

Published: August 31, 2022

Citation: Gardner MT, Singh K, et al., 2022. Rouvière's Sulcus in a Jamaican Population, Medical Research Archives, [online] 10(8). <https://doi.org/10.18103/mra.v10i8.2941>

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DOI
<https://doi.org/10.18103/mra.v10i8.2941>

ISSN: 2375-1924

RESEARCH ARTICLE

Rouvière's Sulcus in a Jamaican Population

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ABSTRACT

Considering the fact that several anatomic variants of the liver have been described in the Jamaican population, we sought to document the prevalence and characteristics of Rouvière's sulcus in this population. This paper has two parts. First, 60 cadaveric dissections were observed to document the prevalence of Rouvière's sulcus as 81.7%. In the second part of this paper, a systematic review identified 811 cadaveric dissections across 9 studies and recorded the global prevalence of Rouvière's sulcus as 77%. The prevalence of Rouvière's sulcus in the Jamaican population closely matched that across the globe in this systematic review.

Keywords: Caribbean; Rouvière, sulcus, liver, groove

INTRODUCTION

Henri Rouvière is credited with describing the sulcus bearing his name in the year 1924 ¹. Rouvière's sulcus has now become a well-known landmark for laparoscopic surgeons who use it as a landmark to identify the right hepatic pedicle, thereby reducing the likelihood of common bile duct injury ²⁻⁴. It is important for laparoscopic surgeons to be aware of the possible variations in Rouvière's sulcus since it holds such an important role intra-operatively.

Considering the fact that a high incidence of hepatic arterial variants ⁵, anomalous venous drainage ⁶, and variant liver surface anatomy ⁷ exist in the Jamaican population, we sought to document the prevalence and characteristics of Rouvière's sulcus in this population. This information is important for laparoscopic surgeons to reduce the incidence of bile duct injuries.

METHODS

After securing ethics committee approval (ECP64,20/21), we carried out an observational study of all cadaveric dissections during anatomical teaching at the University of the West Indies. Three independent investigators observed all consecutive cadaveric dissections from January 1, 2016 to January 30, 2021. We excluded cadavers with hepatic trauma, gross parenchymal liver disease and those who underwent prior liver resections.

After opening the abdomen via a midline incision, the visceral liver surface of the right hemi-liver was inspected in situ and Rouvière's sulcus was identified. Rouvière's sulcus was defined as 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 ⁸. The in-situ relationships with neighboring viscera were noted and recorded. The livers were then explanted and inspected on a dissection table.

In this study we used the classification ⁸ outlined in table 1. In addition, the depth, length, width and relations of Rouvière's sulcus were recorded. Measurements were taken by three independent investigators using electronic calipers (General Tools, New York, USA) and the mean was used as a final measurement. The overlying parenchyma was then dissected to document the course of hepatic veins, portal veins and hepatic arteries in relation to the sulci. Descriptive analyses were performed using the SPSS statistical software.

We also recorded the orientation of Rouvière's sulcus as it relates to the transverse fissure of the liver. This was chosen as it is a consistent landmark that will not change based on patient / cadaver position. A ruler was used to outline a vertical line through the transverse fissure. This vertical line was used as a zero-axis to measure the course of Rouvière's sulcus with a standard protractor. Based on this measurement, three subdivisions were defined as outlined in table 2.

Finally, we carried out a literature search of medical archives including Pubmed, Embase, Scopus and Google Scholar in order to identify all publications that reported the prevalence of Rouvière's sulcus in cadaveric specimens. We excluded publications that reported findings in laparoscopic operations because the characteristics of the liver in formaldehyde-fixed cadavers differed from that of live surgical candidates. Two authors reviewed all publications in detail and extracted data from each study. The raw data from each publication were used to calculate the mean prevalence of Rouvière's sulcus and this was compared to the Jamaican data.

RESULTS:

A total of 60 livers were examined in 31 male and 29 female cadavers. Rouvière's sulcus could be identified in 49 (81.7%) of cadavers as outlined in Table one.

Table 1: Definitions and Subtypes of Rouvière's Sulcus

Type	Description	n (%)
Open	Medial end communicates freely with the transverse fissure	
	<ul style="list-style-type: none"> • Groove: >5mm wide • Slit: ≤5mm in width 	32 (53.3%) 8 (13.3%)
Closed	Medial end covered by a bridge of liver parenchyma so there is no continuity with the transverse fissure	
	<ul style="list-style-type: none"> • Groove: >5mm wide • Slit: ≤5mm in width 	3 (5.0%) 4 (6.7%)
Scar	A discernable depression is not present, but a linear impression is seen at its expected location	2 (3.3%)
Absent	There is no superficial landmark discernable	11 (18.3%)

The orientation of Rouvière's sulcus relative to the transverse fissure are noted in Table 2.

Orientation	Definition	n (%)
Horizontal	Rouvière's sulcus courses an angle $\leq 20^\circ$ to the vertical plane	19 (38.8%)
Oblique	Rouvière's sulcus courses between $21-60^\circ$ to the vertical plane	28 (57.1%)
Vertical	Rouvière's sulcus courses at an angle $>60^\circ$ to the vertical plane	2 (4.1%)

The mean dimensions of Rouvière's sulcus are outlined in Table 3.

Type	Length (mm) Mean \pm SD	Width (mm) Mean \pm SD	Depth (mm) Mean \pm SD
Open Groove	28.83 \pm 11.14	6.73 \pm 3.28	12.55 (\pm 5.65)
Open Slit	28.61 \pm 16.62	3.55 \pm 1.44	11.50 \pm 3.12
Closed Groove	21.11 \pm 1.64	5.48 \pm 0.25	11.83 \pm 1.52
Closed Slit	20.68 \pm 14.87	1.77 \pm 0.93	6.71 \pm 6.86

After all measurements were taken, the hepatic parenchyma overlying Rouvière's sulcus was dissected to expose the underlying structures. In 51 (85%) cases, the right hepatic pedicle was easily identified with minimal dissection at the floor of Rouvière's sulcus.

The literature search returned 49 publications that reported the prevalence of

Rouvière's sulcus. After excluding 40 that reported on live patients undergoing surgery, there were nine publications reporting on Rouvière's sulcus in cadaveric specimens ^{1,8,11,12,13,14,15,16,17,18}. The mean prevalence of Rouvière's sulcus in cadaveric studies was calculated as 80.8% (Table 1).

Study	Population	Cadavers	Prevalence	absent
Rouvière's et al., 1924 ^{1*}	France	100 Children	81 (81%)	19 (19%)
Rouvière's et al., 1924 ^{1*}	France	100 Adults	52 (52%)	48 (48%)
Gans et al., 1955 ¹²	Netherlands	100**	92 (80%)	23 (20%)
Couinaud et al., 1957 ¹¹	France	100	73 (73%)	27 (27%)
Dahmane et al., 2013 ¹³	Slovenia	40	33 (82%)	7 (18%)
Lazarus et al., 2018 ¹⁴	South Africa	75	62 (83%)	13 (17%)
Père et al., 2020 ¹⁵	France	10	8 (80%)	2 (20%)
Bajpayee et al., 2021 ¹⁶	India	45	40 (88.8%)	5 (11%)
Deshatty et al., 2021 ¹⁷	China	60	43 (72%)	17 (28%)
Nyaanga et al., 2021 ¹⁸	Kenya	116	98 (84.5%)	18 (15.5%)
Cawich et al., 2022 ⁸	Trinidad	50	43 (86%)	7 (14%)
		811	625 (77%)	186 (23%)
Gardner et al	Jamaica	60	49 (81.7%)	11 (18.3%)

*Rouvière included fetuses, newborns and very young children in this study

** This study was based on dissection of "100 coloured polyvinylite corrosion specimens of normal human livers, 15 specimens of cancerous human livers, 3 dog livers, and 1 pig's liver".

DISCUSSION

Rouvière's sulcus is 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-liver⁸. Table 4 demonstrates that Rouvière's sulcus is an inconsistent anatomic feature, reported to be present in 52%¹ to 89%¹⁵ of adult cadaveric livers. In the Jamaican population, Rouvière's sulcus was present in 81.7% of cadavers, which compares well to the mean prevalence globally (Table 4).

Most of these studies recorded data from Indian¹⁵, Asian¹⁶ or Caucasian populations^{1,11,12,13,15}. In Jamaica, 91.4% of the population is of West African descent¹⁹. We encountered two studies that reported on the prevalence in black populations^{14,18}. Lazarus et al.¹⁴ reported that 83% of South African cadavers and Nyaanga et al.¹⁸ reported that 84.5% of Kenyan cadavers had a well-defined Rouvière's sulcus. The prevalence in Jamaican cadavers closely matched this at 81.7%. We found it interesting that the prevalence of Rouvière's sulcus in Jamaican population so closely matched that in other predominantly black populations. We thought that this may have been due to a hereditary / developmental link, but we

were not able to definitely state this from our study design. However, this may be the focus of future research.

It is an advantage that the majority of Jamaicans have a well-defined Rouvière's sulcus because it can be used as a landmark to avoid duct injuries during laparoscopic cholecystectomies⁴. This is because the common duct lies posterior to Rouvière's sulcus in almost 100% of cases^{4,13,14}. Since the cystic duct lies anterior to the sulcus, a laparoscopic surgeons can prevent encountering / injuring the common bile duct by limiting his/her dissection anterior to Rouvière's sulcus.

However, surgeons must be aware of variants in their population so they do not miss an opportunity to use Rouvière's sulcus. The closed type is particularly important in this regard. Most surgeons attempt to identify this landmark by finding the transverse fissure and then following it to the right. An open type sulcus (Figure 1) can be identified, but it would be easy to miss a closed-type sulcus this way (Figure 2). The scar subtype (Figure 3) is also important as it may only be recognized by experienced operators. These two variants were present in 15% of Jamaican cadavers.



Figure 1 and 2: A comparison of the open-type and closed-type sulci (arrows). The closed type sulcus may not be easily identified by following the transverse fissure to the right.

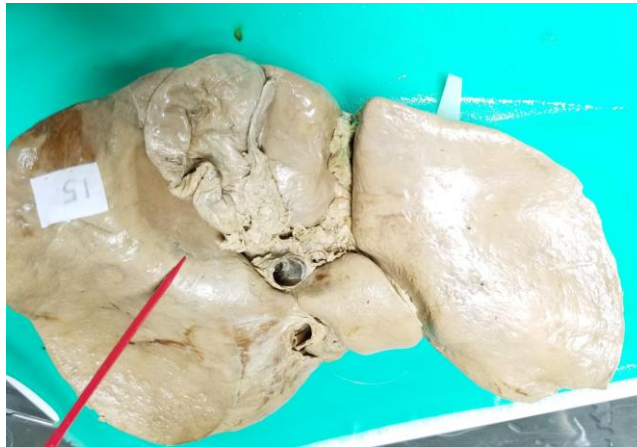


Figure 3: The red pencil points to a scar-type Rouvière's sulcus, which may be difficult to identify by an inexperienced operator

Rouvière's sulcus would be easy to identify in 67% of Jamaican cadavers with the open type sulcus and 57% of sulci ran in an oblique course that made them easily visible. This was similar to other reports in the anatomic literature¹³. Hepatobiliary surgeons can also utilize this since the right hepatic pedicle was easily identified with minimal dissection in 85% of cases.

STUDY LIMITATIONS:

We considered whether the incidence in our population could be affected by human error or

misinterpretation. However, three investigators independently observed and measured the sulci, reducing the potential for inter-personal variations.

CONCLUSION:

Rouvière's sulcus is present in 81.7% of Jamaican cadavers and 57% of sulci run in an oblique course, making them easily to identify at surgery. It is also important that the sulcus is intimately related to the right hepatic pedicle in 85% of cases.

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