Rouviere's Sulcus: An Important Anatomical Landmark in Laparoscopic Cholecystectomy

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ABSTRACT

Introduction: Though laparoscopic cholecystectomy is a gold standard treatment for symptomatic cholelithiasis, safe dissection of Calot's triangle is important to avoid major complications like injury to bile duct, vessels and nearby organs. **Aims: T**his study was designed to determine the frequency, description of Rouviere's sulcus and its role in safe laparoscopic cholecystectomy. **Methods**:This prospective cross-sectional study was conducted at the Department of Surgery, Karuna Hospital, Nepal from January 2022 to September 2022. Patients who underwent laparoscopic cholecystectomy, presence of Rouviere's sulcus were identified and classified, kept in Group A and absent in Group B. If the common bile duct outline visualized, its relation with Rouviere's sulcus was noted and used as reference point for gall bladder dissection. The perioperative complications, conversion to open procedure, operative time and hospital stay were recorded. **Results:** Among 100 patients, the Rouviere's sulcus was present in 79% and absent in 21%. Type I is the most common (65.82%). It was found above the level of common bile duct line in 84.81%. Cystic artery injury was present in 1.26% (Group A) and 14.28% (Group B). Bile/stone spillage 1.26% (Group A) and 9.52% (Group B), port hematoma 2.52% (Group A) and 9.52% (Group B), operative time 43.17±8.57 minutes (Group A) and 61.29±12.07 minutes (Group B), conversion to open procedure was none in Group A and 9.52% (Group B) and hospital stay 1.23±0.59 days in group A and 3.16±1.16 days in Group B. **Conclusion:** Rouviere's sulcus is an important extrabiliary anatomical landmark, seen in majority of patients for safe laparoscopic cholecystectomy.

Keywords: Bile duct injury, Laparoscopic cholecystectomy, Rouviere's sulcus

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INTRODUCTION

Laparoscopic cholecystectomy (LC) is one of the most common surgical procedures performed in the world and considered as gold standard treatment for symptomatic cholelithiasis.[1] In 1990s, LC had higher incidence of surgery related complications than open cholecystectomy that ranged from bile duct injury, vascular injury to bowel injury.[2] It is clear that as the numbers of LCs increased over time, so did the rates of associated injuries even when performed by experienced surgeons. Accurate identification of the hepatobiliary anatomy is critical for safe LC, as most bile duct injuries are the result of misidentification or misinterpretation of the biliary anatomy.[3] In the last decade, surgeons have focused on many strategies to avoid complications during LC.[4] The common anatomical landmark known as Rouviere's sulcus (RS)[5] though lesser known, was an important anatomic work in surgeon's strategy.[6] MH Rouviere in 1924, identified and described this landmark and used as a reference point to guide for safe liver dissection.[7,8] With the development of laparoscopy, the surgical interest in the RS and its relation to common bile duct (CBD) has been increased.[9] This sulcus which was hardly seen or described in open surgery is appreciated clearly during laparoscopy.[10] This 2-5cm long sulcus runs to the right of the liver hilum, contains the right portal triad or its branches and accurately identifies the plane of CBD, present in up to 80% patients.[11,12] This study aimed to determine the frequency, description of RS and its role as a reference point during dissection of gallbladder in LC.

METHODS

This prospective cross-sectional study of 100 consecutive

patients was conducted at the Department of Surgery, Karuna Hospital, from January 2022 to September 2022 after Ethical Committee Board approval. The exclusion criteria included the age <15 years, complicated gallstone disease, unfit for general anesthesia, willing to open cholecystectomy, liver disease, malignancy and immunocompromised status. All patients who fulfilled inclusion criteria were prepared for surgery with informed consent for the study. LC was done by standard four port technique in all patients by the same laparoscopic surgeon. During laparoscopy, RS was identified after retracting the fundus of the gallbladder. Its frequency, morphology and the CBD outline if visualized in relation with the RS was noted. The presence or absence of RS was confirmed by surgeon after CO_2 insufflation and port placement before starting the dissection of the gall bladder. Those patients in whom RS was present were kept in Group A and absent in Group B. The presence of RS was classified into four types. Type I (open) is defined as a cleft in which the right hepatic pedicle is visualized and the sulcus is open throughout its length. Type II (close) is partially fused sulcus which opens only at its lateral end. Type III (slit) is also partially fused but it opens only at its medial end. Type IV (scar) in which pedicle is visualized as a scar or an absent sulcus.[13] The absence of RS was likely due to bowel/omental adhesion, caudate lobe disturbance or complete absence. The RS was used as a guiding point for the initiation of dissection of the gall bladder. All patients who underwent LC, the duration of surgery, intra and postoperative complications, conversion to open procedure and duration of hospital stay were recorded in each Group. Bile duct injury, major vascular injury and nearby organ injury were considered as major complications while port site hematoma and infection, bile and gall stones spillage were considered as minor. The collected data was analyzed using SPSS version 16. Chi-square test was used to compare variables and p-value <0.05 was considered statistically significant.

RESULTS

A total of 100 patients, 83(83%) female and 17(17%) male with female/male ratio of 4.88:1with female preponderance was included in the study. The age of presentation ranged from 15-77 years with mean of 36.61 (SD±9.21) years predominantly in the fourth decade of life. Among these patients, majority of the patients 88(88%) underwent LC for symptomatic cholelithiasis, 6(6%) for gall bladder polyp, 3(3%) for acute mild biliary pancreatitis and 3(3%) for post-ERCP (Table I).

Variables	Frequency (%)
Age	36.61 (SD±9.21) years
Sex	
Female	83
Male	17
Clinical presentation	
Symptomatic cholelithiasis	88
Gall bladder polyp	6
Acute mild biliary pancreatitis	3
Post ERCP	3

*ERCP: Endoscopic Retrograde Cholangiopancreatography SD: Standard deviation

Table I: Demographic profile of the patients (n=100)

The mean operative time was 43.17 (SD±8.57) minutes in Group A and 61.29 (SD±12.07) minutes in Group B (p=0.001), conversion to open cholecystectomy in 2 patients (9.52%) in Group B (p<0.0001) and hospital stay of 1.23 (SD±0.59) days in Group A and 3.16 (SD±1.16) days in Group B (p=0.0001) (Table II).

Variables	Group A (n=79)	Group B (n=21)	p-value
Operative time	43.17 (SD±8.57) minutes	61.29 (SD±12.07) minutes	0.001
Conversion to open procedure	None	2 (9.52%)	<0.0001
Hospital stay	1.23 (SD±0.59) days	3.16 (SD±1.16) days	0.0001

Table II: Outcomes of patients who underwent laparoscopic cholecystectomy (n=100)

During procedure, after retracting the fundus of the gallbladder and before the commencement of dissection in Calot's triangle, the presence or absence of RS was observed in which RS was identified in 79(79%) patients whereas it could not be noted in 21(21%). The RS was found to be above the level of CBD line in 67(84.81%), at the same level in 8(10.1%) and could not be visualized in 4(5.06%) patients (Table III).

Rouviere's sulcus	Frequency (%)
Present	79
Above the level of CBD line	67 (84.81%)
At the level of CBD line	8 (10.1%)
Not visualized	4 (5.06%)
Absent	21
Total	100

Table III: Incidence of Rouviere's sulcus

Among 79(79%) patients in whom RS was present, the open type sulcus was seen in 52(65.82%) followed by close type in 17(21.52%), slit type in 7(8.86%) and scar type in 3(3.8%) (Table IV).

Type	Frequency (%)
Open	52 (65.82)
Close	17 (21.52)
Slit	7 (8.86)
Scar	3 (3.8)
Total	79 (100)

Table IV: Type of Rouviere's sulcus

Regarding intra and postoperative complications, no bile duct and nearby organs injury were found in both Groups while injury to cystic artery was noted in 1(1.26%) patient in Group A and 3(14.28%) patients in Group B with p-value of 0.001. Minor complications including bile/stone spillage were noted in 1(1.26%) patient in Group A and 2(9.52%) patients in Group B with p-value of 0.038 while port hematoma in 2 (2.52%) patients in Group A and 2(9.52%) patients in Group B (p=0.068). There was no port site infection in both Groups (Table V).

Complications	Group A (n=79)	Group B (n=21)	p-value
Major			
Bile duct injury	None	None	
Cystic artery injury	1 (1.26%)	3 (14.28%)	0.001
Nearby organs injury	None	None	
Minor			
Bile/stone spillage	1 (1.26%)	2 (9.52%)	0.038
Port hematoma	2 (2.52%)	2 (9.52%)	0.068
Port site infection	None	None	

Table V: Intra and postoperative complications

DISCUSSION

Laparoscopic cholecystectomy is the most commonly performed surgery worldwide. However this technique has introduced complications like injury to bile ducts, hepatic vessels and nearby organs though its advantages have been discussed extensively in literature.[13] Apart from the well established critical view of safety strategy dissection of Calot's triangle during LC, the need of some extrabiliary anatomical landmark to help to locate the CBD should not be underestimated. The RS, in most patients is clearly visible during LC as a guiding point and CBD is present at the level of RS thus can be used as a safe anatomical landmark that present in hilar surface of liver.[12] Most studies had shown that the age of presentation of symptomatic cholelithisis was in the 4th decade of life with female preponderance and female/male ratio of 4.21:1[14,15] which was in accordance to the present study in which female in their 4th decade of life were affected with female/male ratio of 4.88:1.

The present study had shown the presence of RS in 79% patients and absent in 21%. Those patients in whom RS was present (Group A), 65.82% had open type, 21.52% had close type, 8.86% had slit type and 3.8% had scar type sulcus. The cystic artery injury in Group A was 1.26% and 14.28% in Group B (p=0.001), bile/stone spillage in 1.26% in group A and 9.52% in Group B (p=0.038) and port hematoma 2.52% in Group A and 9.52% in Group B (p=0.068). The operative time 43.17±8.57 minutes in group A and 61.29±12.07 minutes in Group B (p=0.001), conversion to open surgery in 9.52% in Group B (p<0.0001) and hospital stay of 1.23±0.59 days in Group A and 3.16±1.16 days in group B (p=0.001). Hugh et al[12] and Dahmane et al[13] had also reported the presence of RS and its type with open type as a common type and its outcome in terms of operative time, conversion to open surgery, hospital stay and complications accordance to our study.

Hugh et al[12] had noted some inherited factors in the procedure which predispose to surgical error and the most significant is spatial disorientation. To avoid this, he used to start from a fixed point and used RS as an extrabiliary fixed point to start dissection. The importance lies in the fact that the cystic duct and artery lay invariably anterosuperior to the sulcus, confirming the anatomy of the Calot's triangle that result in minimal incidence of CBD injury, vascular injury, conversion to open surgery, less operative time and hospital stay. The present study had also found the same result with the study of Hugh et al[12] in which perioperative complications, conversion to open surgery, operative time and duration of hospital stay is less in Group A patients where RS was present and taken as reference for gall bladder dissection.

From our study, a possible benefit that can be derived is that RS can always be taken as an extra biliary landmark for performing safe LC in consideration with other safety measures.

LIMITATIONS

This study was conducted in a single center for short duration of time and self funded. Possibility of unintentional selection bias can occurred due to small sample size. Follow up studies in multi-center with larger sample size will help to predict the role of RS in safe LC more accurately.

CONCLUSION

Rouviere's sulcus can be considered as an important extrabiliary anatomical landmark, identified in majority of patients for safe laparoscopic cholecystectomy. Its identification before commencement of Calot's triangle dissection may help to minimize the injury to bile duct, major vessels and other nearby organs for better outcomes with less operative time, conversion to open procedure and hospital stay.

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