Original Article

# Conventional Method of Dissection versus Identification of Rouviere's Sulcus and Cystic Lymph Node as Safety Landmarks in Laparoscopic Cholecystectomy: A Comparative Study

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**Abstract**

**Background**: Laparoscopic Cholecystectomy (LC) is the Gold Standard procedure for symptomatic gallstones. With the development of laparoscopic procedure, surgical interest in the Rouviere's sulcus and cystic lymph node in relation to the right portal pedicle and prevention of bile duct injury has increased recently. This prospective study aimed at safety landmarks for avoiding Bile Duct Injuries during surgery and reducing the number of intraoperative and postoperative complications in laparoscopic cholecystectomy. The aim of the study is to compare the frequency of bile duct injury in conventional method of dissection versus the frequency of bile duct injury by delineating rouviere's sulcus and cystic lymph node as safety landmark in laparoscopic cholecystectomy.

**Material and Method**: A comparative study was conducted on 60 patients of cholelithiasis who underwent laparoscopic cholecystectomy at our institution in two-year period. All patients were evaluated in terms of clinical, biochemical, haematological and ultrasonographic parameters and randomised in two groups. Patients were allocated group A and B depending upon Ticket picked by them. Group A patient: Rouviere's sulcus and cystic lymph node was identified intraoperatively and an imaginary line (R4U) that passed from the sulcus across the base of segment 4 to the umbilical fissure drawn and cystic line is an imaginary line running through cystic lymph node and parallel to hepatoduodenal ligament was drawn and dissection superolateral to intersection of these lines along with achievement of CVS. Group B patients: Underwent conventional method of dissection (calot's Triangle dissection with critical view of safety achievement). Patients were followed up after 7 days and assessment was done.

**Conclusion**: The study concluded that before commencement of calot's triangle dissection identification of Rouviere's sulcus [RS] and cystic lymph node of lund is an extra biliary, easily accessible and reliable anatomical land mark from where we can draw two imaginary line [R4U and cystic line] and dissection start above and lateral to intersection of these line and no injury was observed and one bile duct injury was noted during convention method of dissection. So it can help us as an additional safe reference point to avoid bile duct injury and dissection in safe area close to gall bladder in laparoscopic cholecystectomy.

**Keywords**: Rouviere's sulcus, Calot's Triangle, cystic node, CVS, laparoscopic cholecystectomy, bile duct injury.

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## Introduction

Gallstones are common with prevalences as high as 60% to 70% in American Indians and 10% to 15% in white adults of developed countries. Ethnic differences abound with a reduced frequency in black Americans and those from East Asia, while being rare in sub-Saharan Africa. Certain risk factors for gallstones are immutable: female gender, increasing age, and ethnicity/family (genetic traits). Others are modifiable: obesity, the metabolic syndrome, rapid weight loss, certain diseases (cirrhosis and Crohn disease), gallbladder stasis (from spinal cord injury or drugs, such as somatostatin), and lifestyle.[1] Laparoscopic Cholecystectomy is one of the most performed abdominal surgical procedures. By number of studies and research work it is stated that LC is superior to conventional open method because of its advantage like smaller incision, early recovery, less post operative pain and hospital stay and better cosmesis but it is still associated with higher incidence of bile duct injury when compared to open cholecystectomy. Nowadays it has been proven that misconstruction of biliary anatomy is responsible for 71–97% of bile duct injuries (BDI) cases.[2]

So, to decrease the incidence of biliary track injury, we should focus on the defects of the current techniques in the localisation of the cystic duct. The biliary track injury has been a subject for study throughout ages. The main cause of biliary track injury is misinterpretation of anatomy mistaking CBD for cystic duct.[3,4,5] The biliary tract injury is mainly due to anatomical Structural misidentification. Thus, the key solution to such problem should have an anatomical background. So, practicing laparoscopic cholecystectomy safely is based largely on careful delineation of the anatomy. Upon analysis of the new technical strategy of the laparoscopic cholecystectomy, three major overlapping changes could be observed:

- The first was the change of area of dissection by the introduction of the CVS that rapidly replaced the old infundibular approach technique.
- Intraoperative cholangiography
- Identification of extra biliary landmarks
  - Rouvier's sulcus identification
  - Cystic lymph node identification

CVS: The concept of CVS was first introduced by Strasberg in 1995. The Envisages before dividing the cystic duct and artery there structures should be clearly identified.

*Three Components*:

- Clearing the all fibrofatty tissue of hepatocystic triangle.
- Dissecting distal 1/3rd of the gall bladder from the cystic plate
- Identify that only two structures i.e. cystic duct and artery entering the gall bladder.

In about 90-95% of patients there are high chances to establish CVS identify the structure clearly and then divide, ensuring that the cholecystectomy is performed safely

Olsen cholangiocatheter[6] and endoscopically placed optical fiber in the common bile duct, but its disadvantages are to be invasive and increase operative time.[7-9] So it was not used in routine procedure.

Rouvier's sulcus: It is also described as Incisura Dextra of Gansv[10], by Reynaud et al.[11]and also by Stringer.[12] Rouvier's sulcus is 2–5 cm sulcus running to the right lobe of and right to the liver hilum, anterior to the caudate lobe. It was found in 80-90% of patients. Different types of rouvier's sulcus (open type, closed type , slit type, scar type) are found intraoperatively.

Cystic lymph node: Another useful anatomic landmark for leading gallbladder dissection is the "Mascagni's node" or "cystic lymph node," which should represent the medial end for dissection, lying lateral to the biliary tree.[13]

## Materials and Methods

Study design: The present study was a prospective comparative Study. Study Area: The study was conducted in the Department of General Surgery at a Sri Guru Ram Das Institute of Medical Sciences and Research Amritsar, Punjab from 01 January 2023to 31st March 2024. Patients from either sex with no age limit presenting with symptomatic cholelithiasis was taken in the study after an informed consent. The study was conducted after approval from institutional thesis ethical committee. (24/06/2023,ref. no.SGRDU/Cont/Thesis/23-329)

Inclusion Criteria: Patients with symptomatic cholelithiasis who underwent elective laparoscopic cholecystectomy.

Exclusion Criteria: Diagnosed cases of hepatobiliary malignancies, those with previous laparotomy or laparoscopic surgeries were also excluded, patient with history of chronic liver disease.

Procedure: A comparative study was done on 60 patients of cholelithiasis who underwent LC at our institution in two year period. All patients were evaluated in terms of clinical, biochemical, haematological and ultrasonographic parameters and was randomised in two groups. Patient were allocated group A and B depending upon Ticket picked by them. During laparoscopic cholecystectomy standard four port technique was used. Group A patient: Rouviere'ssulcus and cystic lymph node was identified intraoperatively and an imaginary line (R4U) that passed from the sulcus across the base of segment 4 to the umblical fissure was drawn and cystic line is an imaginary line running through cystic lymph node and parallel to hepatoduodenal ligament was drawn. Dissection lateral to intersection of these imaginary lines along with achievement of CVS mark the safe zone of dissection to prevent bile duct injury. Group B patients: Underwent conventional method of dissection (calot's Triangle dissection). Cystic duct and cystic artery were ligated carefully. The outcome was evaluated in all patients in terms of presence or absences of bile duct injury. Drain was inserted in liver bed and was removed post operatively depending upon drain output. Patients were followed up after 7 days and assessment was done. The data was collected and analyzed using appropriate statistical method and conclusion was drawn.

## Results

**Table 1: Table showing association of group A and group B study subjects with age group.**

| Age group | Group A | | Group B | |
|---|---|---|---|---|
| | No. | %age | No. | %age |
| <20 | 1 | 3.333 | 1 | 3.333 |
| 21-30 | 7 | 23.333 | 8 | 26.667 |
| 31-40 | 9 | 30.000 | 8 | 26.667 |
| 41-50 | 6 | 20.000 | 4 | 13.333 |
| 51-60 | 1 | 3.333 | 5 | 16.667 |
| 61-70 | 4 | 13.333 | 1 | 3.333 |
| >70 | 2 | 6.667 | 3 | 10.000 |
| Total | 30 | 100.000 | 30 | 100.000 |
| Mean age | 42.067±16.273 | | 42.300±17.998 | |
| p-value | 0.958 | | | |

**Table 2. Table showing association of group A and group B study subjects with gender.**

| Gender | Group A | | Group B | |
|---|---|---|---|---|
| | No. | %age | No. | %age |
| F | 26 | 86.667 | 28 | 93.333 |
| M | 4 | 13.333 | 2 | 6.667 |
| Total | 30 | 100.000 | 30 | 100.000 |
| p-value | $X^2$: 0.741; p=0.389 | | | |

**Table 3. Table showing association of group A and group B study subjects with post operative complications/ bile duct injury.**

| Post operative complications | Group A | | Group B | |
|---|---|---|---|---|
| | No. | %age | No. | %age |
| 1.0 | 0 | 0.000 | 1 | 3.333 |
| 3.0 | 30 | 100.000 | 29 | 96.667 |
| Total | 30 | 100.000 | 30 | 100.000 |
| p-value | $X^2$: 1.017; p=0.313 | | | |

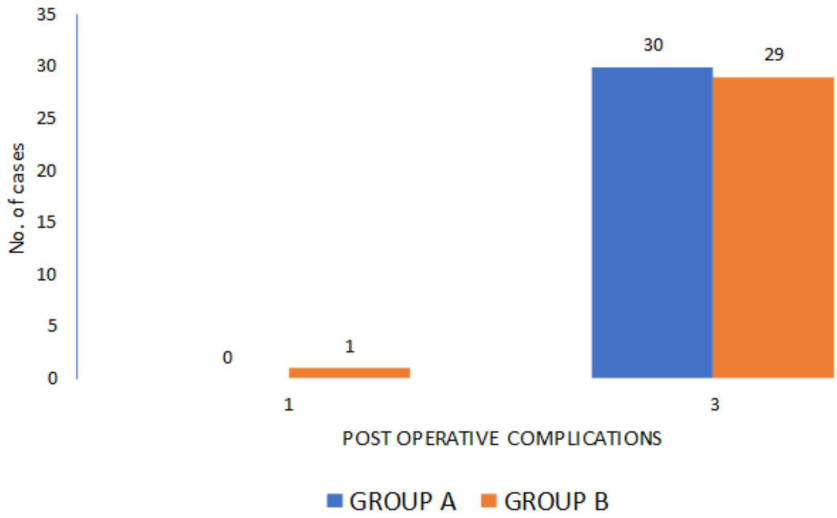


**Figure 1: Distribution of study subjects according to post operative complications.**

Table 1 shows that Out of total 30 patients in group A, 1 were under the age of 20 years, 16 were in age group of 20-40 years, 7 were in age group of 40-60 years and 6 were in the age group of more than 60 years while in case of group B, there were 1 patient in less than 20 years, 16 were in the age group of 20 -40 years, 9 were in age group of 40-60 years and 4 were in more than 60 years age group. The mean age of group a patients was 42.067±16.273 while that of group B patients was 42.300±17.998. The difference was not statistically significant. Table 2 shows that 86.66% females and 13.33% males were present in group A while 93.33% females and 6.66% males were present in group B. The difference was statistically insignificant. Table 3 shows that in group A patients no post operative complication/ bile duct injury was seen whereas in group B patients only 1 patient had post operative complications. The difference was statistically insignificant.

## Discussion

In our study, we present our experience of comparison between 60 cases of laparoscopic cholecystectomy. Study sample were divided into two groups. In group A (30) patients, we drew two imaginary lines intraoperatively i.e. R4U line (passes from rouvier's sulcus -the base of segment IV - umbilical fissure) and cystic line (start from the cystic lymph node and running parallel to hepatoduodenal ligament). Dissection superior to R4U line, lateral to cystic line and superolateral to this intersection of R4U and cystic line with the achievement of CVS and Calot triangle dissection define the safe area of dissection to prevent bile duct injury. In Group B (30) patients we used traditional method of laparoscopic cholecystectomy i.e. Calot's triangle dissection with Critical View of Safety achievement without using any extra biliary landmarks. Outcomes have been compared in terms of number of injuries encountered in group A (identification of Rouviere's sulcus and cystic lymph node as extra biliary safety landmarks) versus Group B (dissection of Calot's triangle with achievement of critical view of safety).

In our study according to the age distribution maximum study subjects belonged to fourth decade. Kumar et al.[14] also conducted a similar study in

2020 and he also concluded that maximum study subject belongs to fourth decade. Sharma et al.[15] was conducted a similar study in 2023 and he also concluded that maximum patients present in fourth decade of life.

According to gender wise distribution of study subjects, our study showed that more number females undergo laparoscopic cholecystectomy. Similar female predominance was present in study conducted by Kumar et al.[14] in 2020. Sharma et al.[15] also conducted a same study in 2023 where he also concluded female predominance in study subjects.

Outcome comparison:

- Group A patients – out of 30 patients no bile duct injury seen.
- Group B- 1 patient had bile duct injury out of 30 patients.

Sharma et al.[15] also conducted a similar study in 2023 he also concluded that rouvier's sulcus and cystic lymph node are extra biliary safety landmark and give a better understanding of major bile duct area and help in prevention of bile duct injury. Abdelmonem et al.[16], conducted a similar study on 250 patients in 2023 and he concluded that more than one safety landmarks like rouvier's sulcus and cystic lymph node help in safeguarding of major bile duct and prevent from any post operative complication. Pathak et al.[17] in 2023 conducted a similar study on 500 patients and he observed that rouvier's sulcus was present in 465 cases no bile duct injury was seen after dissection start from rouvier's sulcus as fixed extra biliary safety landmark along with cvs achievement and he concluded that rouvier's sulcus is safety landmark in laparoscopic cholecystectomy to decrease the incidence of biliary track injury. Similar study conducted by Greene et al.[18], Gupta et al.[19] ,Bajpayee et al.[20] and Baukala et al.[21] showed that rouvier sulcus and cystic lymph node is important landmark during dissection in LC.

## Conclusion

Apart from the well-established calot's triangle dissection with CVS achievement major bile duct injury was still 0.3-0.5% and it was commonly happened because of misidentification of cystic duct [either aberrant origin or normal course of cystic duct]. Before commencement of calot's triangle dissection identification of Rouviere's sulcus [RS] and cystic lymph node of lund is an extra biliary, easily accessible and reliable anatomical land mark from where we can draw two imaginary line [R4U and cystic line] and dissection start above and lateral to intersection of these line and no injury was observed in our study. So it can be help us as an additional safe reference point to avoid bile duct injury and dissection in safe area close to gall bladder in laparoscopic cholecystectomy

Adoption of extra biliary safety landmark technique help in reducing the incidence of bile duct injury. Benefits of decrease bile duct injuries:

- Early return to normal daily activities and increase quality of life.
- Lowering healthcare costs and significant cost saving for the patient. .
- No need of any secondary procedure (ERCP stenting, hepaticojejunostomy, CBD exploration) which is associated with bile duct injury.
- Decrease morbidity and mortality associated with bile duct injury.

**Limitation:**

Being a single-Centre and single surgeon study, it limits the number of patients included in study however, it's the first study to include both imaginary lines [R4U line and cystic line] and its intersection and superolateral plane of dissection as extra biliary safety landmarks of dissection before commencement of calot's triangle dissection. Because of small study sample size, the results of our study were insignificant [$p>0.05$], but no bile duct injury was observed when we use some extra biliary landmarks and safe zone of dissection after intersection of imaginary line in comparison to traditional method of dissection [calot's triangle dissection with CVS achievement].

**Ethical Clearance:** The study was conducted after approval from institutional thesis ethical committee. (24/06/2023, ref. no.SGRDU/Cont/Thesis/23-329)

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## References


1. Stinton LM, Myers RP, Shaffer EA. Epidemiology of gallstones. Gastroenterology Clinics. 2010 Jun 1;39(2):157-69.
2. Pesce A, Portale TR, Minutolo V, Scilletta R, Li Destri G, Puleo S. Bile duct injury during laparoscopic cholecystectomy without intraoperative cholangiography: a retrospective study on 1,100 selected patients. Digestive surgery. 2012;29(4):310-4.
3. Machado NO. Biliary complications postlaparoscopic cholecystectomy: mechanism, preventive measures, and approach to management: a review. Diagnostic and therapeutic endoscopy. 2011;2011.
4. Viste A, Horn A, Øvrebø K, Christensen B, Angelsen JH, Hoem D. Bile duct injuries following laparoscopic cholecystectomy. Scandinavian Journal of Surgery. 2015 Dec;104(4):233-7.
5. Felekouras E, Petrou A, Neofytou K, Moris D, Dimitrokallis N, Bramis K et al. Early or Delayed Intervention for Bile Duct Injuries following Laparoscopic Cholecystectomy? A Dilemma Looking for an Answer. Gastroenterol Res Pract. 2015;2015:104235.
6. Olsen D. Bile duct injuries during laparoscopic cholecystectomy. Surgical endoscopy. 1997 Feb;11:133-8.
7. Wang ZY, Xu F, Liu YD, Xu CG, Wu JL. Prevention of biliary duct injury in laparoscopic cholecystectomy using optical fiber illumination in common bile duct. Gastroenterology Research. 2010 Oct;3(5):207.
8. Zubair M, Habib LU, Memon FA, Mirza MR, Khan MA, Quraishy MS. Rouviere's sulcus: a guide to safe dissection and laparoscopic cholecystectomy. Pak J Surg. 2009;25(2):119-21.
9. Dahmane R, Morjane A, Starc A. Anatomy and surgical relevance of Rouviere's sulcus. The Scientific World Journal. 2013 Jan 1;2013.
10. Gans H, Study of anatomy of the intrahepatic structures and its repercussions of hepatic surgery [Ph.D. thesis], University of Nijmegen, Elsevier, Amsterdam, The Netherlands. 1955.
11. Reynaud BH, Coucoravas GO, Giuly JA. Basis to improve several hepatectomy techniques involving the surgical anatomy of incisura dextra of Gans. Surgery, Gynecol Obstet. 1991 Jun 1;172(6):490-2.
12. Stringer MD, Mirjalili SA. Eponyms in surgery and anatomy of the liver, bile ducts and pancreas. London: Royal Society of Medicine Press; 2009.
13. Ferzli G, Timoney M, Nazir S, Swedler D, Fingerhut A. Importance of the node of Calot in gallbladder neck dissection: an important landmark in the standardized approach to the laparoscopic cholecystectomy. J Laparoendosc Adv Sur Tech. 2015;25(1):28-32.
14. Berci G, Hunter J, Morgenstern L, Arregui M, Brunt M, Carroll B et al. Laparoscopic cholecystectomy: first, do no harm; second, take care of bile duct stones. Surg Endoscopy. 2013 ;27:1051-4.
15. Barrett M, Asbun HJ, Chien HL, Brunt LM, Telem DA. Bile duct injury and morbidity following cholecystectomy: a need for improvement. Surg Endoscop. 2018;32:1683-8.
16. Pucher PH, Brunt LM, Davies N, Linsk A, Munshi A et al. SAGES Safe Cholecystectomy Task Force. Outcome trends and safety measures after 30 years of laparoscopic cholecystectomy: a systematic review and pooled data analysis. Surg Endoscop. 2018;32:2175-83.
17. Pathak R, Mittal L, Chouhan GM, Tripathi A. Rouviere's Sulcus: A Guide to Safe Laparoscopic Cholecystectomy. Journal of Acute Care Surgery. 2023;13(1):10-2.
18. Greene B, Tsang M, Jayaraman S. The inferior boundary of dissection as a novel landmark for safe laparoscopic cholecystectomy. HPB. 2021;23(7):981-3.
19. Gupta V, Jain G. Safe laparoscopic cholecystectomy: Adoption of universal culture of safety in cholecystectomy. World J Gastrointestinal Surg. 2019;11(2):62.
20. Bajpayee P, NeeleshKanaskar PV, Manivikar PR. Significance of Rouviere's Sulcus in Hepatobiliary Surgery: A Cadaveric study. Int J Anat Res. 2021;9(3.2):8074-78.
21. Basukala S, Thapa N, Tamang A, Shah KB, Rayamajhi BB, Ayer D et al. Rouviere's sulcus-An anatomical landmark for safe laparoscopic cholecystectomy: A cross-sectional study. Ann Med Surg. 2022;75:103404.