanket or a mattress with a warm water bath. The final differences in core temperature between the two groups can be partially explained by the extremely central exposure under the diaphragm for more than two hours, despite the fact that gases are inefficient heat conductors. (63)

Several research studies have been carried out to investigate how various methods affect the reduction of lens fogging. With a mean age of 46yrs. and an SD of 14.06yrs., our study sample was primarily middle-aged and cholelithiasis-affected. This finding aligns with previous studies that have reported gallstone disease as more common in middle-aged individuals. Gender distribution showed a higher prevalence in females (61.76%) compared to males (38.24%), which is consistent with the known epidemiological trend of gallstone disease being more common in women due to hormonal influences on bile composition.

The study population exhibited steady hemodynamic and biochemical profiles, according to the descriptive analysis of lab measurements. “Systolic blood pressure” (127.35mmHg), “diastolic blood pressure” (80.29mmHg), and mean pulse rate (78.65 bpm) were all within normal physiological levels. White blood cell counts and hemoglobin levels were both within normal ranges, indicating a generally stable preoperative state. The results of liver function tests, such as SGOT, SGPT, and total bilirubin, were within normal ranges, suggesting that the individuals did not have any discernible liver dysfunction.

Laparoscopic cholecystectomy was performed on all research participants without any intraoperative problems. The surgery took 1.91 hours on average, with a minimum of one hour and a maximum of 2.5 hours. It's interesting to note that the

surgical duration for the two distinct insufflator connection ports (epigastric and umbilical) differed significantly ($p = 0.022$), with the epigastric port, or Group B, resulting in shorter surgery times. Furthermore, Group A, which was the umbilical group, took substantially less time to remove the scope ($p < 0.001$). These results imply that the placement of the insufflator port may affect surgical efficiency and can decrease the total amount of time taken to perform the surgery.

The absence of intraoperative complications and the uniform diagnosis of cholelithiasis reinforce the safety as well as efficacy of laparoscopic cholecystectomy in this patient population. However, the observed differences in surgical duration and scope removal time between insufflator port placements highlight a potential area for surgical optimization. Further research on the effects of port installation on surgical effectiveness and patient outcomes may be possible with bigger sample numbers and randomized approaches. Moreover, exploring postoperative recovery metrics such as pain levels, hospital stay duration, and post-surgical complications could further enhance the understanding of optimal surgical practices.

CONCLUSION

The gold “standard for treating symptomatic cholelithiasis is laparoscopic cholecystectomy, which has supplanted open cholecystectomy in the management of benign gallbladder issues. Cholecystectomy is also the recommended procedure for most patients who are referred for it. However, laparoscopic” lens fogging has been one of the most persistent issues with laparoscopic visibility. The results of this research show that the position of the insufflator port during laparoscopic cholecystectomy has a noticeable impact on lens fogging. better intraoperative visualization and less lens fogging are probably the reasons why the epigastric port connection showed higher surgical efficiency results. These findings imply that in order to maximize surgical workflow and reduce interruptions, preference should be given to insufflation through the epigastric port. This study highlights the importance of insufflator port positioning in minimizing lens fogging during laparoscopic cholecystectomy, reducing interruptions for lens cleaning, and enhancing intraoperative visualization. These findings provide a practical, cost-effective solution that can be easily adopted in laparoscopic surgery without additional equipment. These results might be further supported by bigger sample sizes and more qualitative evaluations of surgeon-reported visibility in future research. The productivity and safety of laparoscopic surgeries could be improved by employing similar insufflation regimens based on these findings.

SUMMARY

Optimal visibility is crucial for surgical safety and precision during the common surgical operation known as laparoscopic cholecystectomy. One of the common challenges faced during laparoscopy is camera lens fogging, which can impair visibility and prolong surgical duration. This study aimed to compare the incidence and severity of lens fogging due to carbon dioxide insufflation between the insufflator port and non-insufflator port in patients undergoing LC.

The study included 68 patients in total, with an equal number of cases where the insufflator was connected to the umbilical port and the epigastric port. Key parameters such as duration of surgery, time after which the scope was removed, and intraoperative complications were analyzed. Statistical comparisons had been performed by employing independent sample t-tests, and significance was determined at $p < 0.05$.

The position of the insufflator port significantly affected the surgical efficiency, according to the results. The epigastric port group exhibited a shorter duration of surgery and longer time before scope removal, suggesting reduced lens fogging and improved visibility compared to the umbilical port group. The fact that neither group experienced any intraoperative problems supports the safety of both strategies.

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ANNEXURES

ANNEXURE – I - INFORMED CONSENT FORM

"COMPARISION BETWEEN USING THE INSUFFLATOR PORT V/S THE NON-INSUFFLATOR PORT TO REDUCE CAMERA LENS FOGGING IN PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY."

Name of Student/Principal Investigator: _____

Name of Guide/Co Investigators: _____

Introduction: The Temperature fluctuation of the scope in the external environment and inside the abdomen causes the camera lens to fog and increases the time taken to finish the procedure. To reduce the time taken to finish the procedure the method of using two separate ports for the camera and CO2 insufflation can be done.

Explanation of procedure: While undergoing laparoscopic cholecystectomy there we will be using two seperate ports, one to place the co2 gas and the other one to pass the laparoscopic camera. To see the effect of doing so on reducing the camera lens fogging and hence reducing the surgery time.

Withdrawal from participation in the study: Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will not get any benefits participating in this study. The data gathered will help population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study.

Cost of investigations done during the course of study will be paid by the **principal Participant.**

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Questions: If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights

CONSENT STATEMENT

I am making a voluntary decision to participate in the study" **COMPARISION BETWEEN USING THE INSUFFLATOR PORT V/S THE NON-INSUFFLATOR PORT TO REDUCE CAMERA LENS FOGGING IN PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY."** My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant: Name of the witness:

Signature or left thumb impression of the witness: Name of the investigator:

Signature of the investigator:

ANNEXURE II (PROFORMA)

CASE NO:	
NAME:	
AGE:	
SEX:	
INFORMANT:	
ADDRESS:	
IP NO:	
UNIT/WARD:	
DATE OF ADMISSION:	
DATE OF SURGERY:	
WHICH SURGICAL PROCEDURE?	
DATE OF DISCHARGE:	
CHIEF COMPLAINTS:	

PAST HISTORY:	
PERSONAL HISTORY:	
TREATMENT HISTORY:	

CLINICAL DIAGNOSIS:	
GENERAL PHYSICAL CONDITIONS:	
INVESTIGATIONS: CBC LFT SERUM CREATININE USG ABDOMEN	
OPERATION DETAILS: PROCEDURE: TYPE OF SURGERY: DURATION: SETTINGS OF THE CO2 INSUFFLATOR:	

TIME AFTER WHICH THE SCOPE WAS REMOVED TO CLEAN INTRA-OP COMPLICATIONS:		
POST OPERATIVE: ANTIBIOTICS: HOSPITAL STAY: OTHERS:		

ANNEXURE III (MASTERCHART)

S.No	IP No.	AGE	GENDER	ADDRESS	DIAGNOSIS	SURGERY	PULSE RATE	BLOOD PRESSURE	TEMP	HB	WBC	T.BILI	SGOT	SGPT	ALK. PHOS	SR. CREAT	USG ABDOMEN	DURATION OF SURGERY	PRESET PRESSURE	FLOW RATE	INSUFFLATOR CONNECTED TO PORT	TIME AFTER WHICH SCOPE WAS REMOVED	INTRA OP COMPLICATIONS
1	1009105	26	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	68	128/74	AFEBRILE	9.4	10,000	3	8.6	9.4	110	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.1CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	22 MINS	NIL
2	1193503	26	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	76	122/76	AFEBRILE	10.6	8,000	3	8.2	9.2	112	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.5CM	1 HOUR 45 MINS	15 MM/HG	5 L/MIN	EPIGASTRIC	18 MINS	NIL
3	10024650	75	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	74	130/80	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN THE GB	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	20 MINS	NIL
4	10024650	60	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	80	128/78	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN THE GB	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	18 MINS	NIL
5	10014603	44	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	64	120/80	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 5X7MM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	22 MINS	NIL
6	10029229	45	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	76	124/82	AFEBRILE	12.7	7,700	3	8.1	9.2	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	20 MINS	NIL
7	10030449	45	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	80	126/78	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	19 MINS	NIL
8	10031180	56	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	74	130/80	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1 CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	24 MINS	NIL
9	10032327	43	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	80	128/78	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN GB	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	20 MINS	NIL

																	WITH LARGEST MEASURING 1 CM					
10	10031343	55	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	80	126/78	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MRCP-CBD STRICTURE WITH DISTENDED GB	2.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	18 MINS	NIL
11	1203907	40	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	64	120/80	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.1CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	24 MINS	NIL
12	10032585	32	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	90	132/78	AFEBRILE	13.9	9,100	3	8.1	9	121	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 9 MM	1 HOUR	15 MM/HG	5 L/MIN	EPIGASTRIC	18 MINS	NIL
13	10030780	37	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	88	122/76	AFEBRILE	12.8	9,500	3	8	8.9	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.5CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	26 MINS	NIL
14	10030935	38	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	66	120/78	AFEBRILE	9.4	10,000	3	8.6	9.4	110	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.6CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	20 MINS	NIL
15	10035648	62	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	86	122/68	AFEBRILE	10.6	8,000	3	8.2	9.2	112	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 0.6CM	1 HOUR	15 MM/HG	5 L/MIN	EPIGASTRIC	20 MINS	NIL
16	10029579	73	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	90	128/78	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.6CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	21 MINS	NIL
17	10018463	32	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	92	130/90	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.3CM	1 HOUR	15 MM/HG	5 L/MIN	EPIGASTRIC	22 MINS	NIL
18	10021573	62	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	74	124/76	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.1CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	27 MINS	NIL
19	10021549	66	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	82	122/74	AFEBRILE	12.7	7,700	3	8.1	9.2	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.1CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	26 MINS	NIL
20	10023374	55	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	90	118/68	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.1CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	26 MINS	NIL

21	10023174	28	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	78	124/68	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 9 MM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	20 MINS	NIL
22	10036749	38	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	96	128/82	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	18 MINS	NIL
23	10040430	34	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	70	130/94	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	19 MINS	NIL
24	10040754	21	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	68	126/78	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	SINGLE CALCULI IN THE GB 1.1 CM	1 HOUR	15 MM/HG	5 L/MIN	EPIGASTRIC	21 MINS	NIL
25	10044732	52	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	70	130/80	AFEBRILE	13.9	9,100	3	8.1	9	121	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.1CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	20 MINS	NIL
26	10046740	45	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	88	126/74	AFEBRILE	12.8	9,500	3	8	8.9	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.1CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	28 MINS	NIL
27	10047869	56	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	90	122/78	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH MINIMAL SLUDGE	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	26 MINS	NIL
28	10044697	59	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	60	120/68	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.1CM	1.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	18 MINS	NIL
29	10057164	35	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	62	124/68	AFEBRILE	13.9	9,100	3	8.1	9	121	1.1	MULTIPLE STONES IN GB WITH GB DISTENTION AND MINIMAL SLUDGE	2.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	28 MINS	NIL
30	10060270	60	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	74	120/80	AFEBRILE	12.8	9,500	3	8	8.9	115	0.9	2 STONES IN GB MEASURING 2.1 AND 1.2 CM	2.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	27 MINS	NIL
31	10062151	34	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	78	116/78	AFEBRILE	9.4	10,000	3	8.6	9.4	110	0.9	MULTIPLE CALCULOUS CHOLELITHIASIS	2.5 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	19 MINS	NIL
32	10062944	37	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	90	120/82	AFEBRILE	10.6	8,000	3	8.2	9.2	112	0.8	SINGLE STONE IN GB WITHOUT ANY GB DISTENTION AND SLUDGE	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	28 MINS	NIL
33	10059878	70	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	82	126/88	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.1CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	19 MINS	NIL

34	10063638	49	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	88	120/78	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2CM	2 HOURS	15 MM/HG	5 L/MIN	EPIGASTRIC	16 MINS	NIL
35	10036811	42	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	86	128/88	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 9 MM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	12 MINS	NIL
36	10031348	45	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	76	130/80	AFEBRILE	12.7	7,700	3	8.1	9.2	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.9 CM	1.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
37	10040009	39	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	70	132/88	AFEBRILE	13	8,200	3	8.1	9	120	1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	12 MINS	NIL
38	10040277	29	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	72	140/90	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.4 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	12 MINS	NIL
39	10041963	46	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	84	138/88	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.8 CM	1.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	11 MINS	NIL
40	10044782	60	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	88	128/86	AFEBRILE	12.7	7,700	3	8.1	9.2	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.1CM	2.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	09 MINS	NIL
41	10044257	57	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	98	134/86	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.5CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
42	10044723	78	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	68	130/74	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.5 CM	1.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	13 MINS	NIL
43	10046966	69	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	78	128/76	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2 CM	1.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
44	10050853	23	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	96	130/88	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.5 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	12 MINS	NIL
45	10049975	51	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	80	132/88	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.6 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	11 MINS	NIL

46	10050768	67	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	86	126/76	AFEBRILE	13.9	9,100	3	8.1	9	121	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.8 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
47	10053744	29	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	80	142/94	AFEBRILE	12.8	9,500	3	8	8.9	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.1CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	09 MINS	NIL
48	10055502	28	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	78	138/92	AFEBRILE	9.4	10,000	3	8.6	9.4	110	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.5 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
49	10055482	28	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	76	126/74	AFEBRILE	10.6	8,000	3	8.2	9.2	112	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2 CM	2.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
50	10056234	48	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	86	120/78	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.8 CM	2.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	09 MINS	NIL
51	10057851	55	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	90	122/80	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.8 CM	2.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
52	10058992	28	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	66	146/98	AFEBRILE	12.7	7,700	3	8.1	9.2	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.4 CM	2.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
53	10060326	41	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	68	136/80	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.6 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	11 MINS	NIL
54	10061175	29	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	78	140/80	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	09 MINS	NIL
55	10061134	44	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	84	130/90	AFEBRILE	12.2	7,700	3	8	9.2	112	0.7	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.5 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
56	10064885	54	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	72	122/84	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.5 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	2 MINS	NIL
57	10065808	45	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	70	130/94	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL

58	10068450	45	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	84	128/74	AFEBRILE	13.9	9,100	3	8.1	9	121	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.4 CM	2.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	11 MINS	NIL
59	10068413	45	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	88	122/70	AFEBRILE	12.8	9,500	3	8	8.9	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.5 CM	2.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
60	10070131	45	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	86	140/90	AFEBRILE	13	8,200	3	8.1	9	120	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.9 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
61	10069190	61	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	64	118/68	AFEBRILE	11.5	8,200	3	8.2	9	113	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.2 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	11 MINS	NIL
62	10070271	38	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	66	122/84	AFEBRILE	13.9	9,100	3	8.1	9	121	1.1	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.1 CM	1.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
63	10071062	48	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	64	130/86	AFEBRILE	12.8	9,500	3	8	8.9	115	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.0 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	09 MINS	NIL
64	10074562	27	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	84	142/90	AFEBRILE	9.4	10,000	3	8.6	9.4	110	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.0 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	14 MINS	NIL
65	10075230	33	FEMALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	90	118/70	AFEBRILE	10.6	8,000	3	8.2	9.2	112	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.2 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	15 MINS	NIL
66	10076231	56	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	88	122/84	AFEBRILE	13.1	6,200	4	8.1	9.1	114	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.2 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	10 MINS	NIL
67	10118711	39	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	60	134/70	AFEBRILE	14.5	6,450	3	7.9	9	120	0.8	MULTIPLE STONES IN GB WITH LARGEST MEASURING 2.3 CM	1.5 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	15 MINS	NIL
68	10102903	66	MALE	BELAGAVI	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	76	124/76	AFEBRILE	12.3	5,600	4	7.9	9	116	0.9	MULTIPLE STONES IN GB WITH LARGEST MEASURING 1.2 CM	2 HOURS	15 MM/HG	5 L/MIN	UMBILICAL	20 MINS	NIL