"INTRAOPERATIVE ANATOMY OF THE BILIARY TRACT: VARIATIONS AND CONGENITAL ANOMALIES AND IMPLICATIONS IN LAPAROSCOPIC CHOLECYSTECTOMY: ONE YEAR OBSERVATIONAL STUDY AT A TERTIARY CARE TEACHING HOSPITAL IN BELAGAVI REGION OF NORTH KARNATAKA."

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LIST OF ABBREVIATIONS

S. No.	ABBREVATIONS	FULL FORM
1.	CBD	COMMON BILE DUCT
2.	CHD	COMMON HEPATIC DUCT
3.	GB	GALL BLADDER
4.	CD	CYSTIC DUCT
5.	HA	HEPATIC ARTERY
6.	CHA	COMMON HEPATIC ARTERY
7.	CA	CYSTIC ARTERY
8.	CVS	CRITICAL VIEW OF SAFETY
9.	LC	LAPAROSCOPIC CHOLECYSTECTOMY
10.	KLE	KARNATAKA LINGAYAT EDUCATION
11.	Hb	HAEMOGLOBIN
12.	g/dl	GRAMS PER DECILITRE
13.	mg/dl	MILIGRAMS PER DECILITRE
14.	HbA1c	GLYCATED HAEMOGLOBIN
15.	SD	STANDARD DEVIATION
16.	USG	ULTRASONOGRAPHY
17	MRCP	MAGNETIC RESONANCE CHOLANGIOPANCREATICOGRAPHY

TABLE OF CONTENTS

LIST OF IMAGES

LIST OF TABLES

LIST OF GRAPHS

LIST OF PHOTOGRAPHS

ABSTRACT

Background: Laparoscopic cholecystectomy has become the standard treatment for symptomatic cholelithiasis. However, the presence of anatomical variations and congenital anomalies in the extrahepatic biliary system can significantly complicate the procedure, increasing the risk of iatrogenic injuries such as bile duct injury, intraoperative hemorrhage, and postoperative complications. Accurate knowledge and identification of these variations are essential for surgical safety and improved outcomes.

Objective: This study aimed to evaluate the prevalence and types of anatomical variations and congenital anomalies in the extrahepatic biliary system observed during laparoscopic cholecystectomy and to determine their clinical and surgical implications.

Methods: A prospective observational study was conducted over a one-year period (September 2023 – August 2024) at a tertiary care teaching hospital in Belagavi, Karnataka. A total of 138 patients undergoing laparoscopic cholecystectomy for gallstone disease were included. Intraoperative findings related to variations in the cystic duct, gallbladder, cystic artery, and hepatic artery were recorded. The presence of complications such as bile spillage, intraoperative bleeding, operative time, and postoperative bleeding from drain sites were analyzed.

Results: Anatomical variations were identified in 32 patients (23.2%), with the most frequent being short cystic duct (5.1%), long cystic duct (4.3%), and buried gallbladder (4.3%). Variations involving the cystic artery and hepatic artery were also noted. Intraoperative bleeding occurred in 15.6% of patients with anatomical variations compared to 0.9% in those without ($p = 0.0021$). Postoperative drain site bleeding was significantly more common in patients with variations (15.6% vs. 1.9%;

p = 0.0082). Although bile spillage and operative time were higher in the variation group, these did not reach statistical significance.

Conclusion: Anatomical variations and congenital anomalies of the extrahepatic biliary system are relatively common and are associated with a significantly increased risk of intraoperative and postoperative complications. Routine awareness, meticulous surgical technique, and use of the Critical View of Safety are essential strategies to mitigate these risks. Preoperative imaging and intraoperative vigilance remain crucial in achieving safe and effective laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy, Extrahepatic biliary system, Anatomical variations, Cystic duct anomalies, Cystic artery variations, Intraoperative complications, Critical View of Safety.

INTRODUCTION

Gallstone disease is a common condition encountered in surgical wards, affecting 10-15% [1] of the general population, either through symptomatic or asymptomatic cholelithiasis. As a result, it is one of the most frequent disorders of the gallbladder and biliary system. Recent studies show that for patients with asymptomatic cholelithiasis, the risk of developing symptoms or complications is about 1-2% per year, with 20% eventually progressing to symptomatic disease after 15 years.

Cholelithiasis can lead to several complications, including cholecystitis, cholangitis, choledocholithiasis, gallstone pancreatitis, and, in rare cases, cholangiocarcinoma. [2] The causes of gallstones are diverse and multifactorial, involving genetic, dietary, anatomical, metabolic, and pathological factors. [3]

Cholecystectomy remains the standard treatment for cholelithiasis, with laparoscopic cholecystectomy being the most common and preferred method. [1] The incidence of cholelithiasis and the number of laparoscopic cholecystectomies is both increasing. Daycare laparoscopic cholecystectomy is considered a safe treatment option. [4] However, the rise in cholecystectomy procedures, along with the shift from open to laparoscopic methods, has led to a corresponding increase in bile duct injuries. [5]

Importantly, the location and course of these ducts are subject to considerable variation, and these anatomical anomalies, typically ranging from 30% to 40% often become apparent only during surgical interventions. [6,7] Given the complexity and importance of the biliary tree, understanding its normal anatomy and potential variations is critical in preventing surgical complications, particularly during laparoscopic cholecystectomy. [8]

The biliary tree is not without its variations, and these differences can pose significant challenges during laparoscopic cholecystectomy. Among the most clinically relevant variations are the position and length of the cystic duct, which may be short, long, absent, or have an unusual point of union with the common hepatic duct. These anomalies can increase the risk of bile duct injury, leading to bile spillage intraoperatively, making it imperative for surgeons to possess a thorough understanding of the potential anatomical differences they may encounter during surgery. [5] Variations and congenital anomalies in cystic arteries or common hepatic arteries such as moynihan's hump can increase the risk of intraoperative injury to hepatic arteries, leading to hepatic ischemia, particularly the couinaud's segments V and VIII if right hepatic artery is injured.

Global studies have estimated that biliary tract anomalies occur in approximately 10-20% of the general population, with a wide range of variations being identified. The variations can include aberrant bile ducts, unusual cystic duct insertion, anomalous junctions between the bile duct and pancreatic duct, and biliary tract duplications. [9,10]

The incidence of common variations includes aberrant cystic ducts, which are found in about 10-15% of laparoscopic cholecystectomy cases. [11] Another variation, such as an accessory bile duct, is found in approximately 1-2% of patients. [12]

In India, the incidence of biliary tract variations has been reported to be comparable to global findings but may differ slightly based on population characteristics. A study conducted in the Indian subcontinent found that anatomical variations in the biliary tree were present in approximately 12-18% of patients undergoing cholecystectomy, which is slightly higher than global averages. [13] Common variations in India include aberrant cystic ducts, which occur in about 10%

of cases, and anomalous cystic duct insertion, which is a critical factor for laparoscopic cholecystectomy planning. [14]

Interestingly, recent research in India has highlighted a growing awareness of the need for preoperative imaging to detect these variations. While most of these anomalies remain undetected through routine preoperative investigations, advanced imaging techniques, such as magnetic resonance cholangiopancreatography (MRCP), multi-detector CT scans, and high-resolution ultrasound, techniques have significantly enhanced the detection rate of biliary variations. [15,16] These imaging modalities allow for better preoperative planning, potentially reducing the risk of intraoperative surprises. However, despite the advances in diagnostic imaging, many variations are still only discovered during surgery, underscoring the importance of surgical expertise and vigilance. [17]

This study aims to assess the prevalence of extrahepatic biliary system structural variations and congenital malformations after laparoscopic cholecystectomy at a teaching hospital providing tertiary treatment in the Belagavi district of North Karnataka. Improving patient outcomes requires an understanding of these differences' prevalence and clinical implications. The risk of iatrogenic harm, such as bile spillage intraoperatively, bleeding, injury to hepatic artery, can be reduced by identifying these abnormalities as early as feasible before surgery and being ready for them throughout the procedure. To improve surgical safety and skill during laparoscopic cholecystectomy procedures, this study attempts to offer important insights into the frequency and relevance of biliary tree abnormalities.

AIMS AND OBJECTIVES

1. To assess the frequency of anatomical variations and congenital anomalies of extrahepatic biliary system in patients undergoing laparoscopic cholecystectomy at tertiary care teaching hospital in Belagavi region in North Karnataka.
2. To study the implications of anatomical variations and congenital anomalies of extrahepatic biliary system in patients undergoing laparoscopic cholecystectomy.

REVIEW OF LITERATURE

A. EMBRYOLOGY OF BILIARY TRACT

The development of the liver and biliary system begins with the formation of the hepatic diverticulum from the ventral wall of the primitive foregut during the fourth week of embryonic life. By the end of this week, the cranial and caudal buds of the hepatic diverticulum become visible. The liver lobes and part of the extrahepatic biliary tree arise from the cranial bud, while both superior and inferior buds emerge from the caudal bud.

The superior caudal bud gives rise to the gallbladder and cystic duct, while the inferior caudal bud contributes to the formation of the left and right ventral pancreas.

1. **3-mm stage:** The cranial bud begins to develop into the liver lobes, while the gallbladder and extrahepatic biliary system start to form from the caudal bud. By day 26, the cystic diverticulum emerges from the caudal duct, which will develop into the gallbladder and cystic duct by the end of the fourth week.

2. **5-mm stage:** The common hepatic duct forms from part of the hepatic portion distal to where the cystic portion originates, while the common bile duct (CBD) forms between the cystic portion and the duodenal part of the foregut.

3. **7-mm stage:** By this stage, the liver, gallbladder, hepatic ducts, cystic duct, and ventral pancreas are fully formed.

4. **12-mm stage:** Around the sixth or seventh week of gestation, the ventral pancreatic bud completes a 180-degree clockwise rotation around the duodenum. This rotation leads to the fusion of the ventral and dorsal pancreatic buds, resulting in the formation of the complete pancreas.

B. SURGICAL ANATOMY OF BILIARY TRACT

1. Gallbladder

- The gallbladder is a pear-shaped organ, measuring between 7 to 10 cm in length.
- It is located within the gallbladder fossa, which is found on the inferior surface of the liver.
- The average capacity of the gallbladder is 30 to 50 ml, but it can hold up to 300 ml in cases of outflow obstruction. [18]

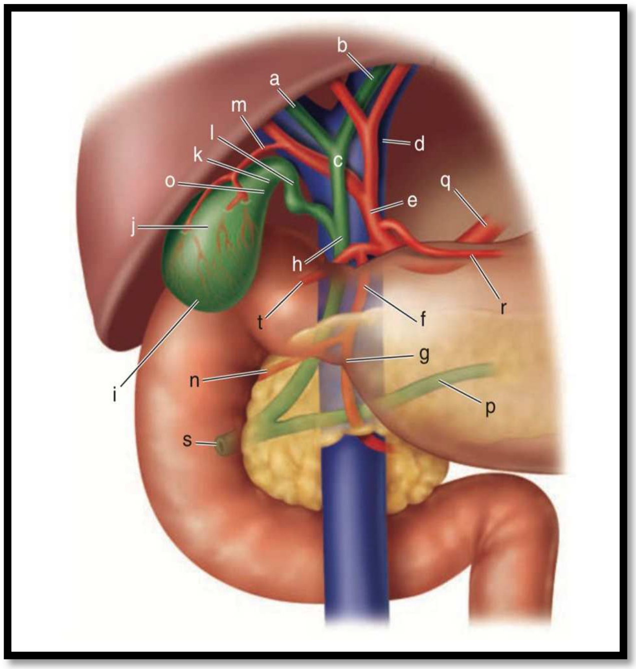
The "gallbladder is anatomically divided into four parts:

a) Fundus: The rounded, blind end of the gallbladder, which extends more than 2 cm below the inferior margin of the liver.

b) Body: Made up of elastic tissue, which allows for distension.

c) Infundibulum: A mucosal outpouching located at the junction of the cystic duct and the neck of the gallbladder.

d) Neck: The lowest point of the gallbladder, which connects to the cystic duct"



a. Right "hepatic duct
b. Left hepatic duct
c. Common hepatic duct
d. Portal vein
e. Proper hepatic artery
f. Gastroduodenal artery
g. Right gastroepiploic
h. Common bile duct
i. Fundus of gall bladder
j. Body of gall bladder
k. Infundibulum of gall bladder
l. Cystic duct
m. Cystic artery
n. Superior pancreaticoduodenal artery
o. Neck of" gall bladder
p. Pancreatic duct

Image 1: Anatomy of Gallbladder[27]

2. Extrahepatic Biliary Tree:

a. **Hepatic Ducts:** The left hepatic duct is longer than the right, although the right duct tends to dilate more. Both hepatic ducts converge in the liver.

b. **Common Hepatic Duct (CHD):** The CHD forms when the right and left hepatic ducts merge near the liver's surface. It has a diameter of about 4 mm and a length ranging from 1 to 4 cm. The CHD is located to the right of the hepatic artery and in front of the portal vein.

c. **Cystic Duct:** This duct exits the gallbladder and has a variable length and course. Its mucosal lining contains spiral folds known as the valves of Heister.

d. **Common Bile Duct (CBD):** The CBD forms when the cystic duct joins the common hepatic duct. It is 7 to 11 cm long and has a diameter of 5 to 10 mm. (19)

- Supraduodenal Segment: This 2.5 cm-long segment is positioned to the right of the hepatic artery, in front of the portal vein, and runs along the free border of the lesser omentum.
- Retroduodenal Segment: Located posterior to the first part of the duodenum, this segment runs away from the portal vein and hepatic artery.
- Infraduodenal Segment: This part is situated on the posterior surface of the pancreatic head and passes through it.
- Intraduodenal Segment: This segment merges with the pancreatic duct and opens into the second part of the duodenum at the ampulla of Vater. [19]

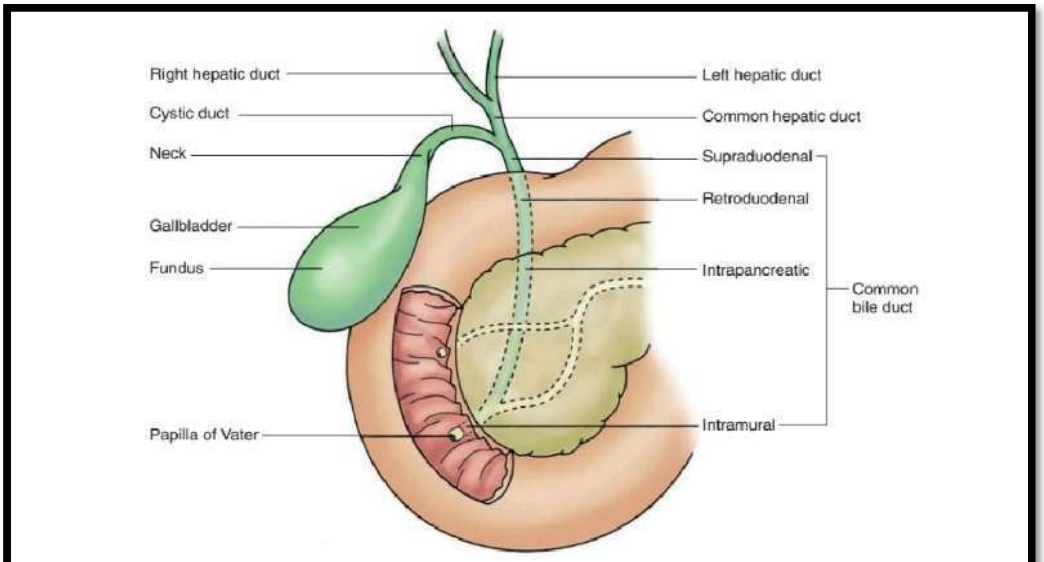


Image 2: Anatomy of Common Bile Duct[27]

3. Blood Supply

A. Arterial Supply:

- The cystic artery has a variable origin but typically arises from the right hepatic artery, which is located near the cystic duct in Calot's triangle. This artery provides blood supply to the gallbladder.
- At the neck of the gallbladder, the cystic artery gives off shallow and deep branches that anastomose across the fundus and body of the gallbladder.
- Caterpillar Turn / Moynihan’s Hump: This is a dangerous anatomical anomaly where a short cystic artery and a tortuous right hepatic artery may cause accidental arterial injury or bleeding during cholecystectomy. (19)

B. Venous Drainage:

- The right portal vein carries several small veins that drain into the liver from the gallbladder bed.
- The veins draining the bile ducts empty into veins located at the 9 o'clock and 3 o'clock positions along the common biliary channel. (20)

C. Lymphatics:

- The cystic lymph node of Lund, located at the junction of the cystic and common hepatic ducts, is responsible for draining lymph from the gallbladder.
- The efferent lymphatic vessels then drain into the celiac lymph nodes and the liver's hilum. Additionally, the subserosal lymphatics of the gallbladder and the subcapsular lymphatics of the liver merge. (20)

4. Anatomical Variations:

The classical description of the biliary tree appears only in 1/3rd of the patients. (19)

Anatomical variations seen in,

A. **Gall bladder**

- Buried
- Rudimentary
- Duplication
- Left sided gallbladder
- Retro displaced gallbladder
- Floating gallbladder

B. **Cystic duct**

- The low point where the CHD and cystic duct converge
- Adherent cystic duct to CHD
- High point where the common and cystic hepatic ducts converge
- The right hepatic duct receives a cystic duct drainage.
- The lengthy cystic duct joins the CHD after the duodenum.
- Absence of cystic duct
- The cystic duct enters the CHD anteriorly after crossing it posteriorly.
- The CHD and the cystic duct connect posteriorly. (19)

Furthermore, the luschka auxiliary ducts may empty straight into the liver fossa or any other location along the biliary tree from the gall bladder's body.

About 5% of people have accessory right hepatic ducts. (19,21)

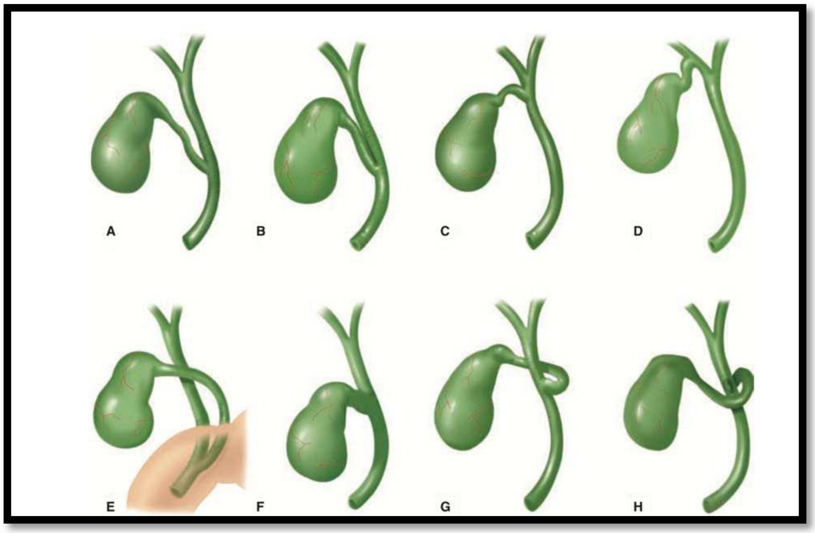
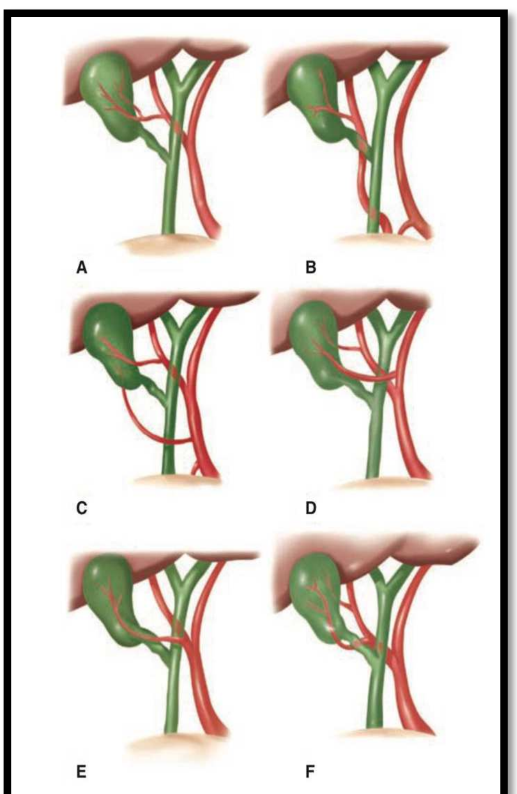


Image 3: Anatomical variations of Cystic Duct[27]

C. **Hepatic and cystic artery**

As many as 40–50% of cases are associated with anomalies in the hepatic and cystic arteries.



A. Cystic "artery from right hepatic artery
B. Accessory cystic artery/ replaced cystic artery arising from superior mesenteric artery (10%)
C. Two cystic artery from right and common hepatic artery
D. Two cystic artery from right and left hepatic artery
E. Cystic artery running anterior to common hepatic duct
F. Dual cystic artery from right hepatic" artery

Image 4: Anatomical variation of Cystic Artery[27]

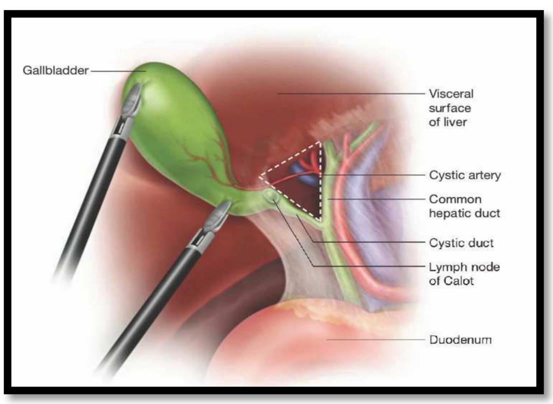
5. CALOT'S TRIANGLE:

BOUNDARIES:

- "Superiorly- cystic artery
- Medially: common hepatic duct
- Laterally: cystic duct and the gallbladder's neck

CALOT'S TRIANGLE CONTENTS

1. Cystic lymph node of Lund
2. Small cystic veins
3. Autonomic nerves" piercing gall bladder
4. Adipose tissue
5. Right hepatic artery (tortuous)
6. Some accessory ducts draining GB. (22)



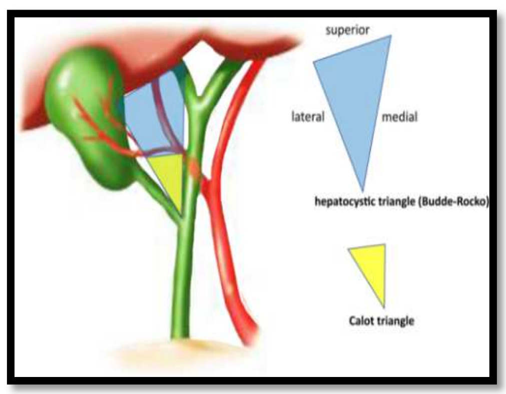


Image 5: Anatomy of Calots Triangle[27]

6. CHOLECYSTOHEPATIC TRIANGLE

BOUNDARIES:

- Superiorly- the inferior surface of the liver
- Medially: common hepatic duct
- Laterally: cystic duct and the neck of gall bladder [23]

7. INTRAOPERATIVE LAPAROSCOPIC ANATOMY OF BILIARY TRACT

During a laparoscopic cholecystectomy, the cystic duct and cystic artery can be located utilizing the Critical View of Safety (CVS) method. [24]

Standards to attain Critical View of Safety (CVS)

a. The hepatocystic triangle loses both fat and fibrous tissue. The hepatocystic triangle” is formed by the liver's border, CHD, and cystic duct. (Note- There's no need to expose CHD and CBD.)

b. Lower gallbladder removal from liver exposes cystic plate. Gall bladder fossa contains the liver bed, or cystic plate. (only structures must be visible entering the gall bladder) (25)

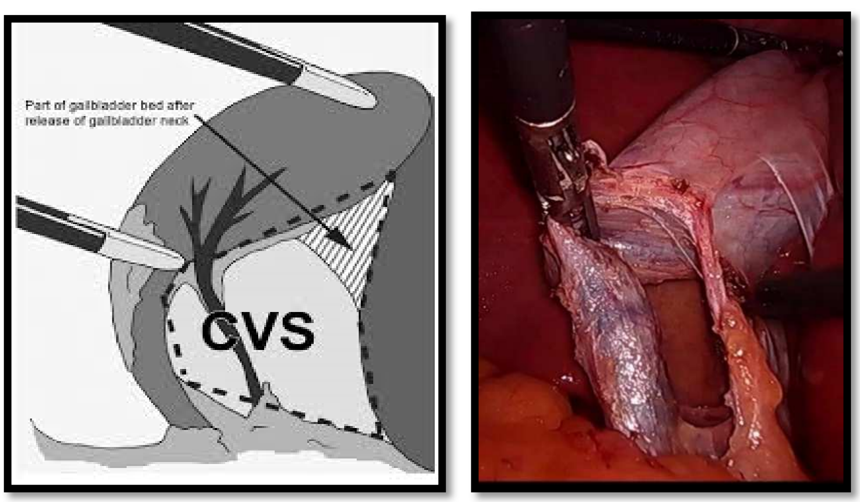


Image 6: Critical View of safety[33]

Rouviere's sulcus-

It is a fissure or sulcus that most people can easily perceive between the liver's right and caudate lobes. This is located at the level of the porta hepatis, where the right pedicle penetrates the liver. To avoid injuring the bile duct, the dissection should be carried out above this sulcus. [26]

C. CHOLELITHIASIS:

Gallstone disease is a common digestive disorder, affecting 11%–36% of people, with risk factors including age, female gender, obesity, pregnancy, and certain medical conditions like Crohn's disease, hemolytic anemias, and cirrhosis. Gallstones may remain asymptomatic, but around 3% of individuals become symptomatic annually, presenting with biliary colic, typically triggered by cystic duct obstruction. Complications include acute cholecystitis, pancreatitis, cholangitis, and rarely gallbladder carcinoma.

Gallstones form when bile becomes supersaturated with cholesterol or bilirubin. They are classified as cholesterol or pigment stones. Cholesterol stones, prevalent in Western countries, form due to cholesterol hypersecretion, while pigment stones—black (linked to hemolysis or cirrhosis) and brown (associated with biliary infections and stasis)—are more common in Asia.

Symptomatic gallstone disease, often manifesting as episodic right upper quadrant pain radiating to the back, may be accompanied by nausea. Diagnosis is primarily through abdominal ultrasound. Management involves laparoscopic cholecystectomy for symptomatic patients, with surgery offering excellent long-term relief in most cases. Elective surgery is also recommended for high-risk individuals, such as diabetics or those with porcelain gallbladder, to prevent complications. [27]

D. PREDICTORS OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY

Identifying predictors of difficult laparoscopic cholecystectomy (LC) is essential for minimizing operative complications. There is a combination of clinical, radiological, and intraoperative factors that increase surgical difficulty.

Patient-related factors such as older age, male gender, obesity, previous upper abdominal surgery, and recurrent attacks of cholecystitis are significant predictors. These factors often result in dense adhesions, altered anatomy, or technical challenges during dissection. Acute or chronic inflammation may obscure vital structures like Calot’s triangle and increase the risk of bile duct injury. [27]

Ultrasonographic features such as a thick-walled gallbladder (>3 mm), pericholecystic fluid, a contracted or distended gallbladder, and impacted stones in Hartmann’s pouch as important preoperative indicators. These imaging findings often correlate with inflammation and fibrosis, making anatomical planes difficult to identify. [75]

Distorted anatomy due to congenital anomalies, anatomical variations or severe inflammation—especially in the presence of a short or absent cystic duct—poses considerable technical challenges. It also cautions against blind dissection in unclear anatomy and advocates for early conversion in such cases. [76]

Operative predictors includes a buried gallbladder, dense omental adhesions, uncontrolled bleeding, or failure to achieve the critical view of safety. It emphasizes the need for intraoperative judgment to consider subtotal cholecystectomy or conversion to open surgery when dissection becomes unsafe. [77]

E. LAPAROSCOPIC CHOLECYSTECTOMY

Laparoscopic cholecystectomy has received nearly universal acceptance and is currently considered the criterion standard for the treatment of symptomatic cholelithiasis. Many centres have special "short-stay" units or "24-hour admissions" for postoperative observation following this procedure.

Conventional 4 port laparoscopic cholecystectomy is replaced by 3 ports and 2 ports and SILS (Single incision laparoscopic cholecystectomy). A suture needle is used to fix the gall bladder to abdominal wall in the right hypochondrial region with 2 ports in 2 port laparoscopic cholecystectomy. These 3 and 2 port laparoscopic cholecystectomy have the advantages of less scar formation compared to conventional 4 port laparoscopic cholecystectomy. The laparoscopic surgeries have the advantages of reduction in number of emergency operations and decreased morbidity, fewer CBD exploration, shortened hospital stay, reduced total costs in expert hands and for cosmetic purposes.

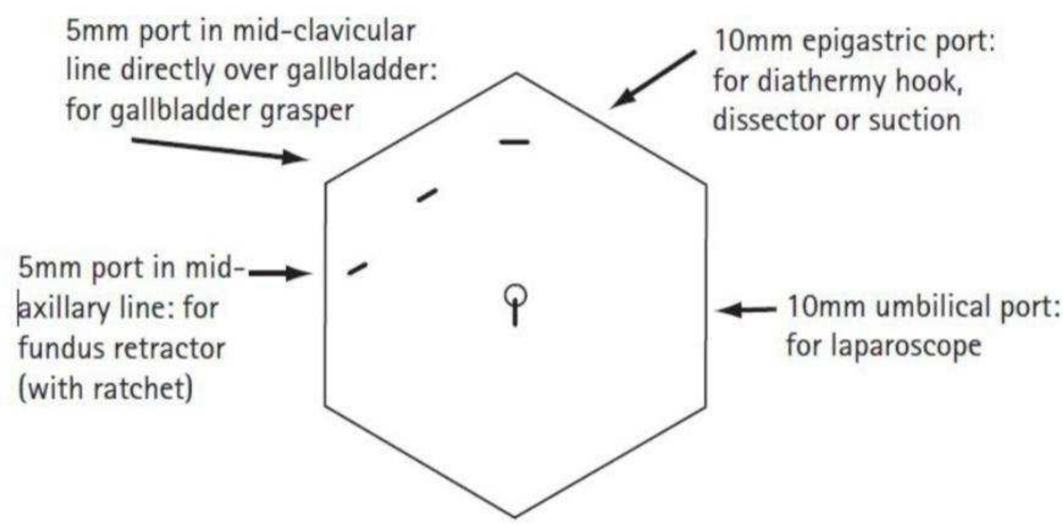


Image 7: Common port placement in Laparoscopic Cholecystectomy[33]

Steps of Laparoscopic Cholecystectomy

1. **Anesthesia:** General anesthesia is administered for all laparoscopic cholecystectomy procedures.

2. **Patient Positioning:** The patient is placed in a supine position with arms by their sides and feet securely strapped.

3. **Preparation:** After intubation, a Foley catheter and a Ryle's tube are inserted.

4. **Creating Pneumoperitoneum:** To create a working space in the peritoneal cavity, pneumoperitoneum is established at a pressure of 12-14 mmHg. There are two techniques for this:

   - **Closed (Veress Needle) Technique:**
     - A Veress needle is inserted through the anterior abdominal wall at the umbilicus.
     - The position is confirmed with a syringe containing normal saline.
     - CO_2 is insufflated at a rate of 2 liters per minute.
     - Correct placement is confirmed by observing uniform abdominal distension.
   - **Open (Hasson) Technique:**
     - A supraumbilical incision is made, and layers are opened under direct vision to enter the peritoneum.
     - A 10mm trocar is inserted and secured with sutures.
     - Additional CO_2 insufflation is performed.

5. **Placement of Ports and Adequate Exposure:** A 10mm port is placed at the periumbilical area. A 30-degree laparoscope is used to examine the abdominal cavity, including the gallbladder, liver, omentum, colon, and pelvis, to check for adhesions or other abnormalities. Additional ports (one 10mm and two 5mm) are placed in the upper right quadrant and at the right anterior axillary line, 2cm below the costal margin, and in the right midclavicular line. These ports are used to introduce laparoscopic instruments such as graspers, dissectors, and scissors to separate the gallbladder from the liver bed and biliary tree.
6. **Exposure of Calot's Triangle:** The fundus of the gallbladder is raised and retracted upward toward the right shoulder with an atraumatic grasper. This provides a clear view of Calot's triangle and the liver for dissection. Any adhesions between the liver and gallbladder are separated from the fundus toward the neck using blunt dissection and cautery.

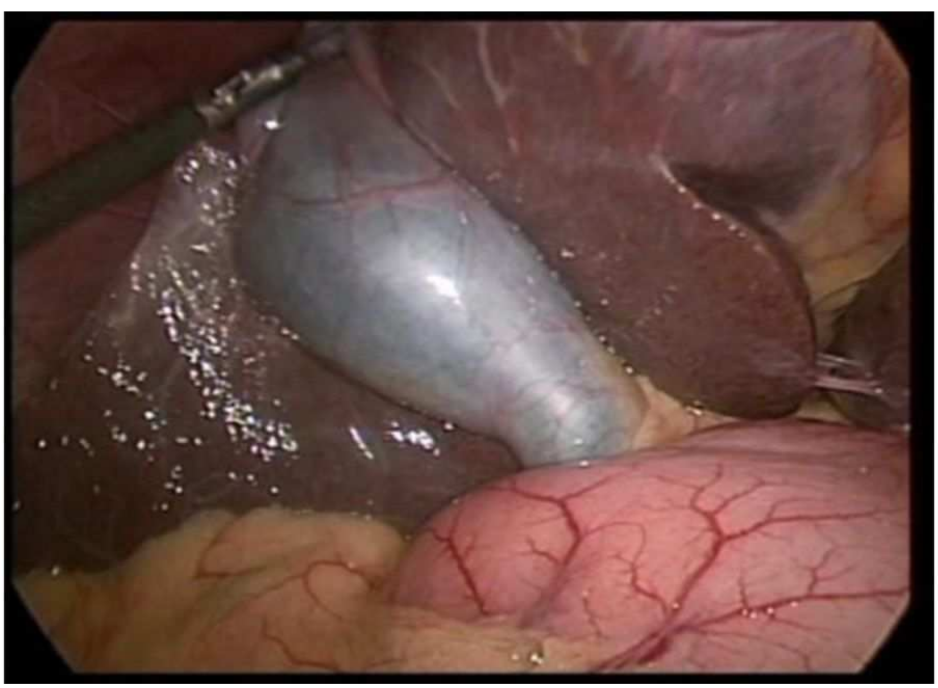


Image 8: Gall Bladder Retraction

7. **Calot's Triangle Dissection:** The peritoneal layer over the neck of the gallbladder is exposed and opened after retracting the infundibulum laterally for better visualization.

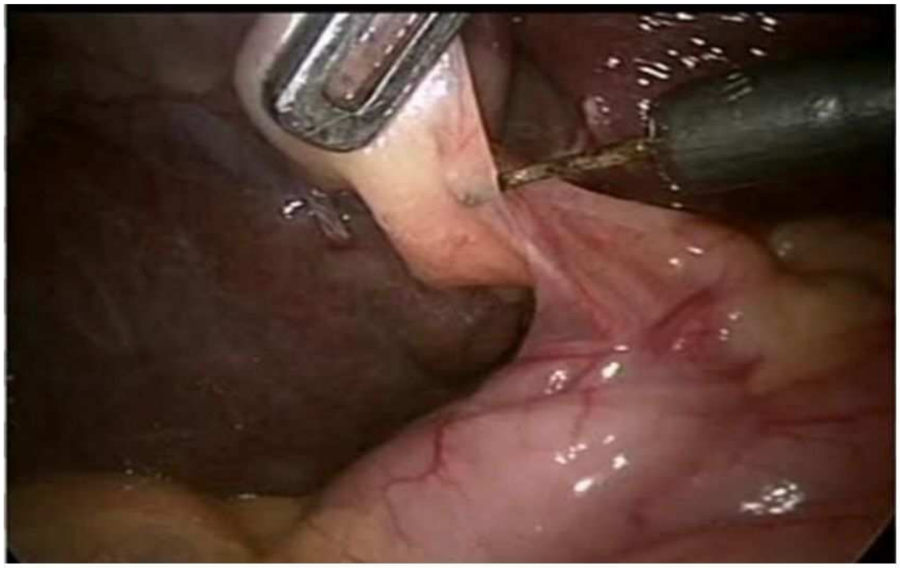


Image 9: Calot's Triangle Dissection

8. **Obtaining a Critical View of Safety:** To avoid bile duct injury, thorough dissection of Calot's triangle is essential. After dissection, only the cystic artery and cystic duct should be visible as they approach the gallbladder. Two clips are applied to the cystic duct, and one clip is applied to the gallbladder over the cystic duct. Stones in the cystic duct are gently expressed before ligation. The cystic artery is ligated first, followed by the cystic duct.

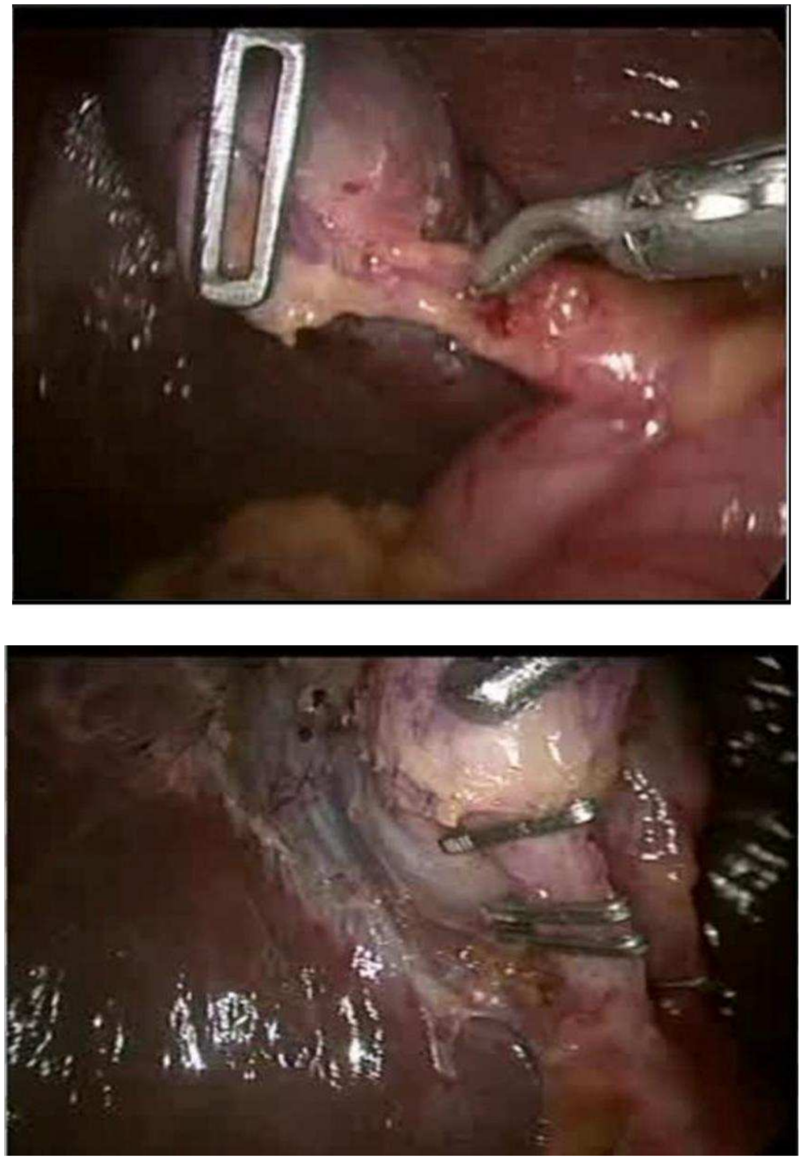


Image 10: Clipping the cystic artery and cystic duct

9. **Detachment of Gallbladder from Fossa:** The cystic plate is exposed after the gallbladder is dissected from its bed.

10. **Extraction of Gallbladder Specimen:** The camera is placed in the subxiphoid port, and the gallbladder, placed in an endobag, is removed through the umbilical port.

Image 11: Typical Gall Bladder specimen

11. **Drainage and Closure:** A drain is placed if there is suspected bleeding from the liver bed or if there is iatrogenic bile spillage due to gallbladder perforation.

Various studies on anatomical variations and congenital anomalies of extrahepatic biliary tree:

Gupta et al., (2023) conducted a study at a tertiary care center in India, involved 298 patients undergoing laparoscopic cholecystectomy. Findings revealed that 16.8% of patients exhibited cystic artery anomalies, while 11.4% had cystic duct anomalies, and 5.4% exhibited gallbladder anomalies. These variations significantly increased the risk of intraoperative haemorrhage and bile leakage, with 16.8% of patients with anatomical variations experiencing hemorrhage compared to only 1.9% in those with normal anatomy ($p < 0.001$). Similarly, bile leaks occurred in 15.7% of patients with variations compared to 6.4% in those with normal anatomy. [28]

Taimur et al. (2021): Taimur and colleagues conducted a study on 450 patients undergoing laparoscopic cholecystectomy to observe vascular variations in Calot's triangle. They found that 18% of patients had variations in the cystic artery, with 8% having a double cystic artery, 6% with a short cystic artery, and 4% with an absent cystic artery. The study concluded that preoperative identification of these variations is crucial to minimize intraoperative complications. The drawbacks in this study was that postoperative complications were not studied which are included in this study. [29]

Zubair et al. (2020): In this study, Zubair and colleagues analyzed 500 cases of laparoscopic cholecystectomy to assess variations in the cystic artery. They reported that 12% of patients had a low-lying cystic artery, 5% had a tortuous cystic artery, and 1% had a cystic artery arising from the gastroduodenal artery. The authors emphasized that awareness of these variations is essential for surgeons to prevent inadvertent injuries and ensure patient safety. It did not include implications of these variations found whereas these implications are addressed in my study. [30]

Farooq et al. (2019): Farooq and colleagues conducted an audit of 400 laparoscopic cholecystectomy cases at a tertiary care unit to document anatomical variations of the cystic artery. Their findings revealed that 15% of patients had variations in the origin and course of the cystic artery. Notably, 10% had a short cystic artery, 3% had a double cystic artery, and 2% had an absent cystic artery. The study highlighted the importance of preoperative imaging and meticulous dissection techniques to avoid vascular injuries during surgery.[31]

Plaza & Moreno (2019) documented several cases of uncommon anatomical configurations in which the cystic duct joined the hepatic duct at atypical locations, significantly complicating both surgical approaches and postoperative biliary drainage. These anomalies included low cystic duct insertions near the common hepatic duct, high insertions near the right hepatic duct, and parallel-running cystic ducts, all of which posed a risk for inadvertent bile duct injury during laparoscopic cholecystectomy. The study emphasized the importance of preoperative imaging, such as MRCP, to identify such variations and guide intraoperative decision-making. Additionally, Plaza & Moreno highlighted how failure to recognize these anomalies can lead to bile leaks, strictures, and the need for complex biliary reconstructions. Their findings reinforce the need for meticulous dissection, use of the Critical View of Safety (CVS), and consideration of intraoperative cholangiography in cases with suspected biliary anomalies. [32]

Singh et al. (2019): In a study conducted at Teerthankar Mahaveer Medical College and Research Centre, Singh and colleagues investigated the prevalence of cystic artery variations in 600 patients undergoing elective laparoscopic cholecystectomy between October 2015 and October 2018. They found that in 85.67% of cases, the cystic artery was located within the boundaries of the triangle of Calot. However, in 13.33% of patients, the cystic artery was situated outside this anatomical landmark, and a compound type was observed in 1% of cases. The study emphasized that recognizing these variations is vital to prevent accidental haemorrhage during surgery. The authors also noted that the classification proposed by You-Ming et al. was particularly useful in identifying these variations. [33]

Merh et al. (2018) highlighted how variations in the cystic duct's insertion point and structure can pose surgical challenges, increasing the risk of bile duct injury during procedures like cholecystectomy. [34]

Talpur et al. (2010) evaluated the prevalence of structural changes in the extrahepatic biliary system among 300 patients having laparoscopic cholecystectomy at Liaquat University of Medical & Health Sciences, Jamshoro. The investigation identified anatomical changes in 20.33% of individuals, with 10.67% displaying cystic artery anomalies, 4.33% exhibiting cystic duct anomalies, and 2.67% showing right hepatic artery anomalies. The research highlighted those congenital defects and normal variations, albeit rare, are crucial in laparoscopic surgery, since their misidentification may result in iatrogenic injuries, heightened morbidity, and even fatality. (35)

You-Ming Ding et al. (2007) studied 600 patients undergoing laparoscopic cholecystectomy and classified cystic artery variations into three types: Calot's Triangle Type (85.5%), Outside Calot's Triangle Type (13%), and Compound Type (1.5%). They emphasized that unrecognized variations increase the risk of bleeding and bile duct injury. The study highlighted the importance of careful dissection and preoperative awareness to avoid complications. Their classification system serves as a valuable surgical guide for ensuring safer cholecystectomy procedures. Recognizing these anomalies can enhance intraoperative decision-making, reduce complications, and improve patient outcomes in biliary surgery. (36)

MATERIALS AND METHOD

1. **Source of Data:**

   Data was sourced from patients with cholelithiasis undergoing Laparoscopic Cholecystectomy admitted in general surgery wards at KAHER'S KLE's Dr. Prabhakar Kore Hospital and MRC, Nehru Nagar and KLE's Dr. Prabhakar Kore Charitable Hospital and MRC**.**

2. **Study Design:**

   The study design was a Prospective Observational Study.

3. **Study Period:**

   The study was conducted over a duration of one year, which spanned from 1st September 2023 to 31st August 2024.

4. **Sample Size:**

   A total sample size of 138 was used.

   The sample size was calculated using the formula.

   n=(p%)2×p(Z1−α/2)2×q

   Where, Z1 - α/2 = 1.96 P= 41

   q= 100-p= 100-41=59

   Hence, n= [(1.96)2x 59] ÷ [(0.2)2 x 41]

   n= 138 (approx.)

   Sample size was calculated at a 95% confidence interval.

Where p is the proportion, calculated according to reference Talpur et al[35],

Z1 is the z score linked with the confidence level and α is the significance level (type 1 error rate), $Z1 - \alpha/2 = 1.96$

By applying the formula, the calculated sample size was 138 patients.

5. Study Participants:

- **Inclusion Criteria**

  - All adult patients diagnosed with cholelithiasis undergoing elective laparoscopic cholecystectomy were included.
  - Patient age group of 18 to 65 years were included.

- **Exclusion Criteria:**

  - Patients with acute cholecystitis, empyema gallbladder, pancreatitis, obstructive jaundice, or gallbladder carcinoma, as these conditions obscure the biliary anatomy were excluded.
  - Cases where laparoscopic cholecystectomy was converted to open surgery were excluded.
  - Pregnant or lactating females were not included in the study.
  - Children under 18 years were excluded.

6. Data Collection:

- **Preoperative Assessment**

Before surgery, all patient underwent a thorough clinical evaluation and basic investigation to support the diagnosis of cholelithiasis. The primary mode of diagnosis was abdominal ultrasonography (USG), which provided a detailed image of the gallbladder and biliary tract. Standard laboratory tests-a complete blood count (CBC), liver function tests (LFT), were conducted in order to rule in or out patient fitness for general anaesthesia and surgical operation.

- **Intraoperative Assessment**

During laparoscopic cholecystectomy, comprehensive recording of the extrahepatic biliary architecture was carried out to detect and assess anatomical variations and congenital anomalies. The study mainly focused on changes in the gallbladder, cystic duct, cystic artery, hepatic arteries.

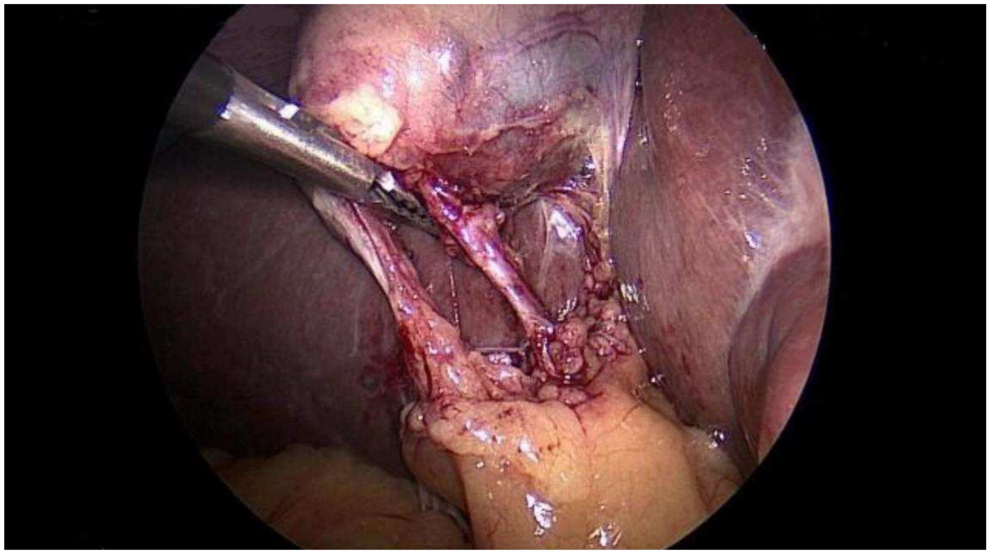


Image 12: The critical view of safety

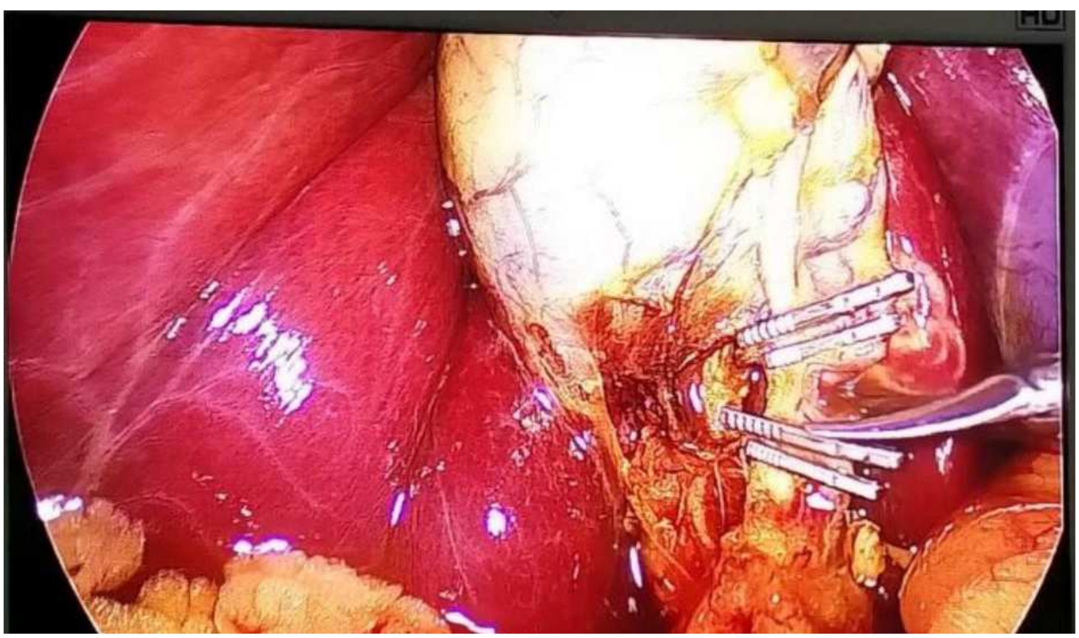


Image 13: Cystic duct transected in between clips

- **Postoperative Assessment**

After surgery, the patient was observed closely for early and late postoperative complications to understand how their anatomical variations affected surgical outcomes. One of the critical parameters that were recorded was bile leakage incidence due to the accessory bile ducts not seen during surgery or inadvertent injury to the duct during surgery. Surgical site infections (SSI) were additionally recorded as port site sepsis and complications accompanying laparoscopic port insertion as potential postoperative risks. The duration of the postoperative stay was recorded to provide a trend for postoperative recovery among the patients. Postoperative shoulder pain, bleeding from drain were also documented.

Image 14: Post laparoscopic cholecystectomy with drain

7. Ethical Considerations:

The research received ethical clearance from JNMC Institutional Ethical Committee in order to conduct the study. Informed consent was obtained from the patients in either English or local language to ensure understanding and contribution.

8. Statistical Analysis:

The study is done in KLE's Dr. Prabhakar Kore Hospital and MRC, Nehru Nagar and the findings were tabulated as below.

Data analysis was conducted using IBM SPSS Statistics (Version 26). Categorical data was denoted as percentage. The expression of continuous data was in the form of mean+/- standard deviation or SD. A comparison of categorical results was carried out using Chi-square test and of continuous results by dependent t-test and independent t-test.

A probability value (p-value) of less than or equal to 0.05 was considered as statistically significant.

RESULTS

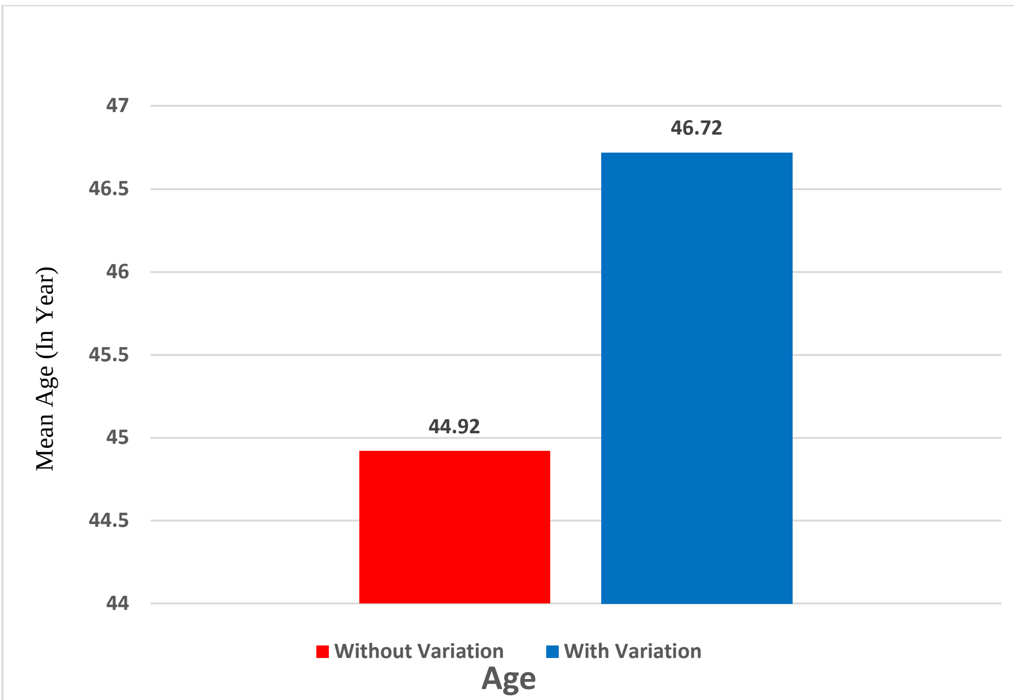
This study was conducted in the Department of General Surgery at KLES Dr. Prabhakar Kore Hospital, Jawaharlal Nehru Medical College, KAHER, Belagavi. It was conducted over a duration of one year, which spanned from 1st September 2023 to 31st August 2024 and followed a prospective observational study. A total of 138 participants who presented with abdominal pain and diagnosed to have cholelithiasis on ultrasonography and underwent laparoscopic cholecystectomy were enrolled in the study with proper consent. Data collected was entered in Microsoft Excel Spreadsheet. The study documented and analysed all intraoperative anatomical variations and congenital anomalies of the biliary tree encountered during laparoscopic cholecystectomy and systematically records intraoperative findings and their implications in surgical outcomes.

1. **Age**

Table 1: Age Distribution

AGE (in years)	Nil Variation (n=106)	With Variation (n=32)	p-Value
Mean Age ± SD	44.92 ± 12.54	46.72 ± 11.55	0.472
Min Age	21	21	
Max Age	65	65	

Graph 1: Mean Age Distribution



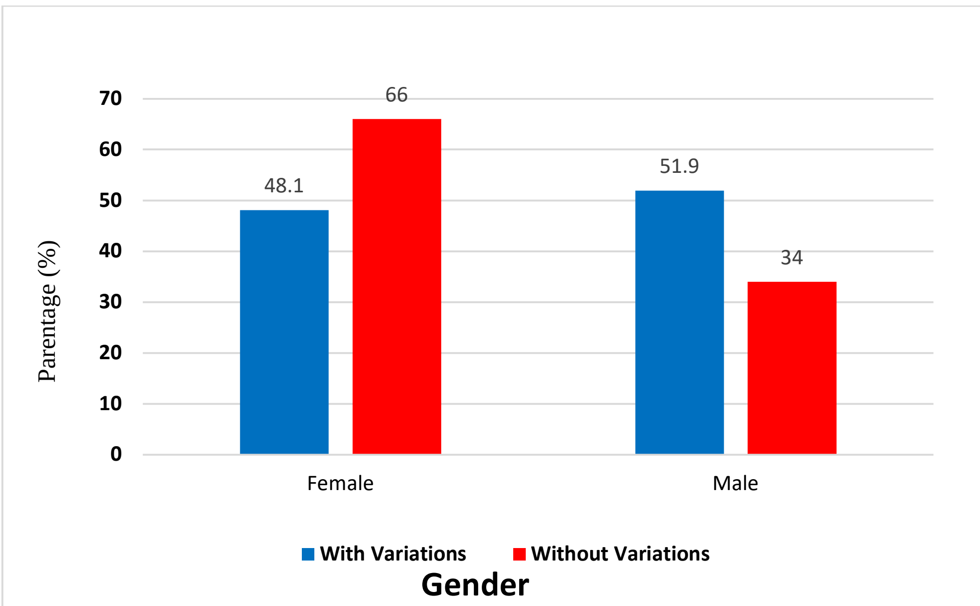
- In the above table 1, Mean age of patients with variations was 46.72 years with standard deviation of 11.5 years.
- Mean age of patients without variations 44.92 years with a standard deviation of 12.54 years.
- It was not statistically significant, p = 0.472.

2. Gender:

Table 2: Gender Distribution

GENDER	With Variations		Without Variations		Total	
	(n)	(%)	(n)	(%)	(n)	(%)
Female	17	48.1	70	66	87	63.04
Male	15	51.9	36	34	51	36.96
Total	32	100	106	100	138	100

Graph 2: Gender Distribution



- In the above table 2, out of 138 patients 87 (63.04%) were female and 51 were male patients (36.96%).
- 17 patients out of 32 patients with anatomical variations and congenital anomalies were females (48.1%).
- 15 out of 32 patients with anatomical variations and congenital anomalies were females (51.9%%).
- 70 patients out of 106 patients without any anatomical variations and congenital anomalies were females (66%).
- 36 patients out of 106 patients without any anatomical variations and congenital anomalies were females (34%).

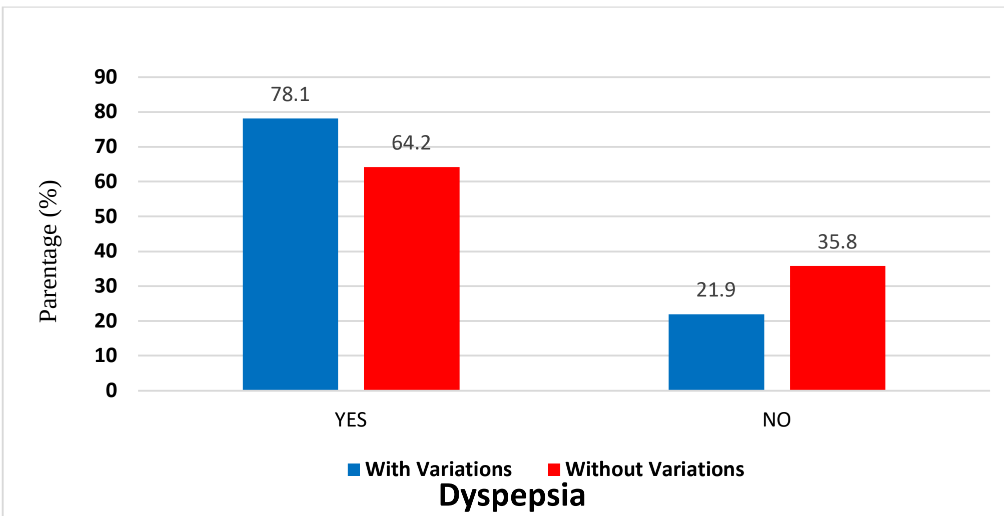
3. Clinical Features:

A) Dyspepsia:

Table 3: Dyspepsia Distribution

Dyspepsia	With Variations		Without Variations		p-value
	(n)	(%)	(n)	(%)	
YES	25	78.1	68	64.2	0.2067
NO	7	21.9	38	35.8	
Total	32	100	106	100	

Graph 3: Dyspepsia Distribution



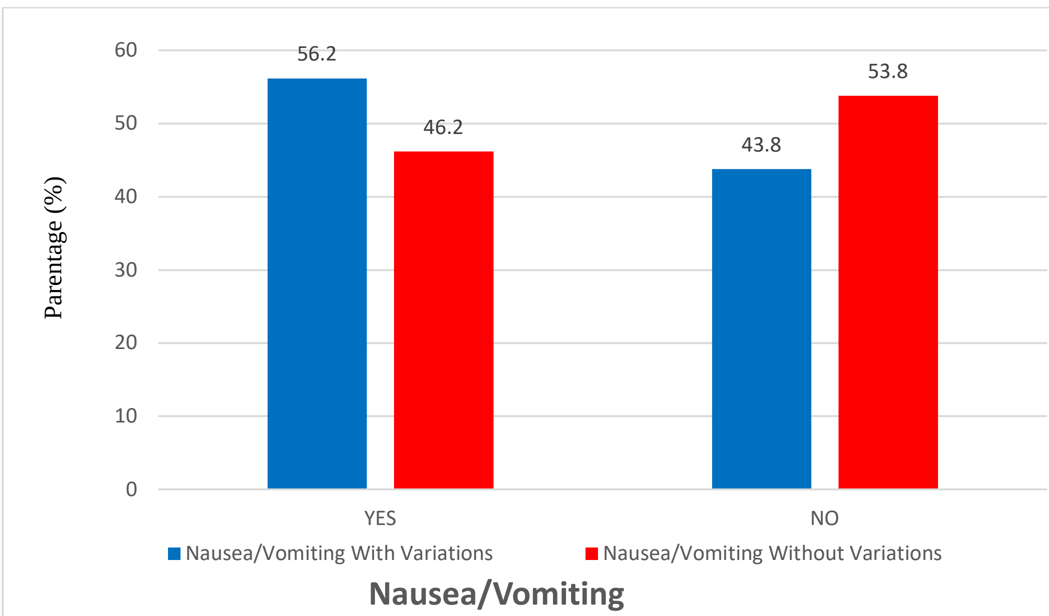
- In the above table 3, among the 138 patients, 93 (67.39%) presented with dyspepsia and 45 (32.61%) did not.
- Out of the 32 patients with anatomical variations and congenital anomalies, 25 (78.1%) had dyspepsia, while 7 (21.9%) did not.
- Among the 106 patients without any anatomical variations, 68 (64.2%) had dyspepsia and 38 (35.8%) did not.
- The association between dyspepsia and anatomical variations was not statistically significant ($p = 0.2067$).

B) Nausea/Vomiting:

Table 4: Nausea/Vomiting Distribution

Nausea/Vomiting	With Variations		Without Variations		p-value
	(n)	(%)	(n)	(%)	
YES	18	56.2	49	46.2	0.4281
NO	14	43.8	57	53.8	
Total	32	100	106	100	

Graph 4: Nausea/Vomiting Distribution



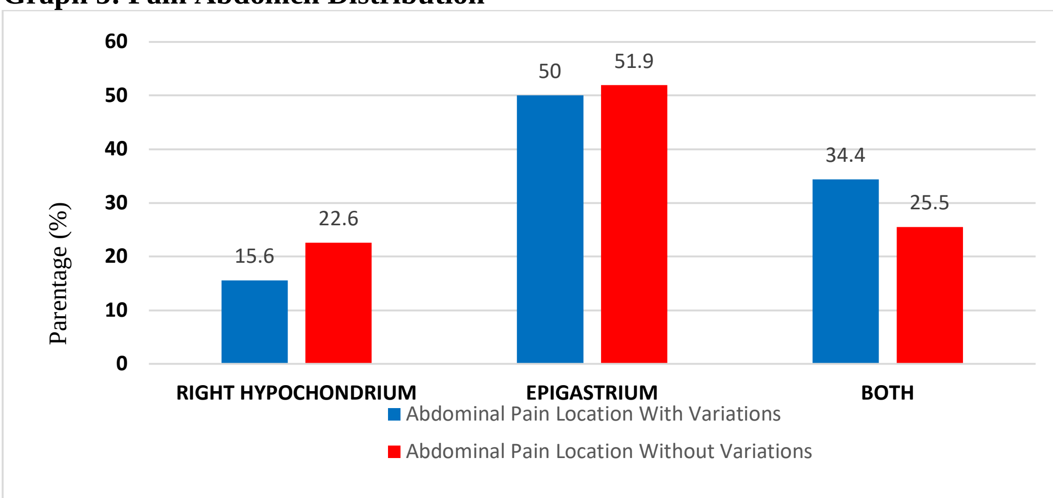
- In the above table 4, out of the total 138 patients, 67 (48.55%) presented with nausea and/or vomiting, while 71 (51.45%) did not have the symptoms.
- Among the 32 patients with anatomical variations and congenital anomalies, 18 (56.2%) had complaints of nausea and/or vomiting, whereas 14 (43.8%) did not have the symptoms.
- Out of the 106 patients without anatomical variations, 49 (46.2%) reported nausea and/or vomiting, while 57 (53.8%) did not have the symptoms.
- The association between the presence of anatomical variations and nausea/vomiting was not statistically significant ($p = 0.4281$).

C) Pain Abdomen:

Table 5: Pain Abdomen Distribution

Abdominal Pain Location	With Variations		Without Variations		p-value
	(n)	(%)	(n)	(%)	
RIGHT HYPOCHONDRIUM	5	15.6	24	22.6	0.5443
EPIGASTRIUM	16	50.0	55	51.9	1.0000
BOTH	11	34.4	27	25.5	0.4458
Total	32	100	106	100	

Graph 5: Pain Abdomen Distribution



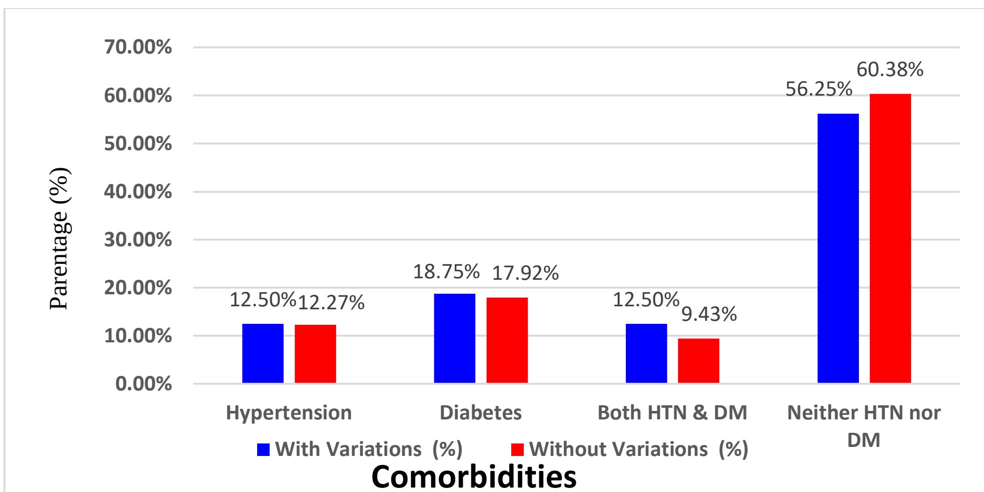
- In the above table 5, abdominal pain was localized to the epigastrium in most patients across both groups: 16 out of 32 patients (50.0%) with anatomical variations and 55 out of 106 patients (51.9%) without variations.
- Pain localized to the right hypochondrium was reported in 5 patients (15.6%) in the variations group and 24 patients (22.6%) in patients without variation.
- Pain involving both the epigastrium and right hypochondrium was seen in 11 patients (34.4%) with anatomical variations and 27 patients (25.5%) without variations.
- None of the abdominal pain location variables showed a statistically significant association with the presence of anatomical variations (p-values: 0.5443, 1.0000, and 0.4458 respectively).

4. Co-morbidities:

Table 6: Co-morbidities Distribution

Comorbidities	With Variations		Without Variations		p-value
	(n)	(%)	(n)	(%)	
Hypertension	4	12.5	13	12.27	0.8803
Diabetes	6	18.75	19	17.92	0.8380
Both HTN & DM	4	12.5	10	9.43	0.8655
Neither HTN nor DM	18	56.25	64	60.38	0.8326
Total	32	100	106	100	

Graph 6: Co-morbidities Distribution



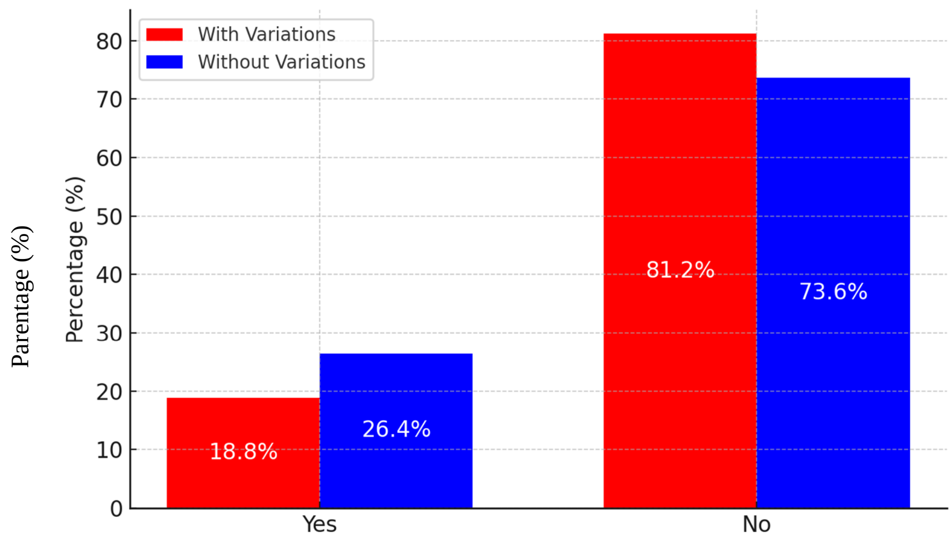
- In the above table 6, among the 32 patients with anatomical variations: 4 patients (12.5%) had hypertension, 6 patients (18.75%) had diabetes, 4 patients (12.5%) had both hypertension and diabetes, and 18 patients (56.25%) had neither condition.
- Among the 106 patients without anatomical variations: 13 patients (12.27%) had hypertension, 19 patients (17.92%) had diabetes, 10 patients (9.43%) had both hypertension and diabetes, and 64 patients (60.38%) had neither condition.
- There was no statistically significant association between the presence of comorbidities (hypertension, diabetes, or both) and the presence of anatomical variations (all p-values > 0.05).

5. Previous history of Abdominal Surgery:

Table 7: Previous history of Abdominal Surgery

Previous h/o abdominal Surgery	With Variations		Without Variations		p-value
	(n)	(%)	(n)	(%)	
YES	6	18.8	28	26.4	0.5171
NO	26	81.2	78	73.6	
Total	32	100	106	100	

Graph 7: Previous history of Abdominal Surgery



Previous Abdominal Surgery History Among Groups With and Without Variations

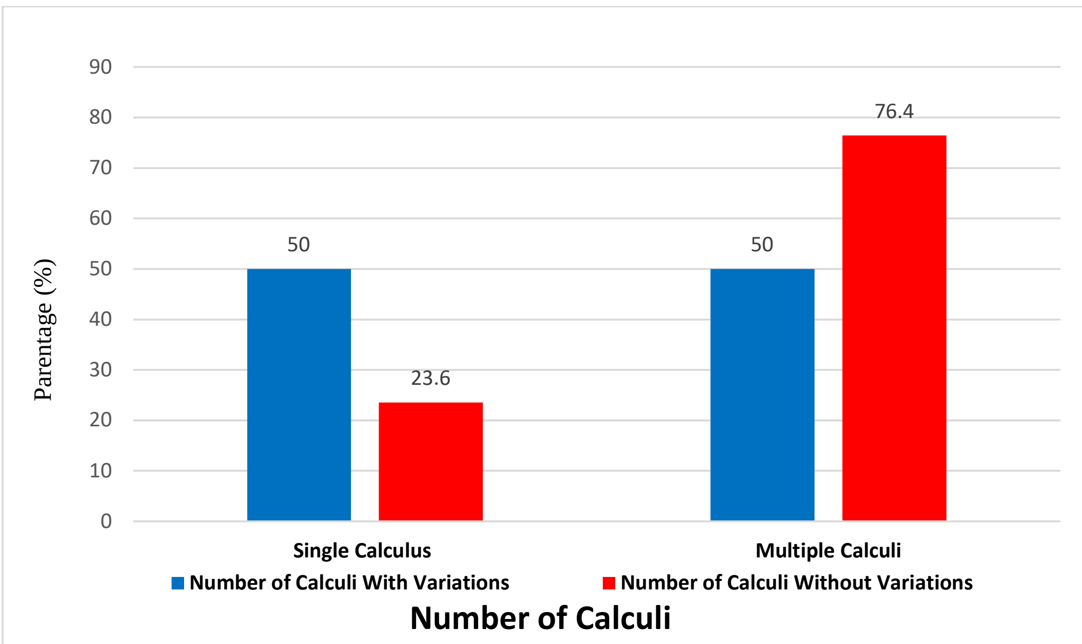
- In the above table 7, among the 32 patients with anatomical variations, 6 (18.8%) had a history of previous abdominal surgery, while 26 (81.2%) had no such history.
- Among the 106 patients without anatomical variations, 28 (26.4%) had a history of previous abdominal surgery, and 78 (73.6%) had none.
- The difference in previous abdominal surgical history between the two groups was not statistically significant (p = 0.5171).

6. USG Findings:

Table 8: Number of Calculi Distribution

Number of Calculi	With Variations		Without Variations	
	(n)	(%)	(n)	(%)
Single Calculus	16	50.0	25	23.6
Multiple Calculi	16	50.0	81	76.4
Total	32	100	106	100

Graph 8: Number of Calculi Distribution

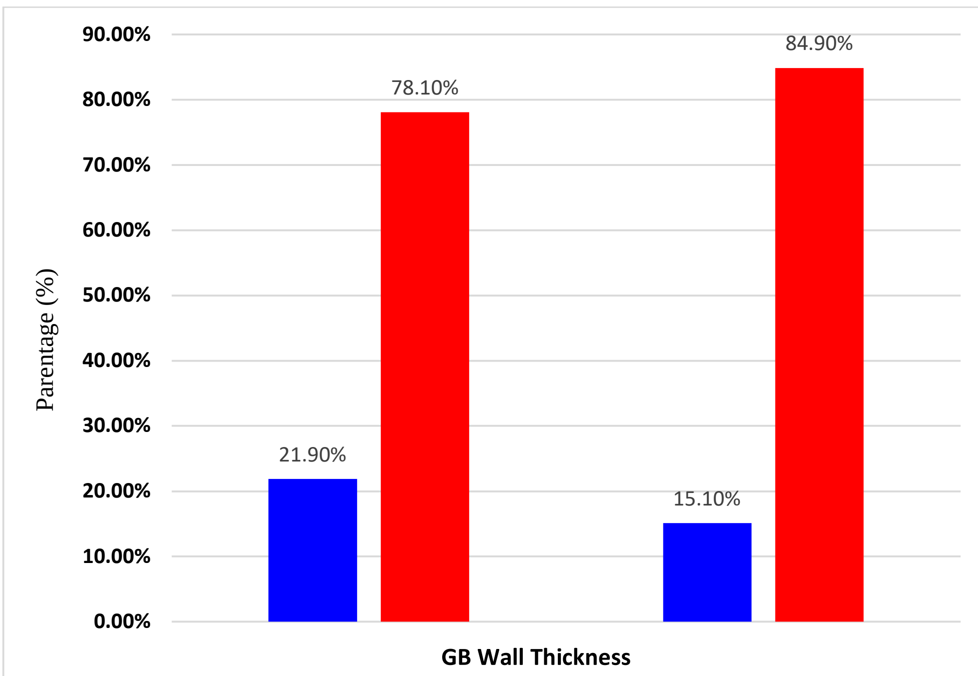


- In the above table 8, among the 32 patients with anatomical variations, 16 patients (50.0%) had a single calculus, and the remaining 16 (50.0%) had multiple calculi.
- Among the 106 patients without anatomical variations, 25 (23.6%) had a single calculus, while 81 (76.4%) had multiple calculi.

Table 9: GB Wall Thickness Distribution

GB Wall Thickness (in mm)	With Variations		Without Variations	
	(n)	(%)	(n)	(%)
>3mm	7	21.9	16	15.1
<3mm	25	78.1	90	84.9
Total	32	100	106	100

Graph 9: GB Wall Thickness Distribution



- In the above table 9, among the 32 patients with anatomical variations, 7 patients (21.9%) had a gallbladder wall thickness >3 mm, while 25 patients (78.1%) had a thickness <3 mm.
- Among the 106 patients without anatomical variations, 16 patients (15.1%) had a GB wall thickness >3 mm, and 90 patients (84.9%) had a GB wall thickness <3 mm.

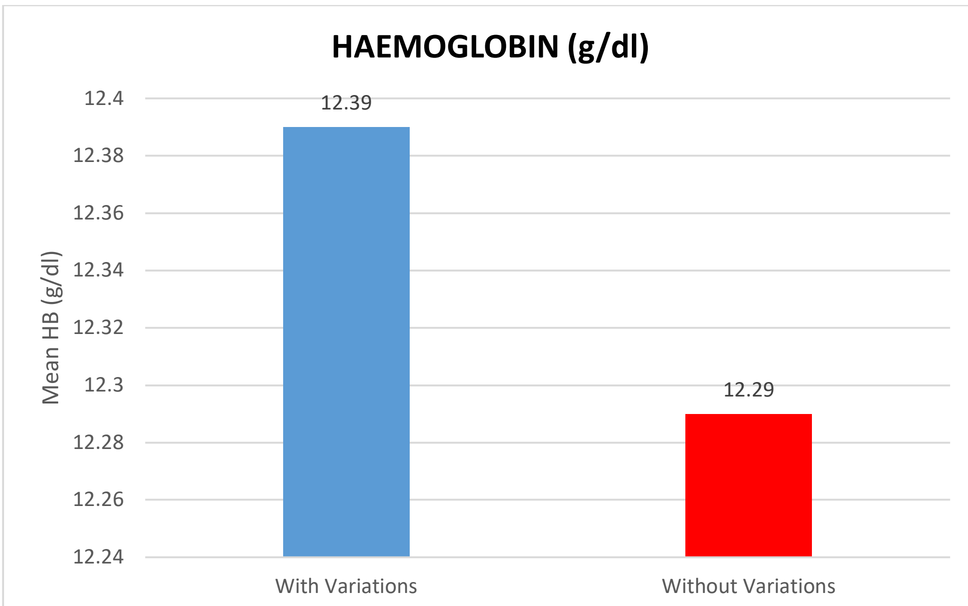
7. Laboratory Investigations:

A) Hemoglobin (g/dl):

Table 10: Hb comparison between with and without variations.

Group	Mean HB (g/dl)	SD HB	Count
With Variations	12.39	1.34	32
Without Variations	12.29	1.58	106

Graph 10: Hb comparison between with and without variations.



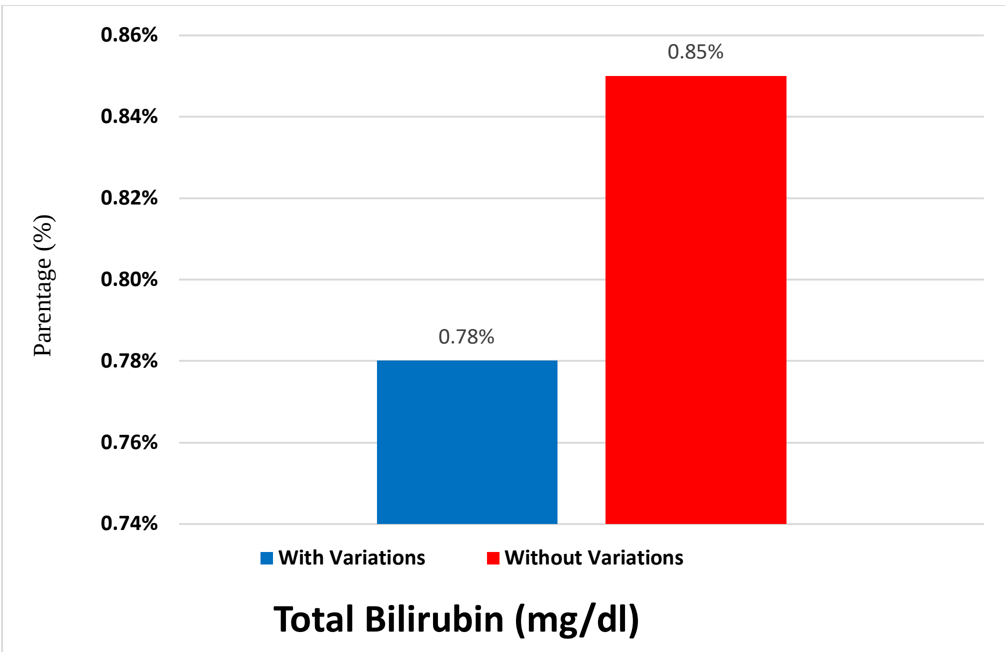
- In the above table 10, the mean haemoglobin (Hb) level among the 32 patients with anatomical variations was 12.39 g/dL with a standard deviation (SD) of 1.34.
- Among the 106 patients without anatomical variations, the mean haemoglobin was 12.29 g/dL with an SD of 1.58.
- Although the mean Hb was slightly higher in the group with anatomical variations, the difference was minimal and not clinically significant.

B) Total Bilirubin (mg/dl):

Table 11: Total bilirubin comparison between with and without variations.

Group	Mean Total Bilirubin (mg/dl)	SD	Count
With Variations	0.78	0.50	32
Without Variations	0.85	0.62	106

Graph 11: Total bilirubin comparison between with and without variations.



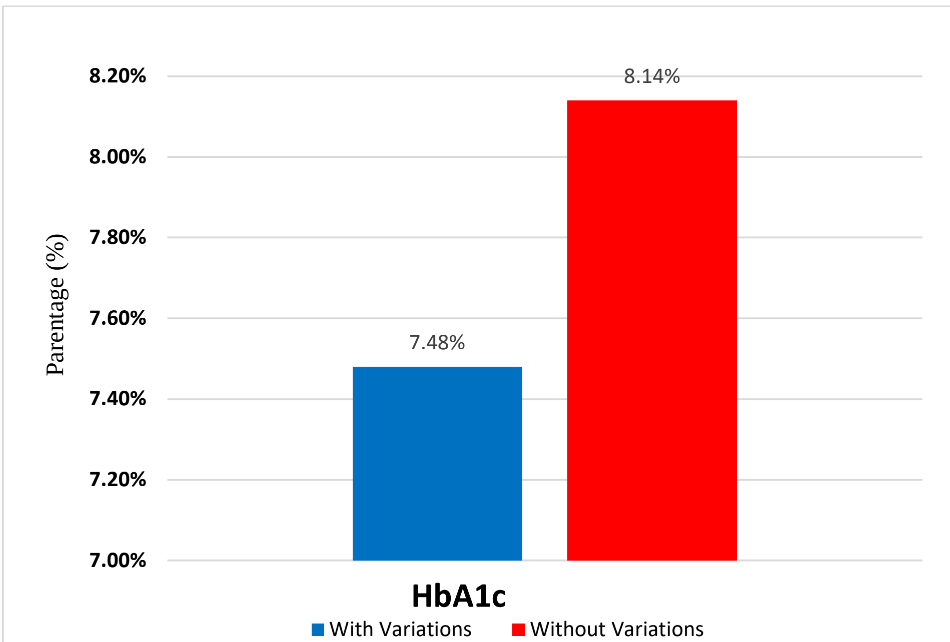
- In the above table 11, the mean total bilirubin level in patients with anatomical variations was 0.78 mg/dL with a standard deviation (SD) of 0.50.
- In patients without anatomical variations, the mean total bilirubin was slightly higher at 0.85 mg/dL, with an SD of 0.62.
- Although there is a marginal difference in mean bilirubin levels between the two groups, it is not clinically significant.

C) HbA1c (%):

Table 12: HbA1c comparison between with and without variations.

Group	Mean HbA1c(%)	Standard Deviation	Count
With Variation	7.48	2.25	32
Without Variation	8.14	1.95	106

Graph 12: HbA1c comparison between with and without variations.



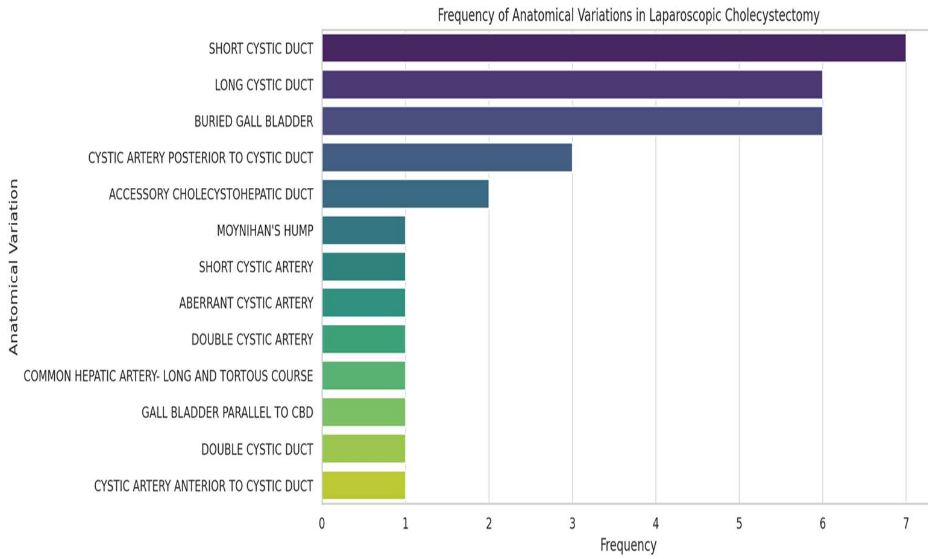
- In the above table 12, the mean HbA1c level among patients with anatomical variations was 7.48% with a standard deviation (SD) of 2.25.
- Among those without anatomical variations, the mean HbA1c was 8.14%, with an SD of 1.95.
- Although there is a marginal difference in mean HbA1c levels between the two groups, it is not clinically significant.

8. Intraoperative Variations and Congenital Anomalies:

Table 13: Frequency of Individual Anatomical Variations and Congenital Anomalies

Anatomical Variation	Frequency	Percentage (%)
Short Cystic Duct	7	5.1%
Long Cystic Duct	6	4.3%
Buried Gall Bladder	6	4.3%
Cystic Artery Posterior to Cystic Duct	3	2.2%
Accessory Cholecystohepatic Duct	2	1.4%
Moynihan's Hump	1	0.72%
Short Cystic Artery	1	0.72%
Aberrant Cystic Artery	1	0.72%
Double Cystic Artery	1	0.72%
Common Hepatic Artery – Long and Tortuous Course	1	0.72%
Gall Bladder Parallel to CBD	1	0.72%
Double Cystic Duct	1	0.72%
Cystic Artery Anterior to Cystic Duct	1	0.72%
No Variations	106	76.81%
Total	138	100

Graph 13: Frequency of anatomical variations and anomalies in Extrahepatic biliary tree



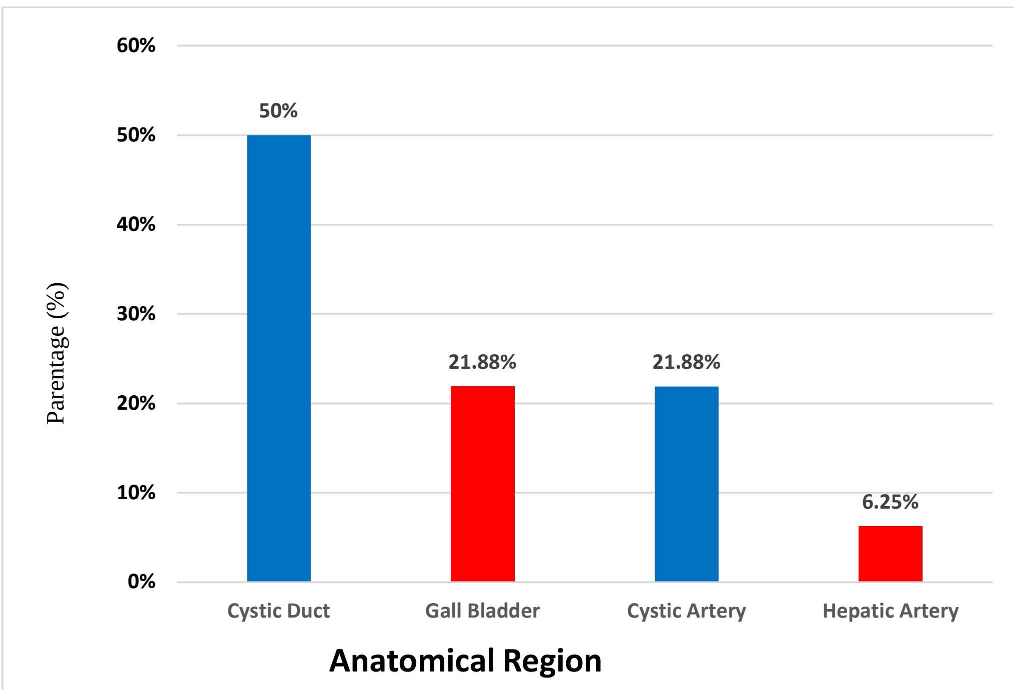
This study analyzed the frequency of anatomical variations encountered during laparoscopic cholecystectomy in 138 patients.

- 106 cases (76.81%) had no significant anatomical variation in the biliary tract.
- Short cystic duct (7 cases, 5.1%) was the most observed variation.
- Long cystic duct (6 cases, 4.3%) and Buried gall bladder (6 cases, 4.3%)
- Other less common variations included:
- Cystic artery posterior to cystic duct (3 cases, 2.2%)
- Accessory cholecystohepatic duct (2 cases, 1.4%)
- Moynihan's Hump (1 case, 0.7%)
- Double cystic duct (1 case, 0.7%)
- Aberrant cystic artery (1 case, 0.7%)
- Cystic artery anterior to cystic duct (1 case, 0.7%)

Table 14: Frequency of Variations and anomalies by Anatomical Region

Anatomical Region	Frequency	Percentage (%)
Cystic Duct	16	50
Gall Bladder	7	21.875
Cystic Artery	7	21.875
Hepatic Artery	2	6.25
Total	32	100

Graph 14: Frequency of Variations and anomalies by Anatomical Region



These variations were then grouped into four anatomical regions which were as followed:

- **Gall Bladder:** It included buried gall bladder and gall bladder parallel to CBD.
- **Cystic Duct:** It included short cystic duct, long cystic duct, accessory cholecystohepatic duct, double cystic duct.
- **Cystic Artery:** It included short cystic artery, double cystic artery, aberrant cystic artery, cystic artery posterior to cystic duct, cystic artery anterior to cystic duct.
- **Hepatic Artery:** It included Moynihan’s Hump, long and tortuous course of common hepatic artery.

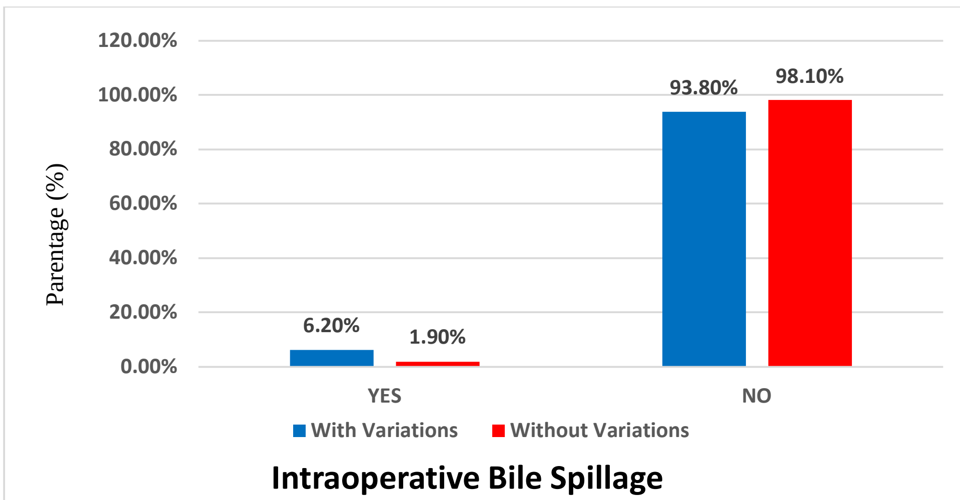
9. Intraoperative Complications:

A) Intraoperative Bile Spillage:

Table 15: Intraoperative Bile Spillage

Intraoperative Bile Spillage	With Variations		Without Variations		Total	p-value
	(n)	(%)	(n)	(%)		
YES	2	6.2	2	1.9	4	0.4913
NO	30	93.8	104	98.1	134	
Total	32	100	106	100	138	

Graph 15: Intraoperative Bile Spillage

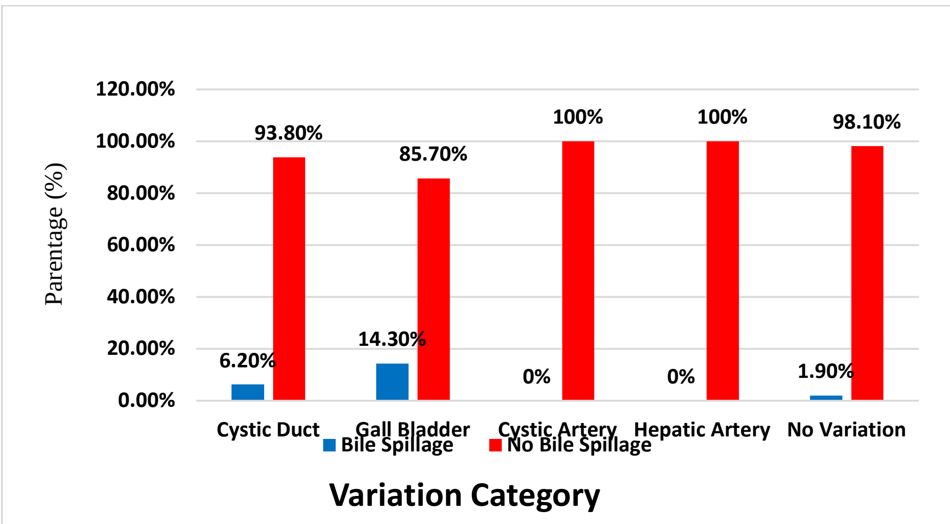


- Bile spill was noted mostly from the fundus of gall bladder while retraction. It was managed by giving warm saline peritoneal lavage.
- In the above table 15, intraoperative bile spillage occurred in 2 out of 32 patients (6.2%) with anatomical variations, while it was observed in 2 out of 106 patients (1.9%) without variations.
- Most patients in both groups did not experience bile spillage, with 30 patients (93.8%) in the variations group and 104 patients (98.1%) in the non-variation group.
- The difference in bile spillage rates between the two groups was not statistically significant (p = 0.4913).

Table 16: Intraoperative Bile Spillage Distribution by Anatomical Variations

Variation Category	Bile Spillage		No Bile Spillage		Total	p-value
	(n)	(%)	(n)	(%)		
Cystic Duct	1	6.2	15	93.8	16	0.9542
Gall Bladder	1	14.3	6	85.7	7	0.4921
Cystic Artery	0	0	7	100	7	1
Hepatic Artery	0	0	2	100	2	1
No Variation	2	1.9	104	98.1	106	0.4913
Total	4		134		138	

Graph 16: Intraoperative Bile Spillage Distribution by Anatomical Variations



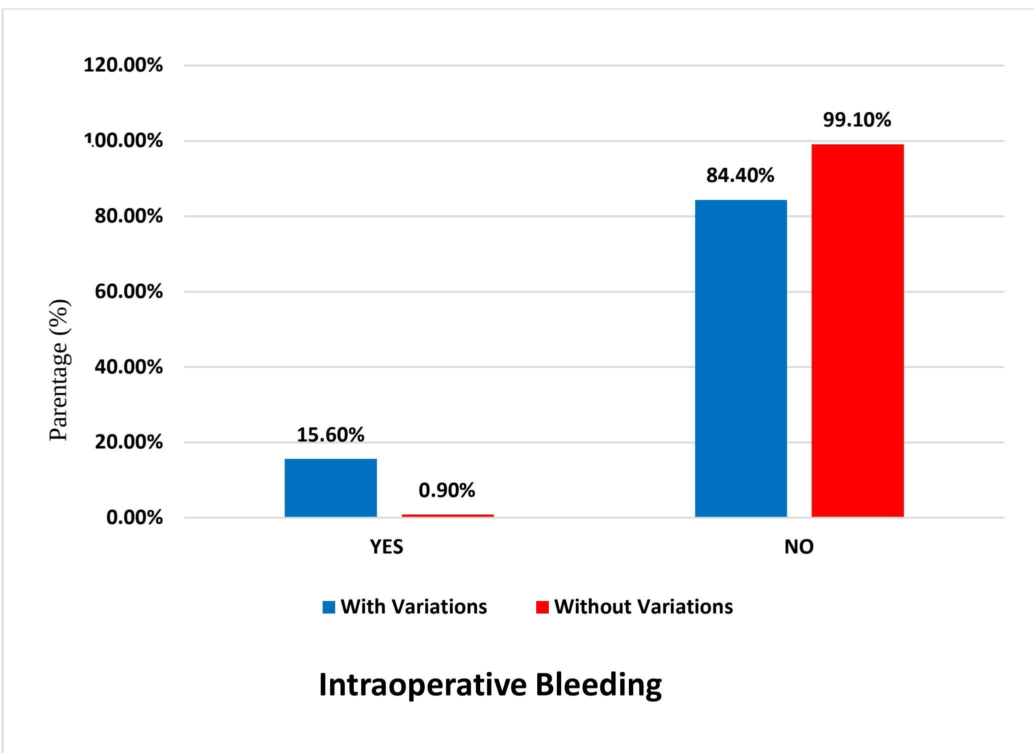
- In the above table 16, among patients with cystic duct variations (n = 16), 1 patient (6.2%) experienced bile spillage, while 15 patients (93.8%) had no spillage.
- Among patients with gall bladder variations (n = 7), 1 patient (14.3%) had bile spillage, and 6 patients (85.7%) had no spillage.
- Among patients with cystic artery variations (n = 7), none had bile spillage (0%), while 7 (100%) had no spillage.
- Among patients with hepatic artery variations (n = 2), no bile spillage was observed (0%).
- Among the 106 patients with no anatomical variation, bile spillage occurred in 2 patients (1.9%), and 104 (98.1%) had no spillage.
- None of the variation categories showed a statistically significant association with intraoperative bile spillage (p-values > 0.05 for all groups).

B) Intraoperative Bleeding:

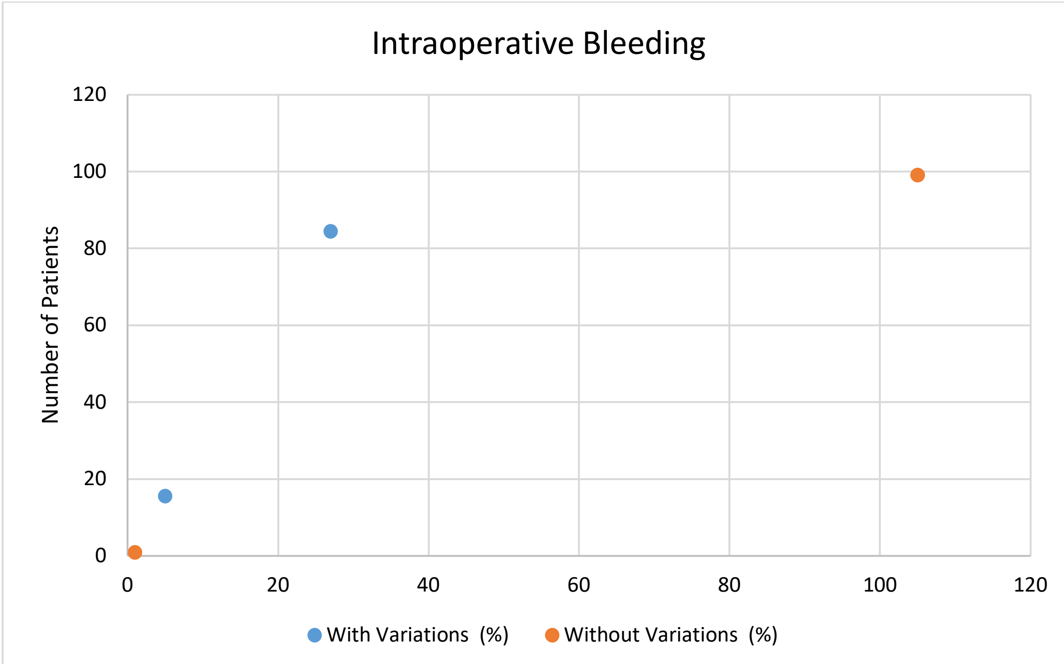
Table 17: Intraoperative Bleeding

Intraoperative Bleeding	With Variations		Without Variations		Total	p-value
	(n)	(%)	(n)	(%)		
YES	5	15.6	1	0.9	6	0.0021
NO	27	84.4	105	99.1	132	
Total	32	100	106	100	138	

Graph 17 a: Intraoperative Bleeding Distribution



Graph 17 b: Intraoperative Bleeding Distribution- Scatter Plot

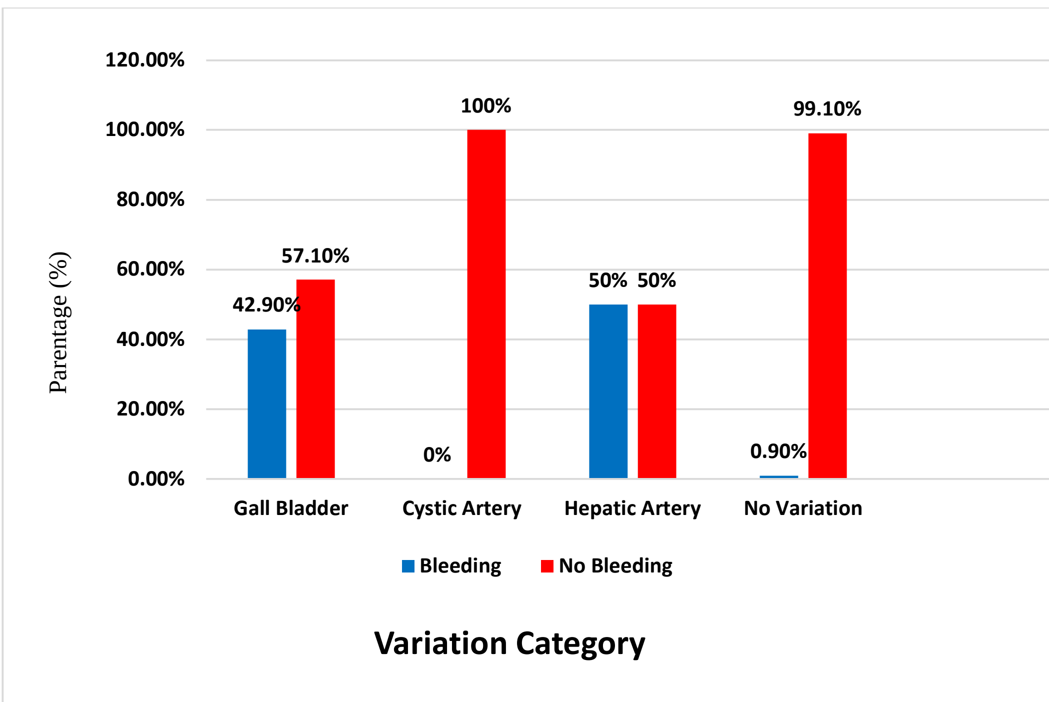


- Intraoperative bleeding occurred in a few cases while dissecting the calot's triangle and while separating the Gall bladder from the GB fossa. It was controlled by using electrocautery.
- In the above table 17, intraoperative bleeding occurred in 5 out of 32 patients (15.6%) with anatomical variations. In contrast, only 1 out of 106 patients (0.9%) without anatomical variations experienced intraoperative bleeding.
- Most patients in both groups did not experience bleeding, with 27 patients (84.4%) in the variations group and 105 patients (99.1%) in the non-variation group.
- The difference in bleeding incidence between the two groups was statistically significant (p = 0.0021), indicating a strong association between anatomical variations and increased risk of intraoperative bleeding.
- In above Graph 17b scatter plot, displays the number of patients experiencing intraoperative bleeding, categorized by those with and without variations. Patients with variations show a higher percentage compared to those without variations.

Table 18: Intraoperative Bleeding Distribution by Anatomical Variations

Variation Category	Bleeding		No Bleeding		Total	p-value
	(n)	(%)	(n)	(%)		
Cystic Duct	1	6.2	15	93.8	16	1.0000
Gall Bladder	3	42.9	4	57.1	7	0.0000
Cystic Artery	0	0.0	7	100.0	7	1.0000
Hepatic Artery	1	50.0	1	50.0	2	0.1491
No Variation	1	0.9	105	99.1	106	0.0021
Total	6		132		138	

Graph 18: Intraoperative Bleeding Distribution by Anatomical Variations



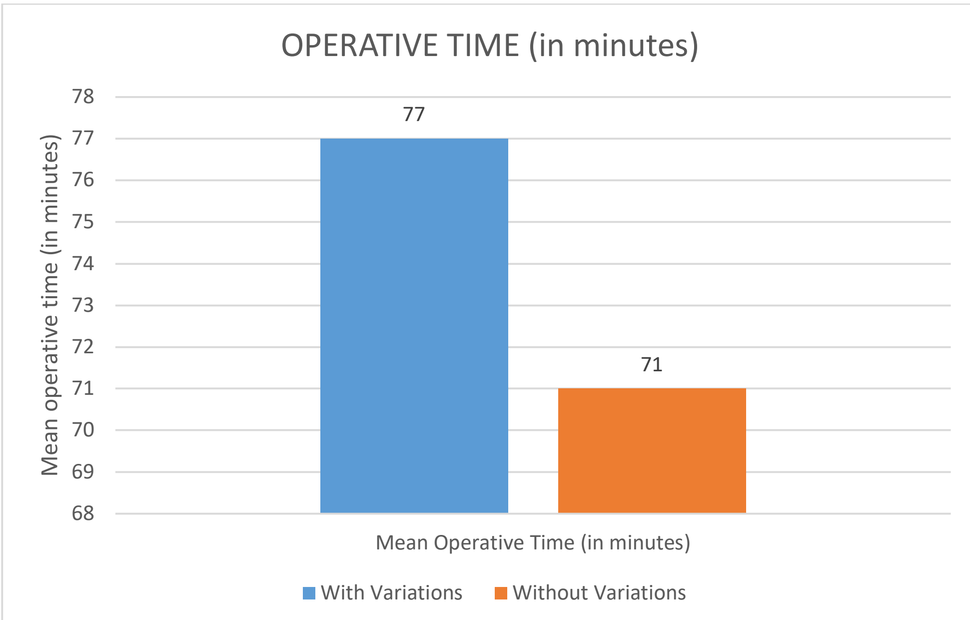
- In the above table 18, Cystic duct variations (n = 16): Bleeding occurred in 1 patient (6.2%), while 15 patients (93.8%) had no bleeding (p = 1.0000, not significant).
- Gall bladder variations (n = 7): Bleeding was observed in 3 patients (42.9%), while 4 patients (57.1%) had no bleeding. This association was statistically significant (p = 0.0000), indicating a strong link between gall bladder variations and intraoperative bleeding.
- Cystic artery variations (n = 7): No bleeding occurred in any patient (p = 1.0000, not significant).
- Hepatic artery variations (n = 2): Bleeding occurred in 1 patient (50.0%), while 1 patient (50.0%) had no bleeding (p = 0.1491, not statistically significant, possibly due to small sample size).
- No anatomical variation (n = 106): Bleeding occurred in 1 patient (0.9%), while 105 (99.1%) did not experience bleeding (p = 0.0021, statistically significant when compared with variations).

C) Operative Time:

Table 19: Operative time (in minutes)

Group	Mean Operative Time (in minutes)	SD	N	p-value
With Variations	77.0	20.0	32	0.1433
Without Variations	71.0	20.4	106	
Total			138	

Graph 19: Operative Time

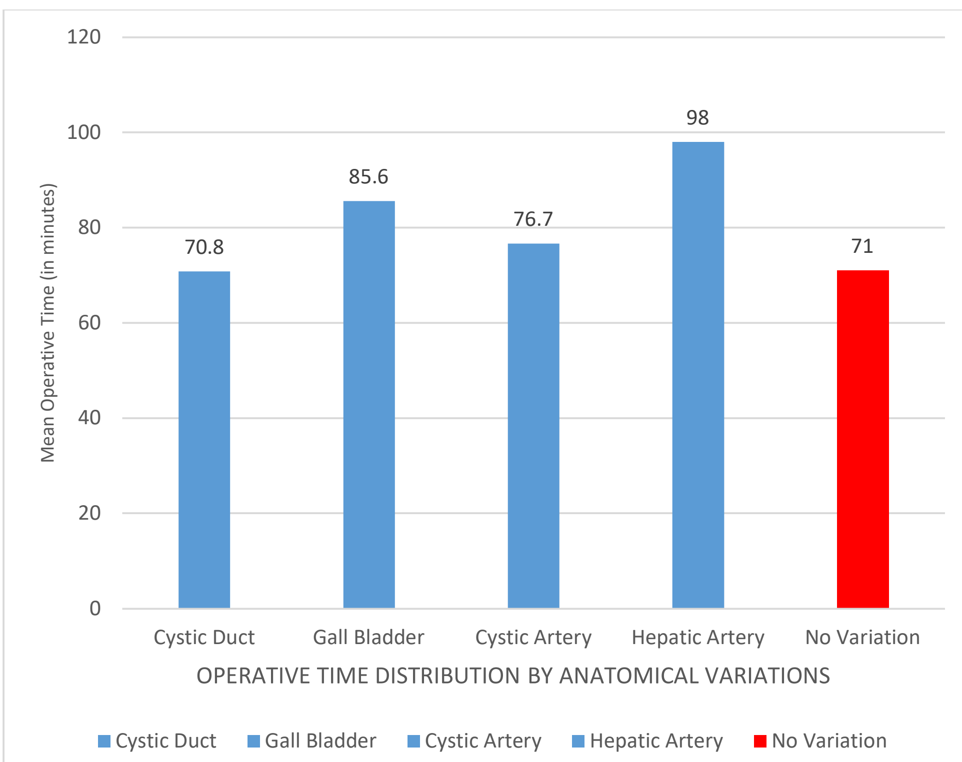


- In the above table 19, the mean operative time for patients with anatomical variations was 77.0 minutes, with a standard deviation (SD) of 20.0.
- For patients without anatomical variations, the mean operative time was 71.0 minutes, with an SD of 20.4.
- Although the operative time was slightly longer in the variation group, the difference was not statistically significant (p = 0.1433).
- This suggests that while anatomical variations may lead to a trend toward increased operative time, it was not significant enough to confirm a definite association in this study.

Table 20: Operative Time Distribution by Anatomical Variation

Variation Category	Mean Operative Time (in minutes)	SD	N	p-value
Cystic Duct	70.8	17.9	16	0.7140
Gall Bladder	85.6	20.5	7	0.1264
Cystic Artery	76.7	18.7	7	0.5546
Hepatic Artery	98.0	31.1	2	0.4466
No Variation	71.0	20.4	106	0.1433
Total			138	

Graph 20: Operative Time Distribution by Anatomical Variations



- In the above table 20, Cystic duct variations (n = 16): Mean operative time was 70.8 minutes (SD = 17.9), which is comparable to the no variation group and not statistically significant (p = 0.7140).
- Gall bladder variations (n = 7): Had the longest average operative time of 85.6 minutes (SD = 20.5), suggesting increased surgical complexity, but the difference was not statistically significant (p = 0.1264).
- Cystic artery variations (n = 7): Mean operative time was 76.7 minutes (SD = 18.7), also not statistically significant (p = 0.5546).
- Hepatic artery variations (n = 2): Showed the highest mean time of 98.0 minutes (SD = 31.1), but due to the small sample size, the difference was not statistically significant (p = 0.4466).
- Patients without anatomical variations (n = 106): Mean operative time was 71.0 minutes (SD = 20.4).
- Overall, although operative time tended to be higher in some variation subgroups—especially gall bladder and hepatic artery variations—none of the differences were statistically significant.

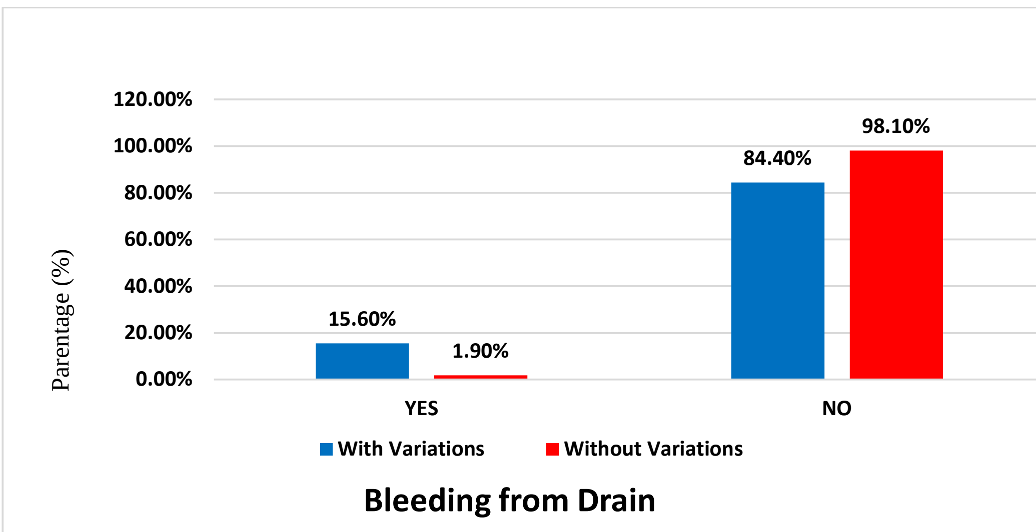
10. Post-Operative Complications:

A) Bleeding from Drain:

Table 21: Post Operative Complications- Bleeding from Drain

Bleeding from Drain	With Variations		Without Variations		Total	p-value
	(n)	(%)	(n)	(%)		
YES	5	15.6	2	1.9	7	0.0082
NO	27	84.4	104	98.1	131	
Total	32	100	106	100	138	

Graph 21: Postoperative Complications- Bleeding from Drain

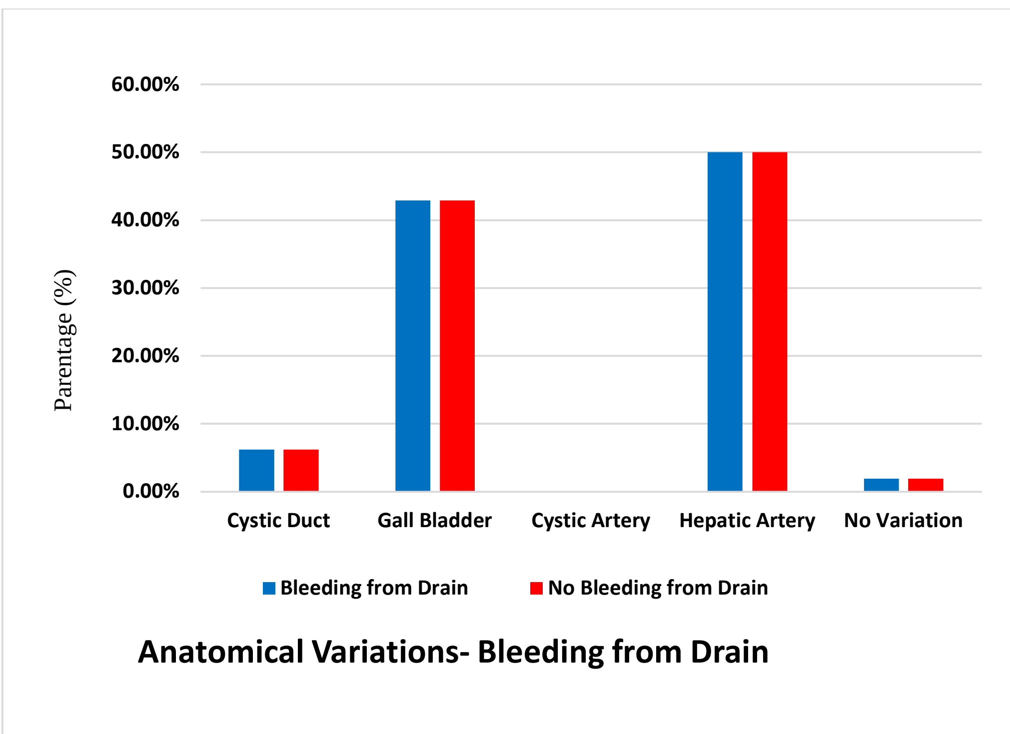


- Bleeding from drain was noted in a few patients in post operatively day 1 which reduced in post operatively day 2 by conservative management. None of these patients underwent re-exploration.
- In the above table 21, among the 32 patients with anatomical variations, 5 patients (15.6%) experienced bleeding from the drain postoperatively, while 27 patients (84.4%) did not.
- In the group without anatomical variations (n = 106), only 2 patients (1.9%) had bleeding from the drain, while 104 patients (98.1%) did not.
- The difference in the incidence of drain site bleeding between the two groups was statistically significant (p = 0.0082), indicating a strong association between anatomical variations and postoperative bleeding from the drain.

Table 22: Post-Op Complications Distribution by Anatomical Variations- Bleeding from Drain

Variation Category	Bleeding from Drain		No Bleeding from Drain		Total	p-value
	(n)	(%)	(n)	(%)		
Cystic Duct	1	6.2	15	93.8	16	1.0000
Gall Bladder	3	42.9	4	57.1	7	0.0001
Cystic Artery	0	0.0	7	100.0	7	1.0000
Hepatic Artery	1	50.0	1	50.0	2	0.1958
No Variation	2	1.9	104	98.1	106	0.0082
Total	7		131		138	

Graph 22: Post-Op Complications Distribution by Anatomical Variations- Bleeding from Drain



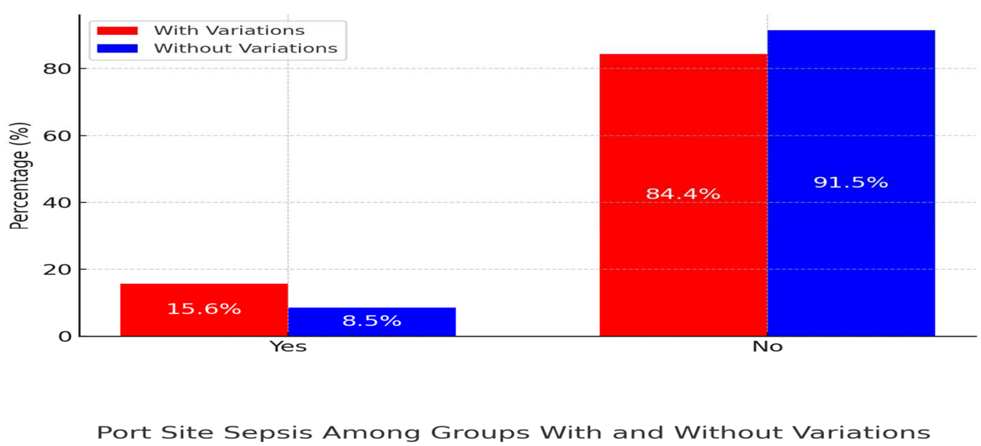
- In the above table 22, Cystic duct variations (n = 16): 1 patient (6.2%) had bleeding from the drain, while 15 patients (93.8%) had no complications.
- Gall bladder variations (n = 7): 3 patients (42.9%) experienced bleeding from the drain, and 4 patients (57.1%) had no complications. This difference was statistically significant (p = 0.0001), indicating a strong association with postoperative drain site bleeding.
- Cystic artery variations (n = 7): No patients (0%) had bleeding from the drain (p = 1.0000, not significant).
- Hepatic artery variations (n = 2): 1 patient (50.0%) had bleeding from the drain, while 1 patient (50.0%) did not (p = 0.1958, not statistically significant, likely due to small sample size).
- No anatomical variation (n = 106): Only 2 patients (1.9%) had bleeding from the drain, and 104 (98.1%) did not (p = 0.0082, statistically significant when compared with variation group).

B) Port Site Sepsis:

Table 23: Post Operative Complications- Port Site Sepsis

Port Site Sepsis	With Variations		Without Variations		Total	p-value
	(n)	(%)	(n)	(%)		
YES	5	15.6	9	8.5	14	0.4023
NO	27	84.4	97	91.5	124	
Total	32	100	106	100	138	

Graph 23: Postoperative Complications- Port Site Sepsis

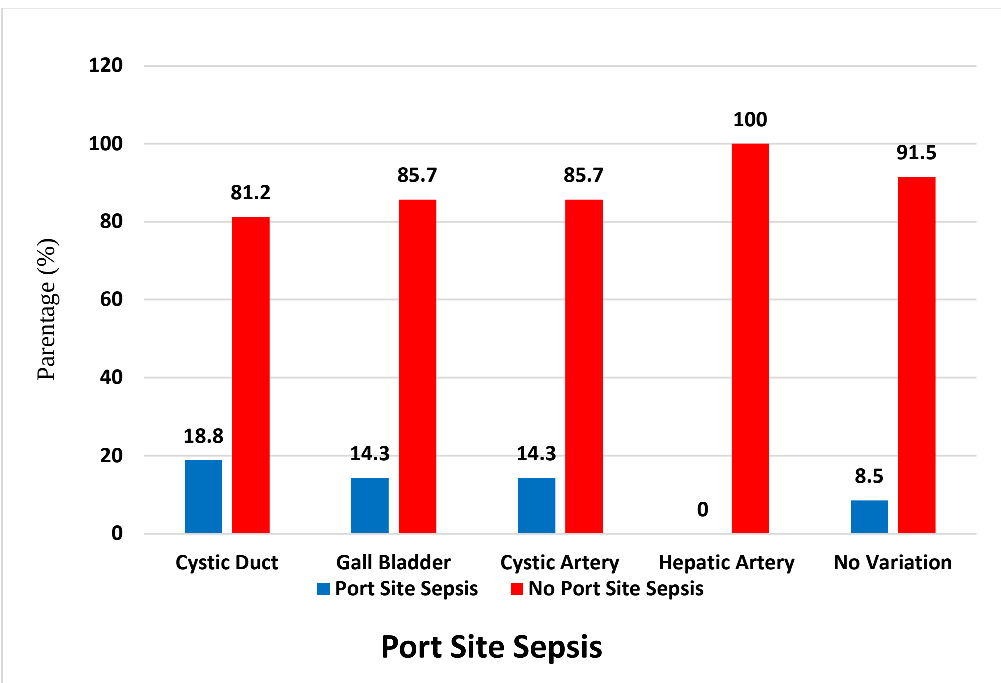


- In patients with Port site sepsis, Intravenous antibiotics were continued for a longer duration and daily dressings with antiseptics were done.
- In the above table 23, among the 32 patients with anatomical variations, 5 patients (15.6%) developed port site sepsis, while 27 patients (84.4%) had no complications.
- In the group without anatomical variations (n = 106), 9 patients (8.5%) experienced port site sepsis, whereas 97 patients (91.5%) had no complications.
- Although port site sepsis was more frequently observed in the variation group, the difference was not statistically significant (p = 0.4023).

Table 24: Post-Op Complications Distribution by Anatomical Variations- Port Site Sepsis

Variation Category	Port Site Sepsis		No Port Site Sepsis		Total	p-value
	(n)	(%)	(n)	(%)		
Cystic Duct	3	18.8	13	81.2	16	0.4400
Gall Bladder	1	14.3	6	85.7	7	1.0000
Cystic Artery	1	14.3	6	85.7	7	1.0000
Hepatic Artery	0	0.0	2	100.0	2	1.0000
No Variation	9	8.5	97	91.5	106	0.4023
Total	14		124		138	

Graph 24: Post-Op Complications Distribution by Anatomical Variations- Port Site Sepsis



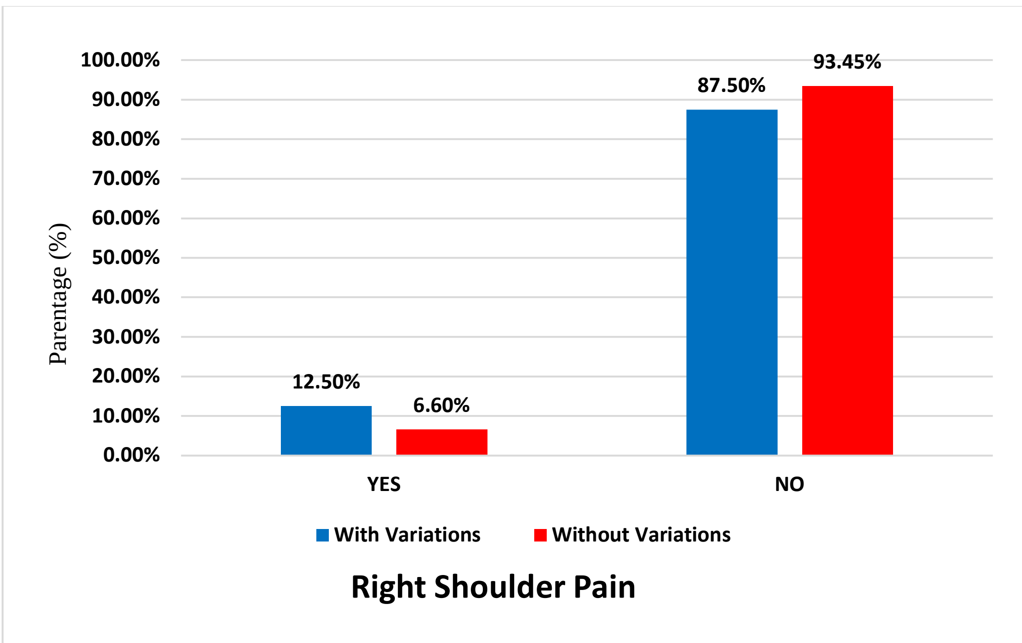
- In the above table 24, Cystic duct variations (n = 16): 3 patients (18.8%) developed port site sepsis, while 13 patients (81.2%) did not (p = 0.4400, not statistically significant).
- Gall bladder variations (n = 7): 1 patient (14.3%) had port site sepsis, and 6 patients (85.7%) did not (p = 1.0000, not significant).
- Cystic artery variations (n = 7): 1 patient (14.3%) had sepsis, and 6 patients (85.7%) did not (p = 1.0000, not significant).
- Hepatic artery variations (n = 2): No patients (0%) developed port site sepsis (p = 1.0000).
- No anatomical variation (n = 106): 9 patients (8.5%) had port site sepsis, and 97 (91.5%) did not (p = 0.4023).
- Overall, while the rate of port site sepsis appeared slightly higher in some variation groups, none of the associations were statistically significant.

C) Right Shoulder Pain:

Table 25: Post Operative Complications- Right Shoulder Pain

Right Shoulder Pain	With Variations		Without Variations		Total	p-value
	(n)	(%)	(n)	(%)		
YES	4	12.5	7	6.6	11	0.4796
NO	28	87.5	99	93.4	127	
Total	32	100	106	100	138	

Graph 25: Postoperative Complications- Right Shoulder Pain

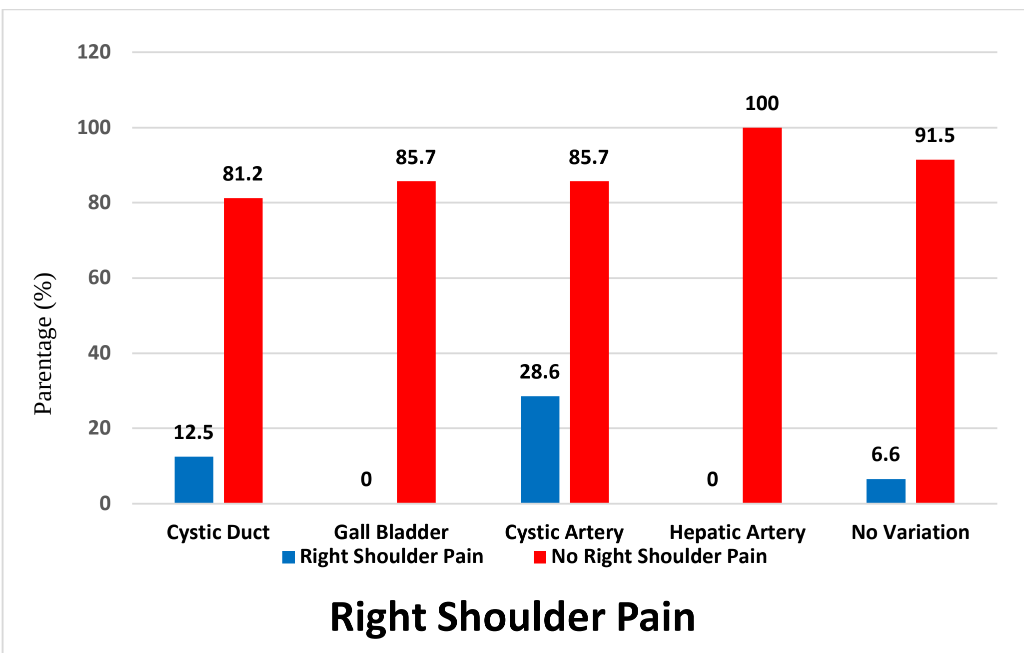


- In the above table 25, among the 32 patients with anatomical variations, 4 patients (12.5%) reported right shoulder pain postoperatively, while 28 patients (87.5%) did not.
- In the group without anatomical variations (n = 106), 7 patients (6.6%) experienced right shoulder pain, and 99 patients (93.4%) did not.
- Although right shoulder pain was reported more frequently in the variation group, the difference was not statistically significant (p = 0.4796).

Table 26: Post-Op Complications Distribution by Anatomical Variations- Right Shoulder Pain

Variation Category	Right Shoulder Pain		No Right Shoulder Pain		Total	p-value
	(n)	(%)	(n)	(%)		
Cystic Duct	2	12.5	14	87.5	16	0.8255
Gall Bladder	0	0.0	7	100.0	7	0.9338
Cystic Artery	2	28.6	5	71.4	7	0.1772
Hepatic Artery	0	0.0	2	100.0	2	1.0000
No Variation	7	6.6	99	93.4	106	0.4796
Total	11		127		138	

Graph 26: Post-Op Complications Distribution by Anatomical Variations- Right Shoulder Pain



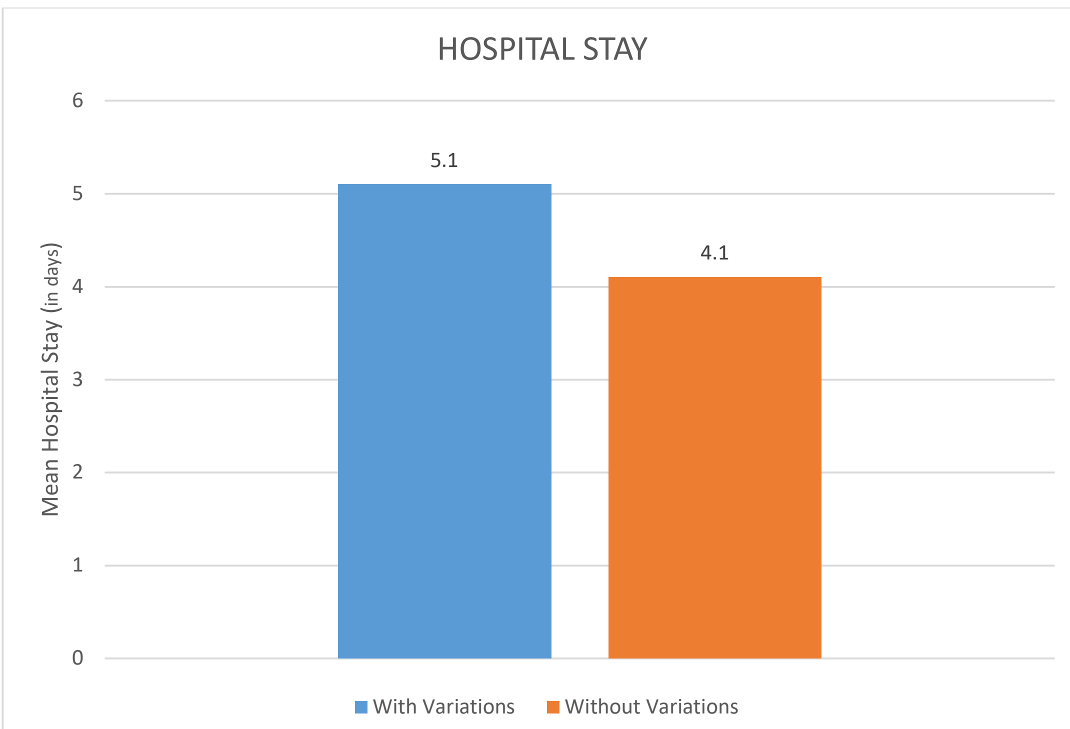
- In the above table 26, Cystic duct variations (n = 16): 2 patients (12.5%) reported right shoulder pain, while 14 patients (87.5%) did not (p = 0.8255, not statistically significant).
- Gall bladder variations (n = 7): No patients (0.0%) experienced shoulder pain; all 7 (100%) were symptom-free (p = 0.9338, not significant).
- Cystic artery variations (n = 7): 2 patients (28.6%) reported shoulder pain, and 5 patients (71.4%) did not. Though the rate was higher, the association was not statistically significant (p = 0.1772).
- Hepatic artery variations (n = 2): No patients (0.0%) experienced shoulder pain (p = 1.0000).
- No anatomical variation (n = 106): 7 patients (6.6%) had right shoulder pain, and 99 (93.4%) did not (p = 0.4796).
- Overall, while right shoulder pain appeared slightly more common in the cystic artery variation group, none of the variation categories showed statistically significant association with this symptom.

11. Hospital Stay:

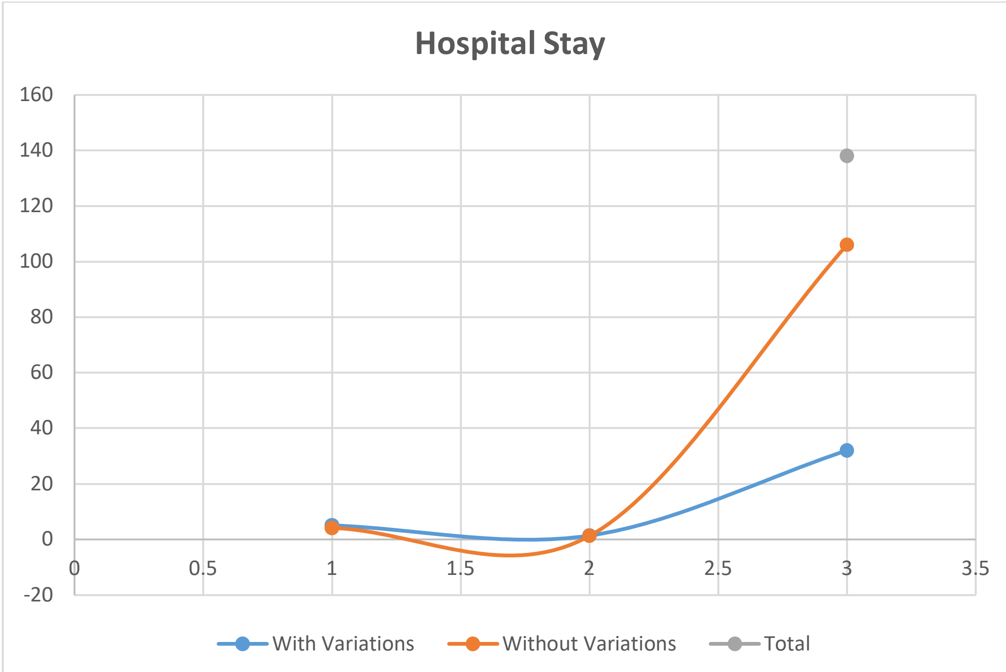
Table 27: Hospital Stay

Group	Mean Hospital Stay (in days)	SD	N	p-value
With Variations	5.1	1.4	32	0.0006
Without Variations	4.1	1.3	106	
Total			138	

Graph 27 a: Hospital Stay Distribution



Graph 27 b: Hospital Stay Distribution- Scatter Plot

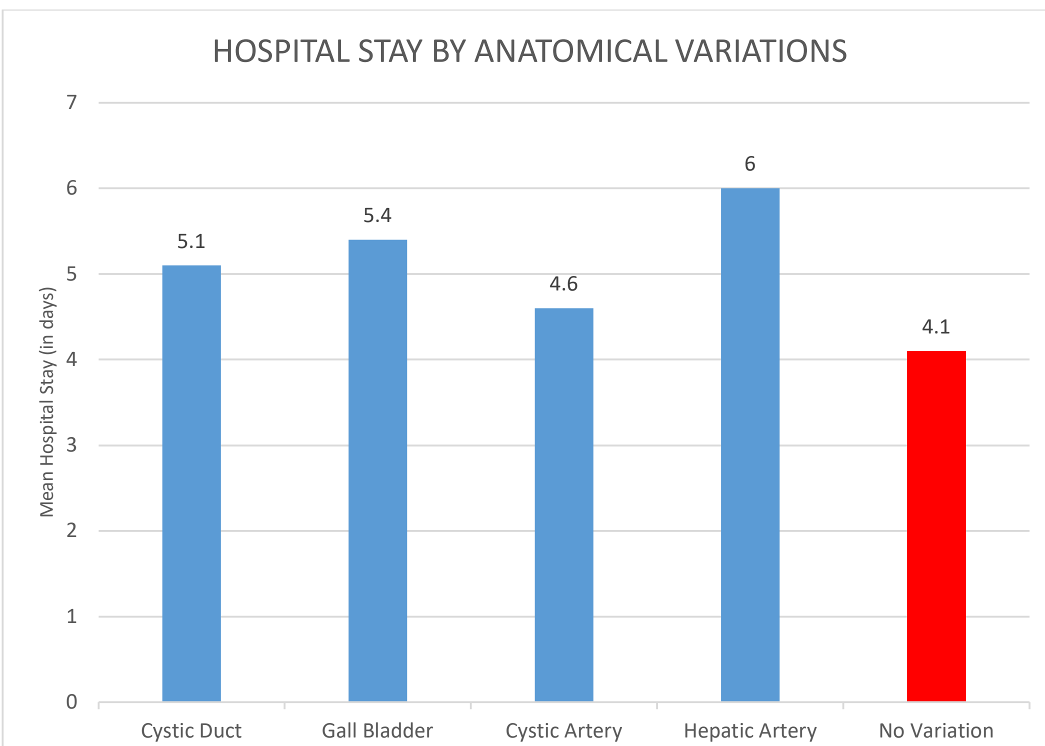


- In the above table 27, the mean hospital stay for patients with anatomical variations was 5.1 days, with a standard deviation (SD) of 1.4.
- For patients without anatomical variations, the mean hospital stay was 4.1 days, with an SD of 1.3.
- The difference in hospital stay between the two groups was statistically significant ($p = 0.0006$), indicating that anatomical variations were associated with a longer hospital stay.
- In the graph 27b, the scatter plot shows hospital stay durations categorized by the presence or absence of anatomical variations. Patients without variations had a notably longer hospital stay, especially at the 3-day mark, compared to those with variations.

Table 28: Hospital Stay Distribution by Anatomical Variation

Variation Category	Mean Hospital Stay (in days)	SD	N	p-value
Cystic Duct	5.1	1.4	16	0.0342
Gall Bladder	5.4	1.3	7	0.0517
Cystic Artery	4.6	1.5	7	0.6634
Hepatic Artery	6.0	1.4	2	0.3344
No Variation	4.1	1.3	106	0.0006
Total			138	

Graph 28: Hospital Stay Distribution by Anatomical Variations



- In the above table 28, Cystic duct variations (n = 16): Patients had a mean hospital stay of 5.1 days (SD = 1.4), which was statistically significant compared to those without variations (p = 0.0342).
- Gall bladder variations (n = 7): Showed the highest average stay of 5.4 days (SD = 1.3); this was borderline significant (p = 0.0517), suggesting a trend toward longer hospitalisation.
- Cystic artery variations (n = 7): Had a mean stay of 4.6 days (SD = 1.5), not statistically significant (p = 0.6634).
- Hepatic artery variations (n = 2): Patients had the longest mean stay of 6.0 days (SD = 1.4), but due to small sample size, this was not statistically significant (p = 0.3344).
- Patients without anatomical variations (n = 106): Had a significantly shorter mean hospital stay of 4.1 days (SD = 1.3), with a highly significant p-value of 0.0006.

DISCUSSION

The present study was conducted to evaluate the frequency of biliary tract variations and congenital anomalies encountered during laparoscopic cholecystectomy and its implications, under the department of general surgery at KLEs Dr. Prabhakar Kore Hospital and Medical Research Centre, Nehru Nagar, Belagavi between September 2023 to August 2024. A total of 138 patients who satisfied the selection criteria and were willing to participate in the study were taken as the study population.

The mean age of patients in the study was comparable between those with anatomical variations (46.72 ± 11.55 years) and those without variations (44.92 ± 12.54 years). This aligns with existing literature that suggests age does not predispose an individual to biliary anatomical variations. Similarly, gender distribution showed no significant correlation, though females comprised the majority in both groups, a total of 63% were females, these findings align with study by Cawich et al. (2021) who observed a female predominance (65%) in their study on biliary variations [48].

In the present study, dyspepsia was the most common symptom, affecting 78.1% of patients with anatomical variations, compared to 64.2% in those with normal anatomy which aligns with Zubair et al. (2020). (30) Nausea and vomiting were present in 56.2% of variation cases compared to 46.2% without variations ($p = 0.4281$) which reflects the trends seen in studies like Plaza & Moreno (2019). (32) Abdominal pain location, particularly in the epigastric region, did not significantly differ between groups as highlighted by Gupta et al. (2023). (21)

Our findings showed no statistically significant association between the presence of anatomical variations and comorbidities like hypertension or diabetes mellitus. A similar lack of association was noted in studies by Singh et al. (2019) and Merh et al. (2018). (33,34) A history of prior abdominal surgery was reported in 18.8% of patients with anatomical variations versus 26.4% without (p = 0.5171) consistent with findings from Taimur et al. (2021) and Talpur et al. (2010). (29,35)

Ultrasonography revealed that 50% of patients with anatomical variations had a single calculus, compared to only 23.6% in those without mirroring the trend seen in study by You-Ming Ding et al. (2007). Gallbladder wall thickness was not significant, similar to Merh et al. (2018) (34,36)

The study found no statistically significant differences in hemoglobin, total bilirubin, or HbA1c levels between patients which is consistent with the observations of Gupta et al. (2023) and Farooq et al. (2019). (28,31)

The present study identified that 23.19% (32 out of 138) of cases exhibited biliary variations, with the most common anomalies being short cystic ducts (5.1%) and long cystic ducts (4.3%) and buried gall bladder (4.3%). This prevalence is comparable to that reported by Gupta et al. (2023), where variations were observed in ~25% of cases, with cystic duct anomalies being the most frequent. You-Ming Ding et al. (2007) and Singh et al. (2019) also highlighted that cystic duct and cystic artery anomalies were among the most encountered variations during laparoscopic cholecystectomy. The presence of a buried gallbladder often increases the technical difficulty of dissection and was similarly reported by Talpur et al. (2010). Rare but critical anomalies such as Moynihan’s hump and double cystic duct have been linked to higher complication rates if unrecognized, as supported by Plaza & Moreno (2019). (33,35,36)

Bile spill was noted mostly from the fundus of gall bladder while retraction. It was managed by giving warm saline peritoneal lavage. The present study found that bile spillage occurred in 6.2% of patients with variations compared to 1.9% in those without which aligns with Zubair et al. (2020). Intraoperative bleeding occurred in a few cases while dissecting the calot's triangle and while separating the Gall bladder from the GB fossa. It was controlled by using electrocautery. Intraoperative bleeding showed a statistically significant association with anatomical variations (15.6% vs. 0.9%, $p = 0.0021$). This is echoed in studies like Taimur et al. (2021). (29,30)

Regarding operative time, our study found that patients with biliary variations had a mean operative time of 75.65 ± 18.70 minutes, compared to 71.47 ± 20.83 minutes in those without variations. This aligns with research by Muazzam et al. (2021) [62] and Peska (2023) [63] showing that biliary anomalies generally increase the operative time.

Bleeding from drain was noted in a few patients in post operatively day 1 which reduced in post operatively day 2 by conservative management. None of these patients underwent re-exploration. Postoperative bleeding from the drain was significantly more common in patients with anatomical variations (15.6% vs. 1.9%, $p = 0.0082$). In patients with Port site sepsis, Intravenous antibiotics were continued for a longer duration and daily dressings with antiseptics were done. Other complications such as port site sepsis and right shoulder pain were more frequently observed in the variation group but did not reach statistical significance similarly as discussed by Singh et al. (2019) and Plaza & Moreno (2019) [32,33,68].

The mean hospital stay in our study was 4.32 ± 1.39 days, which has similar findings from other studies, including Sen et al. (2020), who reported an average of 4.5 days for patients with anatomical variations [67].

Table 29: Comparison of present study with other studies on extrahepatic biliary tract- anatomical variations and congenital anomalies and its implications

Parameter	Present Study	Gupta et al. (2023)	Zubair et al. (2020)	Singh et al. (2019)	Talpur et al. (2010)
Mean Age (years)	45.3	42.8	41.6	43.1	38.5
Female: Male Ratio	1.7:1	2:1	1.8:1	1.6:1	2.1:1
% of Anatomical Variations and congenital anomalies	23.2%	25.8%	21.4%	22.6%	17.3%
Intraoperative Bile Spillage (Variation Group)	6.2%	8.1%	5.6%	6.9%	4.8%
Intraoperative Bleeding (Variation Group)	15.6%	12.5%	10.3%	13.8%	8.7%
Mean Operative Time (minutes)	77	82	74	79	80
Mean Hospital Stay (days)	5.1	4.8	4.6	4.9	4.3

Limitations of the Study:

- The study was conducted in a single center, which may limit the generalizability of the findings to other regions or healthcare settings.
- Preoperative imaging was limited to ultrasonography, and more advanced imaging techniques such as MRCP were not included, which might have provided a clearer understanding of the variations in biliary anatomy.
- The study focused only on patients undergoing laparoscopic cholecystectomy for cholelithiasis, which excludes those with more complex or advanced biliary pathologies.
- The sample size, though calculated statistically, might not fully capture the rarest variations in biliary anatomy, which could have skewed the results.
- The study did not incorporate long-term postoperative follow-up to evaluate the long-term effects of biliary variations on patients' health.

Future Perspective:

- Further studies should include larger sample sizes from multiple centers to validate the findings and provide more robust data on the prevalence of biliary tract variations in diverse populations.
- Incorporating advanced imaging techniques like MRCP in preoperative assessments could provide more detailed insights into biliary anatomy, particularly in detecting subtle or complex variations.
- The role of intraoperative cholangiography and other diagnostic tools should be explored to enhance real-time decision-making during laparoscopic cholecystectomy.

- Investigating the genetic and environmental factors contributing to biliary anatomical anomalies could offer valuable insights into their etiology and prevalence in different regions.
- Long-term follow-up studies are recommended to assess the lasting impact of biliary variations on postoperative outcomes and quality of life.

CONCLUSION

This study, conducted over a one-year period at a tertiary care teaching hospital in Belagavi, North Karnataka, offers significant insights into the intraoperative anatomy of the biliary tract, focusing on the various anatomical variations and congenital anomalies encountered during laparoscopic cholecystectomy.

This prospective observational study identified anatomical variations and congenital anomalies of the extrahepatic biliary system in 23.2% of patients undergoing laparoscopic cholecystectomy. The most frequently encountered variations were short cystic duct, long cystic duct, and buried gallbladder. Intraoperative complications such as bleeding were significantly higher in patients with anatomical variations. Bile spillage, operative time, postoperative complications were higher in the variation group, though not significant. The average hospital stay was significantly prolonged in patients with anatomical variations. These findings emphasize the need for preoperative vigilance and intraoperative caution. Knowledge and anticipation of such variations are vital for safe and successful laparoscopic cholecystectomy.

SUMMARY

The study on the intraoperative anatomy of the biliary tract, focusing on its variations and congenital anomalies during laparoscopic cholecystectomy, aimed to document and assess these variations and their impact on surgical outcomes at a tertiary care teaching hospital in the Belagavi region of North Karnataka. It was prompted by the increasing prevalence of gallstone disease and the rise in laparoscopic cholecystectomy procedures, which are susceptible to complications arising from biliary tract anatomical variations. The research was conducted over one year, beginning in September 2023 and concluding in August 2024, with the primary objective being to evaluate the frequency of these anatomical variations and their clinical significance in a specific region.

The main objective of the study was to assess the frequency of anatomical variations and congenital anomalies of the extrahepatic biliary system in patients undergoing laparoscopic cholecystectomy. Additionally, the study aimed to evaluate how these variations impacted the surgical procedure, with a particular focus on complications, surgical duration, and postoperative outcomes. By analyzing these factors, the study hopes to improve understanding of the challenges posed by biliary tract anomalies and help reduce the incidence of bile duct injuries during surgery.

The study was conducted as a prospective observational study at a tertiary care teaching hospital, which included 138 patients undergoing elective laparoscopic cholecystectomy for cholelithiasis. The study participants were selected based on clear inclusion and exclusion criteria, ensuring that only patients with uncomplicated gallbladder disease were included. The data collected included demographic details, clinical history, preoperative ultrasonographic findings, intraoperative observations, and postoperative outcomes. Descriptive statistics and statistical tests were used to analyze the relationship between anatomical variations and postoperative complications.

The results of the study indicated that the majority of participants were middle-aged women, with 63% of the patients being female. Clinically, the most common symptom reported was abdominal pain, particularly in the epigastrium (51.4%), with dyspepsia being the most frequent associated symptom (67.4%).

Intraoperative findings revealed that 22.5% of patients exhibited variations in biliary anatomy. The most common variations included short cystic ducts (5.1%), long cystic ducts (4.3%), and buried gallbladders (4.3%). Less common anomalies included accessory bile ducts, double cystic arteries, and aberrant cystic arteries. Statistical analysis showed that while the presence of biliary variations resulted in slightly longer operative times. For instance, patients with biliary variations had a mean operative time of 75.65 ± 18.70 minutes, compared to 71.47 ± 20.83 minutes in those without variations. However, no statistically significant impact on operative time was noted for other variations (p values > 0.05 for most variations).

In terms of intraoperative complications, bile spillage occurred in 2.9% of cases, and intraoperative bleeding was noted in 4.3% of cases. The p-value for the association between biliary variations and postoperative complications was 0.001, indicating a weak but statistically significant correlation between biliary variations and the occurrence of postoperative complications. However, the overall impact of biliary variations on complications and operative time remained minimal, with most surgeries being completed without major issues.

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ANNEXURES – I

INFORMED CONSENT FORM

KAHERs JNMC BELAGAVI

INTRAOPERATIVE ANATOMY OF THE BILIARY TRACT: VARIATIONS AND CONGENITAL ANOMALIES AND IMPLICATIONS IN LAPAROSCOPIC CHOLECYSTECTOMY: 1 YEAR OBSERVATIONAL STUDY AT A TERTIARY CARE TEACHING HOSPITAL IN BELAGAVI REGION OF NORTH KARNATAKA.

Name of Student/Principal Investigator: BH0122016

Name of Guide/Co Investigators:

Introduction: Respected Sir/Madam, We request you to participate in our study as titled above, which is being held to understand and assess the frequency of anatomical variations and congenital anomalies in extrahepatic biliary system in patients undergoing laparoscopic cholecystectomy at a tertiary care teaching hospital in Belagavi region of north Karnataka.

Explanation of procedure: In this study, we will be studying the anatomy of the gall bladder, intra and extra hepatic biliary structures and look for congenital anomalies or anatomical variations in patients diagnosed with cholelithiasis and undergoing laparoscopic cholecystectomy for the same.

Withdrawal from participation in the study: Participation in this study in voluntary. Your decision to participate in the study or otherwise will not affect the relationship with KLES Prabhakar Kore Hospital. 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 by participating in this study. The data gathered will help the 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 from identifying you. Your personal 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 **Participant.**

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purposes and or presented to scientific groups.

However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact: **BH0122016.** 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 **"INTRAOPERATIVE ANATOMY OF THE BILIARY TRACT: VARIATIONS AND CONGENITAL ANOMALIES AND IMPLICATIONS IN LAPAROSCOPIC CHOLECYSTECTOMY: 1 YEAR OBSERVATIONAL STUDY AT A TERTIARY CARE TEACHING HOSPITAL IN BELAGAVI REGION OF NORTH KARNATAKA."** 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:

DATE: PLACE:

ANNEXURES – II

PROFORMA

- Case number:
- Patient name:
- Age: Sex:
- IP number:
- Phone number:

- History:
  - Onset of symptoms: Acute ☐ Chronic ☐
  - Pain:
    - Right Hypochondrium ☐
    - Epigastric ☐
    - Both ☐
  - Dyspepsia Yes ☐ No ☐
  - Nausea/vomiting Yes ☐ No ☐
- Comorbidities:
  - Diabetes ☐ Hypertension ☐
- On examination: Tenderness: Yes ☐ No ☐
- **Patient eligible for study:** Yes ☐ No ☐
- **Patient willing to give consent:** Yes ☐ No ☐

Congenital anomalies and anatomical variations seen during laparoscopic cholecystectomy”

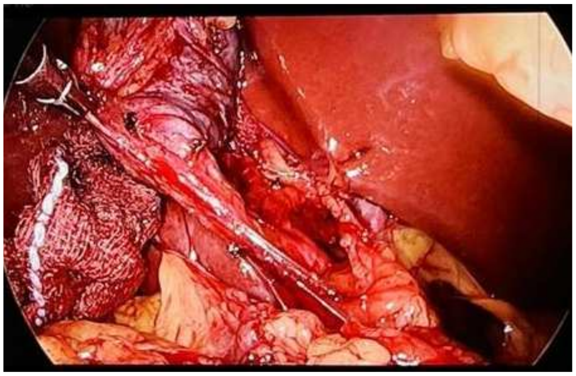
Site of Anomaly	Type of anomaly	Present	Absent
Gall bladder anomalies	1. Buried GB		
	2. Floating GB		
	3. Phrygian GB		
	4. Parallel to CBD		
Cystic duct anomalies	1.Short cystic duct		
	2. Long cystic duct		
	3. Accessory cholecystohepatic duct		
Right hepatic artery anomalies	Moynihan’s hump		
Common hepatic artery	Long and tortuous course		
Cystic artery anomalies	1.Artery arising above Calot’s		
	2.Artery anterior to cystic duct		
	3.Artery posterior to cystic duct		
	4.Artery right to cystic duct		
	5.Double cystic artery		
	6.Aberrant cystic artery		
	7.Short cystic artery		

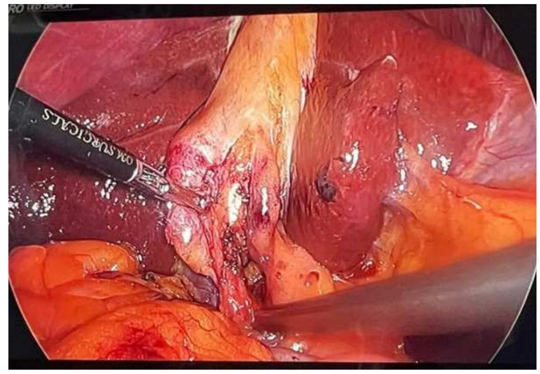
"Post operative patient characteristics"

Parameters	**Yes**	**No**
Main Postoperative complications:		
Bleeding from drain		
Port site sepsis		
Biliary leakage		
Re-exploration		
Shoulder pain		
Hospital stay:		
1 day		
2 days		
3 days		
4 days		
5 days		
6 days		
7 days		
15 days		

ANNEXURES – IIII

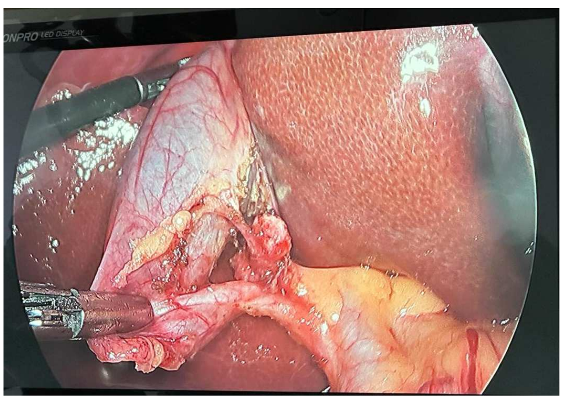
CLINICAL PHOTOGRAPHS





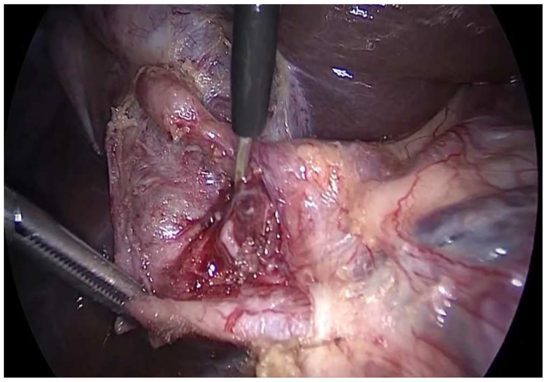
Photograph 1: Long Cystic Duct

Photograph 2: Buried Gall Bladder

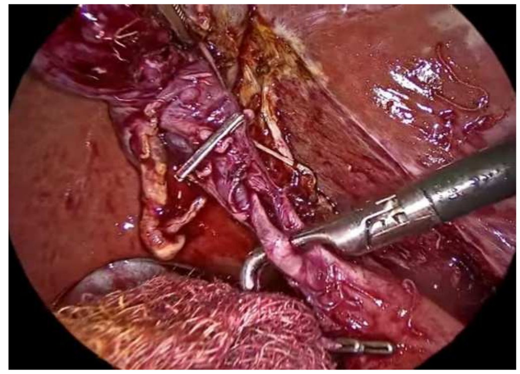


Photograph 3: Short cystic duct

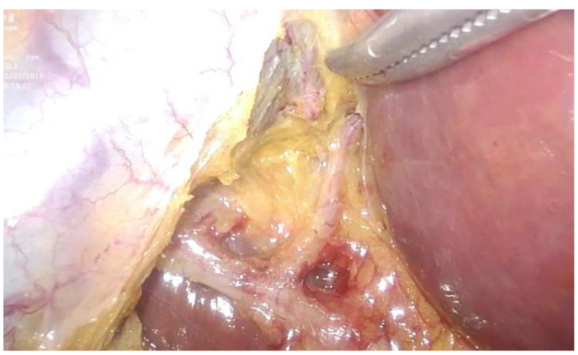
Photograph 4: Moynihan's hump



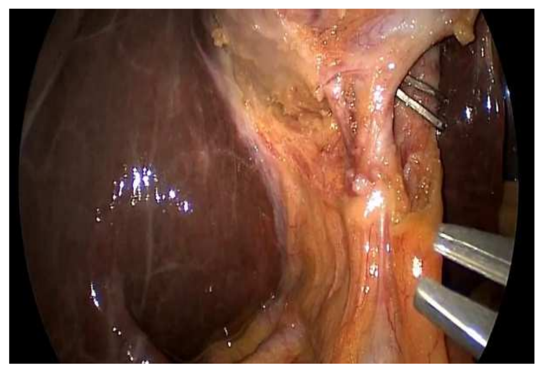
Photograph 5: Accessory Cholecystohepatic Duct



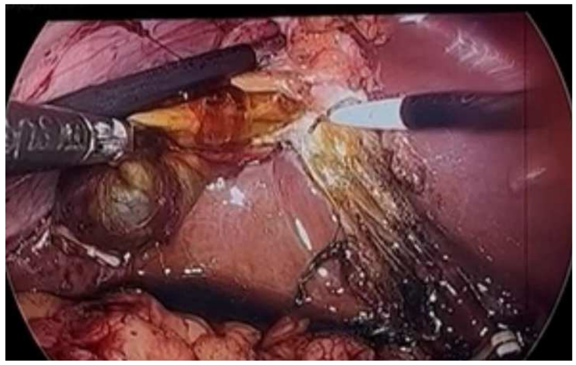
Photograph 6: Double Cystic Duct



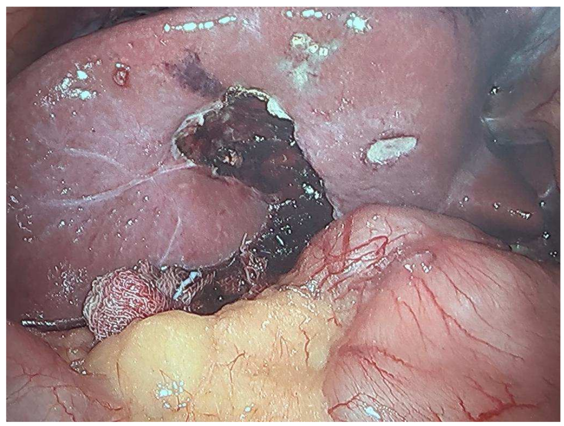
Photograph 7: Cystic Artery Posterior to Cystic Duct



Photograph 8: Double Cystic Artery



Photograph 9: Intraoperative Bile Spillage



Photograph 10: Intraoperative Bleeding

Photograph 11: Port Site Sepsis

ANNEXURE IV

KEY TO MASTERCHART

S. No.	KEY TO MASTERCHART
1.	S. no.- SERIAL NUMBER
2.	IP NO.- IN PATIENT NUMBER
3.	HB- HAEMOGLOBIN
4.	TLC- TOTAL LEUKOCYTE COUNT
5.	HbA1c- GLYCATED HAEMOGLOBIN
6.	USG- ULTRASONOGRAPHY
7.	POST OP- POST OPERATIVE

ANNEXURE V

MASTERCHART

S. No.	IP No.	DATE OF ADMISSION	DATE OF DISCHARGE	AGE	GENDER	ABDOMINAL PAIN	DYSPEPSIA	NAUSEA/VOMITING	HYPERTENSION	DIABETES MELLITUS	PREVIOUS H/O ABDOMINAL SURGE	TENDERNESS	HB
1	1174286	09-09-2023	14-09-2023	45	FEMALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	YES	NO	NO	9.4
2	1177190	12-09-2023	16-09-2023	54	MALE	RIGHT HYPOCHONDRIUM	NO	NO	YES	NO	NO	NO	10.6
3	1172550	02-09-2023	08-09-2023	36	FEMALE	BOTH	YES	YES	NO	NO	YES	YES	13.1
4	1172558	02-09-2023	09-09-2023	34	MALE	BOTH	YES	YES	NO	NO	NO	NO	12.2
5	10001264	18-11-2023	21-11-2023	34	FEMALE	EPIGASTRIUM	YES	YES	NO	NO	NO	YES	11.5
6	10007866	07-12-2023	11-12-2023	21	FEMALE	RIGHT HYPOCHONDRIUM	YES	NO	NO	NO	NO	NO	12.7
7	1169012	01-09-2023	05-09-2023	48	MALE	EPIGASTRIUM	NO	YES	YES	YES	NO	NO	13
8	1169222	02-09-2023	07-09-2023	35	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	NO	NO	13.1
9	1172545	11-09-2023	14-09-2023	27	MALE	BOTH	NO	NO	NO	NO	NO	NO	12.2
10	1179232	18-09-2023	24-09-2023	54	MALE	RIGHT HYPOCHONDRIUM	YES	NO	NO	YES	NO	NO	13
11	1164744	03-09-2023	08-09-2023	32	MALE	EPIGASTRIUM	YES	YES	NO	NO	NO	YES	11.5
12	1176234	09-09-2023	14-09-2023	52	FEMALE	EPIGASTRIUM	NO	NO	NO	NO	YES	YES	13.9
13	1177703	07-09-2023	11-09-2023	42	FEMALE	EPIGASTRIUM	YES	YES	NO	YES	YES	YES	12.8

14	**1173878**	**17-09-2023**	**22-09-2023**	**54**	**MALE**	**BOTH**	**YES**	**YES**	**NO**	**YES**	**NO**	**NO**	**9.4**
15	**1175284**	**16-09-2023**	**20-09-2023**	**28**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**10.6**
16	**10024650**	**01-01-2024**	**07-01-2024**	**55**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**NO**	**NO**	**NO**	**13.1**
17	**1186503**	**19-09-2023**	**23-09-2023**	**65**	**FEMALE**	**EPIGASTRIUM**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**12.2**
18	**10091058**	**22-05-2024**	**26-05-2024**	**26**	**FEMALE**	**BOTH**	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**11.5**
19	**1193503**	**14-09-2023**	**18-09-2023**	**29**	**FEMALE**	**EPIGASTRIUM**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**12.7**
20	**10030449**	**17-01-2024**	**22-01-2024**	**42**	**FEMALE**	**EPIGASTRIUM**	**NO**	**YES**	**NO**	**NO**	**NO**	**YES**	**13**
21	**10029229**	**03-01-2024**	**07-01-2024**	**45**	**FEMALE**	**BOTH**	**YES**	**YES**	**NO**	**NO**	**YES**	**YES**	**13.1**
22	**10060140**	**29-05-2024**	**02-06-2024**	**65**	**FEMALE**	**BOTH**	**NO**	**NO**	**YES**	**YES**	**YES**	**NO**	**12.2**
23	**10061200**	**30-05-2024**	**03-06-2024**	**64**	**FEMALE**	**EPIGASTRIUM**	**NO**	**YES**	**NO**	**YES**	**YES**	**NO**	**13**
24	**10060132**	**28-05-2024**	**01-06-2024**	**62**	**FEMALE**	**EPIGASTRIUM**	**YES**	**YES**	**YES**	**YES**	**YES**	**NO**	**11.5**
25	**10060497**	**27-05-2024**	**04-06-2024**	**28**	**FEMALE**	**EPIGASTRIUM**	**NO**	**YES**	**NO**	**NO**	**NO**	**YES**	**13.9**
26	**10062416**	**02-06-2024**	**06-06-2024**	**32**	**FEMALE**	**BOTH**	**YES**	**YES**	**NO**	**NO**	**NO**	**YES**	**12.8**
27	**10065320**	**15-07-2024**	**20-07-2024**	**60**	**MALE**	**BOTH**	**YES**	**YES**	**NO**	**YES**	**NO**	**NO**	**13**

28	10069190	18-07-2024	23-07-2024	61	MALE	BOTH	NO	NO	NO	YES	NO	NO	11.5
29	10065242	09-07-2024	14-07-2024	48	MALE	BOTH	YES	YES	NO	NO	NO	NO	13.9
30	10065103	11-07-2024	15-07-2024	25	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	NO	YES	12.8
31	10066100	16-07-2024	22-07-2024	21	MALE	RIGHT HYPOCHONDRIUM	YES	NO	NO	NO	NO	NO	9.4
32	10059878	30-06-2024	04-07-2024	50	MALE	BOTH	NO	NO	YES	NO	NO	NO	10.6
33	10061175	11-07-2024	16-07-2024	29	FEMALE	EPIGASTRIUM	YES	YES	NO	NO	NO	YES	13.1
34	10063638	15-07-2024	20-07-2024	49	MALE	EPIGASTRIUM	YES	YES	NO	NO	NO	NO	12.2
35	10060270	08-07-2024	13-07-2024	60	FEMALE	EPIGASTRIUM	NO	NO	YES	YES	NO	NO	11.5
36	10062151	20-07-2024	27-07-2024	34	FEMALE	RIGHT HYPOCHONDRIUM	YES	NO	NO	NO	NO	YES	12.7
37	10062945	21-07-2024	25-07-2024	37	MALE	EPIGASTRIUM	NO	NO	NO	NO	NO	NO	13
38	10056840	13-06-2024	17-06-2024	50	MALE	BOTH	YES	YES	YES	NO	NO	YES	13.1
39	10057164	17-06-2024	21-06-2024	35	FEMALE	EPIGASTRIUM	YES	YES	NO	NO	NO	YES	11.5
40	10053471	11-06-2024	15-06-2024	40	FEMALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	NO	YES	NO	12.7
41	10053711	11-06-2024	19-06-2024	54	MALE	EPIGASTRIUM	NO	NO	YES	YES	NO	YES	13

42	10047697	29-05-2024	03-06-2024	59	FEMALE	EPIGASTRIUM	NO	NO	NO	NO	YES	NO	13.1
43	10047869	01-06-2024	06-06-2024	56	FEMALE	EPIGASTRIUM	YES	NO	NO	YES	YES	NO	12.2
44	10047899	05-05-2024	09-05-2024	47	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	YES	NO	13
45	10046740	11-05-2024	18-05-2024	45	FEMALE	RIGHT HYPOCHONDRIUM	YES	NO	NO	YES	YES	NO	11.5
46	10044732	02-05-2024	07-05-2024	52	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	YES	NO	13.9
47	10040754	18-04-2024	23-04-2024	29	FEMALE	EPIGASTRIUM	YES	YES	NO	NO	YES	NO	12.8
48	10040655	17-04-2024	21-04-2024	34	MALE	BOTH	YES	NO	NO	NO	NO	NO	9.4
49	10038546	02-04-2024	05-04-2024	48	FEMALE	BOTH	YES	NO	NO	NO	YES	NO	10.6
50	10040027	15-04-2024	20-04-2024	35	MALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	NO	NO	NO	13.1
51	10036749	05-04-2024	13-04-2024	48	FEMALE	BOTH	YES	YES	NO	YES	NO	YES	12.2
52	10031937	01-04-2024	09-04-2024	57	MALE	EPIGASTRIUM	YES	YES	YES	YES	NO	YES	12.7
53	10030608	29-03-2024	04-04-2024	45	MALE	EPIGASTRIUM	YES	NO	YES	NO	NO	NO	13
54	10030362	30-03-2024	10-04-2024	61	FEMALE	BOTH	NO	YES	NO	YES	NO	YES	13.1
55	10030664	30-03-2024	04-04-2024	33	MALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	NO	NO	YES	12.2

56	10029418	27-03-2024	31-03-2024	53	FEMALE	EPIGASTRIUM	YES	YES	YES	NO	YES	NO	13
57	10029465	26-03-2024	31-03-2024	63	MALE	EPIGASTRIUM	YES	NO	YES	YES	NO	NO	11.5
58	10025970	22-03-2024	27-03-2024	40	FEMALE	EPIGASTRIUM	NO	NO	NO	NO	YES	YES	13.9
59	10027857	24-03-2024	28-03-2024	43	FEMALE	EPIGASTRIUM	NO	NO	NO	NO	YES	YES	12.8
60	10027263	25-03-2024	31-03-2024	58	FEMALE	BOTH	YES	YES	NO	NO	YES	YES	13
61	10027447	22-03-2024	27-03-2024	62	FEMALE	BOTH	YES	YES	NO	NO	YES	YES	11.5
62	10025988	20-03-2024	24-03-2024	31	MALE	EPIGASTRIUM	NO	NO	NO	NO	NO	YES	13.9
63	10025908	19-03-2024	24-03-2024	51	FEMALE	EPIGASTRIUM	YES	YES	YES	NO	YES	NO	12.8
64	10026260	20-03-2024	27-03-2024	60	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	NO	NO	9.4
65	10021437	14-03-2024	22-03-2024	62	MALE	RIGHT HYPOCHONDRIUM	NO	YES	NO	YES	NO	YES	10.6
66	10021549	13-03-2024	20-03-2024	60	MALE	BOTH	YES	NO	NO	YES	NO	NO	13.1
67	10068223	29-07-2024	04-08-2024	55	MALE	BOTH	NO	NO	YES	YES	NO	YES	12.2
68	10032585	29-03-2024	04-04-2024	32	FEMALE	EPIGASTRIUM	YES	YES	NO	NO	YES	NO	8.7
69	10025228	14-03-2024	19-03-2024	38	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	YES	NO	13.3

70	**10003531**	**03-12-2023**	**09-12-2024**	**28**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**NO**	**YES**	**NO**	**NO**	**NO**	**YES**	**14.2**
71	**10023128**	**11-03-2024**	**17-03-2024**	**42**	**MALE**	**BOTH**	**YES**	**NO**	**YES**	**NO**	**NO**	**NO**	**14.3**
72	**10042057**	**22-04-2024**	**26-04-2024**	**60**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**YES**	**NO**	**NO**	**10.9**
73	**10045098**	**24-04-2024**	**29-04-2024**	**65**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**NO**	**YES**	**YES**	**YES**	**YES**	**YES**	**13.8**
74	**10035648**	**11-04-2024**	**19-04-2024**	**64**	**FEMALE**	**BOTH**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	**14.5**
75	**10044834**	**25-04-2024**	**30-04-2024**	**48**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**YES**	**YES**	**NO**	**NO**	**9.8**
76	**10014057**	**11-01-2024**	**15-01-2024**	**55**	**FEMALE**	**EPIGASTRIUM**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**12.2**
77	**10018853**	**12-01-2024**	**14-01-2024**	**47**	**FEMALE**	**EPIGASTRIUM**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	**16.4**
78	**10025020**	**19-01-2024**	**22-01-2024**	**40**	**FEMALE**	**EPIGASTRIUM**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**12.6**
79	**10003531**	**28-12-2023**	**02-01-2024**	**26**	**FEMALE**	**EPIGASTRIUM**	**NO**	**YES**	**NO**	**NO**	**NO**	**YES**	**15.2**
80	**10036505**	**18-03-2024**	**21-03-2024**	**22**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**YES**	**YES**	**NO**	**NO**	**NO**	**YES**	**12.4**
81	**10048091**	**11-04-2024**	**16-04-2024**	**27**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**NO**	**YES**	**NO**	**NO**	**NO**	**YES**	**11.1**
82	**10039715**	**22-02-2024**	**28-02-2024**	**28**	**MALE**	**EPIGASTRIUM**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**11.2**
83	**10028717**	**11-02-2024**	**16-02-2024**	**36**	**MALE**	**RIGHT HYPOCHONDRIUM**	**NO**	**NO**	**NO**	**NO**	**NO**	**YES**	**9.7**

84	10040580	14-04-2024	18-04-2024	40	MALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	NO	NO	YES	12.5
85	10025020	12-01-2024	18-01-2024	40	FEMALE	BOTH	NO	NO	NO	NO	NO	NO	12.5
86	10014603	11-11-2023	17-11-2023	44	FEMALE	EPIGASTRIUM	YES	NO	NO	YES	NO	YES	14.5
87	10031180	20-02-2024	25-02-2024	56	FEMALE	EPIGASTRIUM	YES	NO	YES	NO	NO	NO	10.8
88	10032327	02-03-2024	06-03-2024	43	FEMALE	BOTH	YES	YES	NO	NO	NO	YES	10
89	10031343	28-02-2024	08-03-2024	55	FEMALE	BOTH	YES	NO	NO	YES	NO	YES	8.7
90	10030780	24-02-2024	28-02-2024	37	FEMALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	NO	NO	NO	13.7
91	10030935	24-02-2024	04-03-2024	38	MALE	EPIGASTRIUM	NO	NO	NO	NO	NO	YES	10.8
92	10029573	18-01-2024	25-01-2024	63	MALE	BOTH	YES	YES	YES	YES	NO	YES	14.5
93	10021573	11-01-2024	18-01-2024	62	MALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	YES	NO	YES	12.7
94	10023374	13-01-2024	19-01-2024	55	FEMALE	EPIGASTRIUM	YES	YES	YES	NO	NO	YES	13.7
95	10023174	13-01-2024	18-01-2024	28	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	NO	NO	6.9
96	10068413	16-07-2024	21-07-2024	45	MALE	EPIGASTRIUM	YES	NO	NO	NO	YES	YES	13.1
97	10068540	17-07-2024	21-07-2024	42	FEMALE	EPIGASTRIUM	YES	YES	NO	NO	YES	NO	12

98	**10065808**	**16-07-2024**	**21-07-2024**	**40**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**YES**	**NO**	**YES**	**NO**	**YES**	**YES**	**10.5**
99	**10064885**	**14-07-2024**	**19-07-2024**	**54**	**FEMALE**	**BOTH**	**YES**	**YES**	**NO**	**NO**	**NO**	**NO**	**13.4**
100	**10061134**	**05-07-2024**	**13-07-2024**	**44**	**FEMALE**	**BOTH**	**YES**	**YES**	**NO**	**YES**	**NO**	**YES**	**11**
101	**10076231**	**11-07-2024**	**15-07-2024**	**56**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**YES**	**NO**	**NO**	**YES**	**13.7**
102	**10075230**	**09-07-2024**	**14-07-2024**	**33**	**FEMALE**	**EPIGASTRIUM**	**YES**	**NO**	**NO**	**NO**	**NO**	**YES**	**10**
103	**10074562**	**06-07-2024**	**10-07-2024**	**27**	**FEMALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**NO**	**NO**	**YES**	**15.7**
104	**10071062**	**01-07-2024**	**07-07-2024**	**48**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**YES**	**NO**	**NO**	**NO**	**15.7**
105	**10070131**	**30-06-2024**	**06-07-2024**	**45**	**FEMALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**YES**	**NO**	**NO**	**12.3**
106	**10070271**	**01-07-2024**	**07-07-2024**	**38**	**MALE**	**RIGHT HYPOCHONDRIUM**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**11**
107	**10073256**	**11-07-2024**	**15-07-2024**	**62**	**FEMALE**	**EPIGASTRIUM**	**NO**	**YES**	**YES**	**YES**	**NO**	**NO**	**14**
108	**10075696**	**14-07-2024**	**20-07-2024**	**58**	**FEMALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**NO**	**NO**	**YES**	**14.4**
109	**10076319**	**15-07-2024**	**22-07-2024**	**51**	**FEMALE**	**BOTH**	**YES**	**NO**	**NO**	**YES**	**NO**	**NO**	**12.8**
110	**10077665**	**18-07-2024**	**22-07-2024**	**50**	**FEMALE**	**EPIGASTRIUM**	**YES**	**NO**	**YES**	**NO**	**NO**	**NO**	**12.8**
111	**10081407**	**20-07-2024**	**25-07-2024**	**38**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**NO**	**NO**	**YES**	**10.8**

112	**10080528**	**16-07-2024**	**20-07-2024**	**53**	**FEMALE**	**EPIGASTRIUM**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**11.2**
113	**10081369**	**18-07-2024**	**22-07-2024**	**33**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**11.7**
114	**10081515**	**19-07-2024**	**23-07-2024**	**63**	**MALE**	**RIGHT HYPOCHONDRIUM**	**NO**	**NO**	**NO**	**YES**	**NO**	**NO**	**12.7**
115	**10083482**	**22-07-2024**	**28-07-2024**	**48**	**MALE**	**EPIGASTRIUM**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**11**
116	**10083698**	**24-07-2024**	**30-07-2024**	**65**	**FEMALE**	**BOTH**	**YES**	**YES**	**YES**	**NO**	**NO**	**YES**	**12.1**
117	**10083732**	**24-07-2024**	**31-07-2024**	**38**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**NO**	**NO**	**YES**	**11.4**
118	**10085432**	**27-07-2024**	**01-08-2024**	**34**	**FEMALE**	**EPIGASTRIUM**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**13.5**
119	**10087613**	**29-07-2024**	**03-08-2024**	**30**	**FEMALE**	**BOTH**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**12**
120	**10088805**	**31-07-2024**	**04-08-2024**	**33**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**YES**	**NO**	**NO**	**NO**	**YES**	**YES**	**12.4**
121	**10088817**	**28-07-2024**	**01-08-2024**	**61**	**MALE**	**EPIGASTRIUM**	**YES**	**NO**	**YES**	**NO**	**NO**	**YES**	**12.8**
122	**10090791**	**31-07-2024**	**05-08-2024**	**62**	**FEMALE**	**EPIGASTRIUM**	**NO**	**NO**	**NO**	**NO**	**YES**	**NO**	**12**
123	**10091319**	**07-08-2024**	**11-08-2024**	**31**	**FEMALE**	**RIGHT HYPOCHONDRIUM**	**YES**	**NO**	**NO**	**NO**	**YES**	**NO**	**8.3**
124	**10097588**	**16-08-2024**	**21-08-2024**	**56**	**FEMALE**	**EPIGASTRIUM**	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**12.1**
125	**10096849**	**03-08-2024**	**07-08-2024**	**43**	**MALE**	**EPIGASTRIUM**	**YES**	**YES**	**NO**	**NO**	**NO**	**NO**	**11.3**

126	10092211	01-08-2024	06-08-2024	62	MALE	RIGHT HYPOCHONDRIUM	NO	NO	NO	YES	NO	NO	12.1
127	10100953	18-08-2024	22-08-2024	48	FEMALE	RIGHT HYPOCHONDRIUM	YES	YES	NO	NO	NO	YES	13.9
128	10106264	22-08-2024	28-08-2024	57	MALE	BOTH	YES	YES	YES	NO	NO	YES	11.4
129	10109144	21-08-2024	29-08-2024	53	FEMALE	EPIGASTRIUM	YES	NO	NO	NO	NO	YES	13.8
130	10073874	22-07-2024	28-07-2024	56	FEMALE	RIGHT HYPOCHONDRIUM	NO	YES	NO	NO	NO	NO	12.3
131	10061174	07-07-2024	14-07-2024	53	MALE	EPIGASTRIUM	NO	YES	NO	YES	NO	YES	14
132	10074264	11-07-2024	15-07-2024	40	FEMALE	BOTH	NO	NO	NO	NO	NO	NO	14.5
133	10042254	05-04-2024	09-04-2024	36	FEMALE	EPIGASTRIUM	YES	YES	NO	NO	NO	YES	11.2
134	10054624	17-04-2024	22-04-2024	24	FEMALE	BOTH	NO	NO	NO	NO	NO	NO	13.6
135	10022941	11-02-2024	18-02-2024	64	FEMALE	BOTH	YES	NO	YES	YES	YES	NO	11.8
136	10042655	09-04-2024	13-042024	28	FEMALE	BOTH	NO	NO	NO	NO	NO	NO	12.2
137	10062944	01-07-2024	06-07-2024	37	MALE	EPIGASTRIUM	NO	NO	NO	NO	NO	NO	13
138	10056840	12-06-2024	16-06-2024	50	MALE	BOTH	YES	YES	YES	NO	NO	YES	13.1