



# STUDY OF ABERRANT LEFT HEPATIC ARTERY FROM LEFT GASTRIC ARTERY AND ITS CLINICAL IMPORTANCE

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## ABSTRACT

**Objectives:** Variations of the hepatobiliary region are frequent and are of concern to the radiologists and gastroenterological surgeons. The variations reported in the literature are of several kinds such as accessory hepatic arteries, replaced hepatic arteries and additional branches. The present study describes the incidence of origin of aberrant left hepatic artery from left gastric artery and its clinical importance.

**Methods:** 50 adult embalmed human cadavers of both the sexes were studied by dissection method at the Department of Anatomy, MVJ Medical College and other medical colleges in and around Bangalore.

**Results:** In 4(8%) specimens, the aberrant left hepatic artery had its origin from left gastric artery. Out of the 4 specimens, the aberrant left hepatic branch was accessory in 3(6%) specimens and replaced in 1(2%) specimens.

**Conclusion:** The knowledge about variations in the anatomy of subhepatic region is of immense significance to hepatobiliary surgeons since bleeding from aberrant vessels may increase the risk of intra-operative complications.

**Key Words:** Accessory left hepatic artery, Hepatobiliary surgery, Left gastric artery, Replaced left hepatic artery

## INTRODUCTION

The common hepatic artery, a branch from coeliac trunk divides into right and left branches to the hepatic lobes. Variations of hepatic arteries are common and surgically important. <sup>1</sup> Aberrant hepatic artery is of two types, replacing and accessory. An aberrant replacing hepatic artery is a substitute for the normal (usual) hepatic artery which is absent. An aberrant (a variable) accessory hepatic appears in addition to one that is normally (usually) present. <sup>2</sup> The most common aberrant hepatic arterial variations are right hepatic artery originating from the superior mesenteric artery (10–12% of individuals) and left hepatic artery or accessory left hepatic artery originating from the left gastric artery (25% of individuals). <sup>3</sup> Michaels <sup>4</sup> in his dissection of 200 cadavers has reported the incidence of accessory left hepatic artery from left gastric artery in 8% and replaced left hepatic artery from left gastric artery in 10% specimens. An aberrant left hepatic artery arising from left gastric artery either as an accessory or replacing the left hepatic artery is occasionally seen in patients with gastric cancer. Resection of this aberrant vessel which feeds a wide area of the

liver, as a part of gastrectomy procedure may cause post-operative liver dysfunction.<sup>5</sup> Present study is undertaken to know the incidence of origin of aberrant left hepatic artery from left gastric artery and its clinical importance.

## MATERIALS AND METHODS

Fifty adult embalmed human cadavers from south Indian population were studied irrespective of their sex. The specimens were obtained from the Department of Anatomy, MVJ Medical College and other medical colleges in and around Bangalore. The gross dissection was done following the guidelines of Cunningham's manual. The peritoneal cavity was opened and the anterior layer of peritoneum from the lesser omentum close to the lesser curvature of stomach was removed. The Coeliac trunk and its branches namely, left gastric, common hepatic and splenic arteries were identified and cleaned. The dense autonomic plexus from its branches was removed. The left gastric artery was traced till it curves posteriorly around the superior surface of omental bursa. The common and proper hepatic artery and its branches to the

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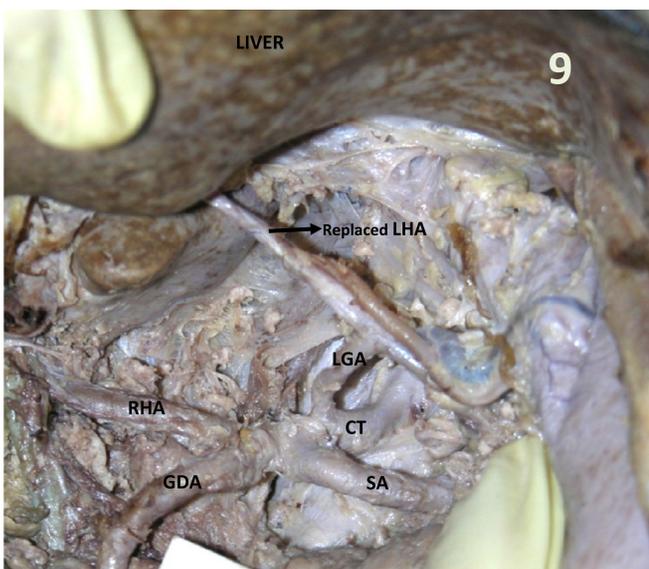
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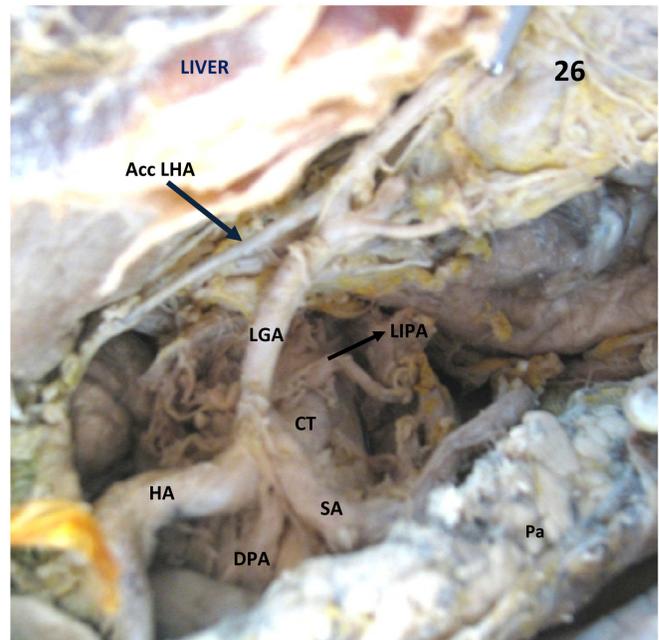
porta hepatis were exposed and cleaned. The aberrant left hepatic artery from left gastric artery if present was identified and cleaned. The data obtained was analyzed and compared with that of previous studies.

## RESULTS

Out of the 50 specimens studied, the aberrant left hepatic artery arising from left gastric artery was seen in 4 (8%) specimens. The remaining 46 (92%) specimens did not show the presence of aberrant left hepatic artery. It was observed that out of the 4 specimens, the aberrant left hepatic artery was accessory in 3(6%) and replacing in 1(2%) specimen. The aberrant left hepatic artery was originating from the proximal one third of left gastric artery in 3(6%) specimens and from the middle one third in 1(2%) specimen. In all the specimens, an aberrant branch arose from the left gastric artery and entered the visceral surface of the left lobe of the liver at a site independent from the porta hepatis. In specimen no.9 (Fig 1), the Coeliac trunk branched into four arteries; Gastroduodenal, Left gastric, Right hepatic and Splenic arteries. The replaced left hepatic artery was arising from left gastric artery and entered the left lobe of the liver. In specimen no. 26 (Fig 2), the coeliac trunk divided into Common Hepatic, Splenic, Left gastric, Dorsal pancreatic and Left inferior phrenic arteries. An accessory left hepatic artery was seen arising from the left gastric artery. This artery passed from below upwards in the cranial part of the lesser omentum and entered the left lobe of liver through the fissure for ligamentum venosum. The rest of the course of left gastric artery was normal in all the specimens.



**Figure 1:** Replaced Left Hepatic Artery arising from Left Gastric Artery



**Figure 2:** Accessory Left Hepatic Artery arising from Left Gastric Artery

### Legends for photos

Acc LHA – Accessory Left Hepatic Artery  
 CT- Coeliac Trunk  
 CHA- Common Hepatic Artery  
 DPA- Dorsal Pancreatic Artery  
 GDA- Gastroduodenal Artery  
 LIPA- Left Inferior Phrenic Artery  
 LGA- Left Gastric Artery  
 Pa- Pancreas  
 Replaced LHA – Replaced Left Hepatic Artery  
 SA- Splenic Artery

## DISCUSSION

The incidence of aberrant left hepatic artery from left gastric artery varies from 6.1-21% in various studies<sup>6-13</sup> and is summarized in Table 1. The highest incidence of aberrant left hepatic artery from left gastric artery was reported by Urugel<sup>11</sup> (21%) and the lowest by Iezzi<sup>10</sup>(6.1%). In the present study, its incidence is 8% which is within the range.

The embryological basis for the origin of aberrant left hepatic artery from left gastric artery is as follows:

The primitive liver is supplied by 3 embryonic hepatic arteries namely, Left hepatic, Right hepatic and Common hepatic arteries. The Left and Right hepatic arteries undergo regression. If they persist, they lead to the development of aberrant hepatic arteries.

Kulesza<sup>14</sup> has explained that there should be presence of sufficient quantities of signalling molecules and growth factors produced by the developing and migrating

**Table 1: Showing the Incidence of Origin of Aberrant Left Hepatic Artery from Left Gastric Artery**

Author	Number of specimens	Aberrant Left Hepatic artery	Replaced Left Hepatic Artery	Accessory Left Hepatic Artery
Covey (2002)	600	15.2%	4.5%	10.7%
Rawat (2006)	125	12.8%	4%	8.8%
Winston (2007)	371	12%	8%	4%
Chitra (2010)	50	14%	10%	4%
Iezzi(2008)	524	6.1%	5.9%	0.2%
Urugel(2009)	100	21%	11%	10%
Andujar (2007)	1081	13.6%	9.7%	3.9%
Sehgal (2013)	50	8.17%	4.17%	4%
Present study(2014)	50	8%	2%	6%

mammalian cells for the normal development of any viscera. In the event of an improper signalling and incorrect gradient, there may occur visceral anomalies. When an artery does not originate from an orthodox position, being the only supply to a particular lobe, it is called a replaced artery.

The left hepatic artery arising from left gastric artery may be injured as it lies in the upper portion of the lesser omentum during mobilization of stomach in gastrectomy and hiatal hernia repair. So these aberrant vessels must be recognized, since even in gastrectomy because of gastric cancer it was shown that leaving the aberrant hepatic artery and the proximal left gastric artery has the same oncologic effect as complete ligation of the left gastric artery. Accessory left hepatic artery provides a source of collateral arterial circulation in cases of occlusion of the vessels in the porta hepatis.<sup>1,5</sup>

It is important that interventional radiologists who perform hepatic arterial embolisation be familiar with both common and rare hepatic arterial variants, because failure to recognize the presence of an aberrant vessel can result in incomplete embolisation of liver tumours. Familiarity with these variants can also help one avoid various surgical complications.

The replaced left hepatic artery originating from left gastric artery must be identified and ligated before left hepatectomy is performed, because the major arterial branch to the left liver does not need to be found in the porta hepatis.

The accessory hepatic artery provides an additional source of arterial blood to the left hepatic lobe and may be sacrificed without compromising the arterial supply to the left hepatic lobe. An accessory left hepatic artery needs to be occluded separately when controlling the in-

flow to the left hepatic lobe because this artery will not be occluded when the blood supply in the porta hepatis is occluded. Distinction between an accessory and a replaced artery is therefore important. Recognition of a replaced or an accessory artery is important so that the vessel can be ligated at the time of catheter placement to allow uniform perfusion of the hepatic parenchyma.<sup>6,8,10</sup>

Accidental ligation of aberrant hepatic arteries may lead to liver necrosis and death. The role of the accessory arteries and the segments of the liver supplied should be considered during planning for liver surgery since these vessels are end arteries in most cases and injury would compromise liver supply, resulting in necrosis of the entire left hemiliver or some segments, commonly two and three.

An aberrant hepatic artery may cause a potential error in the angiographic diagnosis of traumatic liver haematoma. So the aberrant hepatic vascularisation should be assessed preoperatively by invasive and non-invasive techniques to avoid fatal complications.<sup>13,15,16</sup>

## CONCLUSION

Aberrant left hepatic artery arising from left gastric artery is a common anomaly found in 8% of specimens. The knowledge of existence of aberrant hepatic arteries, either accessory or replacing, is important during hepatobiliary surgeries as they present potential bleeding risks and complicates the procedure. They also have importance in partial hepatectomy, gastric resection, operations performed near the gastro hepatic ligament, including esophagogastrectomy, gastric bypass, and antireflux procedures. Knowledge of variant hepatic arteries is of greatest importance in liver transplantation.

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## REFERENCES

- Williams PL., Bannister L.H., Berry M.M., Collins P, Dyson M., Dussek. J.E. et. al. Gray's anatomy 38<sup>th</sup> ed. Churchill Livingstone, 2000, 1548-1552.
- Bergman RA, Afifi AK, Miyauchi R., Hepatic Artery. Illustrated encyclopedia of human anatomic variation: opus II: Cardiovascular System: Arteries: Abdomen: Variations in Branches of Coeliac Trunk.
- Hazirolan T, Metin Y, Karaosmanoglu AD, Canyigit M, Turkbey B, Oguz BS et al. Mesenteric arterial variations detected at MDCT angiography of abdominal aorta. American Journal of Roentgenology. 2009; 192:1097-1102.
- Michels NA. Blood supply and anatomy of the upper abdominal organs with a descriptive atlas. Philadelphia and Montreal, B. Lippincott Company. 1955; 139-143.
- Okano S, Sawai K, Taniguchi H, Takahashi T. Aberrant Left Hepatic Artery arising from the Left Gastric Artery and liver function after radical gastrectomy for Gastric cancer. World Journal of Surgery. 1993; 17: 70-74.
- Covey AM, Brody LA, Maluccio MA, Getrajdman GI, Brown KT. Variant hepatic artery anatomy revisited: digital subtraction angiography performed in 600 patients. Radiology. 2002; 224:542-547.
- Rawat KS. CTA in evaluation of vascular anatomy and prevalence of vascular variants in upper abdomen in cancer patients. Ind J Radiol Imag. 2006; 16:4:457-461.
- Winston CB, Lee NA, Jarnagin WR, Teitcher J, Dematteo RP, Fong Y et al. CT Angiography for Delineation of Coeliac and Superior Mesenteric Artery Variants in Patients Undergoing Hepatobiliary and Pancreatic Surgery. American Journal of Roentgenology. 2007; 189: W13-W19.
- Chitra R. Clinically relevant variations of the coeliac trunk. Singapore Med J. 2010; 51(3): 216-219.
- Iezzi R, Cotroneo AR, Giancristofaro D, Santoro M, Storto ML. "Multidetector-row Computed Tomography angiographic imaging of the Coeliac trunk :anatomy and normal variants. Surg Radiol Anatomy. 2008; 30(4):303-310.
- Urugel MS, Battal B, Bozlar U, Nural MS, Tasar M,ORS F et al. Anatomical variations of hepatic arterial system, coeliac trunk and renal arteries: an analysis with Multidetector CT Angiography. The British Journal of radiology. 2010; 83: 661-667.
- Andujar RL, Moya A, Montalva E, Berenguer M et al. Lessons Learned From Anatomic Variants of the Hepatic Artery in 1,081 Transplanted Livers. Liver Transplantation: 2007; 13:1401-1404.
- Sehgal G, Srivastava AK, Sharma PK, Kumar N, Singh R. Variations of extrahepatic segments of hepatic arteries: A Multislice Computed Angiography Study. International Journal of Scientific and Research Publications: 2013; 3(2): 1-8
- Kulesza RJ Jr, Kalmey JK, Dudas B, Buck WR. Vascular anomalies in a case of situs inversus. Folia Morphol. 2007;60:69-73
- Saeed M, Rufal AA. Duplication of hepatic artery. Saudi J Gastroenterology: 2001; 7(3):103-108
- Hollinshed WH. Anatomy for surgeons. The thorax, abdomen and pelvis. 1<sup>st</sup> edition. New York: Hoeber-Haper, 1956, 344-358.