



# ANATOMICAL PREPARATION OF THE VISCERAL ASPECT OF THE HUMAN LIVER TO DEMONSTRATE THE BRANCHES OF THE HEPATIC PORTAL VEIN APPLYING THE LASKOWSKI FILLING, DISSECTION AND CONSERVATION TECHNIQUES

PREPARADO ANATÓMICO DE LA CARA VISCERAL DEL HÍGADO HUMANO PARA EVIDENCIAR LAS RAMAS DE LA VENA PORTA HEPÁTICA APLICANDO LAS TÉCNICAS DE REPLECIÓN, DISECCIÓN Y CONSERVACIÓN LASKOWSKI

Emanuel Balarezo Rebaza <sup>1,a</sup>, Cesar Pretell León <sup>1,a</sup>, Pamela Torres Blas <sup>1,a</sup>, Athenas Alvaro Montes <sup>1,a</sup>, Ana Lucero Canales Guevara <sup>1,a</sup>

## ABSTRACT

**Objective:** The human anatomy course is crucial in the education of medical students, and therefore, the shortage of anatomical specimens poses a challenge in teaching. **Methods:** This study aims to create an anatomical preparation of the visceral surface of the liver, allowing visualization of the branches of the hepatic portal vein using the repletion, dissection, and Laskowski preservation techniques. **Results:** The preparation successfully revealed the distribution of suprahepatic veins and branches of the portal vein irrigating their respective segments, without encountering anatomical variations. **Conclusions:** Through this study, successfully, produced an anatomical specimen primarily showcasing the branches of the hepatic portal vein. It is recommended inspecting the anatomical specimen before commencing the work, as well as conducting tests to determine the appropriate amount of plant dye to use.

**Keywords:** Anatomy; Liver; Anatomical preparation; Dissection; Portal vein. (Source: MESH-NLM)

## RESUMEN

**Objetivo:** El curso de anatomía humana es crucial en la formación de los estudiantes de medicina y, debido a ello, la escasez de preparados anatómicos significa una dificultad en la enseñanza. **Métodos:** El presente estudio tiene como objetivo realizar un preparado anatómico de la cara visceral del hígado que permita visualizar las ramas de la vena porta hepática mediante la aplicación de las técnicas de repleción, disección y conservación Laskowski. **Resultados:** En el preparado, se logró visualizar la distribución de las venas suprahepáticas y las ramas de la vena porta que irrigan sus respectivos segmentos, sin encontrar variantes anatómicas. Mediante este trabajo, se logró crear un preparado anatómico que permite visualizar principalmente las ramas de la vena porta hepática. **Conclusiones:** Se recomienda realizar una inspección de la pieza anatómica antes de realizar el trabajo y realizar pruebas para determinar la cantidad adecuada de tinte vegetal a utilizar.

**Palabras clave:** Anatomía; Hígado; Preparado anatómico; Disección y vena porta. (Fuente: DeCS- BIREME)

<sup>1</sup> Universidad Nacional del Santa, Chimbote, Peru.

<sup>a</sup> Medical student - IV semester.

Cite as: Balarezo Rebaza E, Pretell León C, Torres Blas P, Montes AA, Canales Guevara AL. Anatomical preparation of the visceral aspect of the human liver to demonstrate the branches of the hepatic portal vein applying the laskowski filling, dissection and conservation techniques. Rev Fac Med Hum. 2024;24(1):115-120. doi:10.25176/RFMH.v24i1.6323

Journal home page: <http://revistas.urp.edu.pe/index.php/RFMH>

Article published by the Journal of the Faculty of Human Medicine of the Ricardo Palma University. It is an open access article, distributed under the terms of the Creative Commons License: Creative Commons Attribution 4.0 International, CC BY 4.0 (<https://creativecommons.org/licenses/by/4.0/>), which allows non-commercial use, distribution and reproduction in any medium, provided that the original work is duly cited. For commercial use, please contact [revista.medicina@urp.edu.pe](mailto:revista.medicina@urp.edu.pe)





## INTRODUCTION

In the academic career of medical students, the Human Anatomy course is positioned as the essential basic science that will lay the foundation for their future medical career<sup>(1,2)</sup>. Human anatomy constitutes the fundamental pillar of good medical practice and serves as the basis for clinical studies<sup>(3)</sup>; therefore, it is essential to learn it correctly through direct contact with anatomical parts that allow an adequate understanding of the structures studied. For the correct understanding of this course, the study material must be preserved correctly and neatly; however, preserving its integrity and preventing its natural decomposition may be adequate without appropriate techniques<sup>(4)</sup>. The dissection technique will be the favoring tool that allows separating structures and accessing certain cavities using a blunt or sharp instrument<sup>(4)</sup>. At the same time, the study of the vascular elements will be favored by the technique of filling the hepatic vessels thanks to the injection of solutions inside<sup>(5)</sup>, to later preserve the organ through the conservation technique with glycerin, which replaces formalization, thus avoiding any possible negative impact on the health of students and teachers<sup>(6)</sup>.

In recent years, our university has been implementing the exhibition of anatomical samples that allow the student's first-hand visual impression with the appropriate permission of the teacher. However, this material is still scarce, making it challenging to identify structures in a correct state and without previous damage. The choice of the topic was inspired by the anatomical preparation exhibited by the "Juan José Naón" Anatomy Museum located in the Faculty of Medical Sciences of the Universidad de Buenos Aires, which details with specificity the internal structure of the organ presented, thus allowing way correct learning for subsequent students and contributing with a new anatomical sample for the Professional School of Human Medicine, supporting their progress and recognition.

As previous works carried out on the subject include Durand C., Rázuri C. and Cervera A. in Peru in 2018, they sought to introduce new definitions and proposals related to the anatomy of the liver to improve the understanding of its structure.

They observed 286 human livers of different sexes, races, and ages using techniques such as dissection, acrylic injection, radiology, and three-dimensional tomographic reconstructions. The result was the presentation of anatomical definitions for various hepatic elements, such as portal segments, portal pedicles, portal fissures, and hepatic veins, among others. Furthermore, new anatomical definitions were proposed. They concluded that these contributions have significantly improved the detailed understanding of liver structure<sup>(7)</sup>.

Durand C. in 2017 set out to clarify the anatomy of portal segment V, due to divergent interpretations between authors that generated confusion in research and clinical practice. The research included evaluating the intrahepatic vascular structure in 200 human livers of both sexes and various ages, using techniques such as acrylic injection and fresh dissection. A single segmental portal branch was identified for the right medial division of the liver, notable for its considerable size and specific divisions. In 80% of cases, this branch originated from the right portal vein. These findings provide clarity to the anatomy of portal segment V, with the potential to influence the terminology and approach to liver anatomy and surgery, contributing to a more precise and complete understanding of this fundamental anatomical structure<sup>(8)</sup>. Therefore, the present study aims to obtain an anatomical preparation of the visceral side of the human liver to demonstrate the branches of the hepatic portal vein, applying the repletion, dissection, and Laskowski conservation techniques.

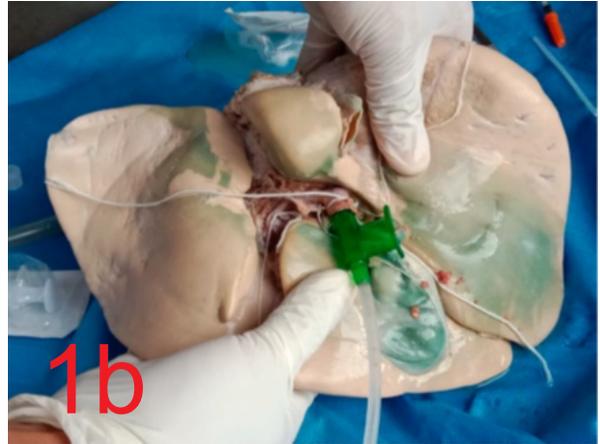
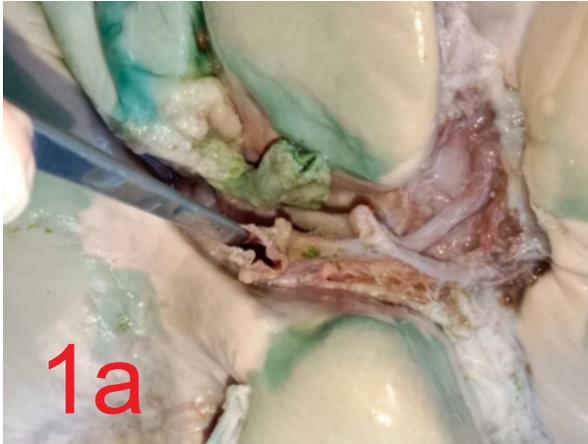
## METHODS

The authors proceeded to fix the human liver in a 10% formaldehyde solution for two weeks. Subsequently, we cleaned the visceral side of the liver by removing the fat and visceral peritoneum from the hepatic pedicle with great care trying to isolate the portal vein, the proper hepatic artery and the common hepatic duct (Figure 1a). Once the hepatic pedicle has been identified, we proceed to canalize the portal vein, securing the proximal end of the vessel to prevent reflux of the solution (Figure 1b). We connected a syringe, and with moderate pressure, began to inject the heparin



sodium solution diluted in water to clean the blood vessels. After cleaning the vasculature, we changed the cannulas and, securing the proximal end of the portal

vein, connected a syringe with the latex solution with blue vegetable ink. Next, with gentle pressure, began to inject the colored latex into the portal vein.



**Fig 1a.** Isolation of the hepatic pedicle. **Fig 1b.** Portal vein cannulation

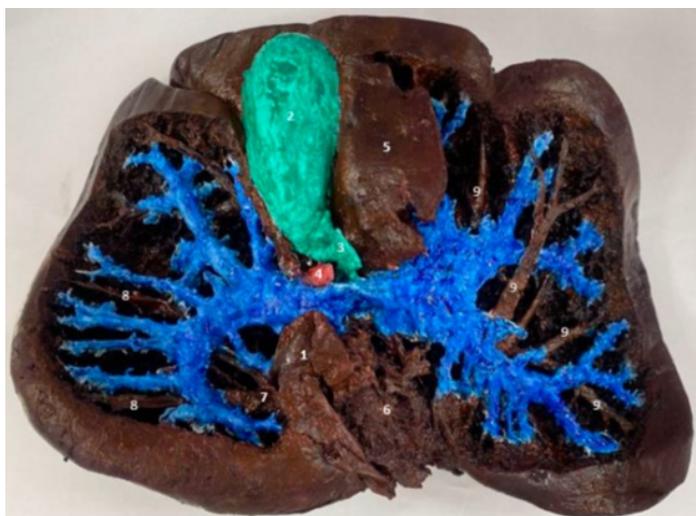
We let it dry for an approximate period of 4 hours. After drying, with a scalpel blade, traced a circumference starting from the edges on the visceral side of the liver, leaving 1 cm of healthy parenchyma around the four lobes. Subsequently, with the handle of the scalpel or grooved probe, we begin to scrape the parenchyma starting from the hepatic pedicle. As we go deeper, we can recognize the branches of the portal vein for the hepatic segments. We immersed the anatomical piece in 4 L of Lakowski solution for a period of 30 days.

We remove the liver and leave it to dry in a colander for a period of 7 days. The chocolate color can be seen in all the structures. We painted all the branches of the holder

with glossy acrylic varnish and then matte white acrylic. Finally, we painted all the portal branches with blue vegetable dye, adding the green tone for the gallbladder and red tone for the evident hepatic artery.

## RESULTS

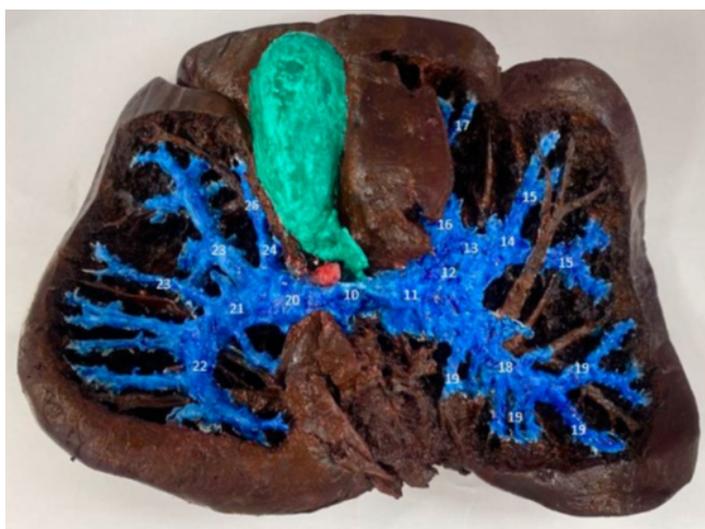
Figure 2 shows the dissection and outcome of the visceral aspect of the human liver, where the following numbered structures are indicated: (1) Inferior vena cava. (2) Gallbladder. (3) Common bile duct. (4) Proper hepatic artery. (5) Square lobe of the liver. (6) Caudate lobe of the liver. (7) Right hepatic vein. (8) Tributaries of the right hepatic vein. (9) Tributaries of the left hepatic vein.



**Figure 2.** Dissection and outcome of the visceral aspect of the liver.

In Figure 3 you can see the dissection of the visceral side of the human liver, where the following numbered structures corresponding to the portal veins and their branches are indicated, (10) Hepatic portal vein. (11) Left branch of the hepatic portal vein. (12) Left paramedian vein. (13) Rex Recess. (14) Left branch of Rex recess. (15) Branches for segment III of the liver. (16)

Right branch of Rex recess. (17) Branch for segment IV of the liver. (18) Left lateral vein. (19) Branches for segment II of the liver. (20) Right branch of the hepatic portal vein. (21) Right lateral vein. (22) Branch for segment VII of the liver. (23) Branches for segment VI of the liver. (24) Right paramedian vein. (25) Branch for segment V of the liver.



**Figure 3.** Dissection of the visceral aspect of the human liver.

## DISCUSSION

The liver, which stands out as the largest gland in our body, plays a vital role in digestive and metabolic processes, such as releasing bile to facilitate digestion, as well as secreting and storing glucose, proteins and clotting factors. It is located in relation superior to the diaphragm, inferior to the duodenum, and anterior to the stomach<sup>(9,10)</sup>.

Regarding venous irrigation, the hepatic veins carry all the blood that reaches the liver through the hepatic artery and portal vein to the inferior vena cava<sup>(4)</sup>. The inferior vena cava is located in the sulcus of the vena cava, a vertical depression located in the middle part of the bare area of the liver (Figure 1 with legend (1))<sup>(9,10)</sup>. These hepatic veins Rouviere divides into major hepatic veins and minor hepatic veins, while Latarjet also divides it into two groups, but an upper group and an lower group. However, the minor hepatic veins that Rouvière mentions are the hepatic veins of the lower group that Latarjet mentions.

These veins are variable in number, but range from approximately 20 to the inferior vena cava and drain blood from the caudate lobe<sup>(9,10)</sup>.

Likewise, as its name suggests, the group of hepatic veins or superior group flows into the inferior vena cava but superior to those of the inferior group. According to Rouviere, these veins are usually two, a right one that is larger than the left and drains blood from the right lobe of the liver, while the left hepatic vein comes from the left, square lobe, and the caudate<sup>(10)</sup>.

In our work, after dissecting the anatomical structure, the tributaries of the right and left hepatic veins could be easily visualized, as well as the right hepatic vein itself (Figure 1, legend<sup>(7)</sup>,<sup>(8)</sup> and<sup>(9)</sup>) as mentioned by Rouviere. The functional blood supply of the liver comes from the hepatic portal vein, which, according to Rouviere, undergoes a bifurcation at the level of the hepatic portal vein, dividing into two branches: right and left.



The right branch, shorter and thicker than its left counterpart, forms an obtuse angle. On the contrary, according to Latarjet, the division of this vein presents asymmetry, since the left branch separates from the right branch creating a right angle<sup>(9,10)</sup>. In our study, we confirmed the asymmetry in the division of the portal vein, coinciding with what is described in the literature (Figure 2, legend (11) and (20)).

Each of the branches of the portal vein presents a special distribution in its respective anatomical lobe, giving rise to thick and thin branches that correspond to the segments of the liver. Rouviere and Latarjet have different names. These names and their comparison with our product will be discussed in the next paragraph. According to Latarjet, the right branch of the hepatic portal vein is divided into an anterior and a posterior branch, the posterior branch is more horizontal and directed backwards, originating the branches for segments VI and VII, while the anterior branch is directed towards above and behind, originating the branches of segment V<sup>(3)</sup>. According to Rouviere, the right branch of the hepatic portal vein has two divisions, a medial division near the main portal fissure and another lateral one limited by the right portal fissure, in both divisions the anterior and posterior segments originate<sup>(10)</sup>.

The anterior branch of the medial division gives the branch for segment V and the second division gives the branches for segment VI and VII (10).

In this case, the anterior and posterior branch described by Latarjet corresponds to the result of the medial division of the hepatic portal vein given by Rouvier. In our work, the corresponding branches for the liver segment can be visualized (Figure 2, legend (22), (23) and (25)). Regarding the division of the left branch of the portal vein and its corresponding hepatic segments. Rouviere mentions that the left branch gives rise to small branches for segment I and two main branches, the umbilical and the thin lateral that supplies segment II, while the umbilical divides again into a medial branch for segment IV and a lateral branch for the segment III<sup>(10)</sup>. Latarjet, for its part, mentions that the left portal vein has two portions, a transverse portion that ends up dividing into a lateral branch that corresponds to segment II and an umbilical portion that ends in the recess of rex and divides into the medial branches for the segment IV and lateral for segment III<sup>(9)</sup>. In our product you can view the branches mentioned in Figure 2 with the legends (11), (13), (14), (15), (16), (17), (18) and (19).

## CONCLUSION

This project provides a valuable resource for medical student learning and sets a precedent for future projects creating anatomical preparations. The recommendations presented at the end of the report will serve as a guide for those who wish to replicate this procedure, improving the effectiveness of the process and contributing to the availability of quality anatomical material for medical education.

**Author contributions:** The authors participated in conceptualizing, researching, using methodology and resources, and writing the original draft and final version.

**Financing:** Self-financed.

**Conflicts of interest:** The authors declare that they have no conflict of interest.

**Received:** January 07, 2024.

**Approved:** April 18, 2024.

**Correspondence:** Emanuel Sebastian Balarezo Rebaza.

**Address:** Urb. Cáceres Aramayo L´21 - Nuevo Chimbote, Perú.

**Telephone:** +51 912 021 466

**Email:** [ebalarezor.iepelnazareno@gmail.com](mailto:ebalarezor.iepelnazareno@gmail.com)





## REFERENCES

1. Suárez J, Posada M, Bedoya L. Enseñar y aprender anatomía: Modelos pedagógicos, historia, presente y tendencias. *Acta Médica Colombiana*. 2020;45(4).
2. Sachin D. Anatomy Museum: Influence on First Year MBBS Students. *International Journal of Anatomy, Radiology and Surgery*. 2020;9(3): p. 4-5.
3. Smith C, Freeman S, Heylings D, Finn G, Davies D. Anatomy education for medical students in the United Kingdom and Republic of Ireland in 2019: A 20-year follow-up. *Anat Sci Educ*. 2022 Noviembre; 15: p. 993-1006.
4. García C, Mejías I, Castillo M. Origen e historia de la disección anatómica. Revisión bibliográfica. *Archivo Médico Camagüey*. 1999;3(2).
5. Concha I. Técnicas Anatómicas. *Técnicas Anatómicas*. In. p. 54.
6. Coello R. La Glicerización Perfeccionada S3: técnica de conservación biológica que superó la pandemia en la Universidad de Guayaquil. *Revista Facultad de Ciencias Médicas*. 2022;3(2).
7. Durand L, Rázuri B, Cervera C. Hígado: Nuevas Definiciones y Propuestas para SILAT-FCAT-IFAA. *Int. J. Morphol*. 2018;36(2): p. 651-654
8. Durand C. Hígado: el segmento portal V. *International Journal of Morphology*. 2017;35(1): p. 363-367.
9. Latarjet M, Ruiz A, Pró E. *Anatomía Humana*. 5th ed.: Médica Panamericana; 2019.
10. Rouvière H, André D. *Anatomía Humana: Descriptiva, topográfica y funcional*. Onceava ed. Barcelona: Elsevier Masson; 2022.

