



ISSN NO. 2320-5407

Journal homepage: <http://www.journalijar.com>

INTERNATIONAL JOURNAL
OF ADVANCED RESEARCH

RESEARCH ARTICLE

The Anatomical and Surgical Importance of Hepatobiliary Triangle of Calot

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Manuscript Info**Manuscript History:**

Received: 13 September 2013

Final Accepted: 22 September 2013

Published Online: October 2013

Key words:

Calot, Triangle, Cystic, Gall bladder, cholecystectomy

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Calot's triangle is an important Anatomical and surgical landmark of great importance in surgical procedure of Laparoscopic Cholecystectomy as well as Open cholecystectomy. The ultimate Safety of any surgical procedure in the region of gall bladder lies in the proper identification of this targeted Anatomical Structure. Only about 25% of major bile duct injuries (common bile duct or hepatic duct) are recognized at the time of operation. Most commonly, intraoperative bile leakage, recognition of the correct anatomy, and an abnormal cholangiogram lead to the diagnosis of a bile duct injury. More than half of patients with biliary injury will present within the first postoperative month. All these injuries are invariably fatal and can be avoided by meticulous dissection and knowledge of normal anatomy and variations in anatomy around the area of Calot's triangle.

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Cholecystectomy defined as surgical removal of gall bladder is Indicated in asymptomatic gall stones or any underlying gall bladder pathology. Two surgical methods for this very purpose are laparoscopic cholecystectomy and open cholecystectomy.¹ The latter one is becoming obsolete since it requires a wider exposure through the surgical incision and post-operatively patients are prone to development of infections.

Laparoscopic cholecystectomy is gaining phenomenal acceptance, being a standard and preferable approach. The challenging aspect of this surgery is safeguarding the structures forming boundaries of Calot's triangle and then carrying out safe dissection of its contents.

Highlights about proper exposure of Calot's triangle via laparoscopic cholecystectomy requires several small incisions in the abdomen to allow the insertion of operating ports, small cylindrical tubes approximately 5 to 10 mm in diameter, through which surgical instruments and a video camera are placed into the abdominal cavity. The camera illuminates the surgical field and sends a magnified image from inside the body to a video monitor, giving the surgeon a close-up view of the organs and tissues. The surgeon watches the monitor and performs the operation by manipulating the surgical instruments through the operating ports.

The Calot's triangle, also known as Cysto Hepatic triangle or the Hepatobiliary Triangle is an anatomic space bordered by the cystic duct, the common hepatic duct, and the inferior border of the liver. The right hepatic and cystic arteries are located within it, and anomalous structures often pass through it. Variations in the anatomy of the gallbladder, the bile ducts, and the arteries that supply them and the liver are important to the surgeon, because failure to recognize them can cause iatrogenic injury to the biliary tract.

Variation 1: The cystic duct may be long and more susceptible to damage by virtue of its length and it becomes essential for a surgeon to properly trace the full length of the duct illustrating the need for its complete dissection.^{2,3}

Variation 2: The duct may pass behind the common hepatic duct to enter on its posterior wall or on its left lateral aspect. An important point for surgeon as he can completely miss the structure and cause unintended damage in case of failure of recognition of the posterior course of cystic duct.^{4,5,6}

Variation 3: In chronic cholecystitis, the gallbladder may be small and shrunken, and the cystic duct may be absent or extremely short; in this circumstance, the common bile duct may easily be mistaken for the cystic duct as dissection proceeds from the gallbladder fundus toward the cystic duct.

Variation 4: A very long cystic duct may enter the common bile duct a variable distance from the sphincter of Oddi and may be fused with the common duct, in which case the two ducts should not be separated because they share a common wall.⁷

Variation 5 :An accessory duct from the liver may enter the cystic duct or the common hepatic duct. Actually, this is not an accessory duct but an anomalous entry and course of either the right anterior or right posterior segmental duct from the liver. Such variations are reported with increasing incidence.

Variation 6: Small accessory ducts such as ducts of Luschka between the liver and gallbladder easily escape detection. Low extrahepatic right segmental duct insertions (most notably VII–VIII or VI) can also join the cystic duct. The latter injury has been recognized since the use of laparoscopic cholecystectomy.

Variation 7: Occasionally, liver parenchyma is partially embedded in the gallbladder, and rarely one may encounter a completely intrahepatic gallbladder.

Variation 8: Passage of the cystic duct posterior and around the common hepatic duct to form a left-sided junction (spiral union) occurs in less than 5% of persons. The cystic duct may also join the right or left hepatic duct or be absent. Rarely, major hepatic ducts drain separately into the gallbladder.

Variation 9: Common variations in the anatomy of the hepatic artery of relevance to this biliary anatomy include a bend in the course of the hepatic artery, which can mimic the cystic artery origin, a short cystic artery takeoff from the right hepatic artery, dual cystic arteries, or an artery that courses anterior to the hepatic ductal system. A bend in the course of the right hepatic artery, throwing it into the configuration of a caterpillar hump, invites injury unless it is carefully dissected free. A very short cystic artery also puts the hepatic artery at risk. Occasionally, the right hepatic artery courses anterior to the common bile duct. The cystic artery which courses through the triangle must be avoided any insult and properly identified by the surgeon.⁸

Dissection deep into the liver parenchyma may cause injury to intrahepatic ducts, and poor clip placement close to the hilar area or to structures not well visualized can result in a clip across a bile duct.^{9,10}

Cancer of the gallbladder which usually has not a good five year survival rate spreads through the lymphatics, with venous drainage, and with direct invasion into the liver parenchyma. Lymphatic flow from the gallbladder drains first to the cystic duct node also known as the Calot's node, then the pericholedochal and hilar nodes, and finally the peripancreatic, duodenal, periportal, celiac, and superior mesenteric artery nodes. The gallbladder veins drain directly into the adjacent liver, usually segments IV and V, where tumor invasion is common.¹¹

It has also been observed that Lymph is produced within the liver and drains via the Perisinusoidal space of Disse and Periportal clefts of Mall to larger lymphatics that drain to the hilar cystic duct lymph node (Calot's triangle node), as well as the common bile duct, hepatic artery, and retropancreatic and celiac lymph nodes. This is particularly important for resection of hilar cholangiocarcinoma, which has a high incidence of lymph node metastases.¹²

Conclusion :

Among the steps involved in laparoscopic cholecystectomy, the most important step is the identification of Calot's triangle and to identify all the normal structures first and look for variations in the Biliary and Extra hepatic biliary system which can exist there. After appraising the Calot's triangle, cystic duct and cystic artery are separated and carefully clipped using titanium clips by the surgeon. The safe and sound dissection or removal of the gall bladder

via portals away from the liver bed, assisted by video camera placed in abdominal cavity can only be made possible by meticulous identification of the Calot's triangle boundaries. As a result considerable reduction in morbidity and mortality can be achieved and hence the Normal Anatomy and variations in Anatomy of structures within the Calot's triangle assumes great importance.

Futhermore the Calots node in the Calots triangle can be a marker for Cholangiocarcinoma

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