

Triangles Associated with the Biliary Tract and Their Surgical Importance: An Article Review

Lara Beatriz Dallaqua Bitiati¹, Ian Caldeira Ruppen^{1*}, Jamile Diogo de Araujo², Leandro Hideki Otani², Vitor Augusto Olivari do Carmo¹, Isabela Matias Cian¹, Gabriel Botequia Zanatta¹, Yasmin Cavatorta Jannani¹, Felicia Satie Ibuki Otani², Gabriel Petermann³, Alana Reigota da Costa Rosa¹, Geórgia Verona Cruz², Larissa da Rosa Piccoli¹, Marcela Castrequini Guimarães do Vale¹, Rafaela Castrequini Guimarães do Vale¹, Jhamille Amanda Cardoso do Val⁴, Valentina Verona Cruz⁵, Gabriel Calvin Klein⁶, Maria Clara Malheiros Vizzotto⁵, Antonio Fabiano Morelli Filho¹, Geovani Almeida Gois⁷, Júlia Alvares Dal' Iago⁸, Amanda Larissa Zotarelli Pasquali¹, Isabela Viana Veronez¹, Camila Yuri Kakumoto Tsuneto¹

¹Centro Universitário Ingá – Uningá, Maringá, PR, Brazil.

²Instituto Maringá de Imagem, Maringá, PR, Brazil.

³Universidade Anhanguera Uniderp, Brazil.

⁴Hospital Universitário Getúlio Vargas, Brazil.

⁵Faculdade Cesumar - Unicesumar Maringá, Paraná, Brazil.

⁶Centro Universitário da fundação ASSIS GURGACZ - FAG, Cascavel, PR, Brazil.

⁷Universidade Federal do Maranhão, Brazil.

⁸Ulbra- Universidade Luterana do Brasil Canoas- Rio Grande do Sul, Brazil.

***Corresponding author:** Ian Caldeira Ruppen, Centro Universitário Ingá - UNINGÁ, **Email:** Ian2ruppen@gmail.com;
ORCID: <https://orcid.org/0000-0003-1706-1662>

Citation: Bitiati LBD, Ruppen IC, de Araujo JD, Otani LH, do Carmo VAO, et al. (2024) Triangles Associated with the Biliary Tract and Their Surgical Importance: An Article Review. Annal Cas Rep Rev: ACRR-419.

Received Date: 13 October, 2024; **Accepted Date:** 23 October, 2024; **Published Date:** 31 October, 2024

Abstract

The anatomical triangles of the biliary tract are fundamental structures in hepatobiliary surgery, especially in procedures like cholecystectomy. Among them, the Triangle of Calot, Latarjet's Triangle, and Hersey's Triangle stand out, each with anatomical features that facilitate the identification and protection of the biliary tract and adjacent structures. A detailed understanding of these triangles is vital to avoid complications such as ductal injuries and hemorrhages. The biliary tract plays an essential role in transporting bile from the liver to the intestine, and precise knowledge of these structures improves surgical safety and outcomes. Technological advancements, such as intraoperative cholangiography and the use of high-definition laparoscopic imaging, aid in visualizing these areas, enhancing safety during surgeries. Techniques like the "critical view of safety" and methodical dissection of these triangles are recommended to prevent injuries. Furthermore, the adoption of these modern practices helps reduce risks and optimize surgical outcomes. Continuous research and the use of innovative technology continue to enhance techniques and safety in hepatobiliary surgeries.

Keywords: Cystic artery. Calot. Biliary ducts. Surgical injuries. Biliary system.

Introduction

The anatomical triangles associated with the biliary tract are crucial structures in hepatobiliary surgical practice, particularly in cholecystectomy and other liver surgeries. A detailed understanding of these triangles is essential for preventing complications and ensuring successful interventions. The most important triangles include the Triangle of Calot, Latarjet's Triangle, and Hersey's Triangle. Each of these triangles has distinct anatomical characteristics that play a fundamental role in identifying and protecting the biliary tract and adjacent structures during surgery. The biliary tract plays a critical role in the digestive system, facilitating the transport of bile from the liver to the gallbladder and, subsequently, to the small

intestine. These triangles are important anatomical structures that must be well understood during surgical procedures. Correct identification of these areas can prevent complications such as ductal injuries and hemorrhages.

Objectives

This study aims to highlight the importance of the biliary triangles as anatomical landmarks and as aids during surgical procedures, thus avoiding complications.

Materials and Methods

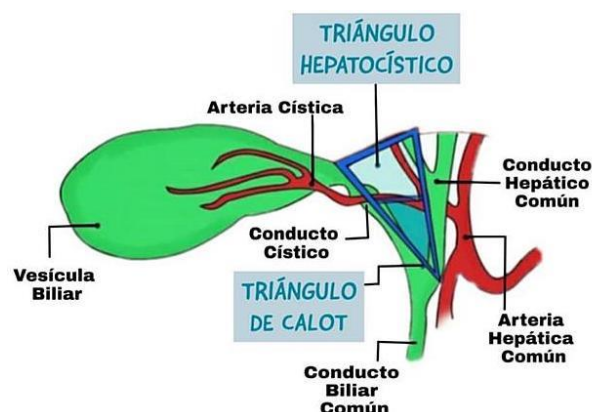
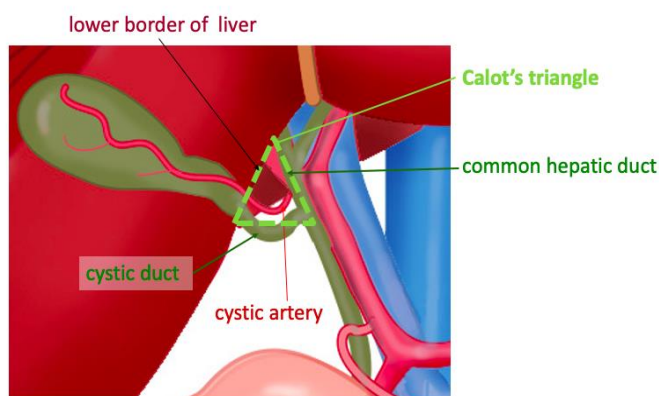
A review and analysis of articles published in the PUBMED, ScienceDirect, and Scielo databases were conducted to support the study.

Discussion

1. Triangle of Calot:

The Triangle of Calot, also known as the hepatocystic triangle, is an anatomical area defined by the cystic duct, the common hepatic duct, and the inferior border of the liver. Precise identification of this triangle is crucial during laparoscopic cholecystectomy, as it allows safe visualization and dissection of the cystic duct and cystic artery, minimizing the risk of injury to the common hepatic duct and hepatic artery. A lack of clear visualization in this triangle can lead to severe complications, such as biliary injuries and hemorrhages.

Trigonum cystohepaticum / Calot's triangle



2. Latarjet's Triangle:

Latarjet's Triangle is formed by the common hepatic duct, the cystic duct, and the right hepatic artery. This triangle is important for identifying the common hepatic duct and ensuring no injuries occur during gallbladder removal. Visualization of this triangle helps differentiate between biliary and vascular structures, reducing the risk of biliary injury and allowing for a safer surgical approach.

3. Hersey's Triangle:

Hersey's Triangle, or the cystic-hepatic triangle, is defined by the cystic duct, the common hepatic duct, and the liver border. Its importance lies in identifying the cystic duct and distinguishing it from the common hepatic duct, which is essential to avoid biliary injuries during dissection. Additionally, the triangle helps identify the cystic arteries and other important structures, contributing to a safer surgical approach.

Each of these triangles offers an anatomical reference that facilitates the safe execution of surgical procedures

involving the biliary tract. A clear understanding and visualization of these triangles are fundamental to avoiding complications and ensuring the success of surgical procedures. Biliary triangles are defined by specific anatomical landmarks that help surgeons locate biliary structures and avoid complications during surgery. The Triangle of Calot, defined by the cystic artery, common hepatic duct, and cystic duct, is crucial in identifying the cystic artery. Careful dissection in this area is essential to prevent injury to the main bile duct, which can result in severe complications such as biliary fistula. Furthermore, recognizing anatomical anomalies, such as the presence of accessory bile ducts or anomalies in the position of the gallbladder, is crucial for surgical planning and safe cholecystectomy performance. Creating an anatomical map combined with surgical experience can help reduce complication rates. Common bile duct injury, one of the most feared complications in biliary surgeries, typically occurs when the anatomy of Calot's Triangle is not properly identified. Several studies indicate that the primary cause of these injuries is related to the failure to adequately identify anatomical structures during dissection. Surgical methods such as the "Critical View of Safety" (CVS), proposed as a preventive measure, are based on the principle of dissecting and clearly visualizing the two main structures—the cystic duct and cystic artery—before their ligation and division.

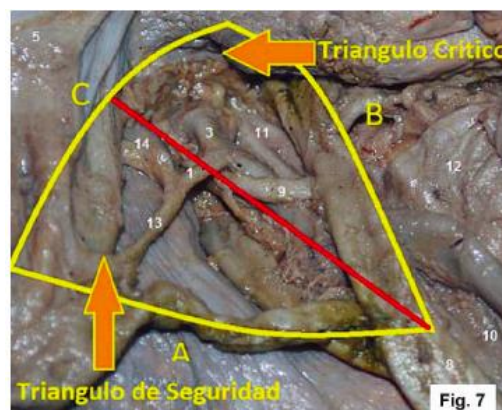


Figure 2: Dissection of Budde's triangle. Schematic division of this triangle into a medial (Critical) and a lateral (Safety) section. A: Cystic Duct; B: Hepatic Duct; C: Liver. 1) Cystic Artery; 3) Right Branch of the Hepatic Artery; 9) Anomalous Biliary Duct; 10) Portal Vein; 11) Right Branch of the Portal Vein; 12) Left Branch of the Portal Vein; 13) Anterior Branch of the Cystic Artery; 14) Posterior Branch of the Cystic Artery.

Conclusion

The anatomy of the triangles associated with the biliary tract plays a crucial role in hepatobiliary surgery. Correct identification and understanding of Calot's Triangle, Latarjet's Triangle, and Hersey's Triangle are essential for the safe and effective execution of procedures such as cholecystectomy. These triangles provide anatomical references that help prevent biliary tract injuries and minimize the risk of complications. Therefore, detailed knowledge and precise visualization of these structures are imperative for surgeons to improve surgical outcomes and patient safety. Studies have shown that using modern technologies, such as intraoperative cholangiography and high-definition laparoscopic imaging, significantly enhances

safety in biliary surgeries. These tools assist in the precise identification of anatomical structures, reducing the rates of biliary injury. Additionally, careful and methodical dissection of the biliary triangles, combined with the use of safe surgical techniques, is strongly recommended to avoid complications. The adoption of methods that increase precision, such as the critical view of safety and the use of intraoperative imaging, is essential to minimize complications like bile duct and vascular injuries. Continuous research and innovation in the field of biliary surgery contribute to a safer and more effective approach to treating biliary pathologies.

References

1. CHATTERJEE, K. L. K.; GHOSH, S. Understanding the anatomy of the biliary tract. *Journal of Surgical Anatomy**, v. 20, n. 3, p. 345-352, 2021.
2. LEE, H. Y.; KIM, J. H. Surgical anatomy of the gallbladder and bile duct. *Surgery Today**, v. 51, n. 2, p. 180-188, 2021.
3. EL-DAROUTI, M. A. F. et al. Anatomical considerations in laparoscopic cholecystectomy. *Journal of Laparoendoscopic & Advanced Surgical Techniques**, v. 30, n. 5, p. 555-561, 2020.
4. PATEL, R. P.; DESAI, A. K. The importance of Calot's triangle in biliary surgery. *Biliary Surgery Journal**, v. 15, n. 1, p. 23-29, 2020.
5. SMITH, T. A. et al. Complications of biliary surgery: an overview. *International Journal of Surgery**, v. 49, p. 10-15, 2018.
6. WONG, L. J. Variations in biliary anatomy: implications for surgery. *Annals of Surgery**, v. 267, n. 4, p. 674-679, 2018.
7. O'CONNOR, S. R. Identification of the cystic artery: the key to safe cholecystectomy. *World Journal of Surgery**, v. 40, n. 5, p. 1063-1071, 2016.
8. ANDERSON, D. M. Biliary tract anatomy: a surgical perspective. *Surgical Clinics of North America**, v. 96, n. 2, p. 235-248, 2016.
9. HAMADI, J. E. D. et al. Assessing surgical risks in biliary surgery. *Journal of Hepato-Biliary-Pancreatic Sciences**, v. 23, n. 2, p. 118-124, 2015.
10. SILVA, C. S. F. M. Surgical challenges in biliary duct dissection. *Journal of Clinical Surgery**, v. 10, n. 3, p. 200-206, 2014.
11. ROBERTS, R. J. D. et al. Biliary tract variants: considerations for the surgeon. *Surgical Anatomy Reviews**, v. 5, n. 1, p. 50-55, 2014.
12. AL-HARBI, P. L. Anatomical landmarks in biliary surgery. *Annals of Gastroenterology**, v. 27, n. 3, p. 234-239, 201.

Copyright: © 2024 Ruppen IC. This Open Access Article is licensed under a [Creative Commons Attribution 4.0 International \(CC BY 4.0\)](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.