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Cawich SO designed the study; Cawich SO, Kluger MD, Pearce NW, Shetty R, Alseidi A, Johnson S, Gardner MT performed the research; Pearce NW, Primrose J, Deshpande R and Dapri G analyzed the data; Cawich SO, Kluger MD, Pearce NW, Shetty R, Gardner MT wrote the paper; and Cawich SO, Kluger MD, Pearce NW, Shetty R, Gardner MT, Alseidi A, Johnson S, Primrose J, Deshpande R, Hewtt B, Johnson S and Dapri G revised the manuscript for final submission.

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Informed consent statement:

All involved persons (subjects or legally authorized representative) gave their written informed consent prior to study inclusion. Identifying data has been anonymized but is available to the editor in chief upon request.

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Abstract

AIM

Rouvière's sulcus is an important anatomic structure that may protect against bile duct injuries and guide parenchymal transection during hepatectomies. However, there are still multifarious classifications in use that prevent proper analysis of existing data. We carried out a systematic review to identify all existing data using a uniform classification of Rouvière's sulcus.

METHODS

This study had two parts. First, a 5-year observational study of all consecutive cholecystectomies in an Eastern Caribbean nation was performed. Data were categorized using a standardized classification identifying open, closed, slit and scar-type variants. The second part of the study was a systematic literature review of medical archiving platforms, searching Rouvière's sulcus variants. In instances where other classifications were used, we studied the descriptions and published images in order to categorize data using the standardized classification. The raw data were used to calculate global prevalence for each variant, which was then compared to that in our population using chi square tests to compare contingency tables in SPSS version 20 (IBM Corp, Armonk, NY). Fisher exact tests were used for values <5. A p-value <0.05 was considered significant.

RESULTS

Data were collected from 356 persons in the observational study, revealing that Rouvière's sulcus was present in 296 (83.2%) individuals. We encountered 140 open-type, 69 closed-types, 65 slit-types and 22 scar-type variants. There were 59 relevant articles from the systematic review that reported 76.88% global prevalence of Rouvière's sulcus in 25,196 persons. This was significantly lower than the prevalence of Rouvière's sulcus in our population (83.2%; P=0.005306). The Eastern Caribbean population was unique for

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having significantly lower proportions of open-type variants (39.33% vs 56.69%; P<0001), and greater proportions of slit-type variants (18.26% Vs 14.15%; P =0.033397). The global prevalence of the closed-type Rouvière's sulcus (23.64% vs 19.38%; P=0.061988) and the scar-type Rouvière's sulcus (8.11 Vs 6.18%; P=0.188331) were similar to that in Eastern Caribbean.

CONCLUSION

Although persons of Eastern Caribbean descent have a greater prevalence of Rouvière's sulcus than global statistics, there are important differences in the proportion of variants. Surgeons practicing in these regions must be aware of these differences, particularly the lower prevalence of the "classic" open-type sulcus, as the other variants are more difficult to recognize intra-operatively.

Key Words: Liver; Rouvière; Sulcus; Groove; Variants

Core Tip:

Even in the year 2026, there is no consensus on a definition nor classification system for Rouvière's sulcus, despite it being an important surgical landmark. In this systematic review, we used a standardized definition and classification system to extract raw data from 59 articles encompassing 25,196 persons and used this to calculate the global prevalence of each variant of Rouvière's sulcus. These data were compared to the data from a 5-year observational study in our local population. Statistical analyses revealed that the prevalence of Rouvière's sulcus was significantly greater in the Caribbean population than global prevalence (83.2% vs 76.88%; P=0.005306). Other unique differences were significantly lower proportions of open-type variants (39.33% vs 56.69%; P<0001), and greater proportions of slit-type variants (18.26% Vs 14.15%; P =0.033397). These are important differences in the proportion of variants that are of great importance to surgeons practicing in these regions.

Cawich SO, Kluger MD, Deshpande R, Pearce NW, Alseidi A, Dapri G, Primrose J, Gardner MT, Shetty R, Johnson S, Javed AA, Hewitt B. A Systematic Review of Rouviere's Sulcus Variants from a Clinical Perspective. World Journal of Metanalysis

INTRODUCTION

In the year 1924, Henri Rouvière described "*grooves or furrows of the caudate lobe that spanned over one-third of the total width of the right lobe of liver*" [1]. They were ascribed many names, including sillon du processus caudé [1], incisura hepatica dextra [2], incisura of Gans [3] and Rouvière-Gans incisura [4]. Only after Couinaud referred to it as the "*sillon du processus caude de Rouvière*" in 1957 [5], did it become widely known by the eponymous name, Rouvière's sulcus.

In the era of open surgery, Rouvière's sulcus had little clinical significance and was largely ignored. There was a paucity of information about its frequency, morphology and variations in anatomical literature. That changed in 1985, when Eric Muhe performed the first laparoscopic cholecystectomy [6]. The benefits of laparoscopic surgery were rapidly recognized and the approach was quickly accepted as superior to open cholecystectomy [6]. However, the rapid shift to a laparoscopic approach led to a rise in bile duct injuries [7].

In order to reduce bile duct injuries, experts recommended performing operative cholangiography [8], attaining Strasberg's critical view [9] and routinely identifying Rouvière's sulcus [10,11]. Routine identification of Rouvière's sulcus was recommended because it is visible laparoscopically [12] and anatomically related to the bile ducts [13]. Only after its clinical value was appreciated did we see a sharp rise in the number of publications on Rouvière's sulcus, but multiple definitions of Rouvière's sulcus also emerged.

DEFINITION:

While there seems to have been consensus to use the eponymous name, Rouvière's sulcus, after Couinaud's landmark publication in 1957 [5], there is still no consensus on its definition. We performed a systematic literature search of all publications discussing Rouvière's sulcus since its original description in 1924 [1] up to March 30, 2025. Two investigators searched medical archiving platforms including, pubmed, medline,

embasse, scopus, google scholar and research gate using the following keywords: Rouvière, incisura of Gans, incisura hepatica dextra, sulcus, furrow, fissure and groove.

We identified 59 publications that discussed Rouvière's sulcus [1-5, 12-64], and each author's definition and classification were recorded in Table 1. This demonstrated that there was no consensus on the definition. Some authors defined Rouvière's sulcus based on dimensions of the sulci [15,20,32], others based on its course [15,22,38], and others on visibility of the right hepatic pedicle [15].

CLASSIFICATION:

Further review of these publications also revealed that there was no consensus on a classification system. Table 1 lists the various classification systems encountered, many using similar terms, but ascribing different meanings to these terms. To give only one example, consider the term "open". Some researchers define an open Rouvière's sulcus as one that is continuous with the transverse hepatic fissure [2,20,42,50]. Others define an open sulcus as one that allows the right hepatic pedicle to be visualized at its base [13,15,21]. Others define an open sulcus as one that is uniformly wide for its entire length [13,15]. Yet others define open as one that is "open toward the gallbladder" [37] or "open toward the right hepatic pedicle" [32]. Table 2 lists similar multifarious definitions encountered for the terms "fused", "partially fused", "sulcus", "slit" and "scar".

The existence of multifarious definitions and classifications do not allow us to scientifically interpret data. Therefore, we carried out a systematic review to identify all existing data using a uniform definition and classification for Rouvière's sulcus.

Table 1: Varied Descriptions and Classifications of Rouviere's Sulcus Encountered in Medical Literature

Citation	Definition	Classification
Rouviere et al., 1924 [1]	Grooves or furrows or cracks of the caudate lobe of the liver	None defined
Gans et al., 1955 [2]	An extension of the porta hepatis extending from its right margin in a caudo-lateral direction	None defined
Couinaud et al., 1957 [5]	An inconsistent cleft of the liver hilum, anterior to segment I	None defined
Reynaud et al., 1991 [3]	A deep groove at the inferior surface of the liver near the bed of the gallbladder with its first	None defined

	segment in the axis of the hilus and bending front and to the right	
Hugh et al., 1997 [12]	A 2-5cm sulcus running to the right of the liver hilum anterior to the caudate process and usually containing the right portal triad	Fully Open: Sulcus opened throughout its length Partial Open: Sulcus covered at medial end
Zubair et al., 2009 [13]	A cleft in the liver running to the right of the hilum anterior to the caudate process which contains the right portal pedicle and accurately identifies the plane of the common bile duct	Open: A cleft in which right hepatic pedicle is visualized and is open throughout its length Fused: Pedicle not visualized or sulcus is open only at its lateral end
Hua-jie et al., 2012 [14]	A natural anatomical fissure on the liver's visceral surface, located on the right lobe, right of the liver hilum, and anterior to the caudate lobe	Open Type (cleft open throughout with visible right hepatic pedicle) Fused (Closed) Type (pedicle not visualized), partially fused medial: A cleft that has a section closed off at its medial end partially fused lateral (aka slit): A cleft that has the lateral end closed off Scar (aka vestigial): A **shallow, white linear notch or fibrous connective tissue line**
Dahmane et al., 2013 [15]	A 2-3cm cleft running to the right of the liver hilum anterior to segment I and usually containing the right portal triad or its branches	Open: A cleft in which branches of the right hepatic pedicle were visible and the sulcus was opened throughout its length. Parenchymatous fused type: The sulcus was open only in its lateral end
Wang et al., 2014 [16]	A 2–5 cm transverse anatomical cleft on the visceral surface of the liver's right lobe, situated to the right of the hepatic portal between the right lobe and the caudate process	Open: A deep cleft that allows visualization of structures and is continuous with hilum Closed: A deep cleft that allows visualization of structures, but is fused medially
Thapa et al., 2015 [17]	No clear definition	I: Right hepatic pedicle visualized and the sulcus opened throughout its length II: Sulcus open only at its lateral end III: Sulcus open only at its medial end IV: Fused and pedicle not visualized or absent
Kim et al., 2016 [18]	A landmark in the liver that marks the level of the right posterior portal pedicle, and indicates reliably the plane of the common bile duct	Open: Not clearly defined Partially Fused: not clearly defined Complete Fused: Not clearly defined Undefined: Not clearly defined
Arora et al., 2016 [19]	A fissure in the liver between the right lobe and caudate process and corresponds to the level of porta hepatis where the right pedicle enters the liver	Sulcus: represented by a deep sulcus Scar: represented by a scar Slit: depth and breadth cannot be measured Open: open toward porta hepatis Closed: closed toward porta hepatis
Singh et al., 2017 [20]	A clear definition was not stated	Deep: Sulcus is deep enough to be measured Open: Medial end open towards porta hepatis making portal structures visible Closed: Medial end closed towards the porta hepatis Slit: Too narrow to be measured Scar: White line
Cîmpeanu et al., 2017 [4]	A morphological cleft on the inferior/visceral surface of the right hepatic lobe, situated between the right lobe and the caudate process	**These authors used the Zubair-Dahmane classification** that defines **two** types:

			Open Type: Sulcus is open at its medial end and continuous with porta hepatis. **Fused Type:** Sulcus is closed at its medial end or appears as a scar/slit that does not communicate with the hilum
35	**Zhao et al., 2017** [10]	A cleft on the visceral surface of the liver between the right hepatic lobe and the caudate process	**Type I (Open Type):** A deep, conspicuous groove that is open throughout its length and continuous with the porta hepatis. **Type II (Semi-open/Closed Type):** A groove that is partially fused or closed at one end (usually the medial end), appearing more like a slit or a pit. **Type III (Scar Type):** A shallow, white fibrous line or "scar" on the liver surface without a patent cleft.
	Al Nasser et al., 2018 [21]	No clear definition	Open: Right hepatic pedicle visible AND sulcus open throughout its length Fused: Pedicle not visualized or sulcus open only at its lateral end
4	Lockhart et al., 2018 [22]	A naturally occurring cleft in the right lobe, anterior to Segment 1	Not defined
24	Lattoo et al., 2018 [23]	A 2-5 cm sulcus running to the right of liver hilum anterior to caudate process usually containing right portal triad or its branches	Deep Open: A cleft deeper than 0.5 cm that communicates with hilum Deep Closed: Cleft is fused medially and opens only laterally Slit: A slit less than 0.5 cm deep Scar: No clear cleft but just a not-well-defined whitish line
4 11	Lazarus et al., 2018 [24]	A structure on the posterior surface of the liver that appears as a transverse cleft extending from the caudate process to the right lobe	Type 1A: A deep sulcus in the right lobe continuous medially within the hilum Type 1B: A deep sulcus in the right lobe fused medially Type 2: Slit-like, superficial and narrow Type 3: A scar appearing as a fused line
5 16	Almas et al., 2018 [25]	A cleft in the liver that progresses to the right of the hilum at the front of the caudate process with the right portal pedicle and accurately determines the plane of the common bile duct	Open: a cleft in which the right hepatic pedicle was visible and sulcus was open throughout its length Fused: not showing the pedicle or open only at the lateral end
14 14	Dubhashi et al., 2018 [26]	A 2-3 cm fissure on the liver between the right lobe and the caudate process, usually containing the right portal triad or its branches	Type I: Open right hepatic pedicle visualized and sulcus open through its length Type II: Sulcus open only at its lateral end Type III: Sulcus was open at its medial end Type IV- Fused: Pedicle was not visualized
31 4	Rafi et al., 2018 [27]	A 2-5 cm fissure in the liver between the right lobe and caudate process seen in laparoscopic cholecystectomy during the posterior dissection, containing the right portal triad or its branches.	Open: Open through its length and in which right hepatic pedicle was visualized Fused: One in which sulcus was not seen or if it was open only at its lateral end
7	Chen et al., 2018 [28]	An extra-biliary landmark on the inferior surface of the liver's right lobe, characterizing it as a 2–5 cm cleft or fissure between the right hepatic lobe and the caudate process	Open Type: A deep and easily identifiable cleft Closed Type: A shallow or fused cleft Absent Type: No visible cleft

Schendel et al., 2019 [29]	An oblique groove or fissure on the inferior surface of the liver's right lobe, measuring 2–5 cm and running right of the liver hilum and anterior to the caudate process	Not defined
Bhatia et al., 2019 [30]	A cleft in the liver that is shown by retracting the gallbladder infundibulum medially	Sulcus: well-defined Just a faint line: not well defined
Garg et al., 2019 [31]	No clear definition given	1A: A deep sulcus open at its medial end and continuous with the liver hilum 1B: A deep fissure that appeared closed on the medial end due to the fusion of liver parenchyma at that point Type 2: A slit-like, superficial, narrow sulcus Type 3: A scar-like, white line where the parenchyma appeared to have fused
Jha et al., 2020 [32]	A 2–5 cm fissure on the liver between the right lobe and caudate process	Open: A cleft in which the medial end was opened toward right hepatic pedicle Closed: Medial end closed toward the right pedicle but lateral end remains open Scar: Linear scar-like structure.
Elwan et al., 2020 [33]	A 2–5-cm sulcus running to the right of the liver hilum anterior to the caudate lobe	Open: Right hepatic pedicle was identified and sulcus open throughout its length Fused: Pedicle not visualized or sulcus open only at its lateral end
Kumar et al., 2020 [34]	A cleft, anterior to the traditionally described "segment 1 of liver" which has been recently described by Couinaud	Deep sulcus: sulcus deep and wide enough (centimetric) to measure Open: Medial end open towards porta hepatis making the portal structures visible Closed: Medical end closed towards porta hepatis Slit sulcus: Too small in its depth and breadth, so only length was measurable Scar: "just appears as a scar"
Mishra et al., 2020 [35]	A groove present in posterior aspect of hepatobiliary triangle to the right of hilum	"Classified according to visual appearances intra-operatively into:" Open: Not clearly defined in this study Closed: Not clearly defined in this study Slit: Not clearly defined in this study Scar: Not clearly defined in this study
Pere et al., 2020 [36]	Horizontal anatomical structure on the inferior face (visceral face) of the liver, from the caudate process to the right hepatic lobe, between the duodenal, renal, and colic prints and behind the cystic cleft	Type Ia: A deep sulcus, with vascular or biliary elements visible, and continuous with hilum of liver Type Ib: A deep fissure, with vascular or biliary elements visible, but closed at the medial end, like a bridge or a fusion of liver parenchyma Type II: A slit-like sulcus Type III: A scar-like sulcus, which appears as a white line of fusion
Abdelfattah et al., 2021 [37]	A naturally occurring fissure on the visceral surface of the junction between right and caudate lobe	Slit: Shallow groove Sulcus: Deep groove pattern - Open: medial end is open toward the neck of the gallbladder - Closed: closed from its medial side.

		Scar: Superficial white scar tissue with no depth into the hepatic parenchyma
Bajpayee et al., 2021 [38]	A sulcus that lies oblique to the anterior and inferior border of the liver and holds the right portal pedicle	Deep, Open: A deep cleft with medial end open Deep, Closed: A deep cleft with medial end closed Slit: A narrow gap Scar: A white scar
Cheruiyot et al., 2021 [39]	An oblique groove on the inferior surface of the liver, running to the right of the hepatic hilum, anterior to the caudate process of the liver, and contains the right posterior portal pedicle	Open: A cleft in which branches of the right hepatic pedicle were visible and the sulcus was opened throughout its length. Parenchymatous fused: the sulcus was open only in its lateral end
Nyaanga et al., 2021 [40]	Any fissure, sulcus or line at the posterior aspect of the right lobe coursing towards the caudate lobe	Open: A cleft in which branches of the right hepatic pedicle were visualized and the sulcus was open throughout its length Parenchymatous fused: sulcus was open only in its lateral end Type 1: Deep sulcus with depth>0.5cm Type 2: Shallow sulcus with depth <0.5cm Type 1A: Open deep sulcus continuous with hepatic hilum medially Type 1B: Closed deep sulcus fused medically Type 3: White hazy line
Deshatty et al., 2021 [41]	A horizontal sulcus on inferior surface of right lobe of the liver extending from fissure on the liver between the right lobe and the caudate process, measuring 2 – 3 cm and containing the right portal triad or its branches	Type 1A: A deep sulcus open at its medial end and continuous with porta hepatis Type 1B: Deep sulcus closed at its medial end Type 2: A slit-like narrow sulcus Type 3: A scar-like white line
Cawich et al., 2022 [42]	An impression on the visceral surface of the right hemi-liver intimately related to the right portal triad and running for various distances and/or directions into the right hemi-liver	Open: Medial end communicates freely with the transverse fissure • Groove: >5mm wide • Slit: ≤5mm in width Closed: Medial end covered by a bridge of liver parenchyma so there is no continuity with the transverse fissure • Groove: >5mm wide • Slit: ≤5mm in width Scar: A discernable depression is not present, but a linear impression is seen at expected location Absent: There is no superficial landmark discernable
Baskula et al., 2022 [43]	A 2–5 cm long sulcus running to the right of the liver hilum and anterior to the caudate lobe	Type I (Open): A cleft in which the right hepatic pedicle is visualized and the sulcus is open throughout its length. Type II (Closed): A partially fused sulcus which opens only at its lateral end Type III (Slit): A partially fused but it opens only at its medial end Type IV (Scar): The pedicle is visualized as a scar or an absent sulcus

Acet et al., 2022 [44]	A transverse sulcus on the inferior surface of the right lobe of the liver, running to the right of the hepatic hilum	Type 1A: A deep sulcus, open at the hilar side Type 1B: A deep sulcus, closed at the hilar side Type 2: Slit-like sulcus Type 3: Scar-like sulcus appears as a white line of fusion
Bhattarai et al., 2022 45[]	A 2-5cm long sulcus that runs to the right of the liver hilum, contains the right portal triad or its branches and accurately identifies the plane of common bile duct	Type I: A cleft in which the right hepatic pedicle is visualized and the sulcus is open throughout its length Type II: A partially fused sulcus which opens only at its lateral end Type III: A partially fused sulcus that opens only at its medial end Type IV: Pedicle is visualized as a scar or an absent sulcus
Manatakis et al., 2022 [46]	A groove in the inferior (visceral) surface of the liver, extending to the right of the porta hepatis, anterior to the caudate process and segment VI and posterior to segment V	Groove: Sulcus extends laterally from the porta hepatis, and may or may not contain a visible glissonian pedicle Slit: Sulcus has fused liver parenchyma over its medial aspect, regardless of dimensions or visible vessels Scar: Sulcus appears as a white line in an otherwise normal-looking liver parenchyma
Wang et al., 2022 [47]	A fissure or hole in the liver parenchyma on the right side of the gallbladder, with its tip pointing to the hilum hepatis or extending from the arc incisure of the right posterior hepatic pedicle	"*Classified according to Dahmane et al*" into: Open type: Not well defined Fused type: Not well defined Absent type: Not well defined *Although the author references the Dahmani classification, this is not what Dahmani described
Ragavan et al., 2022 [48]	a normal fissure on the inferior/posterior surface of the liver that serves as a landmark running from the caudate process toward the right hepatic lobe	Type 1: Deep Sulcus >1mm depth -1a: deep and open to porta hepatis -1b: deep and closed medially Type 2: Slit-like Sulcus <1mm depth Type 3: Scar-like Sulcus / a fused line
El Saman et al., 2022 [49]	A 2–5 cm groove on the liver's visceral surface, extending from the right anterior hilum towards the caudate process and typically containing the right portal triad or its branches	Open: The medial end is open and remains continuous with the hilum of the liver Closed: fused medial end and an open lateral end, appearing as a pit or slit that does not directly communicate with the porta hepatis Scar: a faint, shallow line or a white fibrous notch on the liver surface that lacks depth and does not contain any portal structures
Gardner et al., 2022 [50]	An impression on the visceral surface of the right hemi-liver intimately related to the right portal triad and running for various distances and/or directions into the right hemi-liver	Open: Medial end communicates freely with the transverse fissure Groove: >5mm wide Slit: <5mm in width Closed: Medial end covered by a bridge of liver parenchyma so there is no continuity with the transverse fissure Groove: >5mm wide Slit: <5mm in width

		Scar A discernable depression is not present, but a linear impression is seen at its expected location Absent There is no superficial landmark discernable
Bhattarai et al., 2022 [51]	A 2-5cm long sulcus that runs to the right of the liver hilum, contains the right portal triad or its branches and accurately identifies the plane of CBD	Type I (open): Pedicle is visualized and sulcus is open throughout its length Type II (close): Partially fused sulcus which opens only at its lateral end Type III (slit): Partially fused but it opens only at its medial end Type IV (scar): Pedicle is visualized as a scar or an absent sulcus
Sreevidya et al., 2023 [52]	A fissure on the posterior surface of the liver, running transversely from the caudate process to the right lobe	Type 1A: A deep sulcus that is open at its medial end and continuous with the hilum of the liver Type 1B A deep sulcus that is closed on the medial end due to the fusion of liver parenchyma at that point Type 2: A slit-like, superficial, narrow sulcus Type 3: A white line scar
Voruganti et al., 2023 [53]	A 2–5cm long fissure running transversely between caudate process and right lobe of the liver	Open: Sulcus continuous with porta hepatis at its medial end, has measurable dimensions of length, breadth, and depth, and the right hepatic pedicle is visible Closed: Sulcus has a closed medial end and partly visible right hepatic pedicle. Length, breadth, and depth can be measured. Slit: Sulcus is shallow with no visible right hepatic pedicle. Only length can be measured. The breadth and depth are barely measurable. Scar: Sulcus appears as a white scar that is completely fused
Sharma et al., 2023 [54]	A sulcus of 2-5 centimeters in length, Rouviere's sulcus may be seen to the right of the liver hilum, above the caudate lobe	Open Type: Not defined Closed Type: Not defined
Ibralullah et al., 2023 [55]	A 2–5 cm long fissure located to the right of the liver hilum, visible on the inferior liver surface	Well-formed/deep: A deep groove Slit-like: A narrow and shallow sulcus Scar-like: Fused area without a groove Double sulcus: two parallel sulci
Cirocchi et al, 2024 [56]	Manuscript states that Rouviere's sulcus was "*defined according to Singh and Prasad*", but the publication referenced does not provide any clear definition	Manuscript states "*Rouviere's sulcus was classified according to Singh and Prasad*", but the classification used differed from that proposed in the publication referenced. Type 1 (Deep): A cleft deeper than 0.5 cm is clearly visible Type 1A (Open): The sulcus communicates with the hilum Type 1B (Closed): The sulcus is fused medially and opens only laterally Type 2 (Shallow): A slit deep less than 0.5 cm Type 3 (Scar): There is not a clear cleft but just a not-well-defined whitish line

Hamad et al., 2024 [57]	A fine groove at the inferior surface of the liver, which is open at its medial end, and is claimed to be an indicator of the right hepatic portal pedicle	None documented
Ismaeil et al. ,2024 [58]	No clear definition given by the authors	None documented
Kanhaia et al., 2024 [59]	A sulcus present on the lower surface of the liver	Open Type: Lips of the sulcus far apart so that the portal pedicle is visible at the floor and it is continuous with the hilum Fused type: Lips of the sulcus far apart so that the portal pedicle is visible at the floor, but discontinuous with hilum Groove Type: Lips of the sulcus are far apart, the floor contains liver tissue only & continuous with hilum Pit type: Lips of the sulcus are far apart, the floor contains liver tissue only, but discontinuous with hilum Closed sulcus: Lips are opposed, masking the floor and confluencing medially with the porta hepatis Slit Type: lips are opposed, masking the floor and the medial end not confluencing Scar type: No sulcus was visible but a white fused line is seen
Smithmaitrie P et al., 2024 [60]	Definition not stated	Open Type: Not defined Slit type: Not defined Scar type: Not defined
10 10 Risekesan et al., 2025 [61]	A 2-5 cm cleft running anterior to the right lobe of the liver, corresponding to the line of attachment of the right aspect of the caudate process to the right lobe	Open-type: A visible sulcus with a connection to right hepatic intersegmental fissure Closed-type: A blind-ending sulcus
27 Parsa et al., 2025 [62]	A horizontal anatomical structure that runs from the caudate process to the right hepatic lobe on the inferior face of the liver	Deep open type: A deep, prominent groove where the medial end is open and remains continuous with the **porta hepatis** Deep closed type: A deep groove where the medial end is fused or closed, meaning it does not directly communicate with the porta hepatis Scar type: A shallow, faint white fibrous line or notch on the liver surface without significant depth Slit type: A very narrow, thin, crack-like indentation on the liver surface
Cirocchi et al., 2025 [63]	Manuscript states that "*RS was defined according to Singh and Prasad*", but there is no clear definition in the publication referenced	Manuscript states that "*Rouviere's sulcus was classified according to Singh and Prasad*", but the classification used differs from the publication referenced Type 1 (deep): A cleft deeper than 0.5 cm is clearly visible Type 1A (Open): Sulcus communicates with Type 1B (Closed): Sulcus is fused medially and opens only laterally Type 2 (Shallow): A slit deep less than 0.5 cm

		Type 3 (Scar): There is not a clear cleft but just a not-well-defined whitish line
Cho et al., 2025 [64]	An anatomical groove extending from the anterior side of the caudate process toward the right liver, typically measuring 0.5-1.5 cm in depth and 2-5 cm in length	Open: A visible sulcus with a connection to transverse fissure Closed: A sulcus that does not freely connect

METHODS:

We secured IRB approval to carry out an observational study of all consecutive elective laparoscopic cholecystectomies performed in an Eastern Caribbean nation over a 5-year period from January 1, 2017 to Dec 30, 2021. The operating surgeons deliberately attempted to identify Rouvière's sulcus as the first operative step, and this was corroborated by an independent observer. Once identified, the dimensions of the sulci were estimated using instruments in the operative field.

For this study, we used a standardized definition of Rouvière's sulcus [42]: An impression on the visceral surface of the right hemi-liver intimately related to the right portal triad and running for various distances and/or directions into the right hemi-liver. The authors agreed to use this definition because it included known variants and it did not exclude sulci based on their dimensions, directions, length, width or visualization of portal structures. We utilized the classification [42] outlined in Table 2, that included all known variants of Rouvière's sulcus: open-type (Figure 1), closed-type (Figure 2), slit-type (Figure 3) and scar-type (Figure 4).

Table 2: Classification of Rouvière's Sulcus [42]

Type	Description
Open	A sulcus >5mm in width, whose medial end communicates freely with the transverse fissure
Closed	A sulcus >5mm in width, whose medial end is covered by a bridge of liver parenchyma so there is no continuity with the transverse fissure
Slit	A sulcus that measures ≤5mm in width
Scar	A discernable depression is not present, but a vague linear impression marks its expected location
Absent	There is no superficial landmark discernable

For the second part of this study, we conducted a systematic literature review using medical archiving platforms, including Pubmed, Medline, Google Scholar and the

Cochrane database of Systematic Reviews. The following search terms were utilized: "Rouvière", "incisura of Gans", "incisura hepatica dextra", "sulcus", "furrow", "fissure" and "groove". All relevant studies were retrieved and the data and images reviewed in detail. We excluded data from duplicated publications, individual case reports, small series with <10 cases, and publications that could not be accessed for independent review. In instances where other classifications were used, we studied the descriptions and published images of the variants in order to categorize them according to the standardized classification [42]. We reviewed all available published studies and extracted raw data, where available, to classify variants. The raw data were recorded in a Microsoft Excel® table and descriptive analyses were performed using SPSS version 20 statistical software.

The raw data extracted from published studies, tabulated in Table 3, were used to calculate global prevalence for each variant. Global prevalence was defined as the total number of individuals with a variant divided by the sum of the total number of individuals in each study. The global prevalence was then compared with the prevalence of each variant in our population using chi square tests to compare contingency tables in SPSS version 20 (IBM Corp, Armonk, NY). Fisher exact tests were used for values <5. A p-value <0.05 was considered significant.

RESULTS

During the study period, we recorded data from 356 persons, noting that Rouvière's sulcus was present in 296 (83.2%) individuals. The variants encountered included 140 open-types, 69 Closed-Types, 65 Slit-Types, and 22 Scar-Types. The raw data are presented in Table 3.

Table 3: Publications documenting the prevalence and types of Rouviere's Sulcus

Study	Population	Study Description	Prevalence	Open	Closed	Absent	Undefined	Slit	Scar
Rouviere et al., 1924 [1]	France	Observational study of 45 fetal and newborn cadavers	37/45 (82.2%)	ND	ND	8/45 (17.8%)	ND	ND	ND
Rouviere et al., 1924 [1]	France	Observational study of 40 adult cadavers	21/40 (52.5%)	ND	ND	19/40 (47.5%)	ND	ND	ND

Gans et al., 1955 [2]	Netherlands	Observational study in 115 cadaveric liver corrosion casts	92/115 (80%)	ND	ND	23/115 (20%)	ND	ND	ND
Couinaud et al., 1957 [5]	France	Observational study of 116 cadaveric liver corrosion casts	85/116 (73%)	ND	ND	31/116 (26.7%)	ND	ND	ND
Reynaud et al., 1991 [11]	France	Observational study of 100 cadaveric dissections	73/100 (73%)	NR	NR	27/100 (27%)	ND	ND	ND
Hugh et al., 1997 [12]	Australia	Observation of 100 patients for laparoscopic cholecystectomy	78/100 (78%)	41/100 (41%)	37/100 (37%)	22/100 (22%)	ND	ND	ND
Zubair et al., 2009 [13]	Pakistan	Prospective study of 160 patients at laparoscopic cholecystectomy	109/160 (68%)	48/109 (44%)	61/109 (56%)	51/160 (32%)	ND	ND	ND
Hua-jie et al., 2012 [14]	China	Observation of 584 patients at laparoscopic cholecystectomy	448/584 (76.7%)	346/584 (59.3%)	102/584 (17.5%)	136/584 (23.3%)	ND	ND	ND
Dahmane et al., 2013 [15]	Solvenia	Prospective study of 40 cadaveric liver corrosion casts	33/40 (82.5%)	28/40 (70%)	5/40 (12.5%)	7/40 (17.5%)	ND	ND	ND
Wang et al., 2014 [16]	China	Prospective study of laparoscopic cholecystectomy in 750 patients	705/750 (94%)	ND	ND	45/750 (6%)	ND	ND	ND
Thapa et al., 2015 [17]	Nepal	Prospective study of 200 patients at laparoscopic cholecystectomy	150/200 (75%)	81/150 (54%)	18/150 (12%)	50/200 (25%)	ND	ND	ND
Kim et al., 2016 [18]	Republic of Korea	Prospective study of 369 patients at laparoscopic cholecystectomy	277/369 (75.06%)	229/369 (62.1%)	48/369 (13%)	A1 62/369 (16.8%)	A1 30/369 (8%)	ND	ND
Arora et al., 2016 [19]	India	Observations in 100 patients at laparoscopic cholecystectomy	90/100 (59%)	59/100 (59%)	NR	10/100 (10%)	ND	24/100 (24%)	7/100 (7%)
Cîmpeanu et al., 2017 [4]	Romania	Observation of 300 patients at open/laparoscopic cholecystectomy	186/300 (62%)	130/300 (43.3%)	56/300 (18.7%)	114/300 (38%)	ND	ND	ND
Singh et al., 2017 [20]	Punjab, India	Retrospective study of 117 videos of laparoscopic cholecystectomy	106/117 (90.6%)	60/106 (56.6%)	11/106 (10.4%)	11/117 (9.4%)	6/106 (5.7%)	23/106 (21.7%)	6/106 (5.7%)
Zhao et al., 2017 [10]	China	Prospective study of 75 patients at	56/60 (93.3%)	34/60 (56.7%)	16/60 (26.7%)	4/60 (6.7%)	ND	ND	6/10 (10.0%)

		laparoscopic cholecystectomy							
Al Nasser et al., 2018 [21]	Bhagdad, Iraq	Prospective study of 402 patients at laparoscopic cholecystectomy	319/402 (79.3%)	221/402 (54.9%)	98/402 (24.4%)	83/402 (20.7%)	0	ND	ND
Latoo et al., 2018 23[]	Asia	Prospective study of 382 patients at laparoscopic cholecystectomy	242/382 (63.4%)	152/242 (62.8%)	26/242 (10.7%)	140 /382 (36.6%)	0	58/242 (23.96%)	6/242 (2.48%)
Lazarus et al., 2018 [24]	South Africa	An analysis of 75 formalin-fixed adult cadavers	62/75 (82.7%)	33/75 (44%)	5/75 (6.7%)	13/75 (17.3%)	0	19/75 (25.3%)	5/75 (6.7%)
Almas et al., 2018 [25]	Pakistan	Prospective study of 160 patients at laparoscopic cholecystectomy	109/160 (68.1%)	48/109 (44%)	61/109 (56%)	51/160 (31.9%)	0	ND	ND
Dubhashi et al., 2018 [26]	India	Prospective study of 50 patients at laparoscopic cholecystectomy	49/50 (98%)	42/50 (84%)	8/50 (16%)	1/50 (2%)	0	ND	ND
Rafi et al., 2018 [27]	Pakistan	Prospective study of 131 patients at laparoscopic cholecystectomy	98/131 (74.8%)	57/131 (43.5%)	41/131 (31.3%)	33/131 (25.2%)	0	ND	ND
Chen, et al., 2018 [28]	China	Prospective study of 170 patients at laparoscopic cholecystectomy	152/170 (89.4%)	108/170 (63.5%)	44/170 (25.9%)	18/170 (10.6%)	0	ND	ND
Bhatia et al., 2019 [29]	Punjab, India	Prospective study of 50 patients at laparoscopic cholecystectomy	49/50 (98%)	NR	NR	1/50 (2%)	-	NR	11/50 (22%)
Schendel et al., 2019 [30]	Canada	Prospective study of 127 patients at laparoscopic cholecystectomy	101/127 (79.5%)	NR	NR	26/127 (20.5%)	NR	NR	NR
Garg et al., 2019 [31]	Uttar Pradesh, India	Retrospective study of 90 Cadaveric livers	71/90 (78.9%)	41/90 (45%)	6/90 (7.2%)	19/90 (21.1%)	-	21/90 (23.33%)	3/90 (3.33%)
Jha et al., 2020 [32]	Dehli, India	Prospective study of 99 patients at laparoscopic cholecystectomy	63/99 (63.6%)	43/99 (43.4%)	16/99 (16.2%)	36/99 (36.4%)	ND	ND	4/99 (4%)
Elwan et al., 2020 [33]	Egypt	Prospective study of 300 patients at laparoscopic cholecystectomy	293/300 (97.7%)	175/300 (58.3%)	118/300 (39.3%)	7/300 (2.3%)	ND	ND	ND
Kumar et al., 2020 [34]	Nepal	Prospective study of 230 patients at	208/230 (90.4%)	114/208 (54.8%)	26/208 (12.5%)	22/230 (9.6%)	ND	22/208 (10.6%)	46/208 (22.1%)

		laparoscopic cholecystectomy							
Mishra et al (2020 [35]	Odisha, India	Prospective study of 160 patients at laparoscopic choleycstectomy	147/160 (91.9%)	99/160 (61.9%)	35/160 (21.9%)	13/160 (8.1%)	0	19/160 (11.9%)	7/160 (4.4%)
Pèrè et al., 2020 [36]	France	Prospective study of 10 cadaveric dissections	8/10 (80%)	3/10 (30%)	2/10 (20%)	2/10 (20%)	-	1/10 (10%)	2/10 (20%)
Abdelfattah et al., 2021 [37]	Egypt	Retrospective study of 100 videos of laparoscopic cholecystectomies	86/100 (86%)	53/100 (53%)	16/100 (16%)	14/100 (14%)	-	11/100 (11%)	6/100 (6%)
Bajpayee et al., 2021 [38]	Maharashtra, India	Retrospective study of 45 embalmed cadaveric livers	40/45 (88.9%)	22/45 (48.9%)	4/45 (88.9%)	5/45 (11.1%)	0	12/45 (26.7%)	2/45 (4.4%)
Cheruiyot et al., 2021 [39]	Global	Systematic review of major databases of 4,495 patients across 23 studies	3731/4495 (83%)	2967/4495 (66%)	1528/4495 (34%)	764/4495 (17%)	ND	ND	ND
Nyaanga et al., 2021 [40]	Kenya	Observational study of 116 formalin-fixed cadaveric livers	98/116 (84.5%)	77/116 (66.4%)	11/116 (9.5%)	18/116 (15.5%)	ND	ND	10/116 (8.3%)
Deshatty et al., 2021 [41]	India	Retrospective study of 50 cadaveric livers	36/50 (72%)	24/50 (48%)	5/50 (10%)	14/50 (28%)	0	4/50 (8%)	3/50 (6%)
Cawich et al., 2022 [42]	Trinidad	Prospective study of 50 cadaveric livers	43/50 (86%)	27/50 (54%)	14/50 (28%)	7/50 (14%)	0	ND	2/50 (4%)
Basukala et al., 2022 [43]	Nepal	Observation of 180 patients at laparoscopic cholecystectomy	169/180 (93.9%)	114/169 (67.4%)	26/169 (15.3%)	11/180 (6.1%)	-	22/169 (13%)	7/169 (4.1%)
Acet et al., 2022 [44]	Turkey	Retrospective study of 102 videos of laparoscopic cholecystectomy	80/102 (78.4%)	51/102 (50%)	14/102 (13.7%)	22/102 (21.6%)	0	7/102 (6.9%)	8/102 (7.8%)
Manatakis et al., 2022 [46]	Greece	Prospective study of 103 patients at laparoscopic cholecystectomy	94/103 (91.3%)	65/103 (63.1%)	20/103 (19.4%)	9/103 (8.7%)	ND	ND	9/103 (8.3%)
Manatakis et al., 2022 [46]	Global	Metanalysis of 6661 persons across 27 operative and 11 cadaveric studies (4433 cases compared for morphology)	5309/6661 (79.7%)	2859/4433 (64.5%)	A2 1574/4433 (35.5%)	1352/6661 (20.3%)	ND	ND	A2
Wang et al., 2022 [47]	Hefei, China	Retrospective study of 146 patients at laparoscopic cholecystectomy	122/146 (83.6%)	105/146 (71.9%)	17/146 (11.6%)	A3 24/146 (16.4%)	ND	A3	A3
Ragavan et al., 2022 [48]	Puducherry, India	Observational study of 93 cadaveric livers	61/93 (65.6%)	37/93 (39.8%)	9/93 (9.7%)	32/93 (34.4%)	ND	10/93 (10.8%)	5/93 (5.4%)

El Saman et al., 2022 [49]	Egypt	100 Laparoscopic cholecystectomies	76/100 (76%)	43/100 (43%)	13/100 (13%)	24/100 (24%)	ND	11/100 (11%)	9/100 (9%)
Gardner et al ., 2022 [50]	Jamaica	Prospective study of 60 cadaveric livers	49/60 (81.7%)	40/60 (66.6%)	7/60 (11.7%)	11/60 (18.3%)	0	0	2/60 (3.3%)
Bhattarai et al., 2022 [51]	Nepal	A prospective study of 100 patients undergoing laparoscopic cholecystectomy	79/100 (79%)	52/100 (52%)	17/100 (17%)	21/100 (21%)	0	7/100 (7%)	3/100 (3%)
Sreevidya et al., 2023 [52]	Tamilnadu, India	Retrospective observational study of 52 cadaveric livers	47/52 (90.4%)	26/52 (50%)	4/52 (7.7%)	5/52 (9.6%)	0	8/52 (15.4%)	9/52 (17.3%)
Voruganti et al., 2023 [53]	Andhra Pradesh, India	Prospective study of 130 patients undergoing laparoscopic cholecystectomy	106/130 (81.5%)	77/106 (72.6%)	14/106 (13.2%)	24/130 (18.5%)	0	11/106 (10.4%)	4/106 (3.8%)
Sharma et al., 2023 [54]	Solan, India	Observational study in 50 persons undergoing laparoscopic cholecystectomy	40/50 (80%)	26/50 (52%)	14/50 (28%)	10/50 (20%)	0	0	0
Ibralullah et al., 2023 [55]	Odisha, India	Prospective study of 500 patients undergoing laparoscopic cholecystectomy A4	306/423 (72.34%)	194/423 (45.86%)	57/423 (13.48%)	117/423 (27.66%)	A5 12/423 (2.84%)	1/423 (0.24%)	42/423 (9.93%)
Cirocchi et al., 2024 [56]	Italy	Prospective studies of 123 patients undergoing laparoscopic surgery	105/123 (85.3%)	54/123 (43.9%)	27/123 (22%)	18/123 (14.6%)	ND	12/123 (9.76%)	12/123 (9.76%)
Cirocchi et al., 2024 [56]	Italy	Metanalysis of 1,802 persons across 14 studies investigating the presence of Rouverie's Sulcus	1488/1802 (82.6%)	1083/1802 (60.1%)	256/1802 (14.2%)	314/1802 (17.4%)	ND	312/1802 (17.3%)	153/1802 (8.5%)
Hamad et al., 2024 [57]	Pakistan	Prospective study of 93 patients undergoing laparoscopic cholecystectomy	50/93 (53.8%)	ND	ND	43/93 (46.2%)	ND	ND	ND
Ismaeil et al. ,2024 [58]	Kurdistan, Iraq	Prospective study of 419 patients undergoing laparoscopic cholecystectomy	320/419 (76.4%)	ND	ND	99/419 (23.6%)	ND	ND	ND
Kanhaia et al., 2024 [59]	New Dehli, India	Prospective analysis of 302 patients undergoing laparoscopic cholecystectomy	229/302 (75.8%)	123/302 A6 (40.7%)	30/302 A7 (9.9%)	73/302 (24.1%)	-	53/302 A8 (17.6%)	23/302 (7.6%)

Smithmaitrie et al., 2024 [60]	Thailand	Retrospective analysis of 3320 videos of patients undergoing laparoscopic cholecystectomy	1702/3320 (51.3%)	1166/3320 (35.1%)	A9 -	1618/3320 (48.7%)	ND	A9 -	273/3320 (8.2%)
Risekesan et al., 2025 [61]	Trichy, India	Prospective study of 63 patients at laparoscopic cholecystectomy	44/63 (69.8%)	31/63 (49.2%)	13/63 (20.6%)	19/63 (30.2%)	0	0	0
Parsa et al., 2025 [62]		Prospective study of 192 patients at laparoscopic cholecystectomy	168/192 (87.5%)	126/168 (75%)	37/168 (22%)	24/192 (12.5%)	0	2/168 (1.2%)	3/168 (1.8%)
Cirocchi et al., 2025 [63]	Italy	Prospective study of 111 patients at laparoscopic cholecystectomy	93/111 (83.8%)	45/93 (48.4%)	24/93 (25.8%)	18/111 (16.2%)	0	12/93 (12.9%)	12/93 (12.9%)
Cho et al., 2025 [64]	Seoul, Korea	Prospective study of 83 patients at laparoscopic/robotic hepatectomy	83/83 (100%)	62/83 (74.7%)	21/83 (25.3%)	0/83	0	0	0
Global Prevalence	**Global**		**19,371/25,196 (76.88%)**	**11,741/20711 (56.69%)**	**3039/12858 (23.64%)**	**5,709/24,681 (23.13%)**	**12/423 (2.84 %)**	**682/4819 (14.15%)**	**700/8627 (8.11%)**
This study	**Caribbean**		**296/356 (83.2%)**	**140/356 (39.33%)**	**69/356 (19.38%)**	**60/356 (16.9%)**	**0**	**65/356 (18.26%)**	**22/356 (6.18 %)**
2-Tailed P Value			**0.005306**	**< 0.0001**	0.061988	**0.005230**		**0.033397**	0.188331
Standard Error			**0.0225**	**0.0265**	**0.0228**	**0.0225**		**0.0193**	**0.0147**
Z-Score			**-2.7878**	**6.5506**	**1.8664**	**2.7925**		**-2.1273**	**1.3155**

Key:
ND: Not Defined
NR: Not Reported
A1) absent and "non-determined" grouped together
A2) Excluded because the classification is unclear. It appears that the author has grouped scar and closed types together in this study
A3) Excluded because classification is unclear. It appears that the author has grouped absent, slit and scar types together
A4) 77 could not be evaluated due to adhesions
A5) Type 1c: a sulcus that was fused centrally and open medially and laterally
A6) Reclassified based on images and descriptions published by the authors. Original classification described these as open (66) + groove (47) types
A7) Reclassified based on images and descriptions published by the authors. Original classification described these as pit (19) + fused (11) types
A8) Reclassified based on images and descriptions published by the authors. Original classification described these as closed (33) + slit (20) types
A9) Excluded because the classification is unclear. It appears that the author has grouped closed and slit types together

We retrieved 59 articles [1-5, 12-64] that reported the prevalence and variations of Rouvière's sulcus in a total of 25,196 persons (Table 3). Although some authors utilized different classifications, detailed review of the published descriptions and images within the published articles allowed us to extrapolate data for comparisons. When the variant was not reported or could not be reliably extrapolated from published descriptions, data and/or images, the study data were excluded from the global prevalence statistics.

All 59 publications reported on the prevalence of Rouvière's sulcus, which was present in 19,371 (76.88%) persons. The prevalence of Rouvière's sulcus in our population was significantly greater (83.2% vs 76.88%; P=0.005306)

The Open-Type Sulcus was not defined and/or reported by the authors of 10 publications, and the data from these studies were excluded from calculation of global prevalence. In the remaining 49 publications an Open-Type Rouvière's sulcus was present in 11,741 of 20,711 unselected persons, equating to 56.69% global prevalence. The prevalence of the Open-Type Sulcus in the Eastern Caribbean was significantly lower than global statistics (39.33% vs 56.69%; P<0001).

Eleven publications did not define or report a closed-type sulcus, and data from these studies were excluded. A further 2 were excluded because raw data could not be extracted to classify variants. In one publication [46], the data were excluded because the author groups scar-types and closed-types together. And in another paper [60] the data were excluded because the author grouped closed and slit-types together. In the remaining 46 publications, a closed-type sulcus was present in 3039 unselected persons. The global prevalence of the Closed-Type Rouvière's sulcus was similar to that in Eastern Caribbean (23.64% vs 19.38%; P=0.061988).

For Slit-type variants, two articles were excluded because the classification used was unclear. It appeared the authors grouped absent, slit and scar types together in one publication [47] and in the other closed and slit types were grouped together [60]. In a further 30 publications, the slit type was not reported or defined, and so data from these publications were also excluded. In the remaining 27 publications, the slit-type sulcus was reported in 682/4819 persons, equating to a global prevalence of 14.15%. Slit-Type

variants were significantly more common in our population than the global statistics (18.26% Vs 14.15%; P =0.033397).

For the Scar-Type, 2 publications were excluded because one grouped scar and closed-types together [46] and another reported absent, slit and scar-types as a single group [47]. A further 23 publications did not define or report scar type sulci. In the remaining 34 publications, a scar was reported in 700/8627 (8.11%) persons, and this was similar to that seen in the Eastern Caribbean (6.18%; P=0.188331).

Three publications that described variants that did not fit into the classification systems used [18,20,55]. Ibralullah et al., 2023 [55] referred to a "*double sulcus*" which they defined as two parallel sulci. After studying the authors' descriptions and the accompanying images, we were unable to determine whether they were referring to a closed sulcus (which was not included in their classification), an undefined variant or a totally separate sulcus. Therefore, these were omitted from further analysis. Kim et al., 2016 [18] reported 30/369 (8%) persons who had "*undefined*" sulci, but they did not venture a definition or explanation and included no images to evaluate. It was unclear to our authors whether their "*undefined*" category referred to sulci that could not be seen due to adhesions or represented a variant that was not clearly described. The data from this study were also excluded from further analysis. In the final publication, Singh et al., [20] referred to an "*undefined*" sulcus in 6/106 (5.7%) persons, but it was not clear whether this meant a variant that could not be classified or a sulcus that could not be seen properly. Therefore, the data from this study were also excluded. After removing these three publications for vague data, we could find no reliable data to warrant an adjustment of the classification system used in this paper. There were also no "*unclassified*" variants encountered in our data set.

DISCUSSION

Unfortunately, multifarious definitions and classifications of Rouvière's sulcus still appear in medical literature up to the year 2026, making interpretation of the literature difficult. Therefore, we suggest adopting the standardized definition and classification

system used in Table 2. We acknowledge that each system has its individual merits and drawbacks, but the current definition/classification allowed inclusion of all known variants, regardless of their dimensions, directions, length, width or contents. It is also clinically relevant because it assists surgeons to recognize all Rouvière's sulcus variants, permitting this landmark to be used more frequently for safe cholecystectomy [12] and liver resections [42].

Most authors consider the open-type sulcus as the "classic" Rouvière's sulcus, and it is also the easiest to identify intra-operatively. Unfortunately, there was a significantly lower proportion of open-type sulci in this Eastern Caribbean population. This is important data to acknowledge, because a significant proportion of sulci will not be recognized at the time of operation if regional surgeons are only trained to recognize the "classic" open-type sulci. There were no differences in the closed-type and scar-type sulci. But we noted a significantly greater proportion of slit-type sulci in our population. Again, this places patients from the Caribbean diaspora at a disadvantage as these types of sulci are not as easy to recognize as the "classic" open-type sulci.

This means that surgeons practicing in this setting should be aware that they may need to be vigilant when performing right posterior sectionectomies and laparoscopic cholecystectomies because there are lower proportions of the "classic" open type and greater proportion of the slit-type sulci. The importance becomes apparent when we acknowledge that this study was performed in a resource-poor healthcare system, where there is inconsistent access to operative tools, such as operative cholangiography and indocyanine green.

It was previously been reported that this Eastern Caribbean nation is comprised of equal proportions of persons from the West African (40%) and North Indian (40%) diaspora as a result of the trans-Atlantic slave trade and indentured labour systems [65]. Therefore, we sought to compare the prevalence of variants to studies from these geographic locations. There were 12 publications that reported on Rouvière's sulcus in North Indian populations [19,20,26,29,31,32,35,38,41,54,55,59]. When the raw data for each variant of Rouvière's from North Indian populations were collated and compared to Eastern

Caribbean data there were few similarities (Table 4). The only similarity between the North Indian and Eastern Caribbean populations was in the prevalence of the scar-type Rouvière's sulcus (7.2% vs 6.18%; P=0.5), and these were also similar to the Global prevalence of scar-type Rouvière's sulcus (8.11%).

Table 4: A Comparison of Rouvière's Sulcus Variants in North Indian and Eastern Caribbean Diaspora

Citation	Region	Present	Open-Type	Closed-Type	Slit-Type	Scar-Type
Arora et al., 2016 [19]	India	90/100 (59%)	59/100 (59%)	NR	24/100 (24%)	7/100 (7%)
Singh et al., 2017 [20]	Punjab	106/117 (90.6%)	60/106 (56.6%)	11/106 (10.4%)	23/106 (21.7%)	6/106 (5.7%)
Dubhashi et al., 2018 [26]	India	49/50 (98%)	42/50 (84%)	8/50 (16%)	ND	ND
Bhatia et al., 2019 [29]	Punjab	49/50 (98%)	NR	NR	NR	11/50 (22%)
Garg et al., 2019 [31]	Uttar Pradesh	71/90 (78.9%)	41/90 (45%)	6/90 (7.2%)	21/90 (23.33%)	3/90 (3.33%)
Jha et al., 2020 [32]	Dehli	63/99 (63.6%)	43/99 (43.4%)	16/99 (16.2%)	ND	4/99 (4%)
Mishra et al., 2020 [35]	Odisha	147/160 (91.9%)	99/160 (61.9%)	35/160 (21.9%)	19/160 (11.9%)	7/160 (4.4%)
Bajpayee et al., 2021 [38]	Maharashtra	40/45 (88.9%)	22/45 (48.9%)	4/45 (88.9%)	12/45 (26.7%)	2/45 (4.4%)
Deshatty et al., 2021 [41]	India	36/50 (72%)	24/50 (48%)	5/50 (10%)	4/50 (8%)	3/50 (6%)
Sharma et al., 2023 [54]	Solan	40/50 (80%)	26/50 (52%)	14/50 (28%)	0	0
Ibralullah et al., 2023 [55]	Odisha	306/500 (61.2%)	194/500 (38.8%)	57 (11.4%)	1/500 (0.2%)	42/500 (4.8%)
Kanhaia et al., 2024 [59]	New Dehli	229/302 (75.8%)	123/302 A (40.7%)	30/302 A1 (9.9%)	53/302 A2 (17.6%)	23/302 (7.6%)
North Indians	**Indian Diaspora**	**1226/1613 (76.01%)**	**733/1552 (47.23%)**	**186/1452 (12.8%)**	**157/1353 (11.6%)**	**108/1502 (7.2%)**
Present Study	**Caribbean**	**296/356 (83.2%)**	**140/356 (39.33%)**	**69/356 (19.38%)**	**65/356 (18.26%)**	**22/356 (6.18 %)**
2-Tailed P Value		**0.003612**	**0.006942**	**0.001410**	**0.000890**	0.501519
Standard Error		**0.0245**	**0.0293**	**0.0206**	**0.0200**	**0.0150**
Z-Score		**-2.9102**	**2.6996**	**-3.1927**	**-3.3230**	**0.6721**

There were no publications that studied Rouvière's sulcus variants from West African nations. Therefore, we expanded our criteria to any publication that examined populations from the African diaspora. There were only two publications that examined Rouvière's sulcus variants from South Africa [24] and from Kenya [40]. Their data are collated in Table 5. Again, the populations had few similarities, with only slit-type and scar-type Rouvière's sulci having similar prevalence rates. This comparison, however, was limited by the small number of data available for comparison.

Table 5: A Comparison of Rouvière's Sulcus Variants in the African and Eastern Caribbean Diaspora

Citation	Region	Present	Open-Type	Closed-Type	Slit-Type	Scar-Type
Lazarus et al., 2018 [24]	South Africa	62/75 (82.7%)	33/75 (44%)	5/75 (6.7%)	19/75 (25.3%)	5/75 (6.7%)
Nyaanga et al., 2021 [40]	Kenya	98/116 (84.5%)	77/116 (66.4%)	11/116 (9.5%)	ND	10/116 (8.3%)
African Continent	**African Diaspora**	**160/191 (83.8%)**	**110/191 (57.6%)**	**16/191 (8.4%)**	**19/75 (25.3%)**	**15/191 (7.9%)**
Present Study	**Caribbean**	**296/356 (83.2%)**	**140/356 (39.33%)**	**69/356 (19.38%)**	**65/356 (18.26%)**	**22/356 (6.18 %)**
2-Tailed P Value		0.851906	0.000043	0.000707	0.159796	0.457462
Standard Error		**0.0334**	**0.0447**	**0.0325**	**0.0503**	**0.0225**
Z-Score		**0.1867**	**4.0881**	**-3.3869**	**1.4058**	**0.7430**

There were limitations to this study. Firstly, the multifarious definitions and classifications encountered demanded that we retrospectively examine and categorize data. This may have introduced misclassification bias, despite our attempts to minimize this by having two independent researchers search and categorize data. Secondly, this study relied on secondary data that could introduce bias if they were inaccurately reported and/or miscoded at the source.

CONCLUSION

Although persons of Eastern Caribbean descent have a greater prevalence of Rouvière's sulcus than seen in global statistics, there are important differences in the proportion of variants. Specifically, the Eastern Caribbean diaspora has a lower proportion of open-

type variants and a greater proportion of slit-type variants. Considering that the "classic" open-type variant is the easiest to identify intra-operatively, surgeons practicing in persons of Eastern Caribbean descent must be vigilant in order to identify these variants.

ARTICLE HIGHLIGHTS

Research background

Rouvière's sulcus has great importance to surgeons because it is an adjunct to protect against bile duct injuries and guide parenchymal transection during hepatectomies. However, there is still no consensus on its definition or classification, preventing proper analysis of existing data. This systematic review sought to examine existing data using a uniform classification of Rouvière's sulcus.

Research motivation

There is still no consensus on the descriptions of Rouvière's sulcus in the year 2026, despite it being an important surgical landmark. This systematic review used a standardized definition and classification system to extract raw data in order to establish global prevalence data.

Research Objectives

To use a standardized definition and classification system while extracting raw data from published articles on Rouvière's sulcus, using this to calculate the global prevalence of each variant of Rouvière's sulcus. We also sought to compare these data to those from a 5-year observational study in a Caribbean population.

Research Methods

The first part of this study was a 5-year observational study to collect data at laparoscopy using the standardized classification identifying open, closed, slit and scar-type variants.

Subsequently, we performed a systematic literature review of medical archiving platforms, searching Rouvière's sulcus variants. In instances where other classifications were used, we studied the descriptions and published images in order to categorize data using the standardized classification. The raw data were used to calculate global prevalence for each variant, which was then compared to that in our population using chi square tests to compare contingency tables in SPSS version 20 (IBM Corp, Armonk, NY). Fisher exact tests were used for values <5. A p-value <0.05 was considered significant.

Research Results

The first part of the study returned data from 356 persons, revealing that Rouvière's sulcus was present in 296 individuals. In the subsequent systematic review, we retrieved data from 25,196 persons across 59 relevant articles. The prevalence of Rouvière's sulcus was significantly greater in our population than global prevalence (83.2% vs 76.88%; P=0.005306). Unique findings in our Eastern Caribbean population were significantly lower proportions of open-type variants (39.33% vs 56.69%; P<0001), and greater proportions of slit-type variants (18.26% Vs 14.15%; P =0.033397).

Research Conclusions

Although persons of Eastern Caribbean descent have a greater prevalence of Rouvière's sulcus than global statistics, there are important differences in the proportion of variants. Surgeons practicing in these regions must be aware of these differences, particularly the lower prevalence of the "classic" open-type sulcus, as the other variants are more difficult to recognize intra-operatively.

Research Perspectives

In order to maintain good surgical outcomes after liver resections and to avoid bile duct injuries during cholecystectomy, surgeons should be aware of the varied types of

Rouvière's sulcus, as well as the individualized variants in their populations. This research revealed unique differences in the Caribbean population that will help to improve outcomes in this population.

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Tables and Figure Legends

Table 1: Varied Descriptions and Classifications of Rouviere's Sulcus Encountered in Medical Literature

Table 2: Classification of Rouvière's Sulcus

Table 3: Publications documenting the prevalence and types of Rouviere's Sulcus

Table 4: A Comparison of Rouvière's Sulcus Variants in North Indian and Eastern Caribbean Diaspora

Table 5: A Comparison of Rouvière's Sulcus Variants in the African and Eastern Caribbean Diaspora

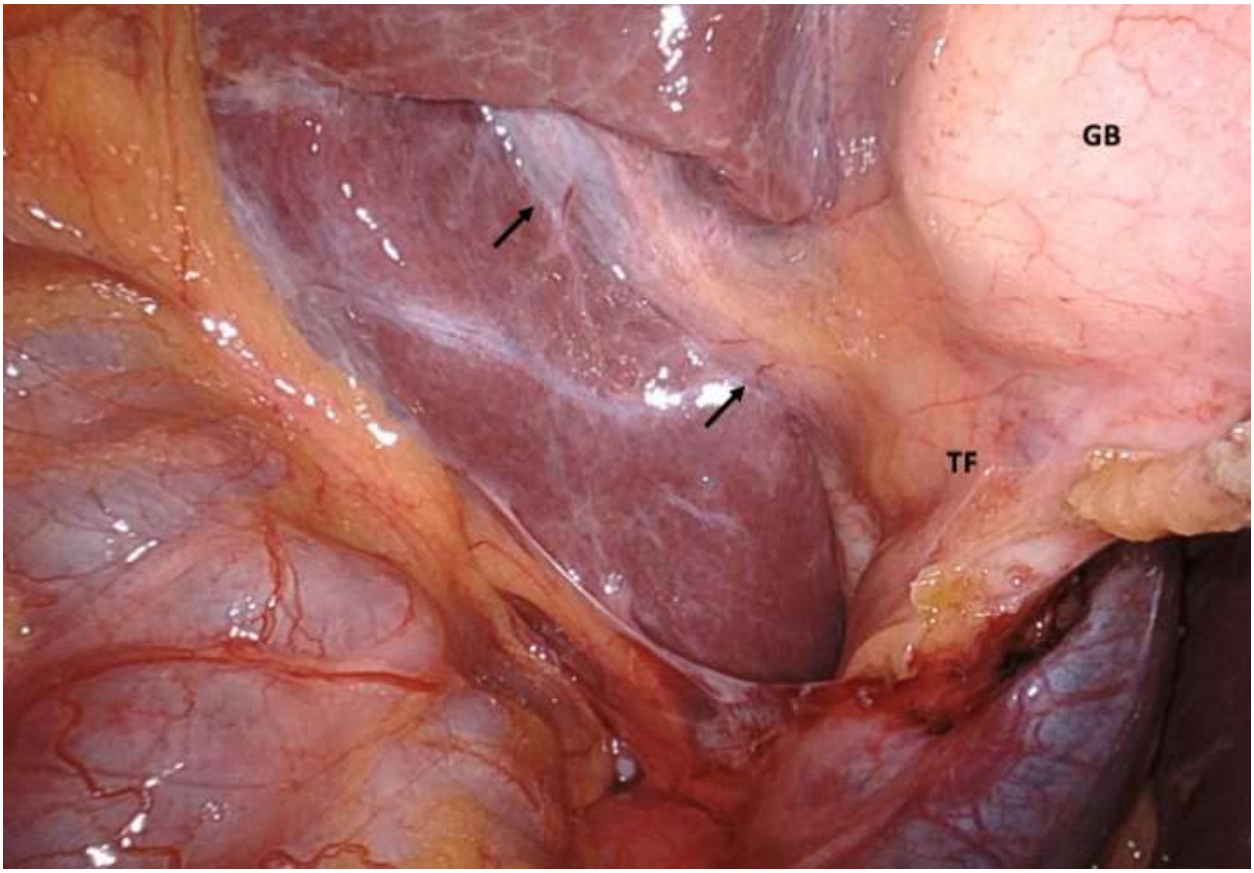

Figure 1: An intra-operative image during single incision laparoscopic cholecystectomy that demonstrates an open-type Rouvière's sulcus (arrows), whose medial end is continuous with the transverse fissure (TF), posterior to the gallbladder (GB)

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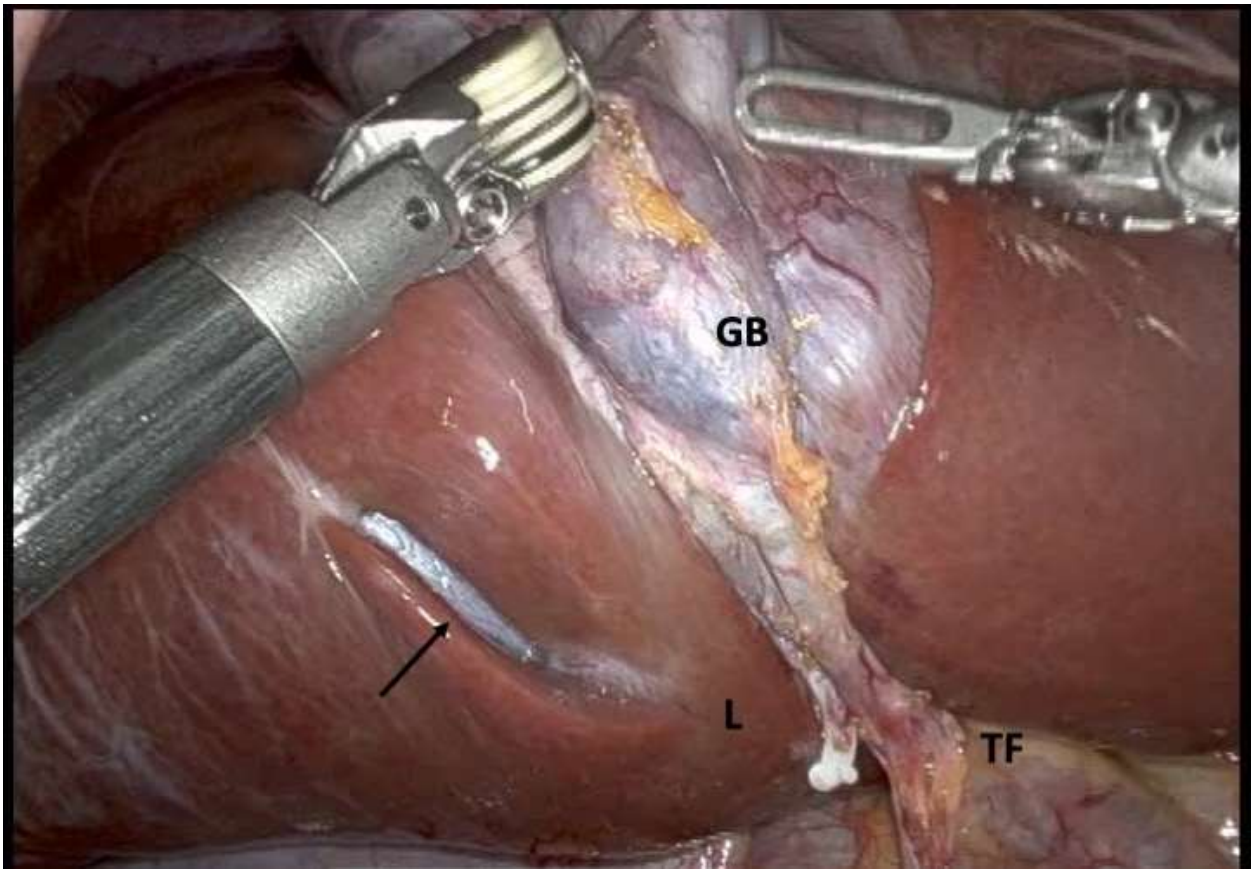

Figure 2: Intra-operative image during cholecystectomy, demonstrating a closed-type Rouvière's sulcus, maintaining its posterior relationship to the gallbladder (GB) neck. The medial end of Rouvière's sulcus is separated from the transverse fissure by a bridge of liver parenchyma (L) so that the sulcus is not continuous with the transverse fissure.

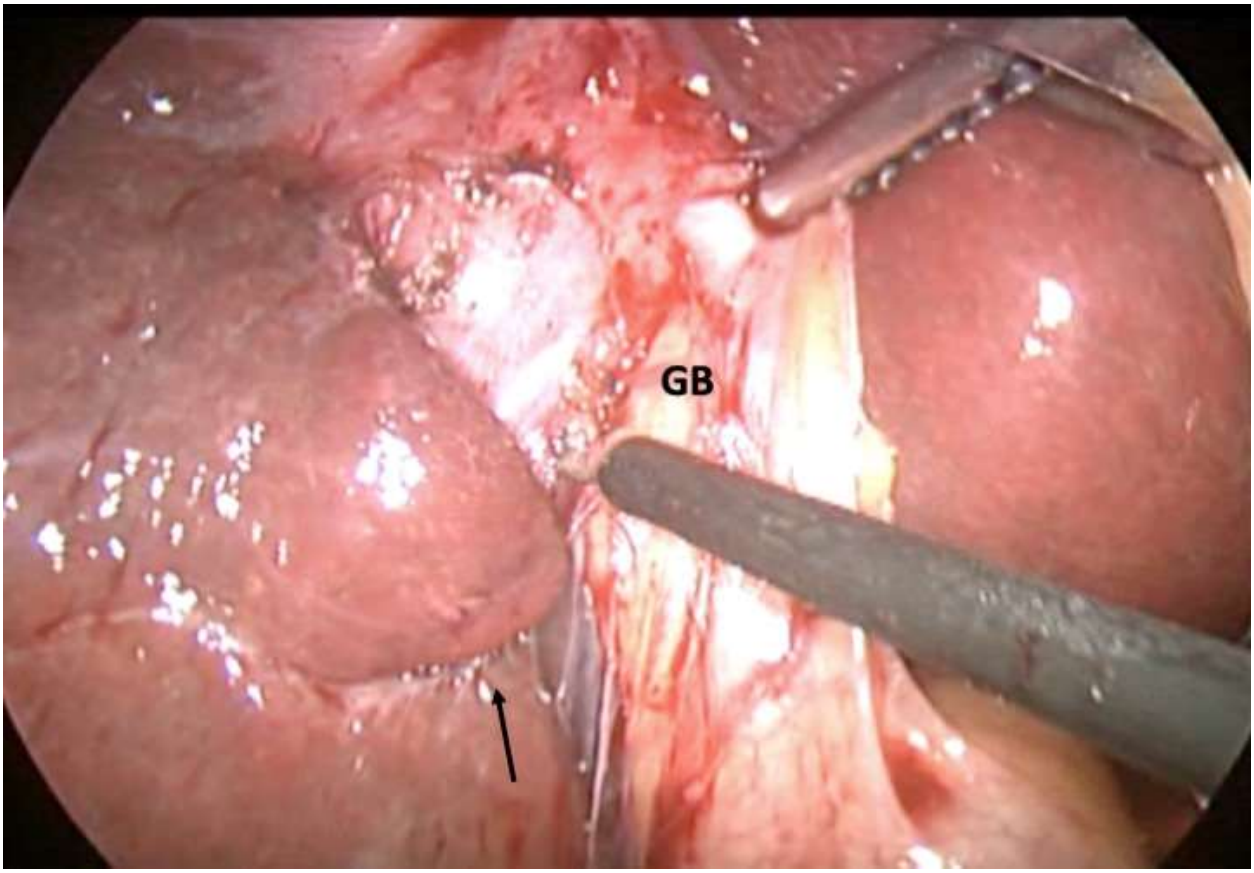

Figure 3: Intra-operative image taken during laparoscopic cholecystectomy, demonstrating a slit-type Rouvière's sulcus (arrow), posterior to the gallbladder (GB). The sulcus is narrower than the operative instruments which are 5mm in diameter.

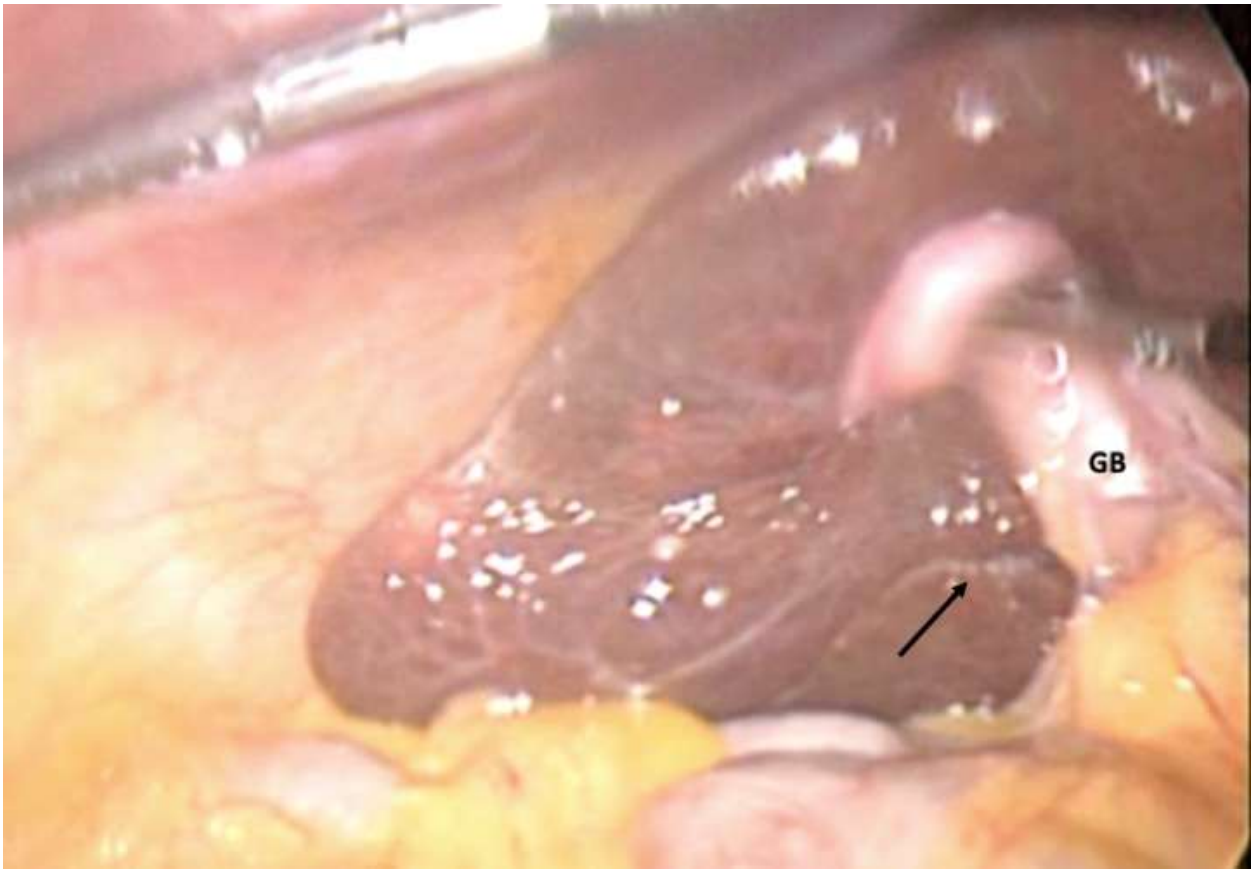

Figure 4: Intra-operative image taken at laparoscopic cholecystectomy, demonstrating a scar-type Rouvière's sulcus (arrow). There is only a vague impression / white line seen at the expected location of Rouvière's sulcus, maintaining its posterior relationship to the gallbladder (GB).