

## Rouviere's Sulcus: A Gaurdian Angel in Laproscopic Cholecystectomy

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### Abstract

**Objective:** To provide an overview of the anatomy of Rouviere's sulcus and its clinical relevance in laparoscopic cholecystectomy.

**Setting & Duration:** JIU'S IIMSR & Noor hospital, badnapur, Warudi, Jalna, Maharashtra from August 2021 to August 2023.

**Methodology:** A prospective study of 122 patients who underwent laparoscopic cholecystectomy at a rural tertiary care center for a period of 2 years from August 2021 to August 2023. The study included patients above 18 years of age, both genders, elective cases of symptomatic cholelithiasis and other gall bladder pathologies. The study is observational and documents the anatomy of the Rouviere's sulcus in cases it was identified during laparoscopic cholecystectomy.

**Result:** A total of 122 patients were included in the study. Rouviere's sulcus was identified in 97 cases. In 73 cases it was open variety and in 24 cases it was closed variety, in all cases, the sulcus was present above CBD and no complications related to biliary tree injury were seen after identification of this landmark.

**Conclusion:** The identification of Rouviere's sulcus during cholecystectomy is a safe and effective technique that can help to prevent injury to the biliary tract and other surrounding structures. Our study demonstrates the importance of this landmark and its clinical relevance in laparoscopic cholecystectomy.

**Keywords:** Laparoscopic Cholecystectomy, Bile Duct injury, Rouviere's sulcus, Callot's triangle

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### Introduction

Laparoscopic Cholecystectomy is a commonly performed surgical procedure and now the treatment of choice for symptomatic cholelithiasis. [1] Compared to open surgery it has various advantages such as reduced morbidity, early recovery, less complications and is cost effective. It is a complex procedure that requires a thorough understanding of the anatomy of the biliary tract and surrounding structures. [2] One important non-biliary landmark that has gained increasing attention in recent years is Rouviere's sulcus. [3] Rouviere's sulcus is a groove located on the undersurface of the liver, between the right and quadrate lobes. It is an anatomical landmark that can be used to identify the junction of cystic duct and CBD, with the CBD lying below this landmark.

The identification of Rouviere's sulcus is important in preventing injury to the biliary tract and other surrounding structures, which can result in serious complications, including bile duct injury and bleeding. Therefore, the purpose of this article is to provide an overview of the anatomy of Rouviere's

sulcus and its clinical relevance in laparoscopic cholecystectomy. [4]

### Methods and Materials:

We conducted a prospective study of 122 patients who underwent laparoscopic cholecystectomy at a rural tertiary care center for a period of 2 years from August 2021 to September 2023 after approval by institutional ethics committee. The study included patients above 18 years of age, both genders, elective cases of symptomatic cholelithiasis and other gall bladder pathologies. Patients with previous biliary surgery, acute cholecystitis, choledocholithiasis, or other biliary tract anomalies were excluded. All cholecystectomies were performed by experienced laparoscopic surgeons using a standardized technique. Technique included 4 ports (10 mm umbilical camera port, two 5 mm RHC working ports and a 10 mm subxiphoid working port subsequently used for gall bladder extraction). After diagnostic laparoscopy, pericholecystic adhesions if present were dissected with monopolar hook and blunt dissection. Callot's dissection was done with monopolar hook, keeping

line of dissection above rouviere’s sulcus in those cases where sulcus was visualised.

Cystic artery and duct were clipped with LT 300 Liga clips and cut after achieving critical view of callot’s in all cases. Eight cases having dilated cystic duct were ligated using 2.0 polygalactin sutures while in 12 cases complete removal of gall bladder was not possible due to adhesions and subtotal cholecystectomy was done and sutured with 2.0 polygalactin. Abdominal drain was placed in selected cases where adhesions were present and dissection of callot’s was difficult. Intraoperative complications, including bile duct injury, bleeding, and conversion to open surgery, were recorded. Data were collected on patient demographics, clinical characteristics, operative details, and postoperative outcomes.

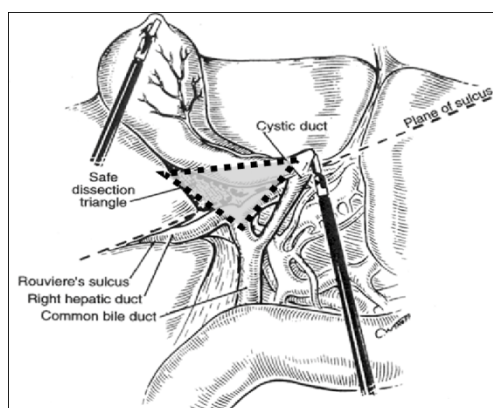
The primary outcome was observation of Rouviere’s sulcus, its variety, approximate size and it’s relation to CBD during cholecystectomy. Secondary outcome included the associated complications. Descriptive statistics were used to summarize the data, including means, standard deviations, and percentages. The results were compared with previous studies in the literature to evaluate the validity of our findings.

**Results:**

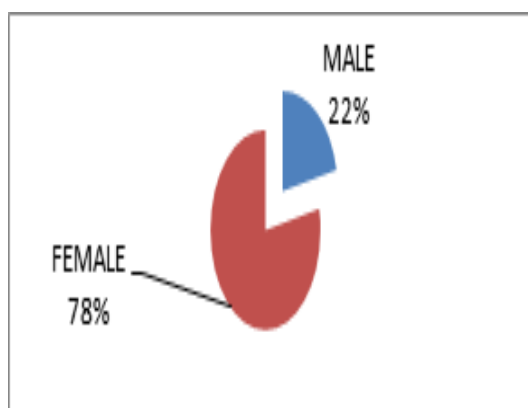
A total of 122 patients were included in the study, with a mean age of 44 years (range, 18-78 years). The majority of patients were female (78.4%).

Out of which 101 were symptomatic cholelithiasis, 5 chronic cholecystitis, 14 interval cholecystectomy and 2 cases were gall bladder polyp. The mean operative time was 50 minutes (range, 30-120 minutes), and the mean length of hospital stay was 3 days (range, 2-7 days). Rouviere’s sulcus was identified in 97 cases. In 73 cases it was open variety and in 24 cases it was closed variety, with approximate size was in a range from 2.5cm to 5cm with a average of 3.2cm. In all cases, the sulcus was present above CBD and no complications related to biliary tree injury were seen after identification of this landmark.

Intra-op findings included difficult callot’s dissection in 32 cases, omental adhesions were present in 47 cases, subtotal/partial cholecystectomy done in 12 cases, Liga Clips were applied in 108 cases suture ligation done in 8 cases and 6 cases were converted to open cholecystectomy. The most common postoperative complications was wound infection (3.6%), No injury to bile duct, vessels, small bowel or any other viscera were encountered. Our findings are consistent with previous studies in the literature, which have demonstrated the safety and efficacy of using Rouviere’s sulcus as a non-biliary landmark during cholecystectomy.



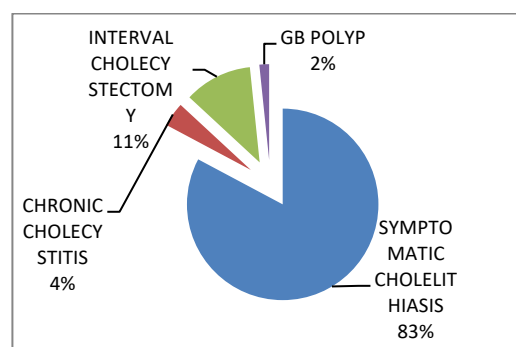
**Image 1: Anatomy of Rouvier’s Sulcus<sup>5</sup>**



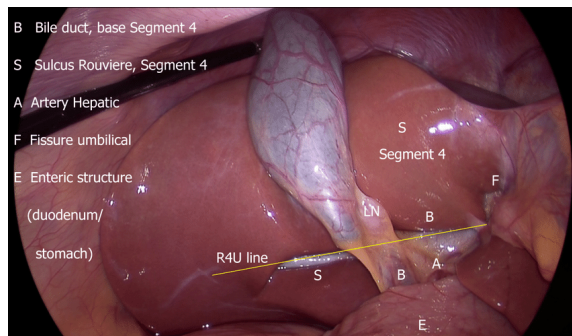
**Chart 1: Sex Distribution**



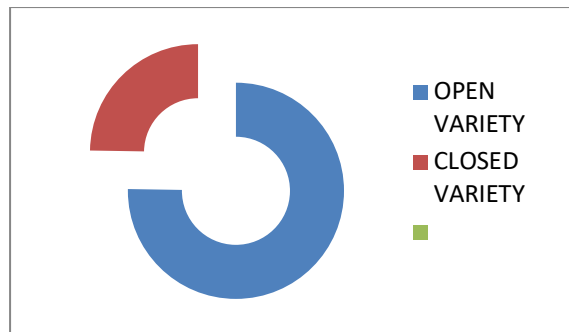
**Image 2: Intra-Op image of Rouvier’s sulcus**



**Chart 2: Diagnosis**



**Image 3:BSAFE anatomical land marks**



**Chart 3 : Type Of Sulcus identified**

### Discussion:

Laparoscopic cholecystectomy is a minimally invasive surgical procedure used to remove the gallbladder. It is the standard treatment for gallbladder diseases, particularly symptomatic cholelithiasis and cholecystitis. [5-6]

Rouviere's sulcus is characterized as a natural groove in the liver bed that corresponds to the right branch of the portal vein and the inferior vena cava. [7] Rouviere H in 1924 was the first to describe the anatomy of this sulcus which was later named after him. [8] This sulcus, can be classified into different types based on its variations and location [7],

1. Rouviere's Type I Sulcus: This is the most common type of Rouviere's sulcus. It is characterized by a well-defined and prominent groove located between the right and quadrate lobes of the liver. It is easily visible during laparoscopic cholecystectomy, making it a reliable non-biliary landmark.

2. Rouviere's Type II Sulcus: This type of sulcus is less commonly encountered compared to Type I. It may have a more subtle or shallow appearance, making its identification slightly more challenging during surgery.

3. Rouviere's Type III Sulcus: Type III sulcus is the least common variation and is characterized by a less well-defined or absent groove. In some cases, the sulcus may be completely absent or not easily recognizable. Surgeons may need to rely on other anatomical landmarks or intraoperative imaging techniques to guide the dissection in such cases. [9]

When the sulcus is identified, the safe zone of dissection lies cephalad to a line extending from the roof of the Rouviere's sulcus to the umbilical fissure across the base of the segment 4, referred to by some as the R4U line. [10,11] A Cadaveric study [12] of healthy livers showed Rouviere's sulcus was present in 82% of the cases and in these the open type was identified in 70% of the livers. The fused type was observed in 12% of the cases while 18% of the livers had no sulcus. The mean length of the open type sulcus was  $28 \pm 2$  mm (range 24–32 mm) and its mean depth was  $6 \pm 2$  mm (range 4–8 mm). [12] Jha et

al [13] in their study of 99 patients, identified Rouviere's sulcus in 63 cases (63.63%), whereas it could not be seen in 36 cases (36.36%) ( $P < 0.007$ ). It was of open type in 68.25% (43 cases), close type in 25.39% (16 cases), and scar like in 6.35% (4 cases) ( $P < 0.0001$ ). The Rouviere's sulcus was found to be above the level of CBD line in 50 patients (79.36%) and at the same level in 11 patients (17.46%), and in two patients, (5.97%) CBD line could not be visualized. [13]

A meta-analysis of 23 studies ( $n = 4,495$  patients) showed an overall pooled prevalence of Rouviere's Sulcus of 83% (95% confidence interval). There were no significant differences in prevalence between cadaveric studies and laparoscopic studies. The open sulcus constituted 66% of all cases, while the closed type was present in 34%. The meta-analysis showed that the sulcus is a relatively constant anatomical structure that can be reliably identified in most patients undergoing cholecystectomy. It can therefore be used as a fixed extra-biliary landmark for the appropriate site at which to start dissecting during LC to help prevent iatrogenic bile duct injury. [5] In all cases in our study, the sulcus was present above CBD and no complications related to biliary tree injury were seen after identification of this landmark. This finding supports the safety and reliability of this technique in routine clinical practice.

**Limitations:** Exclusion of patients below 18 years of age, patients with prior biliary surgery, acute cholecystitis, choledocholithiasis, or other biliary tract anomalies.

### Conclusion:

The identification of Rouviere's sulcus during cholecystectomy is a safe and effective technique that can help to prevent injury to the biliary tract and other surrounding structures. Our study demonstrates the importance of this landmark and its clinical relevance in laparoscopic cholecystectomy. The incorporation of Rouviere's sulcus identification in the armamentarium of laparoscopic cholecystectomy ensures enhanced patient safety, reduced complications, and reinforces the continued dominance of this minimally invasive technique as

the treatment of choice for symptomatic cholelithiasis. The use of this technique should be encouraged in all centers performing laparoscopic cholecystectomy.

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