

## Accessory Sulcus of Liver: An Anatomical Study and Its Clinico-Surgical Implications

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### Abstract

*Background:* Accessory Sulci can be incidentally detected during any radiological procedures, routine autopsies, surgery or anatomical dissections. These have been investigated as congenital development or acquired due to pressure exerted by surrounding viscera. *Aim:* The aim of the present study was to find out the presence of Accessory Sulcus (AS) in the embalmed cadaveric livers, compare it with the normal liver and correlated its clinical implications. *Materials and Methods:* All intact cadaveric formalin-fixed 20 livers were utilised for the study. All the livers belonged to adults of unknown age and known sex (male-18, female-2) in the Department of Anatomy, in order to observe the presence and pattern of AS. *Result:* The diaphragmatic sulci (DS) were present in 2 cases. They were starting from the right side of the inferior vena cava on right lobe of liver extending from superior surface to the anterior and right surfaces. A Rouviere's sulcus containing the right portal pedicle extending from the right of the porta hepatis, anterior to the caudate process was seen in 10% of cases. In one case sulcus extending from the right of fossa for gall bladder having a curved course bisecting the inferior border, was seen. Besides this, some minor sulci on the quadrate and caudate and left lobes were also seen. *Conclusion:* The anatomical knowledge of these hepatic AS may be utilised by radiologists to avoid possible errors in interpretation and subsequent misdiagnosis and may assist hepatobiliary surgeons to plan a safe surgical approaches.

**Keywords:** Hepatic Segments; Laproscopic Cholecystectomy; Portal Fissure; Rouviere's Sulcus.

### Introduction

The liver is the largest abdominal viscera, occupying a substantial portion of the upper abdominal cavity. It has four lobes or eight segments, depending on whether it is defined by its gross anatomical appearance or by its internal architecture. Grossly liver has been divided into the right, left, caudate and quadrate lobes by the surface peritoneal and ligamentous attachments [1]. Depending on the

internal architecture, the most widely-accepted nomenclature is described by Couinaud (1957) and Healy and Schroy (1953) which was also accepted by Federative Committee on Anatomical Terminology. According to this classifications, an imaginary "principal parasagittal plane" passing through the gall bladder fossa, divides the liver into functional right and left lobes. Segments I, II, III and IV make up the functional left lobe, and segments V, VI, VII and VIII make up the functional right lobe [1,2].

Accessory groove or fissure can be incidentally detected at any surface of liver during radiological procedure, routine biopsy, anatomical dissection or during hepatobiliary surgery [3]. The grooves have various lengths, are linear or curve-shaped and are single or multiple in numbers [4]. Diaphragmatic sulcus have been investigated as congenital development or acquired due to diaphragmatic or costal pressure [5,6]. They are commonly present on anterior and superior surface of right lobe of the liver. Apart from diaphragmatic sulcus numerous sulcus, fissure or notches have been observed on inferior

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and posterior surface of both lobe of the liver by many authors.

Rouvier's sulcus is a cleft in the liver running to the right of the hilum, anterior to caudate process which contains the right portal pedicle and accurately identifies the plane of the common bile duct. This sulcus is considered as one of the important landmark which can be used as a reference point to guide safe dissection of Calot's triangle during laproscopic cholecystectomy [7].

Though all these sulci and fissures were observed by different authors from different countries including India but so far none of the articles showed this study in Uttarakhand region. So our aim was to study the presence and frequency of Accessory Sulcus (AS) in the embalmed cadaveric livers, compare it with the normal liver and to correlate its clinical implications in Uttarakhand population.

### Materials and Methods

All intact cadaveric formalin-fixed 20 livers were utilised for the study. All the livers belonged to adults of unknown age and known gender (male-18, female-02) in the Department of Anatomy, VCSGGMS & RI, Srikot, Uttarakhand in order to observe the presence, frequency and pattern of AS. Liver with features of cirrhosis, congenital anomalies apart from accessory sulcus or any damage was excluded from the study. Grossly the major and minor sulci on the hepatic surface were observed. The photographs were captured by 14.1 megapixel digital camera.

### Results

The diaphragmatic sulci (DS) were present in two cases (Figure 1 and Figure 2). The single DS (5%) was seen extending between the anterior and right surface of Liver. The multiple DS (5%) was seen of total cases with variable shape, depth and length. They were starting from the right side of the inferior vena cava on the right lobe of liver extending from the superior surface to the anterior and right surfaces.

A Rouviere's sulcus containing the right portal pedicle extending from the right of the porta hepatis, anterior to the caudate process was seen in 10% of cases (Figure 3 and Figure 4). In one case (Figure 4) sulcus extending from the right of fossa for gall bladder having a curved course bisecting the inferior border, was seen. Besides this, some minor sulci on the quadrate and caudate and left lobes



Fig. 1: The multiple minor sulcus (\*) of variable length starting from the right side of inferior vena cava on superior surface of the liver extending downwards on anterior and right surfaces of liver.



Fig. 2: The solitary minor sulcus (\*) extending from the superior surface of the liver downwards on anterior surface of liver.



Fig. 3: The single minor sulcus (\*) extending from the right side of porta hepatis on inferior surface of the right lobe of liver

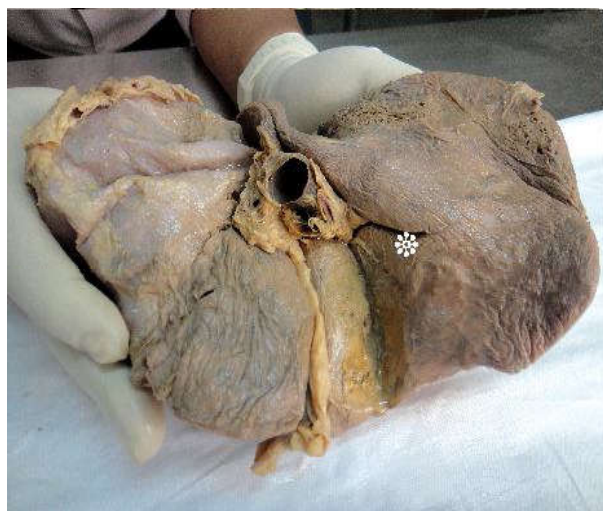


Fig. 4: The multiple minor sulcus (\*) present on postero-inferior surface of the right and left lobes of liver.

were also seen. The diaphragm did not show any signs of hernia.

### Discussion

The AS of the liver is a rare anomaly. It may be due to a developmental defect or may be acquired as a result of pressure by superficial structures. Macchi et al. reported that diaphragmatic sulcus represents weak zones of the hepatic parenchyma particularly susceptible to the mechanical effects of different bundles of the diaphragm muscle. He also showed the relationship between diaphragmatic sulcus and portal fissures as fissure are localized at boundary between the territories of distribution of the segmental branch of portal veins thus indicate the boundaries between adjacent hepatic segments. He also found correspondence between the topography of the sulci and course of right and middle hepatic vein and their tributaries. It was 73% (RHV more than LHV) with corrosion cast and 67% in radiological findings. In radiological practice the course of hepatic veins is used to identify the boundaries between hepatic sector and the hepatic veins constitute indirect landmark for delineation of portal fissure [8].

So, DS may be used as a surface mark for the portal fissures and the superficial projection of the deep course of the hepatic veins and their tributaries, representing evidence of the functional vascular anatomy of the liver. This relationship can be utilized by the surgeon during segmental resection of the liver.

We found DS in 10% of cases with compare to Joshi (6%), Yong Ho Auh (25%) and Macchi (40%) [1, 6, 8]. These grooves were present on the right lobes of the

liver because the right crus and fibers on the right side are more substantial than those of the left, thus able to produce sulcus.

Joe Hoon Lee found single DS in CT which was coincided with Cantile line and was extended towards vena cava. The large groove was present between VIIIa & VIIIc were utilized for subsegmentation and minor groove was present between VI & VII segment helped to do mono segmentectomy as groove played an important role. The minor grooves were also seen in left lobe but it was relatively small & less close to intersegmental line.

In our study posterior and inferior surface of the right lobe was the most common site of AS as seen by Joshi et al. and he also observed veins in the depth of fissure in all the cases. In one case we saw that sulcus extending from the right of fossa for gall bladder having a curved course bisecting the inferior border which was not mentioned in any literature before. Though Joshi et al. (2009) reported that in 80% of liver, fissure for ligamentum teres was continued for a variable distance after cutting the inferior border onto the anterior surface, where the fissure was vertical, oblique or T-shaped. The accessory sulcus on the inferior surface of the right lobe may be caused by the pressure exerted by the colon. Besides this, some minor sulci on the quadrate, caudate and left lobe were also seen which was similar to the Joshi findings.

The frequency of presence of Rouvier's sulcus in our study was 10% as compare to Zubair et al. (68.13%) in Karachi population and 78% in developed world population. Rouviere's sulcus is present in 12% of persons in the Afro-Caribbean population, but when it is present there is 100% correlation with the right branch of portal vein [9]. Thus surgeons can utilize the Rouvier's sulcus as important landmark in laproscopic cholecystectomy.

Cho et al., (2004) reported that the anterior groove of the liver may be regarded as the third door of the liver exposing all the Glissonian pedicles [10]. It is applicable and useful to approach liver hilum using the Glissonian Pedicle Transection Method (GPTM). The major limitation of this study is that it is a small observational study. In this study 20 cadaveric dissections were utilized. It may have been possible to detect other differences if larger numbers of cadaveric dissections were performed. According to Auh et al., (1984) during imaging, any collection of fluid in these fissures may be mistaken for a liver cyst, haematoma or liver abscess [6].

## Conclusion

The anatomical knowledge of hepatic AS may be utilized by radiologists to avoid possible errors in interpretation and subsequent misdiagnosis and may assist hepatobiliary surgeons to plan a safe surgical approaches.

## Conflicts of Interest

None

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