Case Report

Anatomy

Variable Branching Pattern of The Common Hepatic Artery And The Celiac Artery

SHARMILA SARAN RAJENDRAN, SENTHIL KUMAR ANBUMANI, ARUNA SUBRAMANIAM, M.S THOTAKURA BALAJI, HANNAH SUGIRTHABAI RAJILA RAJENDRAN

ABSTRACT

Background: During liver transplantation or any surgical or diagnostic procedures, knowledge of hepatic arterial anatomical is essential.

Aim: This present case may provide a valuable information forsurgeons and radiologists to notice an uncommon variation in hepatic artery. Discrimination of normal arterial patterm from the variant is a key for safe and effective surgery.

Methods: During a dissection of a 56 year old female caaver in the subhepatic region,We noticed a different branching pattern of hepatic artey.At the level of T12, the celiac trunk divided into left gastric,splenic,common hepatic artery and left inferior phrenic arteries.The left gastric artery and splenic artery were normal.Seven branches sprouted from common hepatic artery .

Results: Weobserved totally seven branches from the terminal end of common hepatic artery,Of whichfive were hepatic arteries and other two arteries were superior pancreatico duodenal and rightgastroepiploic arteries.Gastrodudenal.right gastric and properhepatic arteries were absent.Embryological basis of these variations were discussed.

Conclusion: It is necessary for Surgeons and radiologists should be aware of possibilities of various anomalous branching pattern.

Key Words: celiac trunk; common hepatic artery; multiple hepatic arteries; left inferior phrenic artery

INTRODUCTION

Vascular anomalies are usually asymptomatic, until they interfere with the blood supply to the viscera. They are diagnosed accidentally during surgeries and diagnostic angiography. Such variations are frequently encountered in the abdominal vessels. The present case on the anomalous branching pattern of the hepatic artery is a rare variant and it has not been reported so far in the literature. The knowledge on variations in the celiac trunk and its branches are important for conditions like the celiac axis compression syndrome and transcatheter therapy or during surgeries in this region.

CASE REPORT

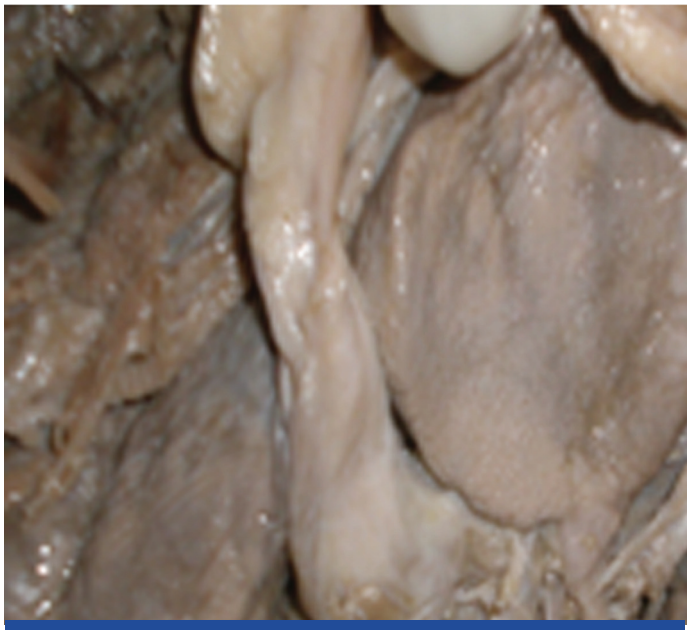
The following variations were encountered in a 56 year old female cadaver during routine dissection in the subhepatic region. The celiac trunk was seen at the T12 level, to be arising from the abdominal aorta. The left inferior phrenic artery was the first branch from the celiac axis. The right inferior phrenic artery was arising from the abdominal aorta normally. The celiac axis then typically trifurcated into the left gastric, splenic and the common hepatic arteries[Table/Fig 1]. The following variations were observed in the common hepatic artery. The common hepatic artery turned upwards towards the porta hepatis. At the porta, it divided into seven terminal branches. Out of the seven branches, five were hepatic arteries. Out of the remaining two branches, one was the superior pancreaticoduodenal artery and the other one was the right gastroepiploic artery. They were given as direct branches from the common hepatic artery. The right gastric, the gastroduodenal and the proper hepatic arteries were absent. The superior pancreatico duodenal and right gatroepiploic arteries ran inferiorly and entered the right free margin of the lesser omentum. After reaching the inferior border of the first part of the duodenum, the courses for both the vessels were normal. Out of its five branches to the liver, two branches supplied the right lobe and three branches supplied the left lobe.[Table/Fig 2] One branch to the right lobe, after giving the cystic artery, directly pierced through its under surface and the other entered through the quadrate lobe (segment IV) of the liver. Out of the three branches to the left lobe, one branch pierced through the ligamentum teres and the other two entered the under surface of the left lobe of the liver directly. The course and the distribution of the left gastric and splenic arteries appeared to be normal.

DISCUSSION

Variations in the hepatic arterial pattern which has been reported in the literature, are purely based on the origin of the hepatic artery and its branching pattern. According to Michel [1], the origin of the hepatic artery is categorized into ten different types. Hiatt et al [2], in 1994, described six different types of origins of the hepatic artery from 1000 cases. The classification which was described by Michel et al and Hiatt et al was more precise and it was universally accepted.

According to Michel et al, the right, left and the middle hepatic arteries arise from the common hepatic artery in 55% of the patients. Most of the existing reports on the variation in the origin and on the branching pattern of the hepatic artery fall under either Michel's or Hiatt's classification. However, the arterial pattern which has been described in the present study is different from that of Michel' and Hiatt classification and has been seldom reported. Previous studies have stated that the normal hepatic arterial branching pattern was 68.1% and that the normal distribution pattern was 72.4% [3,4]. The typical celiac trunk pattern was 66.6% [3] and 89.1% respectively [5]. The existing literature mentions twelve different

[Table/Fig-1]: Branches of celiac axis a-celiac trunk,left inferior phrenic artery, c-Left gastric artery, d-Splenic artery, e-Common hepatic artery.



[Table/Fig-2]: Common hepatic artery division a-right hepatic artery, b-Accesory right hepatic artery, c&e-accesory left hepatic artery, d- Left hepatic artery, f-Superior pancreatico-duodenal artery, g-Right gastropiploic artery, h-Cystic artery, i- common hepatic artery.

types of hepatic arterial patterns in 1081 cadavers. Ten out of the twelve types coincide with Michel's classification [6]. The earlier reports on the origin of the accessory left hepatic arteries from variable sources such as the left gastric artery [4], the common hepatic artery[7,8], and the hepatic artery proper[9] and the origin of the accessory right hepatic arteries from the superior mesenteric artery [4], thehepatic artery proper [10] and the common hepatic artery[11] are extensively available . Miyaki [12], in 1989, stated that the aberrant hepatic artery, if present, arises ery from the left gastric artery or from the superior mesenteric artery in 38.5% of the human foetal livers. In the present case, both the right and the left accessory hepatic arteries were found to arise from the common hepatic artery. The division of the common hepatic artery into a maximum of four branches viz. the gastroduodenal, the right hepatic, the left hepatic and the middle hepatic arteries in 0.5% of the cases has been reported. [13]. In the present case,

Arteries	Origin
Right hepatic artery	Superior mesenteric artery [2,6,17-19]
	Common hepatic artery [20,21]
	Gastroduodenal ,right gastric artery, aorta [15]
Left hepatic artery	Left gastric artery [2,6,15,22]
	Splenic ,gastroduodenal, aorta [15]
	Common hepatic artery [20,21]
	Hepatic artery proper [23]
Accessory right hepatic artery	Right phrenic artery, gastroduodenal, celiac axis [13]
	Superior mesenteric artery [2,4,24,25]
	Common hepatic artery[11]
	Hepatic artery proper [10]
	Aorta [26]
Accessory left hepatic artery	Right hepatic artery, accessory right hepatic artery [13]
	Left gastric artery [2,13,14,19,26]
	Hepatic artery proper [9]
	Common hepatic artery[7,8]
Middle hepatic artery	Right and left hepatic artery [15,27]
	Splenic, left gastric artery, superior mesenteric artery, gastroduodenal artery [15]
	common hepatic artery[16]
Left inferior phrenic artery	Celiac trunk [1,28-30]

[Table/Fig 1]: Origin of accessory or replaced hepatic arteries reported in recent literatures

the common hepatic artery divided into seven branches viz. the right hepatic artery, the accessory right hepatic artery, the left hepatic artery , two accessory left hepatic arteries , the superior pancreatico duodenal and the right gastroepiploic artery. This pattern has seldom been reported. Since the gastroduodenal, the right gastric and the proper hepatic artery were found to be absent, the arterial supply to the stomach was compensated from the right gastoepiploic artery which directly arose from the common hepatic artery. The courses of the left gastric and the splenic artery were found to be normal. In addition, the left inferior phrenic artery was found to arise from the celiac trunk. Shakuntala Pai et al [7], in their study, reported that the incidence of the accessory left hepatic artery was very rare, as compared to that of the accessory right hepatic artery. In the present case, both the accessory hepatic arteries were present. The various sources of the origin of the accessory or the replaced hepatic arteries which have been reported so far in the recent literature have been listed out. [Table/Fig 1]

In 2010, Ugurel et al [14], reported that the incidence of the variations of the celiac trunk and/or the hepatic arteries increased with the presence of the accessory renal arteries. However, the renal arteries were normal in the present case. The middle hepatic

artery, if present, may take its origin from any one of the following arteries, namely, the gastroduodenal, the superior mesenteric, the splenic or the left gastric [15]. The existence of the middle hepatic artery was reported in 103 (71%) of the subjects [16].

The reason for such an anomalous branching pattern is developmental in origin. Initially, the dorsal aorta gives many vitelline/omphalomesenteric branches before its fusion. After the fusion, many of these arteries regress and finally the celiac and the superior and inferior mesenteric arteries persist in adults. The embryonic left hepatic artery, the middle hepatic artery and the right hepatic artery arise respectively from the left gastric artery, the celiac axis and the superior mesenteric artery. Later, the embryonic left hepatic and right hepatic arteries regress and the middle hepatic artery persists as the proper hepatic artery in adult life. Near the left end of the hilum of the liver, the proper hepatic artery divides into the right and the left hepatic arteries. Failure in the regression of these arteries may lead to an additional or variable branching pattern or accessory hepatic arteries. The anomalous branches of the celiac trunk are caused due to the persistent ventral splanchnic branches of the dorsal aorta. The variations in the arterial pattern are common, as explained in various studies, but the permutations and combinations of these branches are unpredictable. The presence of these accessory arteries may be a hindrance for laparoscopic gastric banding procedures. Each variation is unique; the negligence of a combination of such variations may cause considerable risk, leading to lethal complications. The present case has been reported for its rarity and may throw light on the possible variations of the vascular patterns, which will help radiologists and surgeons to perform effective liver transplantation, hepatobiliary surgery, hiatal surgery for gastroesophageal reflux and bariatric, gastric and pancreatic surgeries.

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AUTHOR(S):

1. Dr. Rajendran Saran Sharmila
2. Dr. Senthil Kumar Anbumani
3. Dr. Aruna Subramaniam
4. Dr. M.S Thotakura Balaji,
5. Dr. Hannah Sugirthabai Rajila Rajendran

PARTICULARS OF CONTRIBUTORS:

1. Corresponding Author
2. M.Sc, Department of Anatomy, Chettinad Hospital and Research Institute, Chettinad University, Kelambakkam, Tamil Nadu -603103.
3. Department of Anatomy, Chettinad Hospital and Research Institute, Chettinad University, Kelambakkam, Tamil Nadu -603103.
4. M.Sc, Ph.D., Department of Anatomy, Chettinad Hospital and Research Institute, Chettinad University, Kelambakkam, Tamil Nadu -603103.
5. M.S., Department of Anatomy, Chettinad Hospital and Research Institute, Chettinad University, Kelambakkam, Tamil Nadu -603103.

NAME, ADDRESS, TELEPHONE, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. R. Sharmila Saran
Department of Anatomy, Chettinad Hospital And Research Institute, Chettinad University, Kelambakkam,
Tamil Nadu -603103.
Mobile: +919788663336
E-mail.: sharmilasaran@yahoo.co.in

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