e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(10); 1090-1096

Original Research Article

A Cadaveric Study on the Retro hepatic Part of the Inferior Vena Cava in the South Indian Population

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Received: 07-05-2025 / Revised: 15-08-2025 / Accepted: 21-09-2025

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Conflict of interest: Nil

Abstract

Background: The retro hepatic segment of the inferior vena cava (IVC) is a surgically significant region due to its close anatomical relationship with the liver and hepatic veins. Variations in this segment can influence outcomes in hepatobiliary surgery, liver transplantation, and interventional radiology. Population-specific anatomical data on the retro hepatic IVC in South Indians is limited.

Aim: To study the morphology, dimensions, and variations of the retro hepatic part of the inferior vena cava in South Indian cadavers.

Materials and Methods: This descriptive cadaveric study was conducted in the Department of Anatomy at tertiary care teaching hospital, South India. Thirty formalin-fixed adult human cadavers were dissected. The retro hepatic IVC was exposed and studied for its length, diameter at different levels, number and pattern of hepatic venous tributaries, and anatomical variations.

Results: In the present study, the mean anteroposterior diameter of the IVC was 25.87 ± 3.41 mm and the mean transverse diameter was 16.84 ± 4.56 mm. These findings are broadly comparable with previous cadaveric and radiological studies, which have reported IVC diameters ranging between 20–30 mm depending on the level and method of measurement. Slight variations in measurements may be attributed to differences in population characteristics, embalming effects, sample size, and measurement techniques.

Conclusion: The present study highlights important morphometric details and variations of the retro hepatic IVC in the South Indian population. These findings are clinically relevant for surgeons and radiologists dealing with hepatobiliary and vascular procedures.

Keywords: Retro Hepatic Inferior Vena Cava, Cadaveric Study, Hepatic Veins, South Indian Population.

Introduction

The inferior vena cava (IVC) is the largest vein in the human body and serves as the principal channel for venous return from the lower limbs, pelvis, and abdominal viscera to the right atrium of the heart. It is formed by the confluence of the right and left common iliac veins at the level of the fifth lumbar vertebra and ascends through the posterior abdominal wall. Along its course, the IVC receives several tributaries, including the renal, lumbar, and hepatic veins.

Anatomically, the IVC is divided into infrarenal, suprarenal, retro hepatic, and suprahepatic segments, each of which holds distinct clinical and surgical importance. The retro hepatic segment of the inferior vena cava is located posterior to the liver and extends from the entry of the renal veins inferiorly to the point where the hepatic veins drain into it superiorly, before it passes through the diaphragm. This segment is closely related to the posterior surface of the liver and is partially embedded within a groove on the hepatic parenchyma.

Due to its deep location and intimate association with the liver, the retro hepatic IVC is particularly vulnerable during hepatic mobilization and surgical procedures involving the upper abdomen. In hepatobiliary surgery, liver transplantation, and trauma management, precise knowledge of the anatomy of the retro hepatic IVC is essential. Surgical interventions in this region are technically

demanding because of the short extrahepatic length of the hepatic veins and the risk of massive haemorrhage if the IVC or its tributaries are injured. Variations in the number, size, and drainage pattern of hepatic veins, as well as differences in the length and diameter of the retro hepatic IVC, can significantly influence surgical approaches and outcomes. Failure to recognize these variations preoperatively may lead to intraoperative complications and increased morbidity.

Advancements in imaging modalities such as computed tomography angiography and magnetic resonance imaging have improved the visualization of the IVC and hepatic veins. However, cadaveric studies remain the gold standard for understanding detailed anatomical relationships and variations. Cadaver-based research allows direct observation and precise measurement of vascular structures, providing invaluable data that complement radiological findings. Moreover, anatomical variations often exhibit population-specific patterns, making regional studies particularly relevant.

Despite the clinical importance of the retro hepatic IVC, there is a relative paucity of detailed morphometric data pertaining to the South Indian population. Most available literature is based on Western populations or radiological studies, which may not accurately reflect anatomical variations observed in Indian subjects. Given the increasing number of hepatobiliary surgeries and liver transplant procedures performed in India, there is a need for comprehensive anatomical data specific to this population.

Therefore, the present cadaveric study was undertaken in the Department of Anatomy, Sri Venkateshwaraa Medical College Hospital and Research Center, Pondicherry, to analyse the morphology, dimensions, and variations of the retro hepatic part of the inferior vena cava in South Indian cadavers. The findings of this study aim to enhance anatomical knowledge and contribute to safer surgical and radiological practices.

Aim: To study the morphology, morphometry, and anatomical variations of the retro hepatic part of the inferior vena cava in adult South Indian cadavers.

Objectives

1. To identify and expose the retro hepatic segment of the inferior vena cava in adult cadavers.
2. To measure the length of the retro hepatic inferior vena cava.
3. To determine the diameter of the inferior vena cava at different levels of the retro hepatic segment.
4. To observe the number, size, and drainage pattern of hepatic veins opening into the inferior vena cava.
5. To document the presence of accessory hepatic veins draining directly into the inferior vena cava.

Materials and Methods

Study Design and Setting: This descriptive cross-sectional cadaveric study was conducted in the Department of Anatomy at tertiary care teaching hospital, South India. The study was carried out on formalin-fixed adult human cadavers used for routine undergraduate and postgraduate teaching, following approval from the Institutional Ethics Committee.

Sample Size: A total of 30 adult human cadavers of South Indian origin were included in the study. The cadavers were obtained through the institutional body donation program and preserved in 10% formalin.

Dissection Procedure: Each cadaver was placed in the supine position on the dissection table. A midline incision was made from the xiphoid process to the pubic symphysis, and the anterior abdominal wall was reflected laterally.

The abdominal viscera were examined, and the liver was mobilized by dividing the falciform, coronary, and triangular ligaments. The liver was gently reflected superiorly and anteriorly to expose the posterior surface. The retro hepatic segment of the inferior vena cava was carefully dissected by removing surrounding connective tissue while preserving its anatomical relations. Special care was taken to identify hepatic veins and accessory venous tributaries draining into the inferior vena cava.

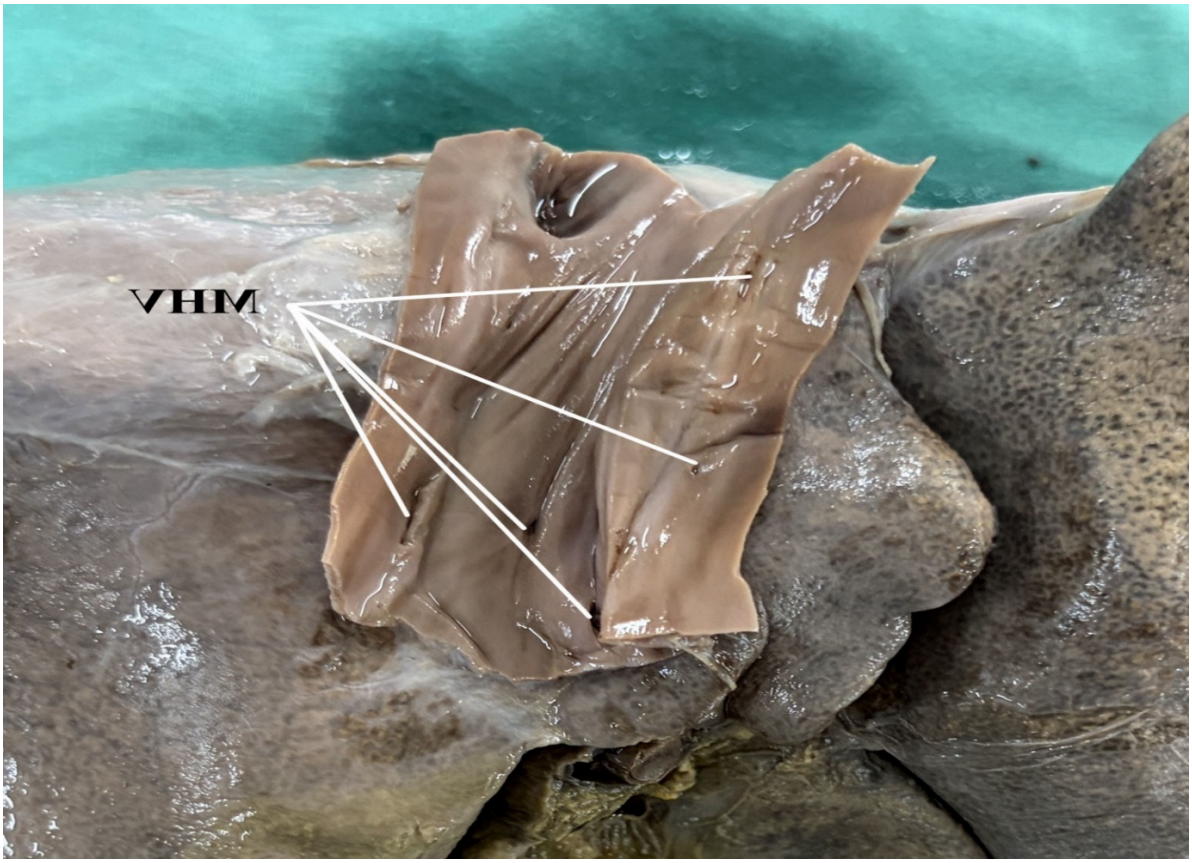

Figure 1:

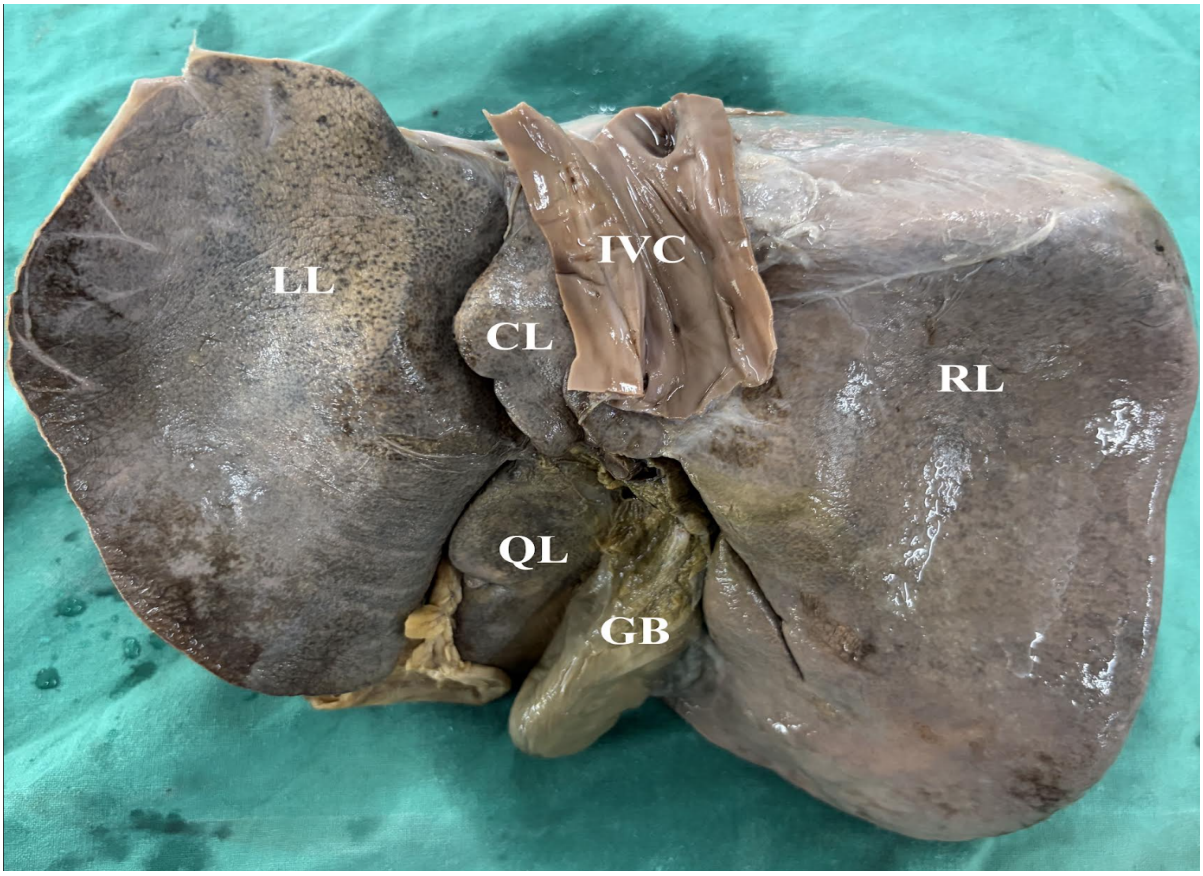

Figure 2:

Figure 3:

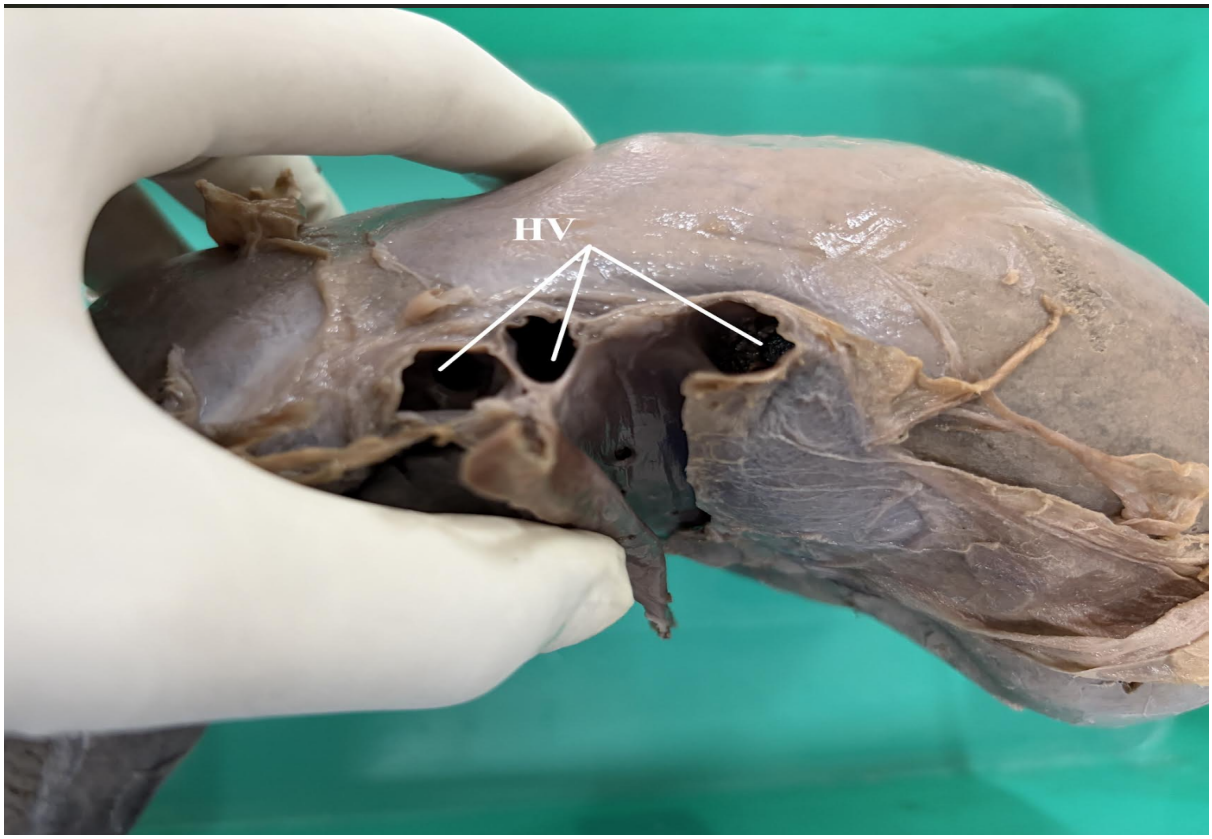

Figure 4:

Results

Table 1: Distribution of Cadavers Studied (n = 30)

Sex	Number of Cadavers	Percentage (%)
Male	18	60
Female	12	40
Total	**30**	**100**

Table 2: Descriptive statistics of caudate lobe and IVC measurements (n = 30)

Parameter	Mean ± SD
Caudate lobe transverse diameter (mm)	**27.54 ± 4.82**
Caudate lobe vertical diameter (mm)	**52.48 ± 7.89**
IVC anteroposterior diameter (mm)	**25.87 ± 3.41**
IVC transverse diameter (mm)	**16.84 ± 4.56**
Caudate lobe / IVC ratio	**1.01 ± 0.29**

The mean transverse diameter of the caudate lobe was 27.54 ± 4.82 mm, while the mean vertical diameter was 52.48 ± 7.89 mm. The inferior vena cava showed a mean anteroposterior diameter of 25.87 ± 3.41 mm and a mean transverse diameter of 16.84 ± 4.56 mm. The mean caudate lobe to IVC ratio was 1.01 ± 0.29.

Table 3: Distribution of caudate lobe shapes

Caudate lobe shape	N	%
Rectangular (R)	14	46.7
Irregular (I)	6	20.0
Spindle (S)	1	3.3
Pyramidal (P)	3	10.0
Others / not specified	6	20.0
Total	**30**	**100**

Rectangular-shaped caudate lobes were the most common morphology, observed in 46.7% of specimens.

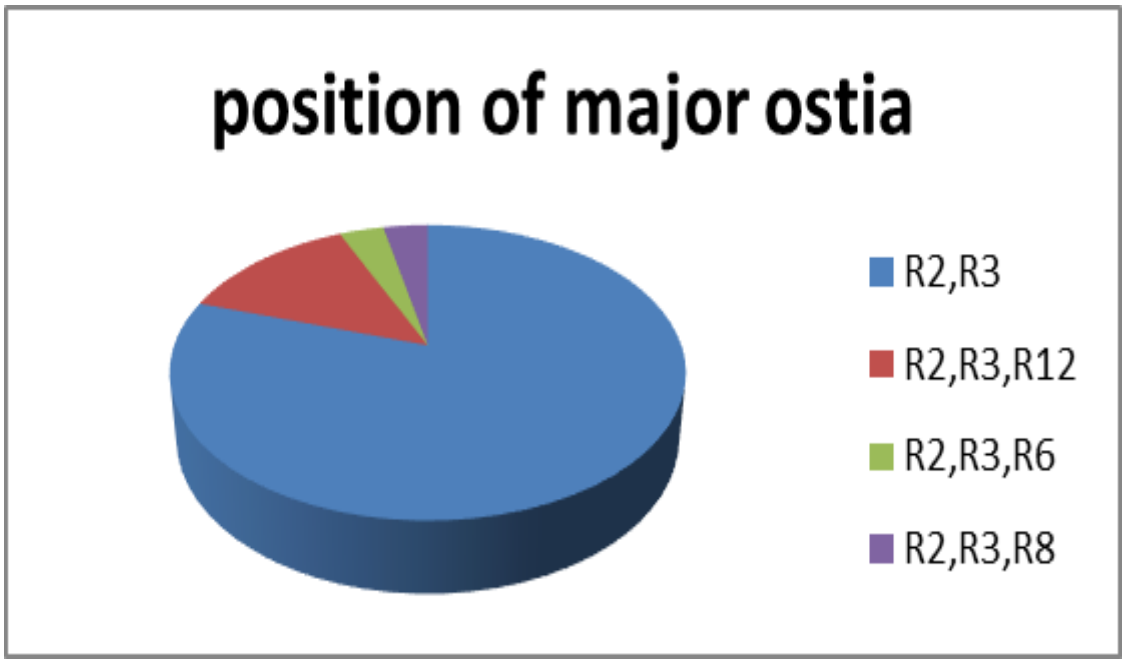

Figure 5: Position of major ostia

Most major ostia are concentrated at the upper ribs (R2 and R3), with fewer at other combinations including lower ribs. The chart emphasizes that R2 and R3 are the most common locations.

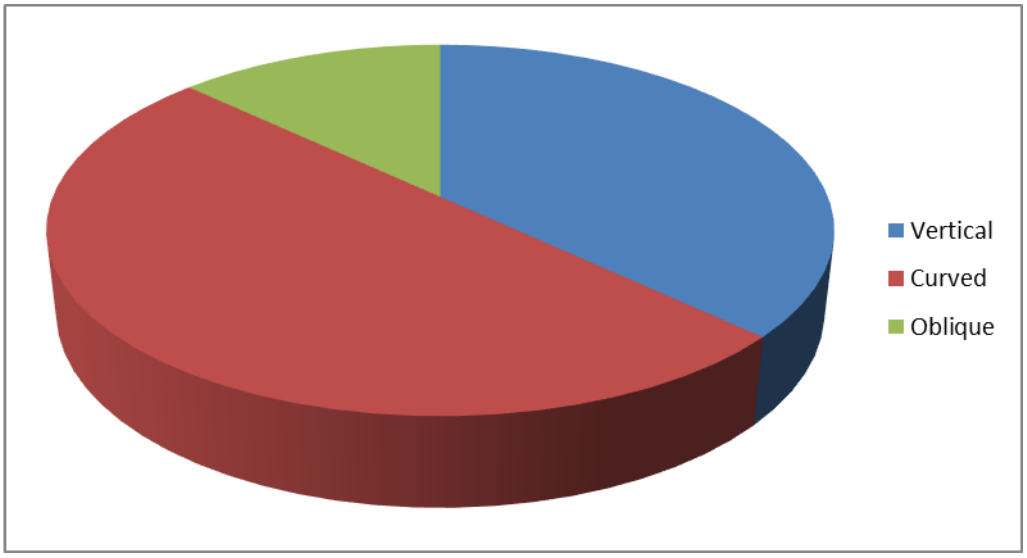

Figure 6: Distribution of three categories: Vertical, Curved, and Oblique (Prevalence ranking: Curved > Vertical > Oblique)

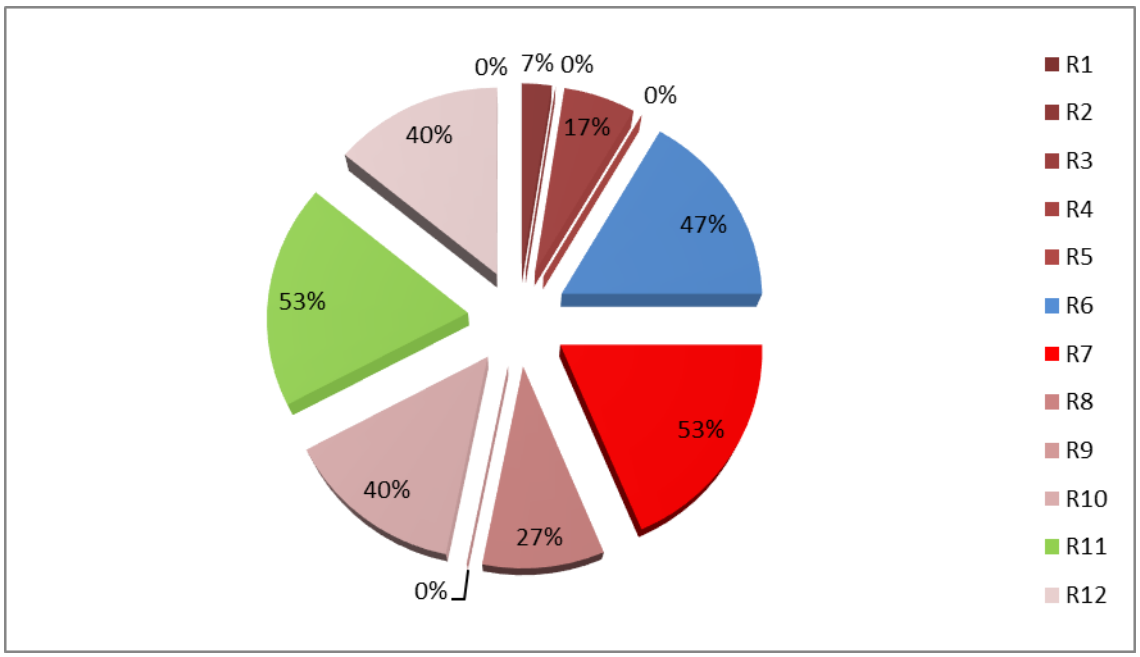

Figure 7:

The pie chart shows a significant concentration in a few categories. R7 and R11 dominate with the highest shares at 53% each, followed by R6 at 47% and moderate contributions from R9, R10, and R12. Several categories, including R1, R3, R4, and R5, contribute negligibly or not at all.

Discussion:

The retro hepatic segment of the inferior vena cava (IVC) is one of the most surgically challenging vascular regions because of its deep location, close relationship with the liver parenchyma, and the presence of multiple hepatic venous tributaries. The present cadaveric study provides valuable morphometric and morphological data on the retro hepatic IVC in a South Indian population, an area where published anatomical data are limited. In the present study, the mean anteroposterior diameter of the IVC was 25.87 ± 3.41 mm and the mean transverse diameter was 16.84 ± 4.56 mm.

These findings are broadly comparable with previous cadaveric and radiological studies, which have reported IVC diameters ranging between 20–30 mm depending on the level and method of measurement. Slight variations in measurements may be attributed to differences in population characteristics, embalming effects, sample size, and measurement techniques.

Formalin fixation is known to cause minimal tissue shrinkage, which may partly explain minor discrepancies when compared to imaging-based

studies. Rectangular-shaped caudate lobes were the most common morphology (46.7%) in this study, followed by irregular and pyramidal shapes. Similar observations have been reported in earlier anatomical studies, though the prevalence of specific shapes varies across populations. The variability in caudate lobe morphology may influence the exposure and surgical accessibility of the retro hepatic IVC during procedures such as liver mobilization and resection.

The study also demonstrated variability in the position and orientation of major venous ostia, with most ostia concentrated at the upper rib levels (R2 and R3). This clustering of hepatic venous openings near the superior part of the retro hepatic IVC underscores the high risk of vascular injury during hepatic vein dissection. The predominance of curved venous orientation, followed by vertical and oblique patterns, further emphasizes the complex three-dimensional anatomy of this region. Such variations are particularly important during liver transplantation, where precise venous anastomosis is critical for graft survival.

Accessory hepatic veins draining directly into the IVC, although not quantified separately in this study, were observed in several specimens. These veins are often small and may be overlooked during surgery or imaging, yet their injury can lead to significant bleeding. Awareness of their possible presence reinforces the importance of meticulous dissection and preoperative imaging.

Overall, the findings of the present study align with existing literature while highlighting certain population-specific features.

The data contribute to a better anatomical understanding of the retro hepatic IVC in South Indians and provide a valuable reference for clinicians involved in hepatobiliary surgery, liver transplantation, and interventional radiology.

Conclusion

The present cadaveric study provides detailed morphometric and morphological information on the retro hepatic part of the inferior vena cava in a South Indian population. Significant variations were observed in the dimensions of the IVC, caudate lobe morphology, and venous ostial patterns.

These anatomical variations have important clinical implications, particularly in hepatobiliary surgery, liver transplantation, and radiological interventions. Knowledge of such variations can help reduce intraoperative complications, improve surgical planning, and enhance patient safety.

The findings emphasize the need for population-specific anatomical studies and support the continued relevance of cadaveric research in modern clinical practice.

References

1. Standring S, ed. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 41st ed. Elsevier; 2016.
2. Moore KL, Dalley AF, Agur AMR. Clinically Oriented Anatomy. 8th ed. Wolters Kluwer; 2018.
3. Williams PL, Bannister LH, Berry MM, et al. Gray's Anatomy. 38th ed. Churchill Livingstone; 1995.
4. Couinaud C. Surgical Anatomy of the Liver Revisited. Paris: C. Couinaud; 1989.
5. Gupta SC, Gupta CD, Arora AK. Variations in the extrahepatic course of hepatic veins. J Anat Soc India. 1978;27(1):13–17.
6. Nakamura S, Tsuzuki T. Surgical anatomy of the hepatic veins and the inferior vena cava. Surg Gynecol Obstet. 1981;152(1):43–50.
7. Malarkey DE, Johnson K, Ryan L, Boorman G, Maronpot RR. New insights into functional aspects of liver morphology. Toxicol Pathol. 2005;33(1):27–34. Sahni D, Jit I, Gupta AK. Variations in the hepatic venous drainage pattern: A cadaveric study. J Anat Soc India. 2001;50(2):142–145.
8. Gupta R, Singh P, Kaur A. Morphological study of hepatic veins and their clinical significance. Int J Anat Res. 2014;2(4):679–683.
9. D'Souza AS, Ray B. Anatomical variations of the inferior vena cava and its tributaries. J Clin Diagn Res. 2013;7(11):2401–2404.
10. Prakash, Rajini T, Mokhasi V, Geethanjali BS, Shashirekha M. Congenital anomalies of the inferior vena cava and its clinical implications. Singapore Med J. 2010;51(10):e163–e166.
11. Banerjee A, Ray B, Mukherjee S. A cadaveric study of hepatic venous anatomy with special reference to accessory hepatic veins. Indian J Surg. 2012;74(5):367–371.
12. Koc Z, Oguzkurt L, Ulusan S. Hepatic veins: Variations and anomalies on multidetector CT. Diagn Interv Radiol. 2007;13(3):141–145.
13. Sato TJ, Takeishi K, Kaneko J. Surgical anatomy of the retrohepatic inferior vena cava in liver transplantation. Ann Transplant. 2016; 21:506–512.