

Incidence Of Riedel's Like Lobe Of Liver: A Cadaveric Study

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Abstract

Background: Riedel in 1888 described Riedel's lobe as a rare anatomical variant of the liver presenting with a "tongue like projection descending from the anterior surface of the anterior margin of the right lobe of the liver to below the umbilicus" and almost always coexists with gallbladder disease. Whereas, Riedel's like lobe is also described as an accessory lobe, which protrudes downward from the anterior margin of the left lobe and not from the right lobe and this term was coined by Dick J. in 1951. The present study was done to determine the prevalence rate of Riedel's like lobe in cadaveric liver.

Methodology: A descriptive, cross-sectional study was done on 30 dissected, formalin fixed human liver specimens. Liver without any external gross defects was selected for the present study. The specimens were preserved in a 10% solution of formalin in the department. All the normal external features such as borders, surfaces, and lobes were studied and the specimens showing any evidence of disease and surgery or damage were excluded in the study.

Results: Out of 30 specimens, an accessory downward projection from the anterior margin of the left lobe of the liver of variable shape and sizes were noted in 4 specimens. In one specimen, Riedel-like lobe was observed on the left lobe of the liver which was also associated with gallbladder enlargement. The prevalence found in the present study was 13.3%.

Conclusion: Riedel's like lobe and any other accessory liver lobes are anatomical variants which can simulate any pathological mass or tumour. This study also helps to determine the influence of these anatomical variations in certain hepatocellular tumours or inflammatory diseases and their impact on surgical technique and diagnosis.

Key Words: Accessory lobe, hepatic lobe, riedel's lobe, riedel's-like lobe, liver abnormality, corset liver, liver anatomy.

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I. Introduction

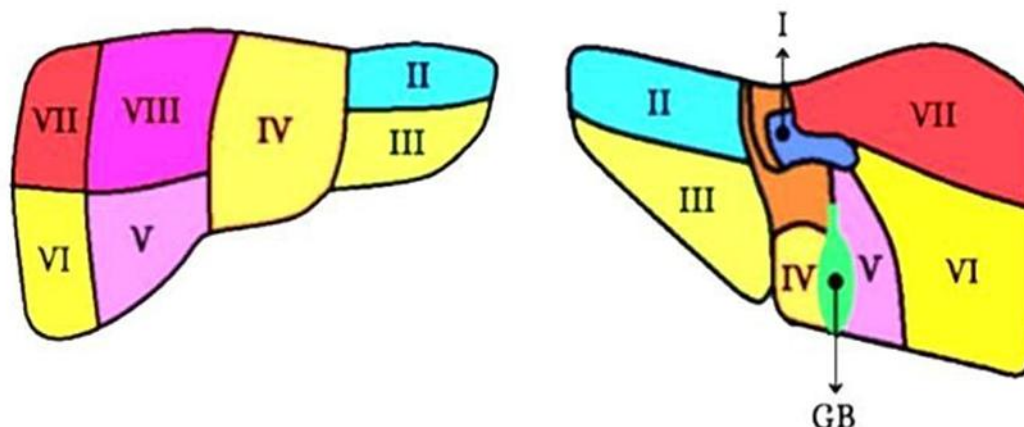
The liver is the largest abdominal viscera, occupying a substantial portion of the upper abdominal cavity. It primarily resides in the right hypochondrium and epigastrium, often extending into the left hypochondrium as far as the left anterior axillary line. Liver size varies according to sex—being generally smaller in females—and overall body size. Morphologically, the liver has a wedge-shaped configuration, influenced in part by the shape of the upper abdominal cavity. Externally, it is classically divided into the right, left, caudate, and quadrate lobes, partly delineated by peritoneal ligamentous attachments.

Segmental variations and developmental anomalies are common, though the formation of accessory liver lobes is relatively rare, with an estimated prevalence of less than 1%². Among these anomalies, Riedel's lobe has been reported frequently in anatomical and radiological studies.

The liver develops from the hepatic diverticulum, an endodermal outgrowth of the ventral foregut, which grows into the septum transversum during the fourth week of intrauterine life. Variations such as Riedel's lobe are thought to result from unequal or excessive localized proliferation of hepatic tissue, particularly in the right lobe, combined with persistence of embryonic lobulations that normally regress later in fetal development. Additional mechanical influences from adjacent structures, including the diaphragm and developing gastrointestinal tract, may further modify hepatic contour. Consequently, Riedel's lobe represents a morphological variation rather than a pathological anomaly.

Riedel's lobe, first described by Riedel in 1888, is a tongue-like projection descending from the anterior surface of the right lobe of the liver, sometimes extending below the umbilicus. Its reported incidence in the general population varies widely, ranging from 3.3% to 14.5%, depending on diagnostic criteria and imaging modalities³. According to Couinaud classification, the liver is divided into eight (I–VIII) segments: segment I (caudate lobe with independent vascular drainage); segments II and III (left lateral superior and inferior segments); segment IV (left medial segment, subdivided into IVa superior and IVb inferior); and segments V and

VIII (right anterior inferior and superior) along with segments VI and VII (right posterior inferior and superior), each supplied by its own portal pedicle and drained by hepatic veins. Riedel's lobe typically arises from hypertrophy of segments V and VI, forming a prominent vertical elongation of the right lobe.



In contrast, the Riedel's-like lobe is an accessory lobe projecting downward from the anterior margin of the left lobe, usually involving hypertrophy of segment III, resulting in a similar tongue-like configuration⁴.

Beaver tail liver is a rare anatomical variant of the liver in which there is an elongated, thin extension of left lobe that extends laterally and may wrap around or lie around the spleen, resembling the flattened tail of a beaver. Various researchers like Neginhal et al., Mansur et al., Chauhan HM et al. have reported the findings of Beaver tail variant in 3 specimens of their studies.

Corset liver is a rare morphological variant of the liver characterized by a constricted, waist-like indentation of the hepatic parenchyma, usually involving the right lobe. Chauhan et al. have reported deep renal impression present on the visceral surface in 3 livers out of 52 specimens.

Knowledge of these external liver variations is essential for clinical examination, radiological assessment, and surgical planning. They are particularly important in the differential diagnosis of palpable abdominal masses in the right hypochondrium or epigastric region, as misinterpretation may lead to unnecessary investigations or surgical interventions.

II. Materials And Methods

- A descriptive cross-sectional study was done on 30 dissected formalin fixed human liver specimens, obtained during routine dissections in the Department of Anatomy, RIMS, Imphal.
- External features of the left lobe of the liver were studied and photographed.
- Results were expressed using descriptive parameters- frequency and percentage (%).

III. Results

In the present study, 30 dissected liver specimens of unknown sex in the department of RIMS were studied.

The most common anomalies observed in the present study was Riedel's-like lobe which was tongue like projection coming from the anterior margin of the left lobe. This tongue like projection was seen in 4(13.33%) specimens.

Beavers tail liver which is described as the lateral extension of the left lobe of the liver and it was seen extending laterally was also observed in 2 liver specimens. (fig.3)

Another rare acquired anatomical variation characterized by deep vertical grooves/ fissures also known as "Corset liver" on the diaphragmatic surface of the liver was also observed in 1(3.33%) specimen. No other vertical groove was seen on any other surfaces. The deep vertical groove was made by the lower border of the 10th rib as observed during dissection. (fig.2A)

Table1: Incidence of liver anomalies in our present study

Morphological variations	Riedel's-like lobe	(Beaver's lobe)	Beaver's lobe) with Riedel's-like lobe	Corset liver
Number of specimens	4	2	1	1
Percentage	13.33%	10%	3.33%	3.33%



Figure 1: Photograph showing *Riedel's like lobe projecting from the antero-inferior margin of the left lobe liver in situ.



Figure 2a: Photograph of the diaphragmatic surface of the liver showing Corset liver (deep vertical groove).



Figure 2b: Photograph of the visceral surface of the liver showing Riedel's like lobe projecting from the antero-inferior margin of the left lobe.



Figure 3: Photograph showing Riedel's like lobe projecting from the antero-inferior margin and also Beaver tail extending laterally upward from the upper left lobe.



Figure 4: Photograph showing Riedel's like lobe as seen from the visceral surface.



Figure 5a: Photograph of the visceral surface of the liver showing Beaver tail.



Figure 5b: Photograph of the visceral surface of the liver showing Beaver tail..

IV. Discussion

Table 2: Comparison of morphological variations of the liver in various studies with the present study

Morphological variations	Neginhal et al.	Singh et al.	Mansur et al.	Sharma et al.	Singh	Chauhan HM et al.	Present study
Riedel lobe	1(2%)			3(4%)		5(9.61%)	
Riedel's-like lobe							04(13.33%)
Elongated left lobe (Beaver's lobe)	04 (5.71%)	09 (12.86%)	05 (7.14%)	07 (9.33%)	07 (14%)	03 (5.76%)	02(6.66%)
Elongated left lobe(Beaver's lobe)with Riedels-like lobe							02(6.66%)
Corset liver						03(5.76%)	01(3.33%)

The common congenital anomalies in liver are agenesis of the lobes, absence of segments, deformed lobes, smaller lobes, atrophy of the lobes and hypoplastic lobes. These anomalies were seen in 44% of the livers as reported by Wahane et al and Patil et al. Likewise in our present study, a Riedel's-like lobe, a rare abnormal elongation from the left lobe (tongue like projection from the anterior margin) was found in 4(13.33%) specimens out of 30 specimens.

Many researchers have reported the presence of Riedel's lobe in various studies which are discussed below.

In the study conducted by Neginhal et al on 50 cadaveric livers, only 4 specimens were normal in their external appearance. However, 46 specimens showed morphological variations in form of fissures, lobes, shape and sizes and variations were observed according to Netter's classification.

Accessory fissures were observed in 10(20%) specimens. According to Netter's classification, Riedel's lobe was observed in 1 of 50 livers ($\approx 2\%$) in their study and described as tongue like process of right lobe. Sharma et al. also reported 3 of 75 livers ($\approx 4\%$) described as extra lobe on the right lobe.

Chauhan et al. observed 5 Riedel's lobe in 52 livers ($\approx 9.61\%$). The right lobe showed normal in 28 livers with no other impressions. Nine livers showed fissures on the posterior surface, 13 livers had diaphragmatic grooves on the anterosuperior surface.

Singh et al. and Mansur et al did not report any case of Riedel's lobe incidence in their 70-liver study which is similar to the findings in our present study i.e., no Riedel's lobe was observed in 30 specimens.

In the study conducted by Mansur et al on 70 formalin-fixed human livers, half of the livers showed morphological variations, including accessory fissures, Beaver tail liver. The present study showed Beaver tail liver in 2(6.66%) specimens.

Across cadaveric liver morphology studies, Mansur et al. examined 70 livers and reported beaver tail (elongated left lobe) in 5 specimens ($\approx 7.14\%$), Singh & Rabi (Singh et al.) studied 70 livers and observed the beaver tail variant in about 9 specimens ($\approx 12.86\%$), while Chauhan et al., in their study of 52 livers, reported 3 specimen ($\approx 5.76\%$) showing a beaver tail-type elongated left lobe. Neginhal et al. also observed elongated left lobe in 4(8%) specimens. Similar observations were reported by Arya R S et al and Nayak BS in 15% liver specimens with tongue like elongation of left lobe and 1.81% livers were reported with extremely long left lobe respectively. Likewise, in our present study, the beaver tail variant was also observed in 2 livers out of 30 specimens ($\approx 3.33\%$)

Chauhan et al. observed corset liver in 3 out of 52 livers ($\approx 5.76\%$) described as deep renal impressions with corset like constrictions whereas Neginhal et al., Mansur et al., and Singh et al. did not report any cases of corset liver in their respective cadaveric liver studies. In our present study, corset liver was observed in 1($\approx 3.33\%$) out of 30 livers as shown in figure 2.

V. Conclusion

Cadaveric studies reveal that the human liver exhibits a range of morphological variations, including Riedel's lobe, Riedel's-like lobe, beaver tail, and corset liver, which differ in prevalence across populations. These variations, while often asymptomatic, have important clinical and surgical implications, particularly in radiological interpretation, hepatobiliary surgery, laparoscopic procedures, and liver transplantation. Awareness of such anatomical variants is essential to avoid misdiagnosis of hepatic masses or pathological enlargements, to plan safe surgical interventions, and to guide accurate imaging assessment. Morphological variations of left lobe include hypertrophy of left lobe, hypoplasia of left lobe and presence of fissures. Atrophy or hypoplasia of left lobe has been reported.

Our study, consistent with previous research, emphasizes that even rare variants, such as Riedel's lobe or corset liver, may be encountered in routine practice and accidentally find extra accessory fissures highlighting the need for thorough anatomical knowledge among clinicians and surgeons.

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