CASE REPORT

Aberrant Hepatic Artery Arising from the Left Gastric Artery: A Cadaveric Case Report

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Abstract

Anatomical variations of the hepatic artery are of considerable clinical importance due to their implications in hepatobiliary surgery, liver transplantation, and interventional radiology. Rare arterial variations, if unrecognized, may significantly increase the risk of iatrogenic vascular injury and procedure-related complications. This study aims to describe a rare hepatic arterial variation identified during cadaveric dissection and highlight its clinical and surgical relevance.
A routine cadaveric dissection was carried out at the Faculty of Medicine, University of Kelaniya. During abdominal dissection of a 65-year-old male cadaver, the branching pattern of the celiac trunk and hepatic arterial system was carefully examined, documented, and analysed.
The celiac trunk trifurcated into the left gastric artery, splenic artery, and gastroduodenal artery, with a complete absence of the common hepatic artery. The hepatic artery originates from the left gastric artery and subsequently divides into the right and left hepatic arteries. The cystic artery arose from the right hepatic artery. This arterial configuration represents a rare variation differing from the classical hepatic arterial anatomy. Knowledge of rare hepatic arterial variations is essential for surgeons and interventional radiologists to minimize the risk of vascular injury during hepatobiliary, pancreatic, and transplant procedures. Preoperative awareness and careful intraoperative assessment of such variations can significantly reduce iatrogenic complications.

Key words: Aberrant hepatic artery; Left gastric artery; Cadaveric study; Anatomical variation

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Introduction

With advances in surgical techniques, surgical procedures like liver transplantations have become increasingly common. Anatomical variations in the hepatobiliary arterial system can significantly influence the outcome of these surgical procedures. The liver and gallbladder are organs supplied by the celiac trunk, a branch of the abdominal aorta. It emerges immediately after the aortic hiatus at the level of the T12 vertebra. Classically, the celiac trunk gives off the left gastric artery, which courses along the lesser curvature of the stomach, the splenic artery, which runs to the spleen through the spleno-renal ligament, and the common hepatic artery. After originating from the Celiac trunk, the common hepatic artery courses along the superior border of the pancreas and travels through the foramen of Winslow. Then it bifurcates, forming a characteristic "Y shape", giving rise to the proper hepatic artery and the gastroduodenal artery (1). The proper hepatic artery gives off the right gastric branch close to its origin and terminates by dividing into right and left hepatic arteries, which supply the liver and gall bladder (2,3). In the classical hepatic arterial anatomy, the liver receives dual blood supply from two main vessels: the portal vein, carrying nutrient-rich blood from the gastrointestinal tract, and the hepatic artery, which carries oxygenated blood.

Anatomical variations of the celiac trunk and hepatic artery are well documented in the literature. The classical trifurcation is reported in approximately 89% of cases, while bifurcation is observed in about 11%. Complete absence of this trunk is reported in approximately 0.2% of individuals. Common variations of the hepatic artery are the presence of replaced left hepatic artery or accessory left hepatic artery arising from left gastric artery in 20-25% of the population; presence of replaced right hepatic artery or accessory right hepatic artery arising from superior mesenteric artery in 10-15% of the population; presence of replaced hepatic artery arising from superior mesenteric artery or aorta in 4% of population (2). A thorough knowledge of these variations is essential for planning interventional radiological procedures and therapeutic embolization, and is vital in open and laparoscopic hepatobiliary surgeries, including cholecystectomy and whole and split liver transplantation. This case report aims to highlight this rare arterial variation and alert clinicians to its presence, which could result in fatality during procedures.

Case presentation

This vascular variation was identified in a 65-year-old male cadaver weighing 73 kg during a routine anatomical dissection conducted to demonstrate the celiac trunk and its branches at the Department of Anatomy, Faculty of Medicine, University of Kelaniya. Gross dissection was carried out according to the standard dissection guidelines using standard dissecting tools. The celiac trunk was observed to be trifurcated into the large left gastric artery, the splenic artery and the large gastroduodenal artery. The common hepatic artery was absent. The large left gastric artery gave rise to the proper hepatic artery, which, in turn, divided into the right and left hepatic arteries. The right hepatic artery was seen to give a cystic artery to the gallbladder. This hepatic artery was the sole arterial supply to the liver (Figure 1).

Discussion

In classical anatomy, the celiac trunk gives off the left gastric artery, the splenic artery and the common hepatic artery. After originating from the celiac trunk, the common hepatic artery bifurcates into the hepatic artery proper and the gastroduodenal artery. The proper hepatic artery subsequently bifurcates into left and

right hepatic arteries supplying the liver (Figure 2).

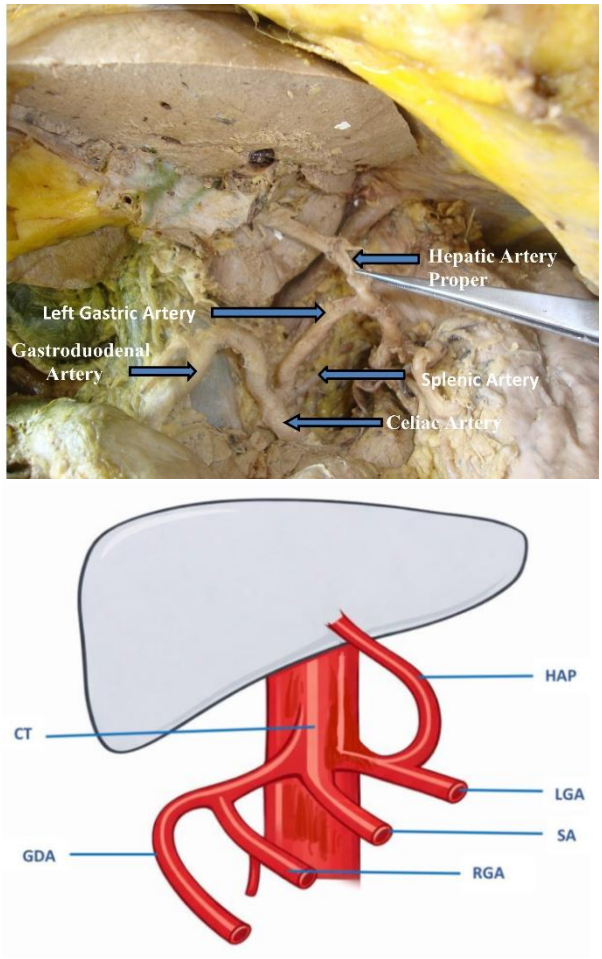

Figure 9: Anatomical variation showing the absent common hepatic artery and a proper hepatic artery arising from the left gastric artery. Top figure shows a photograph with a graphical representation given below it. CT-coeliac trunk, HAP -hepatic artery proper, LGA – left gastric artery, SA – splenic artery, right gastric artery, RGA – right gastric artery, GDA – gastroduodenal artery

Understanding the embryological development of the hepatic artery is crucial for identifying its anatomical variants. During early embryonic development, four ventral segmental arteries from the dorsal aorta are interconnected by longitudinal anastomosis. While the second and third roots regress during fetal growth, the coeliac artery typically forms from the first root and the rudimentary junctions of the second and third roots. The fourth trunk gives rise to the superior mesenteric artery. During advanced fetal development, the longitudinal interconnections between the coeliac and superior mesenteric artery roots regress, leading to their anatomical separation. Individual differences in the process result in variations in the coeliac, superior mesenteric, and common hepatic arteries, depending on the extent of persistence or regression of these primitive splanchnic vessels (4).

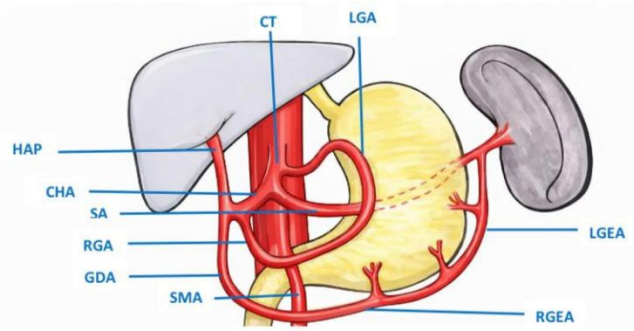

Figure 10: Normal anatomy of the celiac trunk and its branches. CT-coeliac trunk, LGA – left gastric artery, LGEA – left gastroepiploic artery, RGEA -right gastroepiploic artery, SMA – superior mesenteric artery, GDA – gastroduodenal artery RGA – right gastric artery, SA – splenic artery, CHA – common hepatic artery, HAP -hepatic artery proper

Variations of the celiac trunk and the hepatic arteries are well documented in the literature. Several classification systems have been proposed to describe hepatic arterial anatomy. The most widely accepted and now the standard classification system was introduced by American anatomist Neil A. Michel in 1966 (5). This classification, based on analysis of 200 cadaveric dissections, describes the 10 most common hepatic arterial variants. According to Michel's classification, a common hepatic artery originating from the left gastric artery is described as a type X variation (4). However, the variation observed in our case, in which the proper hepatic artery arises from the left gastric artery and subsequently divides into the left and right hepatic arteries, is not included in this classification (Table 1). There are several reports in literature regarding hepatic artery

variations that do not fit in with Michel classification (6).

Table 1: Neil A. Michel's Hepatic Arterial Classification Pattern

Classification Type	Hepatic Arterial Pattern
Type I	Normal anatomy
Type II	Replaced left hepatic artery from left gastric artery
Type III	Replaced right hepatic artery from superior mesenteric artery
Type IV	Replaced left and right hepatic artery
Type V	Accessory left hepatic artery
Type VI	Accessory right hepatic artery
Type VII	Accessory left hepatic artery and accessory right hepatic artery
Type VIII	Replaced left hepatic artery and accessory right hepatic artery or replaced right hepatic artery and accessory left hepatic artery
Type IX	Common hepatic artery from superior mesenteric artery
Type X	Common hepatic artery from left gastric artery

Several imaging modalities are available for evaluating hepatic arterial anatomy, including computed tomography angiography (CTA), magnetic resonance angiography (MRA), and digital subtraction angiography (DSA). Among these, the first choice for imaging is CTA, as it provides excellent visualization of arterial branching patterns and the detection of stenosis and occlusions (7). In a large image-based analysis of the celiac axis and common hepatic artery using spiral CT (computed tomography) and DSA (digital subtraction angiography) scans in 5002 patients, 14 variations of the celiac trunk were identified in 492 (9.6%) patients (8). Of these thirty-four (0.67%) patients demonstrated a variation in the origin of the hepatic artery (any segmental, lobar, or proper hepatic artery that arose from the celiac axis with a supra-pancreatic pre-portal course) and the gastroduodenal artery rather than from the common hepatic artery.

In a study of hepatic arterial anatomy among 1000 patients who underwent liver harvesting for orthotopic transplantation, 6 variants of the hepatic arterial origin were identified in 243 (24.3%) of the study population (9). Specifically, three types of variant origin of right and left hepatic arteries and 2 types of variant origin of common hepatic artery were identified in 226 patients and 17 patients, respectively (9). In another study done by Reman Z (2014) of anatomical variations in the origin of the hepatic artery in 139 patients undergoing hepatobiliary surgery, the common hepatic artery originated from the celiac trunk in all cases. However, one or more aberrant hepatic arteries were identified in 60 patients (42.8%) (1). The common hepatic artery arising from the left gastric artery was identified during a cadaveric liver donor harvesting in which the celiac trunk was bifurcated into the left gastric and the splenic arteries. In this case, the gastroduodenal artery was long and originated from the common hepatic artery closer to its division into right and left hepatic arteries (10). Similarly, during dynamic enhanced contrast CT studies performed for various clinical indications, common hepatic arteries arising from the left gastric artery were found in 3 patients (11). In these cases, the gastroduodenal arteries were derived from the common hepatic artery, the splenic artery or both.

A detailed assessment of hepatic arterial anatomy is pivotal in the preoperative phase of liver surgery, particularly resections and transplantations, which are among the most common procedures requiring arterial imaging. Research has demonstrated that atypical arterial anatomy is associated with an increased incidence of hepatic artery thrombosis (HAT) in liver transplantation (12).

This case highlights the importance of vigilance regarding potential variations of the hepatic artery for clinicians planning and performing all surgical, diagnostic, and interventional radiological procedures in the upper abdomen, especially in the hepatobiliary and pancreatic regions, thereby decreasing the risk of serious iatrogenic vascular injuries.

Conclusion

This case highlights a rare and clinically significant variation in hepatic arterial anatomy, in which the common hepatic artery was absent, and the proper hepatic artery originated directly from the left gastric artery, supplying both the liver and the gallbladder. However, this configuration does not conform to Michel's classification of hepatic arterial variations. Awareness of these variations is essential for surgeons, interventional radiologists, and clinicians involved in hepatobiliary and pancreatic procedures, as inadvertent injury to an atypical hepatic artery can lead to severe complications. Preoperative imaging, particularly computed tomography angiography, plays a crucial role in identifying such variations and facilitating safe surgical planning.

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