

**Case Report****A RARE CASE OF CYSTIC ARTERY ARISING FROM GASTRODUODENAL ARTERY****D Mahajan, G Agnihotri**

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**SUMMARY**

An uncommon anatomical variation in the origin and course of cystic artery was found during human cadaveric dissection in our laboratory. A blood vessel was seen arising from the gastroduodenal artery about 1 cm distal to its origin from the common hepatic artery. The vessel when traced towards its termination was found to be cystic artery and was supplying the peritoneal surface of the gall bladder. The visceral surface of the gall bladder was receiving its blood supply by fine twigs from the right hepatic artery. The tortuous cystic artery arose outside hepatobiliary triangle, crossed the common bile duct anteriorly and was lying anterior to the cystic duct hiding it from view. On reaching the neck of gall bladder, it again travelled for short distance before its termination. The non-peritonealised surface of the gall bladder was receiving its blood supply by fine twigs from the right hepatic artery in the gall bladder fossa. The knowledge of this rare variant will aid surgeons to avoid accidental haemorrhage during surgery in and around the hepatobiliary triangle.

**Keywords:** Cystic artery, Gastroduodenal artery

**INTRODUCTION**

Variations in the origin and course of the cystic artery are common and are important in surgical procedures in the perihepatic region (Gammon and Jacob, 1976; Komatsu et al., 1999). In most of the cases, the cystic artery arises from the right hepatic artery (Baliya et al., 1999; Futara et al., 2001). Other origins include the left hepatic artery, the proper hepatic artery, the common hepatic artery, the gastroduodenal artery, the superior pancreaticoduodenal artery and the superior mesenteric artery (Price and Holden, 1993; Harris and Pellegrini, 1994).

In addition to the variability in origin of the cystic artery, its course can also follow diverse paths, often in close proximity to the common bile duct (Price and Holden, 1993). In its usual course, the cystic artery is found within the hepatocystic triangle of Calot (Saidi et al., 2007; Torres et al., 2009). We, present a rare case of cystic artery arising from the gastroduodenal artery, runs outside the hepatocystic triangle. The cystic artery in its further course ascended to the neck of gall bladder anterior to the cystic duct almost hiding the cystic duct from view.

**MATERIAL & METHODS**

Sixty adult human cadavers were dissected over a span of 5 years from HSJ institute of Dental Sciences, Chandigarh, India and Govt. Medical Colleges of Punjab, India. The

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dissection included proper exposure of area by cutting right costal arch upto the fifth intercostal space. The lesser omentum attached to lesser curvature of stomach was cut taking care not to include the hepatoduodenal ligament. The stomach bed was exposed by removing the stomach, cutting at the cardiac and pyloric end. Fine dissection of hepatoduodenal ligament and hepatobiliary regions was done. From amongst the 60 dissected adult cadavers we encountered the present unique and rare variation of cystic artery arising from the gastroduodenal artery, outside the hepatobiliary triangle. The origin and course of this cystic artery was traced, the findings noted and photographed in situ (Fig 1).

## RESULTS

The common hepatic artery arose from the celiac trunk, traversed horizontally towards the right for a short distance and before entering the hepatoduodenal ligament, the gastroduodenal artery branched from it in front of the portal vein. A blood vessel was seen arising from the gastroduodenal artery about 1 cm distal to its origin from the common hepatic artery. The vessel when traced towards its termination was found to be cystic artery and was supplying the peritoneal surface of the gall bladder while the visceral surface of the gall bladder was receiving its blood supply by fine twigs from the right hepatic artery in the gall bladder fossa. The tortuous cystic artery arose outside hepatobiliary triangle, crossed the common bile duct anteriorly and was lying anterior to the cystic duct hiding it from view. On reaching the neck of gall bladder, it again travelled for short distance before its termination.

## DISCUSSION

The knowledge of possible variations in the anatomy of the cystic artery and the use of safe method of dissection that enables arteries to be visualized before they are divided are important tools in laparoscopic cholecystectomy. The present variation is unique and rare as its incidence ranges from 0.5%-2%. This variation has an embryological basis as explained below and knowledge of its aberrant course enables careful delineation prior to ligation of either the cystic artery or duct.

The cystic artery originates from the following sources: right hepatic ( $63 \pm 9\%$ ), hepatic trunk ( $26 \pm 9\%$ ), left hepatic ( $5 \pm 5\%$ ), gastroduodenal ( $2 \pm 6\%$ ), superior pancreaticoduodenal ( $0 \pm 3\%$ ), right gastric ( $0 \pm 1\%$ ), celiac trunk ( $0 \pm 3\%$ ) and superior mesenteric ( $0 \pm 8\%$ ) artery (Anson, 1963). A little difference in origin was noted by Harris & Pellegrini, 1994 where the right hepatic artery was the main contributor (75%). The other contributors were the left hepatic artery ( $6 \pm 2\%$ ), hepatic artery proper ( $2 \pm 2\%$ ), common hepatic artery ( $0 \pm 6\%$ ), superior pancreaticoduodenal artery ( $0 \pm 2\%$ ) and the superior mesenteric artery as reported by Anson, (1963). The incidence of origin of cystic artery from gastroduodenal artery as reported by Flint, (1923) was 0.5%. Sarkar & Roy, (2000) found a cystic artery arising from gastroduodenal artery in one out of 96 cases (1.04%). The incidence in present study was one out of 60 cases (1.67%). The variations in origin and course of cystic artery are less perplexing if one recalls the embryonic development of the liver and biliary duct system. The early embryonic hepatic diverticulum destined to form gall bladder, cystic duct, common hepatic duct

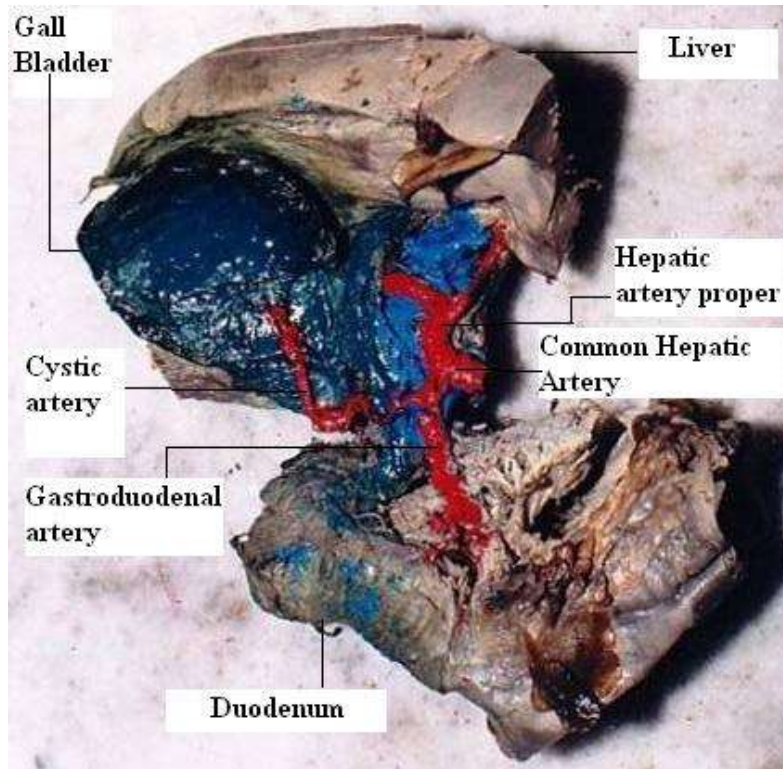


Figure 1: Inferior Cystic artery arising from gastroduodenal artery, outside the hepatobiliary triangle (one variation amongst the 60 dissected adult cadavers).

and sub hepatic ducts migrates cephaloid from the duodenum towards the developing liver mass accompanied by a dense meshwork of intercommunicating blood vessels arising from the aortic, celiac and superior mesenteric arteries (Moosman, 1975). These are branches of ventral splanchnic arteries arising from dorsal aorta and are distributed to the capillary plexus in the wall of yolk sac, but after fusion of dorsal aortae they merge as unpaired trunks distributed to the increasingly defined and lengthening primitive digestive tube (Collins, 2008). Subsequently, all but few of these multiple channels are absorbed to form the postnatal vascular pattern. The inexplicable retention of some of the less common communication results in variations of origin and course of the cystic and hepatic arteries (Nowak, 1977).

In the case reported, cystic artery arose from gastroduodenal artery, close to its origin (outside hepatobiliary triangle) crossed the

common bile duct anteriorly towards the right. The cystic artery in its further course ascended to the neck of gall bladder anterior to the cystic duct almost hiding the cystic duct from view. Scott et al. (1992) while discussing the laparoscopic anatomy of cystic artery have mentioned about such an artery arising from either the superior mesenteric artery or gastroduodenal artery. They have classified it as low-lying cystic artery. In such circumstances, it is the first structure encountered when the gall bladder pedicle is dissected. This has been termed "transposition of cystic duct and cystic artery". The artery lies closer to the laparoscope than to the cystic duct and may appear in the position normally occupied by the cystic duct. In addition, Hugh and Kelly, (1992) have discussed about the inferior cystic artery. The cystic artery was the first structure encountered in the dissection of the inferior border of the hepatobiliary triangle. It is usually necessary to divide such an artery

in order to visualize the cystic duct adequately. Careful dissection will demonstrate that the cystic duct terminates by blending imperceptibly with the gall bladder, but that the cystic artery runs on the surface of the gall bladder. The careful delineation of all structures with direct visualization of both cystic artery and cystic duct prior to ligation of either is important.

It can be concluded that the awareness of incidence of the present unique and rare anomaly is vital for careful dissection and

identification of structures prior to ligation of cystic duct and cystic artery. Even after ligation of cystic duct and cystic artery, dissection of gall bladder fossa must be done with care to avoid injury to a variant redundant right hepatic artery or any deep branch of cystic artery arising from it as in the present case. 'Our eyes only see what our mind knows' and a comprehension of the rare variation will definitely aid surgeons to avoid accidental haemorrhage during surgery in and around the hepatobiliary triangle.

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