

An Autopsy based Study on the Relationship of Cystic Artery with Respect to Common Bile Duct, Common Hepatic Duct and Calot's Triangle in Light of Hepato-Biliary Surgery

Puloma Chakraborty¹, Sayak Sovan Dutta², Sandip Mukhopadhyay²

¹Post-graduate Trainee, Dept of Anatomy, Medical College Kolkata ²Assistant Professor, Dept of FMT, NRS Medical College, Kolkata

Abstract

Background: The arterial system of human body is often subjected to a good number of variations. Therefore, trying to find out variations in relationship of cystic artery with CBD, CHD and Calot's triangle will surely be a useful endeavor for an Anatomist and Autopsy Surgeon, moreover such an effort will help the surgeons in planning and operating upon the hepatobiliary system. **Method:** The present work was carried out in the Department of FMT, NRSMCH, Kolkata in collaboration with the Department of Anatomy, Medical College, Kolkata over a period of one year to find out relationship of Cystic artery with CBD and CHD and also to check whether Cystic artery was present within Calot's triangle. Fifty cadavers of both sexes were subjected to detail dissection method based on inclusion and exclusion criteria. Adult human cadavers above 18 yrs of age were included in this study whereas paediatric cadavers below 18 yrs of age, cadavers above 18 years where dissection cannot be done because of pathology in and around porta hepatis, decomposed dead bodies and dead bodies came for autopsy with gross abdominal injury involving hepato-biliary system were excluded from the study. The study was prospective, cross sectional, observational, autopsy based study. The cystic artery was lying posterior to CHD or CBD in 90% cases where as it was placed anteriorly in 10% of specimens. The cystic artery was lying anterior to CHD in 6% cases whereas and anterior to the CBD in 4% cases. In these 4 % cases CA was also inferior in position with respect to the cystic duct. In 96% of specimens the cystic artery was lying inside the Calot's triangle whereas the 4% cases showed presence of cystic arteries outside the Calot's triangle. **Conclusion:** Because variations are very common in hepatic and Cystic arteries, sound knowledge will allow the surgeons to practice safe laparoscopic or open Cholecystectomy, liver resections and vascular recombination in transplantation and there by avoid errors and patient morbidity. A good knowledge of Calot's triangle is important for conventional and laparoscopic Cholecystectomy.

Key Words: Cystic artery, Common Bile Duct, Common Hepatic Duct, Calot's triangle. Cholecystectomy

Introduction

The arterial system of human body is often subjected to a good number of variations. Therefore, trying to find out variations in relationship of cystic artery with CBD, CHD and Calot's triangle will surely be a useful endeavor for an Anatomist and Autopsy Surgeon, moreover such an effort will help the surgeons in planning and operating upon the hepatobiliary system.

The liver and the gallbladder constitute the main parts of the hepatobiliary system. They are supplied by the branches of the coeliac trunk, one of the ventral

branches of the abdominal aorta. Actually these hepatobiliary structures are supplied by the branches of the hepatic artery proper, one of the terminal branch of the common hepatic artery which via its gastro duodenal branch supplies parts of stomach, duodenum and lower part of the common bile duct, while the proper hepatic artery provides the right gastric artery and then divides into the right and left branches, which supply the right and left liver lobes. The right hepatic artery provides a cystic branch, which passes through Calot's triangle and supplies the gallbladder.

Successful hepatobiliary surgery necessitates the preservation of all the arteries except the ones that need sacrifice. Division or damage with subsequent thrombosis produces ischemia of liver or bile duct which can have devastating consequences on the patient. The promotion of the knowledge of hepatic vascular distribution and its variations is fundamental to plan and to make all surgical and radiological procedures in upper abdomen¹. Because of the advent of interventional and surgical techniques to treat both primary and metastatic liver tumours and the increasing availability of living related liver transplant donors, the depiction and definition of the hepatic arterial anatomy has become crucial².

Cholelithiasis with or without cholecystitis needs removal of gall bladder and examination of the duct system. The traditional approach of gall bladder removal was open Cholecystectomy. The approach is now frequently replaced by minimal access procedure i.e. "Laparoscopic Cholecystectomy (LC)".

A good knowledge of Calot's triangle is important for conventional and laparoscopic Cholecystectomy. Calot's triangle is an important imaginary area for biliary surgery. In 1981, Rocko³ drew attention to possible variations in the region of Calot's triangle bordered by the cystic duct, common hepatic duct, and lower edge of the liver. In 1992, Hugh⁴ suggested Calot's triangle should be renamed as the hepatobiliary triangle, with the small cystic artery branches supplying the cystic duct being called Calot's arteries. Cystic artery bleeding is a troublesome complication during laparoscopic Cholecystectomy, which increases the rate of conversion to open surgery. Safe laparoscopic Cholecystectomy demands a good knowledge of the anatomy of the cystic artery and its variations. The cystic artery has many possible origins, with the right hepatic artery being the most common. The other origins include the left hepatic artery, the proper hepatic artery, the common hepatic artery, the gastro-duodenal artery, the superior pancreaticoduodenal artery and the superior mesenteric artery (Williams⁵, 1989; Price & Holden⁶, 1993; Harris & Pellegrini⁷, 1994).

Currently, laparoscopic Cholecystectomy is widely accepted as the gold standard in the treatment of cholelithiasis⁴. This new technique was initially

associated with a significant increase in morbidity, and in particular, in iatrogenic biliary injury and arterial haemorrhage⁸⁻¹⁰ perhaps due to a lack of knowledge of the laparoscopic anatomy of the gallbladder pedicle. Therefore, the laparoscopic surgeon has to deal with the new anatomical views and must be aware of the possible arterial and biliary variants.

Hepato cellular carcinoma (HCC) is the 5th most common cancer in the world¹¹. Systemic chemotherapy has been shown to have limited therapeutic effect for both primary and secondary hepatic malignancies. Hence the advent of local Control with Trans Arterial Embolization (TAE), Trans Arterial Chemoembolization (TACE) considered beneficial. TAE/TACE are effective means for unresectable liver tumours¹², cholangiocarcinoma and also for haemangiomas. Hepatic and cystic arteries play important role in both TAE and TACE.

The anatomical knowledge of different variations of hepatic and cystic arteries is required to reduce the number of iatrogenic complications in traditional and laparoscopic hepatobiliopancreatic surgery. Likewise, the surgeon applies this knowledge in the surgical management of liver trauma in the region, aneurysm of the hepatic artery, liver transplant surgery, pancreaticoduodenectomy, radical gastrectomy and countless surgeries themselves of this complex anatomical region.

In spite of considerable surgical importance, there are not many studies on cystic arteries particularly from this part of India which drives the present researcher to pursue this dissection oriented study on hepatic and cystic arteries in human cadavers with particular inclusion and exclusion criteria.

Brief Anatomy of Cystic Artery:

Gall bladder is a pear shaped organ on the inferior surface of liver. It is divided into fundus, body and neck. The neck ends at the cystic duct and the cystic duct joins the common hepatic duct to form common bile duct. The cystic artery commonly arises from RHA and is given off in Calot's triangle. The course and length of cystic artery is variable in Calot's triangle. Although the artery classically traverses the triangle almost at the centre, but it can be very close or lower than the cystic duct.

It usually passes posterior to common hepatic duct and anterior to cystic duct and gives a superficial branch and a deep branch. The superficial branch ramifies over inferior aspect of body of gallbladder, the deep branch on the superior aspect¹³. These branches anastomose over the surface of body and fundus.

In approximately 80% of individuals, the cystic artery arises from the right hepatic artery. In the rest the artery may arise from the left hepatic artery, the proper hepatic artery, the common hepatic artery, the gastroduodenal artery, the superior pancreaticoduodenal artery or even from the superior mesenteric artery.

When it takes origin from sources other than RHA it may pass anterior to common bile duct or common hepatic duct to reach gallbladder. In case of a low lying cystic artery it may not be a content of Calot's triangle. Calot's triangle is an imaginary area limited by cystic duct, common hepatic duct, and inferior surface of liver. An accessory cystic artery can arise from common hepatic arteries or one of its branches. Cystic artery also provides branches to cystic duct, common hepatic and upper part of common bile duct.

Aims & Objectives

1. To observe the relation of cystic artery with respect to CHD or CBD
2. To find out whether cystic artery was traversing the Calot's triangle or not.

Materials & Methods

Study Design: Cross-sectional observational prospective study

Study Tools:

1. Dissection Instruments
2. Digital Camera
3. Computer for data analysis

Study Technique: A group of 50 dead bodies including well embalmed and preserved (both male and female) and also dead bodies came for Autopsy examination above 18 years of age were selected. Anterior abdominal wall with parietal peritoneum was reflected

as described in the *Cunningham's Manual of Practical Anatomy*¹⁴. The greater part of right hypochondrium was occupied by liver. Inferior margin of liver was lifted up and lesser curvature of stomach traced from the entry of abdominal part of esophagus up to the thickened pyloric sphincter. The lesser omentum with its right free margin was identified between the lesser curvature of stomach with the ascending part of duodenum and the liver. The epiploic foramen was identified. At its left boundary the free margin of lesser omentum was felt thickened by palpation. The superficial layer of lesser omentum was stripped off and 3 underlying structures were identified. The hepatic artery proper (HAP) the common bile duct and the portal vein whether or not maintaining their usual position and mutual relationship were sought after in the right free margin of the lesser omentum.

The cystic artery was looked after whether usual or not with regard to its relation with CBD, CHD and Calot's triangle.

Afterwards the HAP was traced downwards up to the origin of gastroduodenal artery (GDA) which was coursing behind the 1st part of duodenum. The GDA was then examined for any branch to GB from it. From the point of its division into terminal branches the HAP and the GDA the common hepatic artery (CHA) was traced towards the left up to its origin, the coeliac trunk. From the coeliac trunk the left gastric artery was traced towards the esophageal end of stomach and it was examined for the presence of any accessory or replaced LHA. Similarly the presence of accessory or replaced RHA was also searched. The cystic duct was found out and its union with the CHD was also noticed. Any variation regarding source of origin, course and relation of cystic artery were carefully examined. The observations were both recorded on paper and photographed.

Inclusion Criteria: Adult human cadavers above 18 yrs of age.

Exclusion Criteria:

1. Paediatric cadavers below 18 yrs of age
2. Cadavers above 18 years where dissection cannot be done because of pathology in and around porta hepatis.

3. Decomposed dead bodies

4. Dead bodies came for autopsy with gross abdominal injury involving hepato-biliary system.

Study Period: One Year

Study Duration: 1st September 2015 to 31st August 2016.

Study Area: The present study was conducted in the Department of Anatomy, Medical College and Hospital, Kolkata in collaboration with Dept of Forensic Medicine, NRS Medical College, Kolkata.

Study Population: A group of 50 cadavers

Statistical Analysis: Collected data were analyzed and statistical test were done with the help of appropriate statistical tools.

Review of Literature

Cystic artery is the chief arterial supply for the gallbladder. It is most commonly a branch of right hepatic artery and is given off in Calot's triangle. The course and length of cystic artery is variable in Calot's triangle. Although the artery classically traverses the triangle almost at the centre, but it can be very close or lower than the cystic duct.

The Calot's triangle is bounded by cystic duct, common hepatic duct/bile duct and inferior surface of liver. Its contents usually include the right hepatic artery, cystic artery, cystic lymph node (of Lund), and lymphatics.

The cystic artery arises from the right hepatic artery. The other origins include the left hepatic artery, the proper hepatic artery, the common hepatic artery, the gastroduodenal artery, the superior pancreaticoduodenal artery, the superior mesenteric artery etc.

When it takes origin from sources other than RHA it may pass anterior to common bile duct or common hepatic duct to reach gall bladder. In case of a low lying cystic artery it may not be a content of Calot's triangle. An accessory cystic artery can arise from common hepatic arteries or one of its branches. Cystic artery also provides branches to cystic duct, common hepatic and

upper part of common bile duct.

Currently, laparoscopic cholecystectomy is widely accepted as the gold standard in the treatment of cholelithiasis. A good knowledge of Calot's triangle and vascular variations are important for conventional and laparoscopic cholecystectomy to prevent iatrogenic injuries in this region and conversion of laparoscopic to open cholecystectomy thus reducing mortality and morbidity due to intra and postoperative complications. The reported incidence of conversion to open surgery because of blood vessel injuries is approximately 0%-1.9% during laparoscopic cholecystectomy, and its mortality is about 0.02%.

The cystic artery arising outside the hepatobiliary triangle usually passes ventral to the CBD and in some case it may even be inferior to the cystic duct, thus becoming the first structure encountered in dissection of the inferior border of the hepatobiliary triangle by laparoscopy and has a chance of accidental injury.

Since near total 'tumour response' was obtained by intraarterial chemotherapy in gall bladder cancer, knowledge of the variation of gall bladder blood supply may also help oncosurgeons.

The cystic artery is a highly variable structure regarding its origin, course and relation with the surrounding structures. Many studies have been done to demonstrate and evaluate the variations by the help of gross dissection or laparoscopic visualisation. The observations from different studies help the surgeons and interventional radiologists.

Michels NA¹⁵ described that, the cystic artery arises within Calot's triangle in approximately 80% of cases and outside the triangle in 20% to 30%. He also suggested that careful dissection of Calot's triangle is essential for safe cholecystectomy.

Flint et al¹⁶ studied 200 specimens and found the variation in the origin of cystic artery in 2% cases. The percentage of dual cystic artery was 15.5%.

Daseler EH¹⁷ et al (1947) reported that variations in the origin and course of cystic artery occur in 24.5% of people. He also described the variations of cystic artery

and classified them into 12 main types

According to Hollinshead¹⁸ (1961), gallbladder is normally supplied by a single cystic artery and it commonly arises, as a rule from right hepatic artery and soon divides into two branches, superficial and deep. In 25% cases there is presence of double cystic arteries

Rocko JM⁴ et al (1981) pointed to possible variations in the region of Calot's triangle bounded by cystic duct, common hepatic duct and lower edge of liver

Cimmino PT¹⁹ et al (1992) mentioned that anatomic variations in and around Calot's triangle are frequent and can be found in 20% to 50% of cases. Among these variations in biliary tree, cystic artery variations, based on its origin, course and number are quite common and are found in 20% to 50% of cases.

Balija M²⁰ et al (1999) warned that good knowledge of variations in cystic artery anatomy is required for safe performance of laparoscopic cholecystectomy. He also mentioned that anatomy of cystic artery is differently presented in endoscopic visualization than during classic cholecystectomy and proper knowledge of position and variations of cystic artery which need not be found in Calot's triangle always facilitates the laparoscopic procedure.

They presented an original classification of the anatomic variations of the cystic artery into two main groups based on their experience with 200 laparoscopic cholecystectomies, with due consideration of the known anatomicotopographic relations. Group I designated a cystic artery situated within the hepatobiliary triangle on laparoscopic visualization. This group included three types: (1) normally lying cystic artery, found in 147 (73.5%) patients; (2) most common cystic artery variation, manifesting as its doubling, found in 31 (15.5%) patients; and (3) the cystic artery originating from the aberrant right hepatic artery, observed in 11 (5.5%) patients. Group II designated a cystic artery that could not be found within the hepatobiliary triangle on laparoscopic dissection. This group included two types of variation: (1) cystic artery originating from the gastroduodenal artery, found in nine (4.5%) patients; and (2) cystic artery originating from the left hepatic artery, recorded in two (1%) patients.

According to Russel²¹ et al (2004), the cystic artery, a branch of right hepatic artery, is given off behind the common hepatic duct. Occasionally, an accessory cystic artery arises from gastroduodenal artery. In 15% cases the right hepatic artery and cystic artery arises in front of common hepatic and cystic duct.

Ding²² et al undertook a retrospective evaluation of 600 non-emergency patients, 232 men and 368 women, who underwent laparoscopic cholecystectomy for different gallbladder diseases, including 530 with cholecystitis and gallstones, and 70 with gallbladder polyps. All of the patients were examined with ultrasound before surgery. Laparoscopic cholecystectomy was carried out under general anesthesia using the four ports technique. The information of Calot's triangle and distribution of cystic artery on endoscopic visualization was recorded respectively.

Based on our laparoscopic observations, they classified cystic artery anatomy into three groups.

Group I: Group I represented the Calot's triangle type, in which the cystic artery passed through Calot's triangle. They observed this type in 513 of the 600 patients (85.5%). Group I was further subdivided into two subtypes. The classical single cystic artery originated from the RHA within the Calot's triangle and was divided into superficial and deep branches and supplied the GB. In their study it was recorded in 440 of 600 patients (73.3%). They observed double cystic artery in 12.2% cases.

Group II: This group represented cystic artery traversing outside the Calot's triangle. In this group CA originated from the gastroduodenal artery (7.5%), aberrant RHA (3%) and from liver parenchyma (2.5%).

Group III: This group represented compound cystic artery, where one cystic artery was present inside the Calot's triangle and another cystic artery traversing outside the Calot's triangle. They found 1.5% cases belonged to this group.

Rahaman and Anwar²³ carried out the study on 60 (sixty) post mortem gallbladder collected from

Bangladeshi adult people They observed that out of 60 specimens, the cystic artery was passing within Calot's triangle in 58 specimens (96.65%) but in 2 specimens (3.35%) the cystic artery was outside the Calot's triangle. In all cases single cystic artery was found. Regarding the relations of the cystic artery, out of 60 specimens, in 54 cases (90%) cystic arteries were observed to pass behind the common hepatic duct. In four cases (6.67%) cystic arteries were found crossing over the common hepatic duct, and in two cases (3.33%), cystic artery were found crossing below the cystic duct.

Result and Analysis

The study on Extrahepatic part of hepatobiliary vasculature was conducted on 50 cadavers, out of which 40 were male and 10 were female. The cystic artery was

studied with regard to its relation with CBD and CHD. The specimens were also observed for the presence of cystic artery whether inside or outside the Calot's triangle.

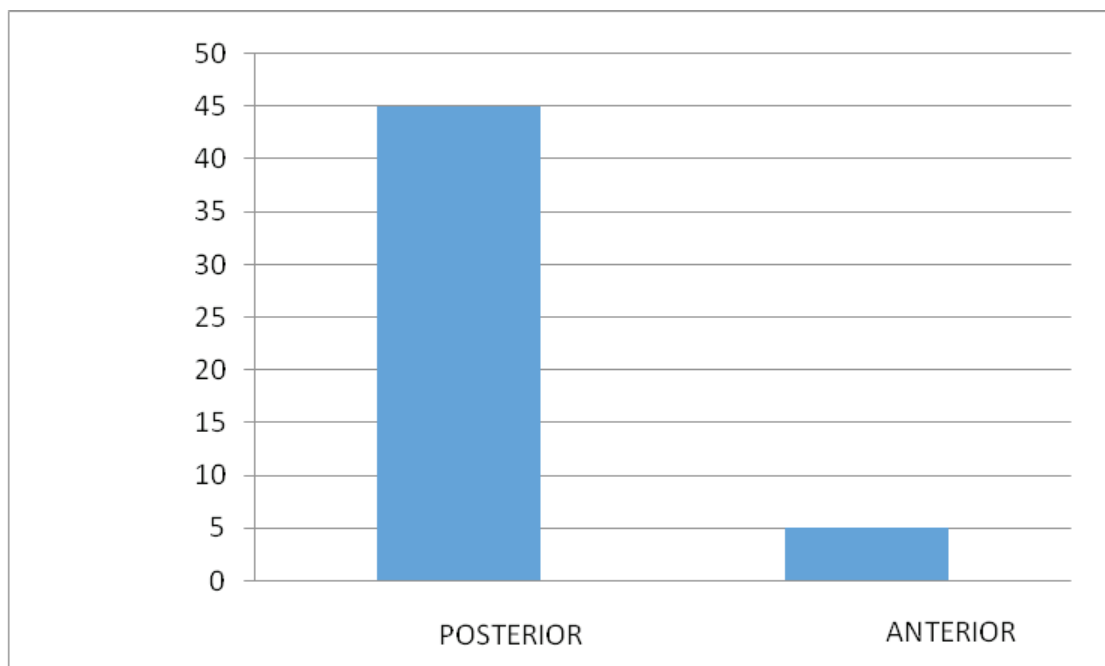
In this study we found the cystic artery was lying posterior to CHD or CBD in 90% cases, where as it was placed anteriorly in 10% of specimens.

In 96% of specimens the cystic artery was lying inside the calot's triangle whereas 4% of total cases showed presence of cystic arteries outside the calot's triangle.

On the basis of these observations statistical analysis of the obtained data was done.

Table 1: Relation of cystic artery with common hepatic duct or common bile duct.

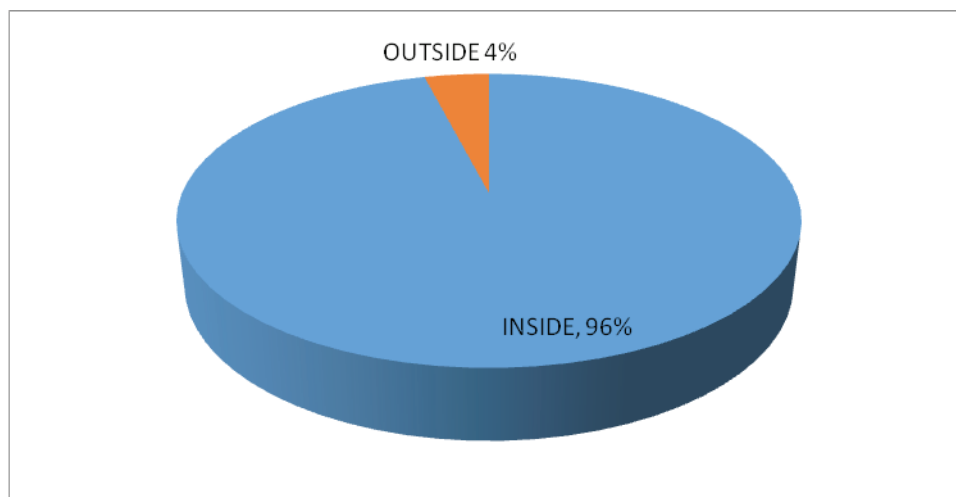
Relation	Total no of case (n=50)
CA is ANTERIOR	5 (10%)
CA is POSTERIOR	45 (90%)



BAR DIAGRAM SHOWING RELATION OF CYSTIC ARTERY WITH RESPECT TO CHD OR CBD

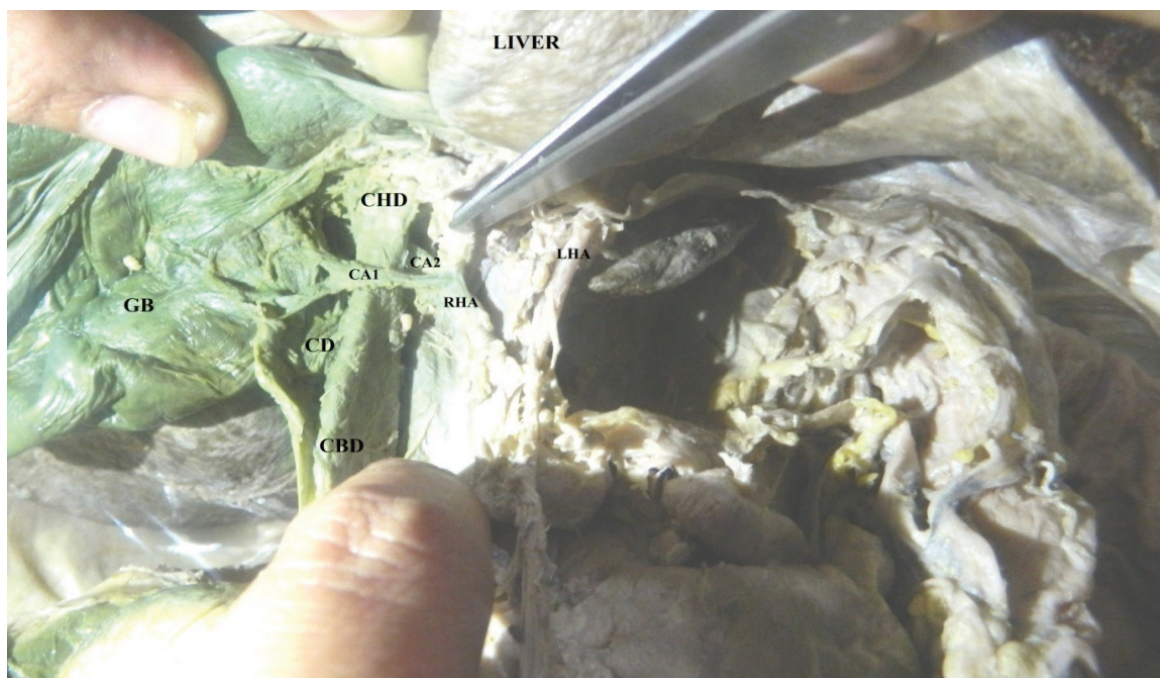
Table 2: Cystic Artery (CA) inside or outside the Calot's Triangle.

CA Inside or Outside the calot's triangle.	Total no of case (n=50)
INSIDE	48
OUTSIDE	2



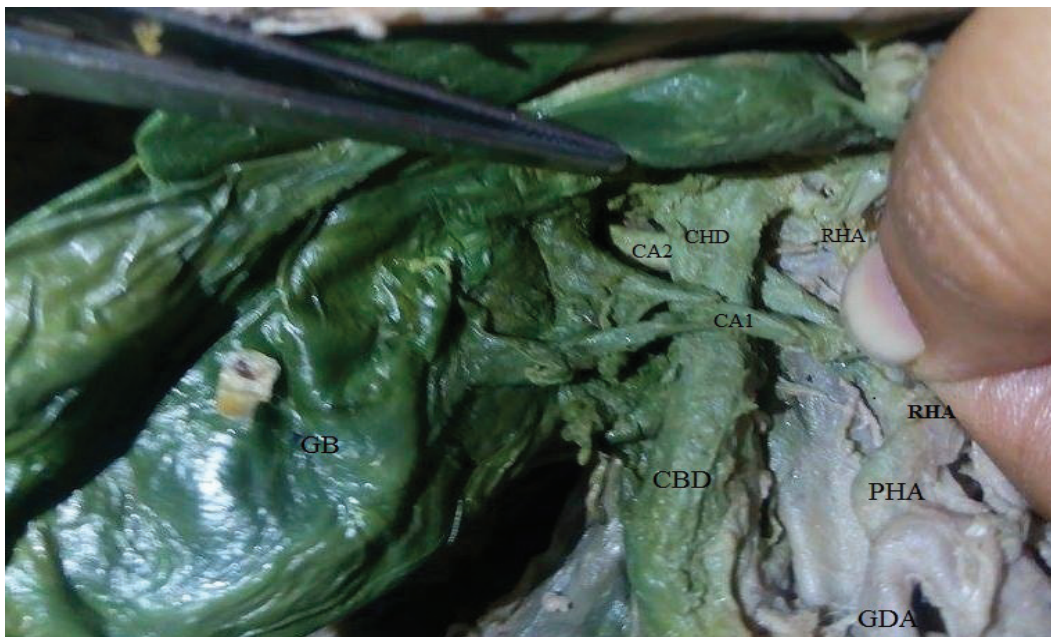
PIE DIAGRAM AM SHOWING PRESENCE OF CYSTIC ARTERY INSIDE OR OUTSIDE THE CALOT'S TRIANGLE.

Color plates:



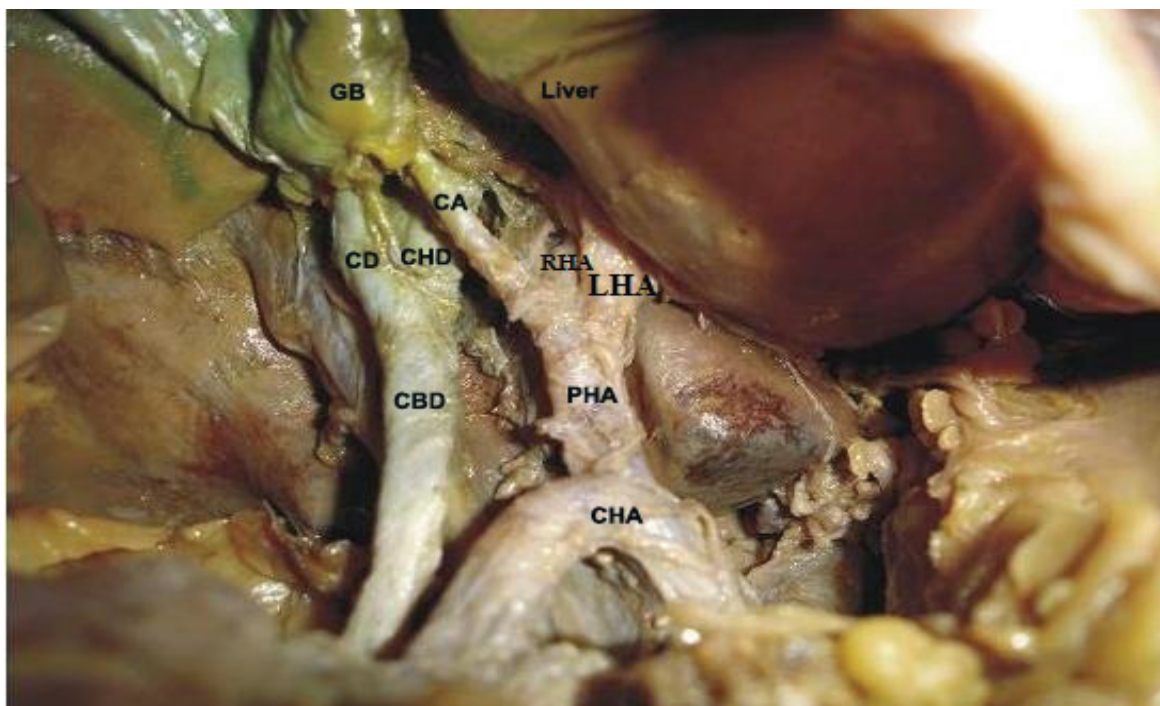
Picture.1: showing origin of double cystic artery from RHA. CA1 passing anterior to CHD and CA2 passing posterior to CHD.

[GB-Gall Bladder, RHA- Right Hepatic Artery, LHA- Left Hepatic Artery, CA1-1st Cystic artery, CA2-2nd Cystic artery, CD- Cystic Duct, CHD- Common Hepatic Duct, CBD- Common Bile Duct]



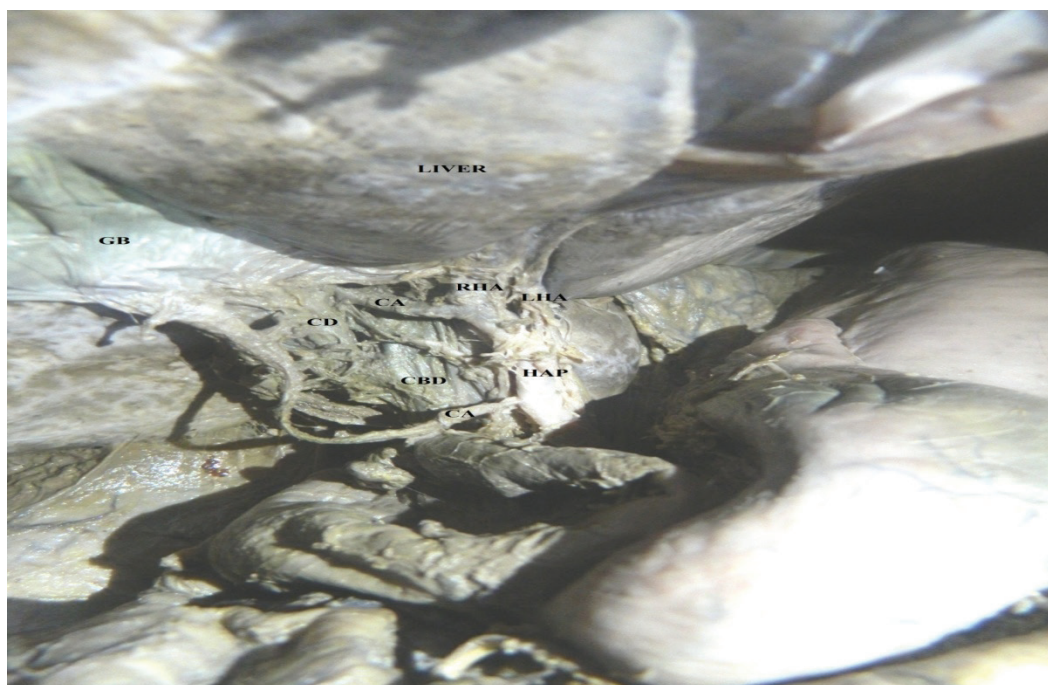
Picture 2: Showing magnification of some part of the Pic 1. Two cystic arteries taking origin from RHA passing anterior and posterior to CHD respectively.

RHA- Right Hepatic Artery; LHA- Left Hepatic Artery; PHA- Proper Hepatic Artery [also known as Hepatic Artery Proper (HAP)]; CA- Cystic Artery; CHA- Common Hepatic Artery; GB- Gall Bladder; CD- Cystic Duct; CHD- Common Hepatic Duct; CBD- Common Bile Duct



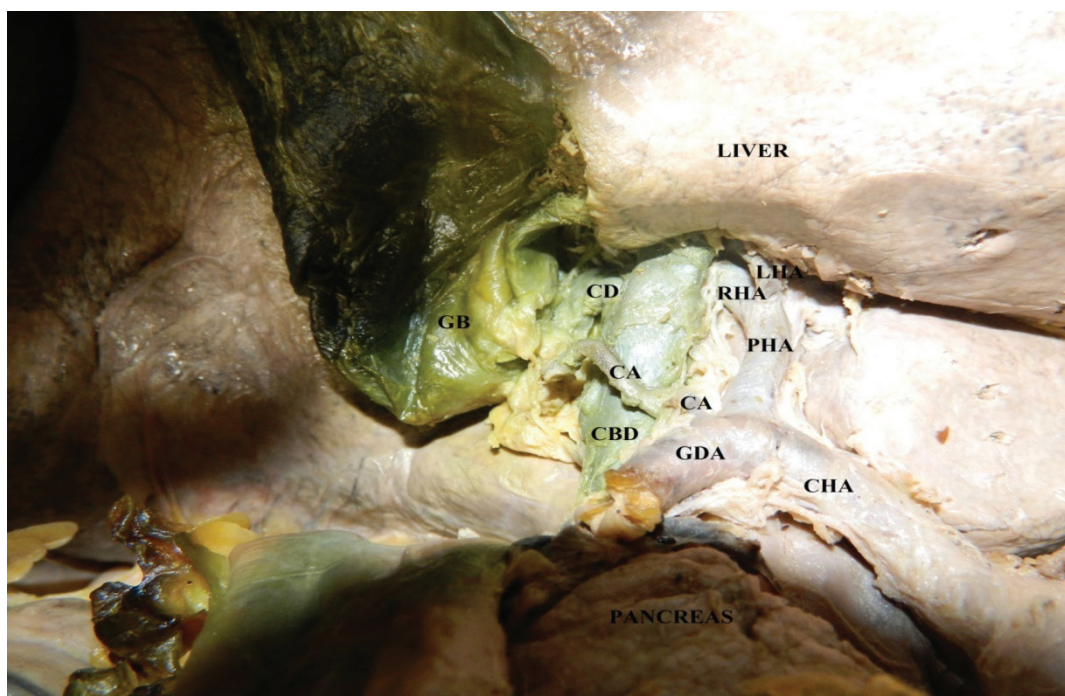
Picture 3: Showing Cystic Artery arising from PHA passing anterior to CHD.

RHA- Right Hepatic Artery; LHA- Left Hepatic Artery; PHA- Proper Hepatic Artery [also known as Hepatic Artery Proper (HAP)]; CA- Cystic Artery; CHA- Common Hepatic Artery; GB- Gall Bladder; CD- Cystic Duct; CHD- Common Hepatic Duct; CBD- Common Bile Duct



Picture.4: Showing HAP dividing into RHA and LHA- one cystic artery taking origin from the RHA traversing through the calot's triangle and the other cystic artery taking origin from HAP and lying outside the calot's triangle.

RHA- Right Hepatic Artery; LHA- Left Hepatic Artery; PHA- Proper Hepatic Artery [also known as Hepatic Artery Proper (HAP)]; CA- Cystic Artery; GB- Gall Bladder; CD- Cystic Duct; CBD- Common Bile Duct



Picture.5: Showing the origin of the CA from the gastro duodenal artery and CA crossing anterior to CBD and lying outside the calot's triangle.

RHA- Right Hepatic Artery; LHA- Left Hepatic Artery; PHA- Proper Hepatic Artery [also known as Hepatic Artery Proper (HAP)]; CA- Cystic Artery; CHA- Common Hepatic Artery; GB- Gall Bladder; CD- Cystic Duct; CBD- Common Bile Duct; GDA- Gastro Duodenal Artery

Discussion:

The present study was done in 50 cadavers by gross dissection to observe the the relationship of Cystic artery with CBD and CHD and also whether the Cystic artery lies within the Calot's triangle.

THE CYSTIC ARTERY

The performance of a safe cholecystectomy depends

on a thorough knowledge about the normal anatomy and anatomical variations of cystic artery that may contribute to the occurrence of major postoperative complications. The famous triangle originally described by Calot in 1891, usually contain the right hepatic artery, the cystic artery, the cystic lymph node, connective tissue and lymphatics. During cholecystectomy this triangle is dissected to identify the cystic artery and cystic duct before their ligation and division.

Relation of cystic artery with respect to CHD & CBD

Studies	Total No of Case	Anterior to CHD	Posterior to CHD	Not Related
Daseler ³⁹ et al.	580	21.2%	52.4%	26.4%
Futara G Ali ⁴⁸ et al.	110	28.2%	10.9%	60.9%
Flisinski ⁴⁷ et al	34	29.4%	66.7%	-
Gawali R ⁵⁹	30	46.66%	50%	-
Khalilur Rahaman ⁵³ et al.	60	6.67%	90%	3.33%
Patil S ⁵⁶ et al.	30	40%	36%	23.3%
Present Study	50	6%	90%	4%

In the present study, the cystic artery crossed anterior to CHD and/or CBD in 10% cases whereas it ran posterior to CHD in 90% cases. In this present study it was running anterior to CHD in 6% cases and it was crossing anterior to CBD in 4% cases. In 4% cases where it was crossing anterior to CBD cystic artery was also inferior in relation with respect to cystic duct. This finding of the present study is close to the findings of

studies done by Khalilur Rahaman²³ over Bangladeshi population.

Observation of cystic artery running posterior to CHD is much higher than studies done by Daseler et al. (52.4%), Flisinski²⁴ et al (66.7%), Balija M⁴² (58.8%). This finding of the present study is slightly higher than the finding of Gadjiev⁶⁸ et al. (80%)

Relation of cystic artery with respect to Calot's Triangle

Studies	Total No of Cases	Relation with respect to Calot's Triangle	
		Inside	Outside
Daseler ³⁹ et al.	580	69.8%	31.2%
Futara G Ali ⁴⁸ et al.	110	89%	11%
Flisinski ⁴⁷ et al	34	97.06%	2.94%

Cont... Relation of cystic artery with respect to Calot's Triangle

Michels NA22	200	81%	19%
De Silva ⁵ et al	50	86%	14%
Khalilur Rahaman ⁵³ et al	60	96.65%	3.35%
Patil S ⁵⁶ et al	30	86.6%	13.4%
Gawali R ⁵⁹	30	90%	10%
Tejaswi HL ⁵⁷ et al	100	65%	35%
Present Study	50	96%	4%

Present study showed the cystic artery was traversing through the calot's triangle in 96% case and cystic artery was lying outside the calot's triangle in 4% cases. These observations are closer to the findings from other studies done by Khalilur Rahaman²³ et al and Flisinski²⁴ of et al.

In this present study, the percentage of cystic artery present inside the calot's triangle is little higher than the findings of Futara G Ali²⁵ (89%), Gawali R²⁶ (90%), De silva²⁷ et al (86%) and Patil S²⁸ et al (86.6%). This observation of the present study is much higher than the observations from Daseler¹⁷ et al (69.8%) and Tejaswi H L²⁹ et al (65%).

In the present study where cystic artery was lying outside the calot's triangle, the cystic arteries were taking origin from GDA and HAP (CA was arising close to the origin of HAP from CHA).

When cystic artery arises from the GDA (low lying cystic artery), it courses upwards and laterally and lies below the cystic duct to reach the GB. Caution should be taken during dissection of lower border of calot's triangle to avoid injury to this low-lying cystic artery. Perforations of the duodenal ulcer on the posterior wall may involve the low-lying cystic artery.

Summary and Conclusion

A study of extrahepatic part of hepatobiliary vasculature was carried out in the department of Anatomy, Medical College, Kolkata in collaboration with Dept of Forensic Medicine, NRS Medical College,

Kolkata. Fifty cadavers of both sexes (observing proper inclusion & exclusion criteria) were subjected to detail dissection method and the relationship of cystic artery with CBD and CHD were examined and also it was examined that whether the cystic artery lied within the Calot's triangle. The findings so obtained were compared to similar such studies done in the past.

The cystic artery was lying posterior to CHD or CBD in 90% cases where as it was placed anteriorly in 10% of specimens. The cystic artery was lying anterior to CHD in 6% cases whereas and anterior to the CBD in 4% cases. In these 4 % cases CA was also inferior in position with respect to the cystic duct.

In 96% of specimens the cystic artery was lying inside the calot's triangle whereas the 4% cases showed presence of cystic arteries outside the calot's triangle.

To facilitate the safe operative procedures on the liver and gall bladder, there is a need of exact and comprehensive knowledge of the varied patterns of hepatic and cystic arteries. Because variations are very common in hepatic and Cystic arteries, sound knowledge will allow the surgeons to practice safe laparoscopic or open Cholecystectomy, liver resections and vascular recombination in transplantation and there by avoid errors and patient morbidity. A good knowledge of Calot's triangle is important for conventional and laparoscopic Cholecystectomy.

Ethical Clearance: Taken from Institutional Ethics Committee

Source of Funding: Self

Conflict of Interest: Nil

Abbreviations:

AB RHA- Aberrant Right Hepatic Artery

AB LHA- Aberrant Left Hepatic Artery

CA-Cystic Artery

CHA- Common Hepatic Artery

CHD- Common Hepatic Duct

CBD- Common Bile Duct

CT- Coeliac Trunk

GB- Gall Bladder

GDA- Gastro Duodenal Artery

HAP- Hepatic Artery Proper (also referred as PHA)

LC- Laparoscopic Cholecystectomy

LDLT- Living Donor Liver Transplantation

LHA- Left Hepatic Artery

MHA- Middle Hepatic Artery

PHA- Proper Hepatic Artery

RHA- Right Hepatic Artery

SMA- Superior Mesenteric Artery

TAE- Trans Arterial Embolization

TACE- Trans Arterial Chemo Embolization

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