ORIGINAL RESEARCH

Prevalence and structural variants of Rouvière's sulcus in a sample of Kenyan livers: A cadaveric study with implications for laparoscopic cholecystectomy

Fiona Nyaanga, Bernard Ndung'u, Isaac Cheruiyot, Wycliffe Kaisha, Jeremiah Munguti, Paul Odula

Department of Human Anatomy, University of Nairobi, Nairobi, Kenya

Correspondence: Ms Fiona Nyaanga (fionakemunto8@gmail.com)

East Cent Afr J Surg. 2022;27(2):51-56
https://doi.org/10.4314/ecajs.v27i2.2

Abstract

Background
The sudden increase in the number of centres offering laparoscopy services in our setting and the wide acceptance of laparoscopic cholecystectomy (LC) have led to a large volume of procedures being performed by surgeons with limited experience in this area, resulting in a surge in the number of complications. Knowledge of important anatomical landmarks may help prevent damage to important structures during LC. Rouvière's Sulcus (RS) is such a landmark whose utility in preventing bile duct and vascular injury during LC is highly recognized. This study aimed to estimate the frequency and anatomical variants of RS in the Kenyan population.

Methods
This cadaveric study was conducted at the Department of Human Anatomy, University of Nairobi. One hundred sixteen livers were examined to assess for the presence of RS and anatomical variants.

Results
RS was identified in 98 of the 116 examined livers (84.5%). The deep RS variant was found in 77 livers (66.4%), with its subtypes—continuous with the hepatic hilum medially vs fused medially—present in 63 (54.3%) and 14 (12.1%) livers, respectively. The shallow and scar-like RS types were observed in 11 (9.5%) and 10 (8.6%) livers, respectively. In 18 livers (15.5%), RS was not identified.

Conclusions
RS is a frequent anatomical landmark present in 84.5% of the livers of the Kenyan sample studied, either as an open or fused type. It can, therefore, be reliably used as a landmark in LC to avoid bile duct and concomitant vascular injury and to enable vascular control during segmental surgery of the right liver.

Keywords: Rouvière's sulcus, laparoscopic cholecystectomy, bile duct injury, Kenya

Introduction

A clear understanding of normal, variant, and pathologic laparoscopic anatomy of the hepatobiliary apparatus is important for the safe execution of any surgical procedure and should minimize the risks of inadvertent injuries. Laparoscopic cholecystectomy (LC) is among the commonest general surgical procedures,[1] and the sudden increase in the number of centres offering laparoscopy services in Kenya has led to a large volume of procedures being performed by surgeons with limited experience, resulting in a surge in the number of complications.

Although LC offers numerous benefits, it has been associated with higher bile duct injury (BDI) rates relative to those associated with open cholecystectomy.[2] However, these LC-associated injury rates have been reported to decrease and become comparable to open cholecystectomy once surgeons are beyond the initial learning phase of laparoscopic techniques.[3] Regardless of this reduced incidence, the reported rate of 0.3% BDI that occurs in association with LC[4] is still high in an era when between 750 000 and 1 million LCs are being performed annually in the United States only.[5]

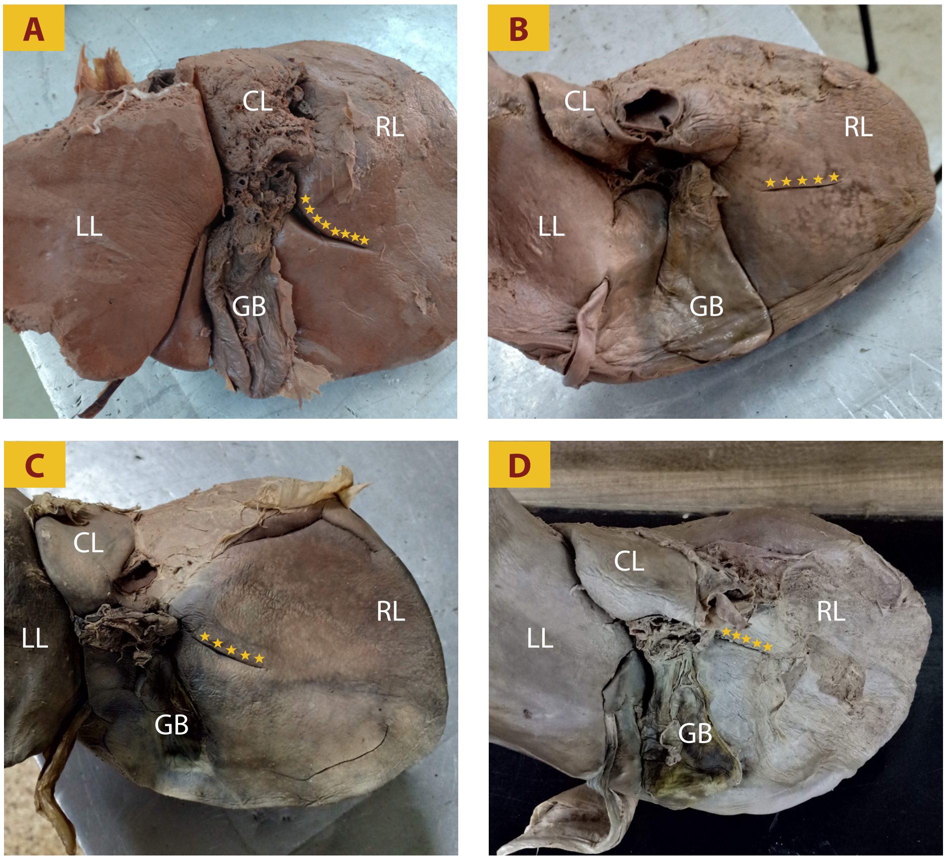

Figure 1. Morphological types of Rouvière's sulcus

(A) Type 1A Rouvière's sulcus (yellow stars): the deep sulcus runs continuously with the liver hilum medially; (B) type 1B Rouvière's sulcus (yellow stars): the deep sulcus is fused medially; (C) type 2 Rouvière's sulcus (yellow stars): the sulcus is shallow; (D) type 3 Rouvière's sulcus (yellow stars): the scar-like sulcus is represented by a line where we expect to see Rouvière's sulcus

CL, caudate lobe; GB, gallbladder; LL, left lobe; RL, right lobe

In the last decade, researchers have focused on many strategies to avoid complications during LC.[6],[7] Other than Calot's triangle anatomy, another anatomical landmark is Rouvière's sulcus (RS),[8]-[10] identified by Rouvière[11] in 1924 as a 2- to 5-cm sulcus lying anterior to the caudate lobe and running to the right of the liver hilum, usually containing the right portal triad. Rouvière used it as a reference to guide the starting point of safe liver dissection.[12]-[14] Based on anatomic studies and supported by LC studies, this sulcus has been shown to accurately identify the plane of the common bile duct (CBD), as substantiated by cholangiogram.[15] Peti and Moser[16] determined that RS dissection is a lesser-known but important landmark in every surgeon's strategy for safe LC and the segment-oriented approach to right liver resection. RS was hardly seen and described in the open surgery era but is very clearly seen during LC due to the pressure of CO_2 insufflation opening up the sulcus widely and due to the enhanced illumination and image quality afforded by digital endoscopic cameras.[17] The introduction of laparoscopic techniques has sparked renewed interest in RS and its anatomical relationship with the right portal pedicle. It is now commonly characterized as a deep sulcus, a slit, or a scar.[17] The use of RS as an anatomical landmark in LC has been associated with reduced BDI incidence, minimized blood loss, and shortened operative time.[18],[19]

RS has been described to be present in about 52%[11] to 90%[17] of the general population. It also displays morphological variants with regard to its depth.[17],[20] Although these morphological variants do not affect clinical outcomes, they have been reported as key in the prediction of anomalous bile duct organization.[21] With the advent and quick progression of LC procedures in Kenya,[22] knowledge of anatomical landmarks, particularly the RS, remains pertinent. Our study aimed to determine the frequency and anatomical variants of RS in a selected Kenyan population.

Methods

Study design and setting

This was a descriptive cross-sectional cadaveric study conducted at the Department of Human Anatomy, University of Nairobi.

Specimens

One hundred sixteen formalin-fixed cadaveric livers were used for this study. Livers with visible damage, shrinkage, or any gross pathology were excluded.

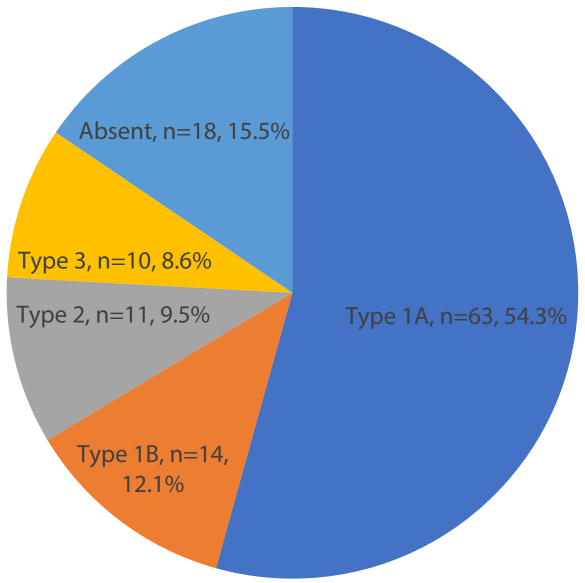

Figure 2. Proportions of Rouvière's sulcus types in a Kenyan population

Assessment and definition of RS types

The presence of the sulcus was established by studying the posterior aspect of the right lobe and noting any fissure, sulcus, or line coursing towards the caudate lobe. Figure 1 depicts morphological RS variants. The open type of sulcus was defined as a cleft in which branches of the right hepatic pedicle were visualized, and the sulcus was open throughout its length. The parenchymatous fused type was defined as the type in which the sulcus was open only at its lateral end.[18] The type of sulcus was determined using criteria based on the findings of Singh and Prasad[17]: if a clear fissure was seen, its depth was measured; a depth of ≥0.5 cm defined deep sulci (type 1), while a depth of <0.5 cm defined shallow sulci (type 2). The deep sulci were further described as either open or closed, where the open sulci were continuous with the hepatic hilum medially (type 1A), and the closed sulci were fused medially (type 1B). If a white hazy line was observed, this was described as a scar-like sulcus (type 3).

Study outcomes

The primary outcome of the study was the RS prevalence, with the secondary outcome being the various morphological types observed.

Data synthesis

Quantitative data on the prevalence of RS and its various morphological types were entered into SPSS Statistics for Windows, version 21.0 (IBM Corp., Armonk, NY, USA) for analysis using descriptive statistics (frequencies and percentages). Data are presented in images and charts.

Results

Primary outcome

RS was present in 98 of the 116 livers (84.5%).

Secondary outcome

The deep RS type was observed in 77 livers (66.4%). The subtypes of the deep type, types 1A and 1B, were identified in 63 (54.3%) and 14 (12.1%) livers, respectively. The shallow type (type 2) was present in 11 livers (9.5%), and the scar-like type (type 3) was observed in 10 livers (8.6%). There were 18 livers (15.5%) in which RS was absent (Figure 2).

Discussion

LC is currently considered the gold-standard treatment for symptomatic cholelithiasis.[23] Its advent in the late 1980s and subsequent uptake was rapid and unregulated, resulting in a 3-fold higher incidence of iatrogenic BDI (IBDI) than rates reported in association with the open approach.[2] Recent large-scale studies, however, have demonstrated that it is possible to perform LC with IBDI incidence rates similar to those associated with open procedures.[3] Although the incidence of IBDI is relatively low, the high number of LCs performed globally each year highlights the importance of this issue.[4] BDIs, therefore, remain a major cause of morbidity, mortality, and reduced quality of life among patients who have undergone LC.[24]

Inaccurate identification of hepatobiliary anatomy has been identified as the major contributor to IBDI.[25] During LC, the surgeon is presented with a 2-dimensional view of structures that are 3-dimensional.[26] This, coupled with limited haptic feedback, makes it difficult to distinguish anatomical structures.[27] The presence of inflammation, haemorrhage, and aberrant biliary anatomy further increases the risk of IBDI.[28]

Various methods, including intraoperative cholangiography and the critical view of safety, have been implemented to lower the incidence of BDI.[29] However, these methods have been deemed only moderately effective. For example, the critical view of safety technique often proves challenging to achieve in cases of inflammation,[29] while the cost-effectiveness of intraoperative cholangiography has been a subject of concern.[30] Furthermore, despite the adoption of intraoperative cholangiography and the critical view of safety, as well as advancements in surgical education, the incidence of BDI has not seen a significant decline over the years.[25] Fluorescent cholangiography using indocyanine green is gaining popularity, but it has not yet demonstrated statistically significant reductions in BDI rates. As a result, many authors continue to advocate for the use of anatomical landmarks as a reliable and cost-effective method to improve outcomes.[31]

A stable extrabiliary reference point, like RS, is essential for providing anatomical guidance and ensuring the safe dissection of the hepatobiliary triangle to prevent IBDIs. This is especially pertinent in Kenya, where the use of LC for symptomatic cholelithiasis is on the rise.[22]

In this study, RS was observed in the majority of specimens (84.5%), manifesting as any of 3 morphological forms: deep, shallow, or scar-like. This prevalence is significant, although slightly lower than the 97.7% reported by Elwan et al.[32] in an Egyptian cohort. The consistency in RS occurrence may be attributable to genetic variation, ancestral evolutionary influences, or pressure from the ribs or diaphragm

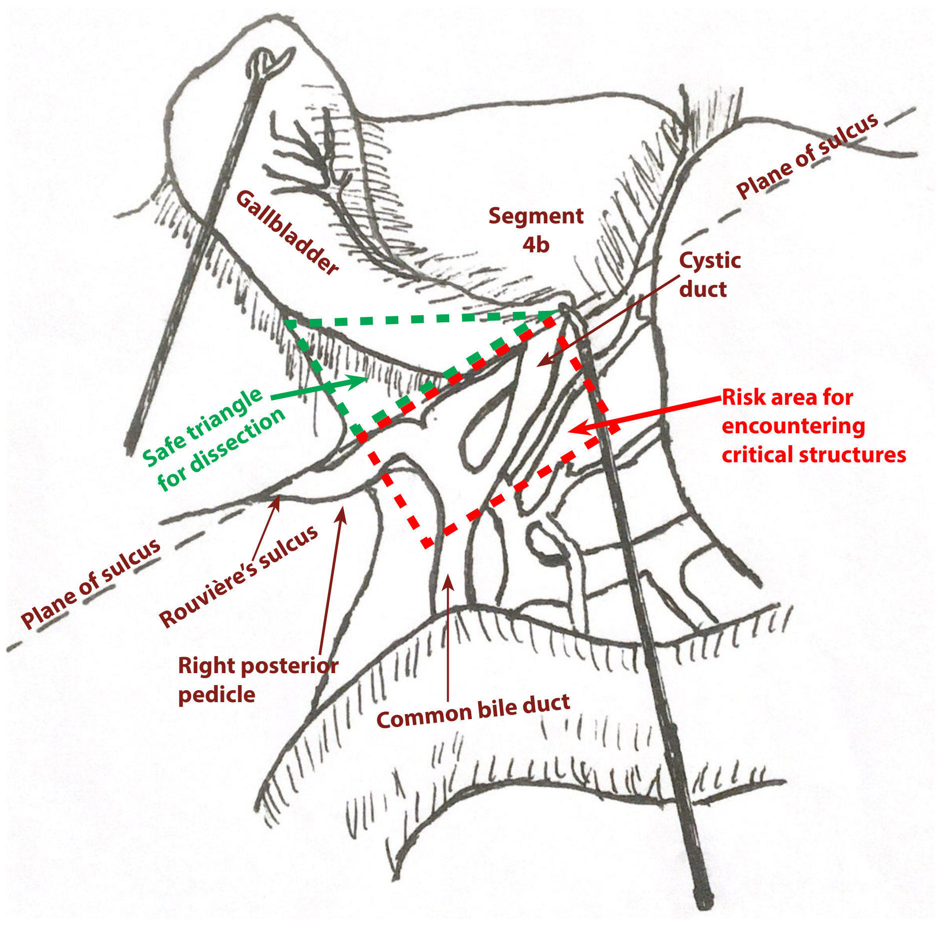

Figure 3. Rouvière's sulcus and its application in laparoscopic cholecystectomy

during development.[33] Such a high prevalence underscores the reliability of RS as an anatomical marker during laparoscopic interventions to mitigate the risk of injuries to the CBD and right posterior portal pedicle.

The distribution of RS morphologies varies across populations (Table), with a predominance of the deep type 1 RS in the Kenyan specimens examined in our study. This type often encompasses branches of the right posterior portal pedicle, serving as a crucial point for vessel clipping in liver segmentectomy.[34] Genetic diversity also contributes to the variation in sulcus anatomy.[33] While the implications of these morphological differences remain to be fully understood, studies by Shimizu et al.[21] and Kim et al.[35] have suggested varying associations with biliary tree anomalies and LC outcomes, respectively. Despite these uncertainties, the prevalence of the deep RS type supports its use as a dependable structure during LC in the Kenyan population to avert BDI and associated vascular injuries.

After port insertion and CO_2 insufflation, RS can be best visualized by retracting the gallbladder cephalad and to the left to expose the hepatocytic triangle. The RS can then be safely identified as a landmark to map out the R4U line (RS→ segment 4→ umbilical fissure), as outlined by Gupta and Jain.[36] The R4U line is an imaginary line extending from the roof of the sulcus to segment 4b of the liver. The cystic duct and cystic artery lie above this line, while the CBD lies below it. Dissection ventral and cephalad to this line are considered safe as there is a minimal chance of encountering the CBD[37] (Figure 3).

Lockart and Singh-Ranger[38] also propose that once the RS has been identified, the CBD can be located below it, with the cystic duct and artery above it. When the gallbladder is retracted, the sulcus points towards the neck of the gallbladder, which could facilitate dissection of Calot's triangle and a resultant safe LC. Compared with conventional LC, the use of RS as a fixed landmark ('RS-first LC') has been associated with shorter operative durations, minimized blood loss, lower conversion rates, and lower IBDI incidence.[15],[18],[19],[39],[40] The visual clarity of RS, unaffected by inflammation, enhances its reliability as an extrabiliary landmark.[41]

While avoiding LC complications is challenging, fostering a culture of safe cholecystectomy remains critical in preventing IBDI. Proficiency in hepatobiliary anatomy and the surgical landmarks of LC, along with a thorough understanding of BDI mechanisms, is central to minimizing hepatobiliary complications.

This study's small sample size was a limitation; larger-scale intraoperative laparoscopic studies are warranted to enrich our findings.

Table. Distribution of Rouvière's sulcus among different populations

Author (publication year)	N	Rouvière's sulcus prevalence	Morphological variants
Rouvière (1924)[11]	–	52%	–
Gans (1955)[42]	–	80%	–
Reynaud et al. (1991)[43]	–	73%	–
Hugh et al. (1997)[15]	100	n=78, 78.0%	Fully open (n=41, 41.0%), partially open (n=37, 37.0%)
Zubair et al. (2009)[23]	160	n=109, 68.1%	Open (n=48, 30.0%), fused (n=61, 38.1%)
Dahmane et al. (2013)[20]	40	82%	Open (70%), fused (12%)
Thapa et al. (2015)[44]	200	n=150, 75%	Open (40.5%), partially fused/open laterally (9.0%), partially fused/open medially (6.8%), fused (18.8%)
Kim et al. (2016)[35]	369	75%	Open (62%), partially fused (13%)
Singh and Prasad (2017)[17]	117	n=100, 85.5%	Deep (n=71, 60.7%), slit (n=23, 19.7%), scar (n=6, 5.1%)
Al-Naser (2018)[45]	402	n=319, 79.4%	Open (n=221, 55.0%), fused (n=98, 24.4%)
Lazarus et al. (2018)[46]	75	n=62, 82.7%	Deep (n=38, 50.7%), slit-like/superficial/narrow (n=19, 25.3%), scar-like white line (n=5, 6.7%)
Elwan et al. (2019)[32]	300	n=293, 97.7%	Open (n=175, 58.3%), closed (n=118, 39.3%)
Present study – Nyaanga et al. (2021)	116	n=98, 84.5%	Deep (≥0.5 cm; n=77, 66.4%), shallow (<5 cm; n=11, 9.5%), scar-like (n=10, 8.6%)

References

1. Mangieri CW, Hendren BP, Strode MA, Bandera BC, Faler BJ. Bile duct injuries (BDI) in the advanced laparoscopic cholecystectomy era. *Surg Endosc*. 2019;33(3):724-730. doi:10.1007/s00464-018-6333-7 [View Article] [PubMed]
2. Calvete J, Sabater L, Camps B, et al. Bile duct injury during laparoscopic cholecystectomy: myth or reality of the learning curve? *Surg Endosc*. 2000;14(7):608-611. doi:10.1007/s004640000103 [View Article] [PubMed]
3. Halbert C, Pagkratis S, Yang J, et al. Beyond the learning curve: incidence of bile duct injuries following laparoscopic cholecystectomy normalize to open in the modern era. *Surg Endosc*. 2016;30(6):2239-2243. doi:10.1007/s00464-015-4485-2 [View Article] [PubMed]
4. Chun K. Recent classifications of the common bile duct injury. *Korean J Hepatobiliary Pancreat Surg*. 2014;18(3):69-72. doi:10.14701/kjhbps.2014.18.3.69 [View Article] [PubMed]
5. Osborne DA, Alexander G, Boe B, Zervos EE. Laparoscopic cholecystectomy: past, present, and future. *Surg Technol Int*. 2006;15:81-85. [PubMed]
6. Hunter JG. Exposure, dissection, and laser versus electrosurgery in laparoscopic cholecystectomy. *Am J Surg*. 1993;165(4):492-496. doi:10.1016/s0002-9610(05)80948-1 [View Article] [PubMed]
7. Tebala GD, Innocenti P, Ciani R, et al. Identification of gallbladder pedicle anatomy during laparoscopic cholecystectomy. Article in Italian. *Chir Ital*. 2004;56(3):389-396. [PubMed]
8. Singh K, Ohri A. Anatomic landmarks: their usefulness in safe laparoscopic cholecystectomy. *Surg Endosc*. 2006;20(11):1754-1758. doi:10.1007/s00464-005-0528-4 [View Article] [PubMed]
9. Machado MA, Herman P, Machado MC. A standardized technique for right segmental liver resections. *Arch Surg*. 2003;138(8):918-920. doi:10.1001/archsurg.138.8.918 [View Article] [PubMed]
10. Machado MA, Herman P, Machado MC. Anatomical resection of left liver segments. *Arch Surg*. 2004;139(12):1346-1349. doi:10.1001/archsurg.139.12.1346 [View Article] [PubMed]
11. Rouvière H. *Anatomie Humaine: Descriptive et Topographique*. Masson; 1924.
12. Troidl H. Disasters of endoscopic surgery and how to avoid them: error analysis. *World J Surg*. 1999;23(8):846-855. doi:10.1007/s002689900588 [View Article] [PubMed]
13. Olsen D. Bile duct injuries during laparoscopic cholecystectomy. *Surg Endosc*. 1997;11(2):133-138. doi:10.1007/s004649900315 [View Article] [PubMed]
14. Nagral S. Anatomy relevant to cholecystectomy. *J Minim Access Surg*. 2005;1(2):53-58. doi:10.4103/0972-9941.16527 [View Article] [PubMed]
15. Hugh TB, Kelly MD, Mekisic A. Rouvière's sulcus: a useful landmark in laparoscopic cholecystectomy. *Br J Surg*. 1997;84(9):1253-1254. doi:10.1046/j.1365-2168.1997.02769.x [View Article] [PubMed]
16. Peti N, Moser MA. Graphic reminder of Rouviere's sulcus: a useful landmark in cholecystectomy. *ANZ J Surg*. 2012;82(5):367-368. doi:10.1111/j.1445-2197.2012.06032.x [View Article] [PubMed]
17. Singh M, Prasad N. The anatomy of Rouviere's sulcus as seen during laparoscopic cholecystectomy: A proposed classification. *J Minim Access Surg*. 2017;13(2):89-95. doi:10.4103/0972-9941.201731 [View Article] [PubMed]
18. Zhao F, Wang PB, Hu QS, et al. Use of Rouviere groove guide localization combined with "safety window" technique during difficult laparoscopic cholecystectomy. Article in Chinese. *Chin J Gen Surg*. 2017;26(11):1506-1510. doi:10.3978/j.issn.1005-6947.2017.11.023 [View Article] [PubMed]
19. Wang S, Wang Y, Wang Q, et al. Role of Rouviere's sulcus as anatomical landmark in laparoscopic cholecystectomy: a report of 750 cases. Article in Chinese. *J Clin Hepatol*. 2014;30(8):776-778. doi:10.3969/j.issn.1001-5256.2014.08.019 [View Article]

20. Dahmane R, Morjane A, Starc A. Anatomy and surgical relevance of Rouviere's sulcus. *ScientificWorldJournal*. 2013;2013:254287. doi:10.1155/2013/254287 [View Article] [PubMed]
21. Shimizu A, Lefor A, Noda Y, Sata N. Bile duct anomalies are associated with closed Rouviere's sulcus of the liver: "the closed Rouviere's sulcus sign" for increased intraoperative vigilance. *HPB (Oxford)*. 2016;18:e589. doi:10.1016/j.hpb.2016.03.570 [View Article]
22. Jani PG, Gill H. A decade of cholecystectomy at Kenyatta National Hospital: demographics, patterns and transition to laparoscopy. *Ann Afr Surg*. 2014;11(1).
23. Zubair M, Habib L, Memon F, Mirza MR, Khan MA, Quraishy MS. Rouviere's sulcus: a guide to safe dissection in laparoscopic cholecystectomy. *Pak J Surg*. 2009;25(2):119-121.
24. Renz BW, Bösch F, Angele MK. Bile duct injury after cholecystectomy: surgical therapy. *Visc Med*. 2017;33(3):184-190. doi:10.1159/000471818 [View Article] [PubMed]
25. Iwashita Y, Hibi T, Ohyama T, et al. Delphi consensus on bile duct injuries during laparoscopic cholecystectomy: an evolutionary cul-de-sac or the birth pangs of a new technical framework?. *J Hepatobiliary Pancreat Sci*. 2017;24(11):591-602. doi:10.1002/jhbp.503 [View Article] [PubMed]
26. Galketiya KP, Beardsley CJ, Gananadha S, Hardman DT. Rouviere's sulcus: review of an anatomical landmark to prevent common bile duct injury. *Surg Pract*. 2014;18(3):136-139. doi:10.1111/j.1744-1633.2012.00628.x [View Article]
27. Vettoretto N, Foglia E, Ferrario L, et al. Why laparoscopists may opt for three-dimensional view: a summary of the full HTA report on 3D versus 2D laparoscopy by S.I.C.E. (Società Italiana di Chirurgia Endoscopica e Nuove Tecnologie). *Surg Endosc*. 2018;32(6):2986-2993. doi:10.1007/s00464-017-6006-y [View Article] [PubMed]
28. Malik AM, Laghari AA, Talpur AH, Khan A. Iatrogenic biliary injuries during laparoscopic cholecystectomy. A continuing threat. *Int J Surg*. 2008;6(5):392-395. doi:10.1016/j.ijsu.2008.07.005 [View Article] [PubMed]
29. Strasberg SM, Brunt LM. Rationale and use of the critical view of safety in laparoscopic cholecystectomy. *J Am Coll Surg*. 2010;211(1):132-138. doi:10.1016/j.jamcollsurg.2010.02.053 [View Article] [PubMed]
30. Törnqvist B, Strömberg C, Akre O, Enochsson L, Nilsson M. Selective intraoperative cholangiography and risk of bile duct injury during cholecystectomy. *Br J Surg*. 2015;102(8):952-958. doi:10.1002/bjs.9832 [View Article] [PubMed]
31. Cheruiyot I, Nyaanga F, Kipkorir V, et al. The prevalence of the Rouviere's sulcus: a meta-analysis with implications for laparoscopic cholecystectomy. *Clin Anat*. 2021;34(4):556-564. doi:10.1002/ca.23605 [View Article] [PubMed]
32. Elwan AM. Critical view of safety and Rouviere's sulcus: extrahepatic biliary landmarks as a guide to safe laparoscopic cholecystectomy. *Sci J Al-Azhar Med Fac Girls*. 2019;3(2):297-301. doi:10.4103/sjamf.sjamf_7_19 [View Article]
33. Macchi V, Feltrin G, Parenti A, De Caro R. Diaphragmatic sulci and portal fissures. *J Anat*. 2003;202(Pt 3):303-308. doi:10.1046/j.1469-7580.2003.00160.x [View Article] [PubMed]
34. Aoki S, Mizuma M, Hayashi H, et al. Surgical anatomy of the right hepatic artery in Rouviere's sulcus evaluated by preoperative multidetector-row CT images. *BMC Surg*. 2016;16(1):40. doi:10.1186/s12893-016-0155-0 [View Article] [PubMed]
35. Kim JK, Kim JY, Park JS, Yoon DS. Clinical significance of Rouviere sulcus during laparoscopic cholecystectomy. *HPB (Oxford)*. 2016;18:e515-e516. doi:10.1016/j.hpb.2016.03.370 [View Article]
36. Gupta V, Jain G. The R4U planes for the zonal demarcation for safe laparoscopic cholecystectomy. *World J Surg*. 2021;45(4):1096-1101. doi:10.1007/s00268-020-05908-1 [View Article] [PubMed]
37. Gupta V, Jain G. Safe laparoscopic cholecystectomy: adoption of universal culture of safety in cholecystectomy. *World J Gastrointest Surg*. 2019;11(2):62-84. doi:10.4240/wjgs.v11.i2.62 [View Article] [PubMed]
38. Lockhart S, Singh-Ranger G. Rouviere's sulcus – aspects of incorporating this valuable sign for laparoscopic cholecystectomy. *Asian J Surg*. 2018;41(1):1-3. doi:10.1016/j.asjsur.2016.07.012 [View Article] [PubMed]
39. Shen F, Wu H, Sun S. Application value of Rouviere groove guide positioning in laparoscopic cholecystectomy. Article in Chinese. *Chin J Bases Clin Gen Surg*. 2013;20(7):804-805.
40. Hugh TB. Laparoscopic bile duct injury: some myths. *ANZ J Surg*. 2002;72(2):164-167. doi:10.1046/j.1445-2197.2002.02311.x [View Article] [PubMed]
41. Jha AK, Dewan R, Bhaduria K. Importance of Rouviere's sulcus in laparoscopic cholecystectomy. *Ann Afr Med*. 2020;19(4):274-277. doi:10.4103/aam.aam_4_20 [View Article] [PubMed]
42. Gans H. *Introduction to Hepatic Surgery*. Elsevier; 1955.
43. Reynaud BH, Coucoravas GO, Giuly JA. Basis to improve several hepatectomy techniques involving the surgical anatomy of incisura dextra of Gans. Surg Gynecol Obstet. 1991;172(6):490-492.
44. Thapa PB, Maharjan DK, Tamang TY, Shrestha SK. Visualisation of Rouviere's Sulcus during laparoscopic cholecystectomy. *JNMA J Nepal Med Assoc*. 2015;53(199):188-191. [View Article] [PubMed]
45. Al-Naser MK. Rouviere's sulcus: a useful anatomical landmark for safe laparoscopic cholecystectomy. *Int J Med Res Health Sci*. 2018;7(1):158-161.
46. Lazarus L, Luckrajh JS, Kinoo SM, Singh B. Anatomical parameters of the Rouviere's sulcus for laparoscopic cholecystectomy. *Eur J Anat*. 2018;22(5):389-395.

Peer reviewed

Competing interests: None declared

Received: 21 May 2021 • **Revised:** 21 Sep 2021

Accepted: 22 Sep 2021 • **Published**: 1 Nov 2021

Cite this article as: Nyaanga F, Ndung'u B, Cheruiyot I, Kaisha W, Munguti J, Odula P. Prevalence and structural variants of Rouviere's sulcus in a sample of Kenyan livers: a cadaveric study with implications for laparoscopic cholecystectomy. *East Cent Afr J Surg*. 2022;27(2):51-56. doi:10.4314/ecajs.v27i2.2