

# LAPAROSCOPIC DESCRIPTIONS OF COURSE, RELATION AND VARIATIONS OF CYSTIC ARTERY IN HEPATOBILIARY TRIANGLE<sup>3</sup>

MIAN AZHAR AHMAD<sup>1</sup>, NAWAB MOHAMMAD KHAN,<sup>2</sup> FAUZIA FARZANA<sup>3</sup>,  
MIAN MAZHAR AHMAD,<sup>4</sup> ASMATULLAH<sup>5</sup>

*1Assistant Professor of Anatomy, Department of Anatomy, Postgraduate Medical Institute / Ameer-ud-Din Medical College, Lahore. 2Professor of Anatomy, (Ph.D Anatomy), HEC Approved, Department of Anatomy, King Edward Medical University, 3Professor of Anatomy, Department of Anatomy, Postgraduate Medical Institute / Ameer-ud-Din Medical College, Lahore. 4Chief Laparoscopic Surgeon, DHQ Hospital, Sahiwal. 5University of the Punjab, Lahore. Correspondence: Dr. Mian Azhar Ahmad, drazharahmad@hotmail.com*

## ABSTRACT

**Objective:** To know in detail the level of origin, course and relation of the cystic artery and to assess frequency of the anatomical variations of cystic artery in hepatobiliary triangle observed during laparoscopic exposure for the guidance of laparoscopic surgeons.

**Study Design:** It was a descriptive cross-sectional study in 600 patients.

**Place and Duration of Study:** This research work was undertaken in five teaching hospitals with adequate facilities and skillfull surgical team, from 8<sup>th</sup> Jan 2011-15<sup>th</sup> Jan 2014.

**Methadology:** Surgical management of Six hundred patients with laparoscopic cholecystectomy was done from 8<sup>th</sup> April 2012 to 9<sup>th</sup> April 2014 prospectively. The Stryker, American laparoscope of 30° was employed in this study. We selected patients on the basis of non-probabilty convenient sampling technique. The DVD recorder was used to display course and relations of cystic artery and its variations on endoscopic visualization. using Medical grade video monitor was practiced to display and document anatomical variations. Photographs of each observed anatomical variation was taken.

**Results:** Our experience with 600 laparoscopic cholecystectomies has revealed that anatomic variations of the cystic artery occur frequently. Overall results demonstrated 24% variations in the origin, course, relation of cystic artery in hepatobiliary triangle. In 76% of patients we demonstrated usual anatomy of cystic artery.

**Conclusion:** Laparoscopic surgeons must know origin, course, relation of cystic artery and its variations to avoid vascular injuries, which can cause serious hemorrhage during laparoscopic cholecystectomy and to prevent postoperative complications. These injuries can result into significant morbidity and even mortality.

**Keywords:** Cystic artery, Variations, Laparoscopic Cholecystectomy, Calot's triangle.

## INTRODUCTION

Videoscopic technology and advanced surgical techniques have imparted new look to laparoscopic cholecystectomy during last three decades. The morphology of cystic artery appears different in laparoscopic exposures as compared to open cholecystectomy. Cystic artery is principal vessel to supply gallbladder and the cystic duct. Right hepatic artery gives in the area between the common hepatic duct and cystic duct and then courses behind the common hepatic and cystic duct, in the Calot's triangle.<sup>6</sup> It approaches the gallbladder by channeling behind the bile duct or the common hepatic duct. On the surface of the neck of the gallbladder, it gives rise to superficial and deep branches. Hepatic artery proper, left hepatic

artery, right gastric artery, superior pancreaticoduodenal artery, or even superior mesenteric artery may also give rise to cystic artery. It frequently shows variations in its course in the Calot's triangle. Exact information regarding the cystic artery and its variations ensures safe laparoscopic cholecystectomy. The deficient knowledge about gall bladder vasculature particularly variations of cystic artery can be dangerous and uncontrolled bleeding can occur during cholecystectomy.<sup>2,3,5</sup> Cystic artery bleeding is a dangerous issue during laparoscopic cholecystectomy, and can force surgeons to convert to open surgery. Hence it is important for the biliary and minimally invasive surgeons to appreciate the basic anatomical facts and to have a sound information regarding variations of the gallbladder vasculature in

order to minimize the chances of intraoperative and postoperative complications.

## MATERIAL AND METHOD

Between 8<sup>th</sup> Jan 2011–15<sup>th</sup> Jan 2014, we prospectively evaluated 600 non-emergency patients including 385 women. Laparoscopic cholecystectomy was selected surgical procedure for study. Ultrasound all of the patients was done before surgery. Four ports technique was employed in Laparoscopic cholecystectomy under general anesthesia. Three-dimensional video monitor was used to display anatomical structures.

We assessed anatomic variations of the cystic artery under classified into three groups: (1) Calot's triangle type, Single artery in found in hepatobiliary triangle. (2) Double cystic artery in hepatobiliary triangle. (3) Outside Calot's triangle. (4) Compound type of Artery one outside and other within the Calot's triangle. Statistical analysis was done with level of significance 5% (acceptable error 5%), probability of type I error (alpha)-error of rejecting the tested hypothesis when in fact it is true margin of error 5% and frequency of 22.3 %. Confidence interval or confidence level = 100-level of significance

## RESULTS

We found single cystic artery emerging from the right hepatic artery coursing posterior to the cystic duct, within Calot's triangle, and in hepatoduodenal ligament to divide into the anterior and posterior branches. We observed this type in 76% cases. Double cystic artery is congenital absence of deep branch of cystic artery. During our experience with laparoscopic cholecystectomy we demonstrated double cystic artery in 12.98% patients. A double cystic artery has previously been recorded in 15 – 25% of patients.

Cystic artery was found outside Calot's triangle, and could not be observed within the triangle by laparoscopy during dissection. We found in this type in 9% patients as compared to 13% stated in literature. Compound type of Artery one outside and other within the Calot's triangle compound type, observed in 2.2% which is comparable to work done by past researchers.

## DISCUSSION

Not many reports are available about laparoscopic descriptions of the course, relations and variations of cystic artery in Pakistan. Vascular supply to gallbladder have been focus point of laparoscopic surgeon since the introduction of laparoscopic surgery. Preoperatively the possible anatomic position and variations of the cystic artery are difficult to establish. We can only pick them up intraoperatively when we remove gallbladder.

Smooth laparoscopic procedure is main objective of every laparoscopist and they always desire to avoid conversion to open cholecystectomy. Standard knowledge about the variations of cystic artery strongly recommended for the surgeons to errors that subsequently, lead to a hemorrhage.

Based on our experience with Laparoscopic cholecystectomies, we found single cystic artery in hepatobiliary triangle and we label it as Calot's triangle type. That cystic artery originated from the right hepatic artery within Calot's triangle posterior to the cystic duct, and in hepatoduodenal ligament, under laparoscopic observation. This is the most common type and has been reported in about 80 – 96% of cases in previous studies. We observed this finding in 76% cases. The cystic artery does originate from the right hepatic artery, while it divides into the anterior and posterior branches at their cystic artery origin. As we know that congenital absence of the deep branch of cystic artery is labeled as double cystic artery. During our experience with laparoscopic cholecystectomy we demonstrated double cystic artery in hepatobiliary triangle in 12.98% patients while previous studies by Balijs and Ignjatovic, double cystic artery was recorded in 15 – 25% of patients. Cystic artery may also be located outside Calot's triangle, and this artery cannot be observed within the triangle by laparoscopy during dissection. We found this cystic artery in 9% patients as compared to 13% stated in literature. The position of the cystic artery appears differently during laparoscopic and conventional cholecystectomy. The main areas of research in laparoscopic cholecystectomy is compound type of Artery one outside and other within the Calot's triangle compound type, observed in 2.2% which is consistent with earlier work. The results of our research work can help surgeons understand the cystic artery more thoroughly, and may be more practical to use in real operations. Variations in the cystic artery are miscellaneous, and we must be cautious during the performance of laparoscopic cholecystectomy. Theme of our laparoscopic findings will be very useful for dissection of Calot's triangle to reduce uncontrollable cystic artery hemorrhage.

## CONCLUSION

Anatomic variations of the cystic artery are frequent and can differ in origin, position and number. Our results will be useful for help reduce incidences of intraoperative bleeding during laparoscopic cholecystectomy. These injuries can result into significant morbidity and to prevent major postoperative complications.

**REFERENCES**

1. Abdomen. In: Moore KL, Dalley AF, Agur AMR, eds. Clinically oriented anatomy. 6th ed. Philadelphia, PA: Lippincott William and Wilkins; 1999: 279.
2. Borley NR. Gall bladder and biliary tree. In: Standring S, Ellis H, Healy JC, Johnson D, Williams A, Collins P, et al. Gray's Anatomy, The anatomical basis of clinical practice. 40th ed. New York: Elsevier Churchill Livingstone; 2005: 1178-1180.
3. Nagral S. Anatomy relevant to cholecystectomy. J Min Access Surg 2005; 1 (2): 53-8.
4. Romanes GJ. Cunningham's Manual of practical anatomy. 15th ed. Thorax and Abdomen. New York: Oxford University Press; 2007; 2: 125.
5. Flisinski P, Szpinda M, Flisinski M. The cystic artery in human fetuses. Folia Morphol 2004; 63 (1): 47-50.
6. Flint ER. Abnormalities of the right hepatic, cystic and gastroduodenal arteries and of the bile ducts. Br J Surg 1923; 10: 509-19.
7. Daseler EH, Anson BJ, Hambley WC, Reimann AF. The cystic artery and constituents of the hepatic pedicle. Surg Gynecol Obst 1947; 85: 47-63.
8. Michels NA. Blood supply and anatomy of the upper abdominal organs. 1st ed. London: Pitman; 1956: pp. 32-73.
9. DeSilva M, Fernando D. Anatomy of the Calot's triangle and its relevance to laparoscopic cholecystectomy. Ceylon Med J 2001; 46 (1): 33-4.
10. Khalil M, Sultana ZR, Rahman HR, Sultana SZ, Mannan S, Rahman MM, et al. Origin and position of cystic artery in Bangladeshi corpse. J Bangladesh Soc Physiol 2008 Dec; 3: 66-70.
11. Pushpalatha K, Shamsundar NM. Variation in the origin of cystic artery. J Anat Soc India 2010; 59 (1): 35-7.
12. Michels NA. Variational anatomy of the hepatic, cystic and retroduodenal arteries. A statistical analysis of their origin, distribution and relations to the biliary ducts in two hundred bodies. Arch Surg 1953; 66: 20-34.
13. Futara G, Ali A, Kinfu Y. Variations of the hepatic and cystic arteries among Ethiopians. E