

Study of Variations of Umbilical Fissure for Ligamentum Teres Hepatis in Human Cadaveric Livers

Gyanaranjan Nayak^{1*}, Sujita Pradhan², Lopamudra Nayak³, Niranjana Sahoo⁴

^{1,2,3} Department of Anatomy, IMS and SUM Hospital, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, PIN-751003, Odisha, India.

⁴Department of Forensic Medicine, AIIMS, Bhopal, PIN- 462020, Madhya Pradesh, India.

**Corresponding Author*: Dr Gyanaranjan Nayak. Professor, Department of Anatomy, IMS and SUM Hospital, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, PIN-751003, Odisha, India. Mobile phone No- 09937750477, E mail ID- drgrn82@gmail.com

ABSTRACT

Background- The classical umbilical fissure is a groove for ligamentum teres hepatis located on the visceral surface of human liver. It may present several variations as highlighted by the current study.

Materials and Methods- The study comprised of twenty formalin preserved human adult livers of unknown sex harvested from embalmed cadavers. The livers were examined and variations of the umbilical fissure for ligamentum teres hepatis were observed and recorded suitably.

Results- Normal or classical umbilical fissure was observed in only 40% cases. The variations noted were as follows- fibrotic capsule bridging across umbilical fissure (10%); liver parenchyma (pons hepatis) bridging across umbilical fissure (15%); incomplete umbilical fissure with partially demarcated quadrate lobe, but ligamentum teres hepatis absent (15%); no quadrate lobe (5%); projection (designated as lingual process in this study) arising from right lobe (5%) and projecting into umbilical fissure; lingual process arising from left lobe (5%) and projecting into umbilical fissure; lingual process arising from both lobes (5%) and projecting into umbilical fissure.

Conclusion- These anatomical variations of umbilical fissure are clinically significant as they can pose challenges in diagnostic and surgical procedures involving the liver.

Key Words- Liver, ligamentum teres, umbilical fissure, variations, pons hepatis.

INTRODUCTION

The ligamentum teres hepatis is the embryological remnant of the obliterated left umbilical vein. It's usually placed in a narrow groove on the visceral or inferior surface of liver. This fissure on the inferior surface of liver is designated as classical umbilical fissure.[1] The fissure for ligamentum teres hepatis is also referred as Rex recess.[2] The umbilical fissure is very important for hepatologists. The fissure for ligamentum teres is a landmark for imaging studies of liver. It's used to localize umbilical segment of portal vein for hepatic vascular assessment. The surgeons doing hepatic resection rely on the umbilical fissure as an anatomical landmark. The ligamentum teres hepatis is grasped as a 'handle' to manipulate the liver for laparoscopic liver resection.[3]

Various authors have reported anatomical variations of the umbilical fissure.[3,4] As the umbilical fissure is such an important anatomical landmark of liver for various diagnostic and therapeutic procedures we have ventured to highlight its anatomical variations in the current study.

MATERIALS AND METHODS

We have conducted the study on twenty numbers of formalin preserved human livers used for teaching gross anatomy to MBBS students in a Medical College of Eastern India. The livers were used in the study were harvested from embalmed cadavers during routine dissection classes of undergraduate medical students during the period from September, 2015 to August, 2023. The cadavers belonged to adults of both the sexes mostly dying of natural causes. Livers showing obvious anatomical or pathological deformities were excluded from the study. All the livers were thoroughly examined for the anatomical variations of umbilical fissure and the findings were suitably photographed and recorded. The result was duly tabulated as well.

RESULTS

The umbilical fissure was normal in 8 livers(40%). The following variations were noted-

- (1) A fibrotic band lacking in hepatic parenchyma (Type A, Figure- 1A,B) bridged across the umbilical fissure in 2 cases(10%).
- (2) The umbilical fissure was found to be covered by a bridge of hepatic parenchyma (pons hepatis) (Type B, Figure-2) in 3 cases(15%). In these cases the ligamentum teres hepatis was found to be located in a tunnel.
- (3) In another 3 cases (15%) incomplete umbilical fissures were observed with partially demarcated quadrate lobe and a definite ligamentum teres hepatis could not be found (Type C, Figure-3).
- (4) In one specimen(5%) the quadrate lobe was found to be absent (Type D, Figure-4).
- (5) In the present study we have noted hepatic tissue projecting from both anatomical right and left lobes of liver into the umbilical fissure. Such projections are labelled as "lingual

process” in the study for their supposed resemblance to the human tongue. Such “lingual process” was found to be projecting from the right lobe in one case (5%) (Type E1, Figure-5); from the left lobe in one case(5%) (Type E2, Figure-6); from both lobes in one case(5%) (Type E3, Figure-7).

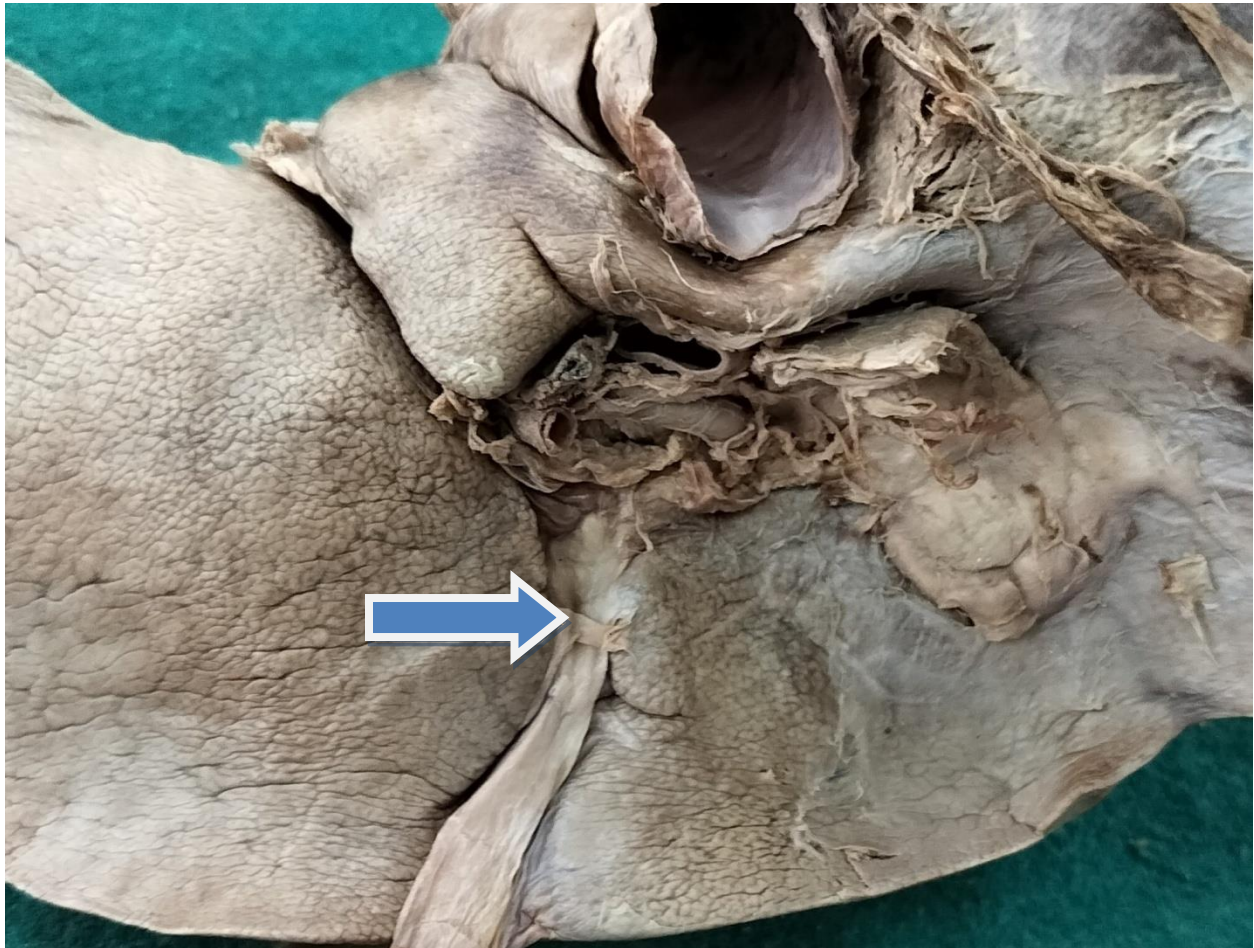


FIGURE-1A(Type A variation)- A fibrotic band lacking hepatic parenchyma bridging across the umbilical fissure.

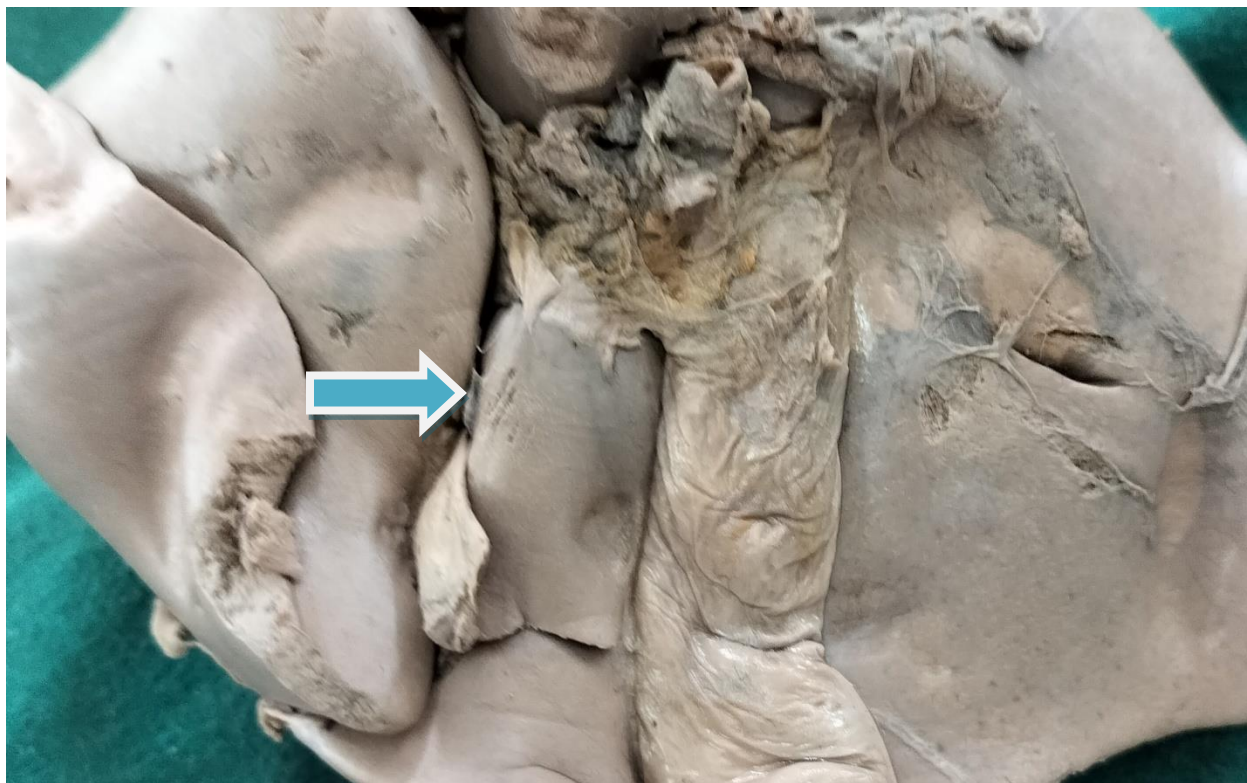


FIGURE-1B(Type A variation)- A fibrotic band lacking hepatic parenchyma bridging across the umbilical fissure.

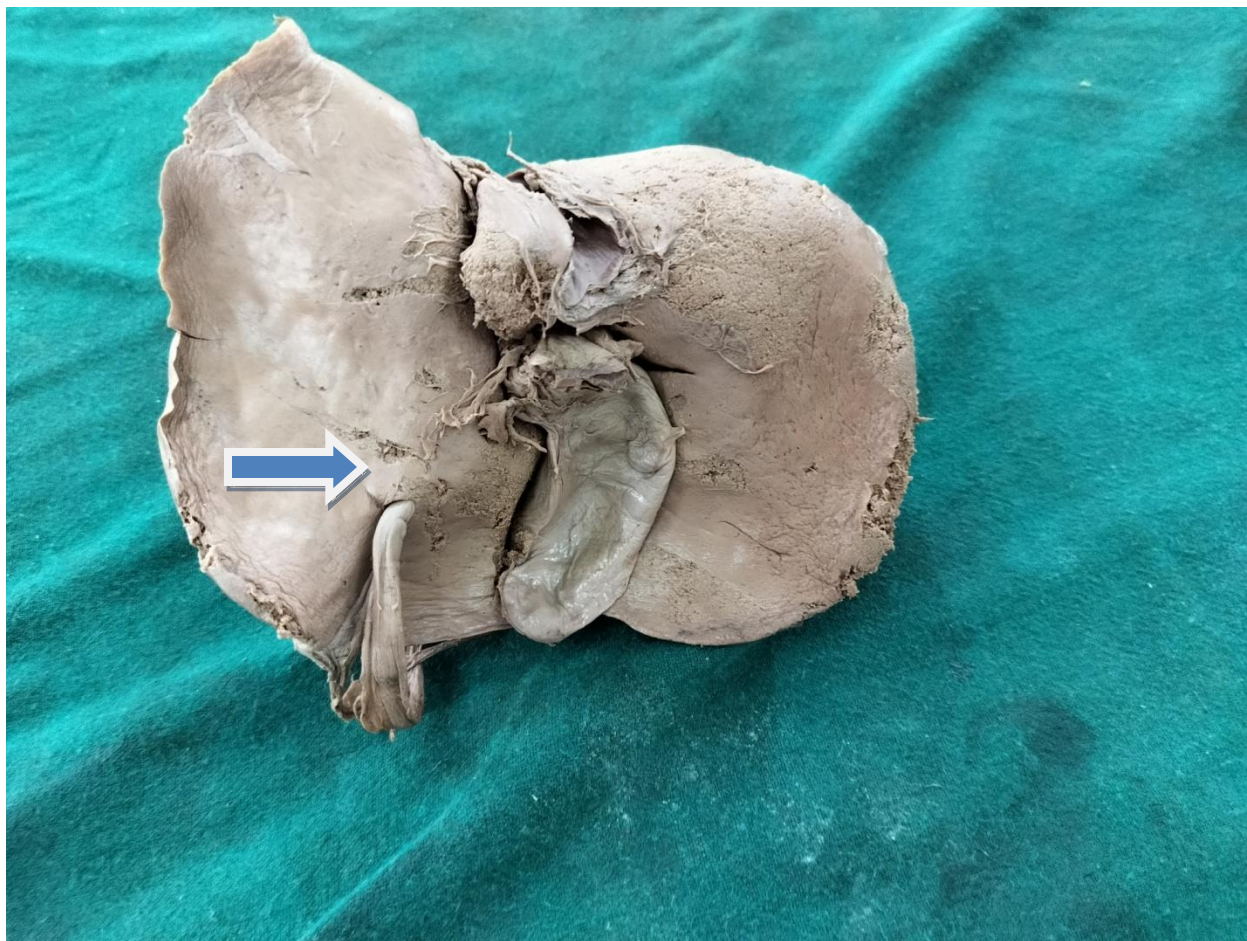


FIGURE 2(Type B variation)- Umbilical fissure bridged by hepatic parenchyma (pons hepatis)



FIGURE-3 (Type C variation)- Incomplete umbilical fissure with partially demarcated quadrate lobe and a definite ligamentum teres could not be found.



FIGURE 4 (Type D variation)- Quadrate lobe absent.



FIGURE -5 (Type E1 variation)- Lingual process projecting from right lobe of liver into the umbilical fissure.



FIGURE-6 (Type E2 Variation)- Lingual process projecting from left lobe of liver into umbilical fissure.

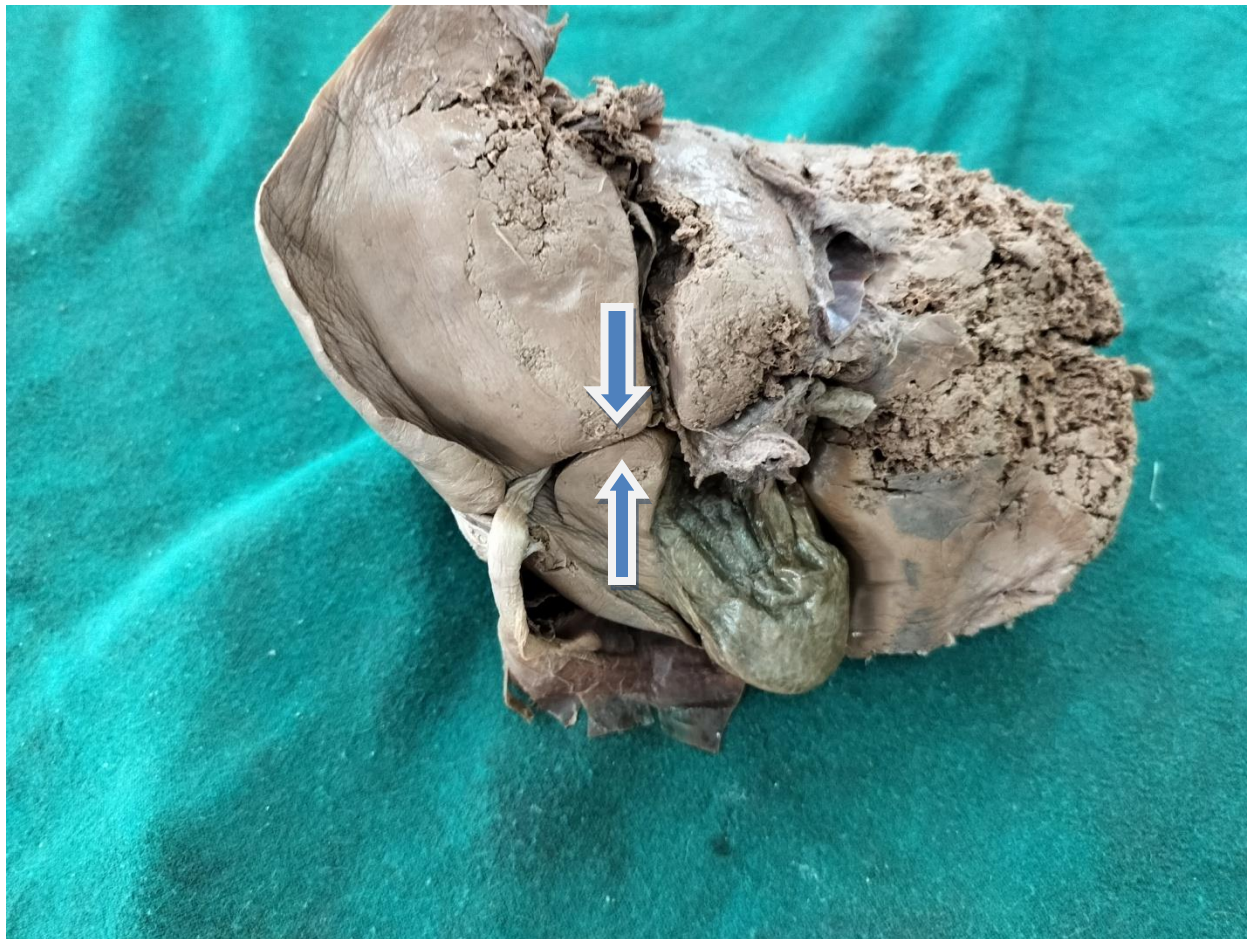


FIGURE-7 (Type E3 variation)- Lingual processes projecting from both lobes of liver into umbilical fissure.

DISCUSSION

The classical umbilical fissure is a normal groove on the inferior (visceral) surface of liver extending from the inferior border of the liver to the porta hepatis. However, various authors have reported deviations from the current study, many of which are similar to the current study.

Type A variation (hepatic capsular bridge across the umbilical fissure) was reported to have a frequency of 1.5% in the study by Cowich et al.[3] These capsular bridges are very thin and short and they can be easily separated from the underlying ligamentum teres hepatis. They are insignificant clinically as liver surgeons face little resistance during dividing these capsular bridges in surgeries like Rex (mesenterico-portal) bypass [5] or cryoreductive procedures during hyperthermic intraperitoneal chemotherapy. [6,7]

Type B variant or pons hepatis has also been reported by various authors.[8-12] The frequency of this variation is reported to be 1.25% by Chaudhari et al[9] whereas Joshi et al[6] report a frequency of 27.88% and Cowich et al[3] report a frequency of 33.33% in their study. In case of

livers with pons hepatis, such a bridge of liver parenchyma will be clinically important during both diagnosis and treatment of hepatic diseases. Such a large mass of hepatic tissue will hinder the Doppler assessment of the umbilical segment of the left portal vein while preparing for Rex shunts between superior mesenteric vein and umbilical branch of left portal vein.[3]

Type C variation (inconspicuous quadrate lobe with absent ligamentum teres hepatis) and type D variation (no quadrate lobe) have been reported by Kale et al[13]; Anbumani et al[14]; Ebby and Ambika [15]; Joshi et al[6]. The frequency of the variation is reported as 1.5% by Cowich et al[3], 4.4% by Joshi et al[6], 10% by Anbumani et al[14] and 3.2% by Aktan et al[16]. Umbilical fissure is used as a landmark to plan for hepatic resection and this becomes impossible in livers with type C and type D variations. The ligamentum teres hepatis is often grasped like a 'handle' to manipulate the liver during laparoscopic liver resection. This maneuver becomes very hazardous in livers with type C and type D variations because the overlying liver parenchyma can be lacerated leading to significant hemorrhage thereby compromising the safety of the patient.[3]

Type E1, E2 and E3 variations (projections from left or right lobe of liver into umbilical fissure) are reported by Cowich et al[3] at a frequency of 20.3% in their study. These variations due to their typical appearance can be confused with primary hepatic tumours or metastasis to liver by unsuspecting radiologists.[3,17,18] By narrowing the umbilical fissure, these variations decrease the accessibility of umbilical segment of left portal vein, posing hinderance to vascular surgeons performing Rex shunt and for hepatic procedures such as cytoreduction surgeries with hyperthermic intraperitoneal chemotherapy.[3]

CONCLUSION

The variations observed in our study are highly significant clinically as they can be confused with liver tumours or metastasis to liver and make sonographic assessment of the umbilical segment of the left portal vein difficult. Some of the variants can affect surgical procedures such as Rex shunts, intra-peritoneal chemotherapy and laparoscopic liver resection.

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