



Research Article

Volume 3 Issue 3– September 2017  
DOI: 10.19080/APBIJ.2017.03.555612

Anatomy Physiol Biochem Int J

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# Cadaveric Study of Anatomical Variations of Hepatic artery in Sudanese 2014



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**Submission:** September 11, 2017; **Published:** September 19, 2017

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## Abstract

**Introduction:** The hepatic artery, a branch of the celiac trunk, may be divided into the common hepatic artery, from the celiac trunk to the origin of the gastroduodenal artery, and the hepatic artery proper, from the origin of the gastroduodenal artery to the bifurcation of the hepatic artery.

**Objectives:** This study was aimed to determine the variations of hepatic arterial system and the variations branches of the hepatic artery.

**Methods:** A cross sectional study cadaveric study was conducted in the six Sudanese Colleges of Medicine. The sample size was 39 cadavers (Male and Female) Measurement of Hepatic artery were done after Full Exploration.

**Results:** The hepatic artery originate as common hepatic (by common stem) in 76.9% of cases and the left and right hepatic are separate (by division) in 23.1% of cases. The right hepatic originates from celiac trunk in 76.9% of cases and from superior mesenteric in 17.9% of cases and from abdominal aorta 5.1% of cases. The left hepatic artery divide from common hepatic in 76.9% of cases or originate from celiac in 15.4% of cases and from left gastric in 7.7% of cases.

**Conclusion:** The study findings the common hepatic artery usually arises from the celiac trunk 76.9% of cases and the right hepatic artery arises from abdominal aorta in (5.1%) of cases or from superior mesentery artery in (17.9%) of cases or divide from hepatic proper in (76.9%) of cases And the left hepatic artery arises from left gastric in (7.7%) of cases or from celiac trunk in (15.4%) of cases or divide from hepatic proper in (76.9%) of cases

## Introduction

The hepatic artery, a branch of the celiac trunk, may be divided into the common hepatic artery, from the celiac trunk to the origin of the gastroduodenal artery, and the hepatic artery proper, from the origin of the gastroduodenal artery to the bifurcation of the hepatic artery at or close to the porta hepatis, the hepatic artery and hepatic portal vein terminate by dividing into right and left branches; these primary branches supply the right and left lobe of the liver livers, respectively [1].

A small number of normal variants are important to demonstrate by angiograph because they may influence surgical and interventional radiological procedures. A vessel that supplies a lobe in addition to its normal vessel is defined as an accessory artery [2].

A replaced hepatic artery is a vessel that does not originate from an orthodox position and provides the sole supply to that lobe. Rarely a replaced common hepatic artery arises from the superior mesenteric artery and is identified at surgery by a relatively superficial portal vein (reflecting the absence of a common hepatic artery that would normally cross in front of the vein). More commonly a replaced right hepatic artery or an accessory right hepatic artery arises from the superior mesenteric artery [2].

In this case they run behind the portal vein and bile duct in the lesser omentum and can be identified at surgery by pulsation behind the portal vein. The accessory right hepatic artery may be injured during resections of the pancreatic head because the artery lies in close proximity to the portal vein. Occasionally,

a replaced left hepatic artery or an accessory branch arises from the left gastric artery: these vessels provides a source of collateral arterial circulation in cases of occlusion of the vessels in the porta hepatis but may also be injured during mobilization of the stomach as it lies in the upper portion of the lesser omentum. Rarely, accessory left or right hepatic arteries may arise from the gastroduodenal artery or aorta [2].

The presence of replaced arteries can be lifesaving in patients with bile duct cancer: because they are further away from the bile duct they tend to be spared from the cancer, making excision of the tumor feasible. Knowledge of these variations is also important in planning whole and split liver transplantation [2].

Sometimes the common hepatic artery arises from the superior mesenteric artery or aorta the right hepatic artery may arise from the superior mesenteric (15%) and the left hepatic artery from left gastric (20%) [3].

Johnson et al. [4] found that in the classic description of hepatic arterial supply, the common hepatic artery originates from the coeliac trunk. However, there are numerous variations to this classic pattern.

Song et al. [5] reported that 15 possible types of CA variation, 13 types were identified. A normal CA was noted in 4457 (89.1%) of the 5002 patients.

Twelve types of CA variation were identified in 482 (9.64%) patients. In the remaining 63 (1.26%) patients, the CA anatomy was classified as ambiguous because the CHA was absent owing to separate origins of the hepatic arteries and the gastroduodenal artery (n = 55) or because the origin of the CHA could not be determined owing to persistent anastomotic channels (n = 8). Seven CHAs originating from the normal CA had a retroportal (n = 6) or transpancreatic (n = 1) course. All eight CHAs originating from the left gastric artery passed the fissure of the ligamentum venosum. The 148 CHAs originating from the superior mesenteric artery showed diverse relationships with the pancreas--being supra-, trans-, or infrapancreatic--and the superior mesenteric-portal venous axis--being pre- or retroportal. The 20 CHAs originating from the aorta had a normal suprapancreatic preportal course [5].

Uva et al. [6] found that some of the variations such as the presence of a right or left hepatic branch are more common, but other ones are extremely rare. They are described here a rare case in which the common hepatic artery arose from the left gastric artery, found during a cadaveric liver donor harvesting and confirmed with imaging studies. Cases like this one highlight the importance of knowing the hepatic arterial anatomy and the possibility of its numerous variations by the transplant and hepatobiliary surgeons.

Rajini et al. [7]. Reported that the left gastric, common hepatic and splenic arteries arise from the coeliac trunk in 86% of cadavers. In 76% of cadavers, the origin of the gastric artery was

proximal to the bifurcation of the coeliac trunk into the common hepatic and splenic arteries. In one case, all three branches arose directly from the abdominal aorta, and the origin of the splenic artery was 1 cm distal to the origin of the left gastric and common hepatic arteries. In another case, the common hepatic and left gastric arteries arose from the coeliac trunk, and the origin of the splenic artery was 1.5 cm distal to the abdominal aorta.

Sebben GA et al [8] found that there was some kind of anatomical variation in 40% (n = 12) of cadavers. We found 2 variations in the common hepatic artery, 03 in the gastroduodenal artery, 3 in the right hepatic artery, 1 in the left hepatic artery, 1 in the right gastric artery, and 2 in cystic artery. As for the celiac artery, there were variations in length, diameter and height in its origin, which was common on the aorta. The variation of right hepatic artery originating from the superior mesenteric artery was found in 10% (n = 3) of the specimens studied and it was considered the most prevalent type of variation in this study.

Futara et al. [9] reported that the right hepatic artery took origin from the proper hepatic artery (66.3%), the common hepatic artery (18.2%), the superior mesenteric artery (8.2%) or the coeliac trunk (7.3%). 10 cases of accessory right hepatic artery originating from the superior mesenteric artery (7 cases), gastroduodenal artery (2 cases) or the left hepatic artery (1 case) were observed. The origin of the left hepatic artery included the proper hepatic artery (71.8%), the common hepatic artery (16.4%), the coeliac trunk (10.9%) and the splenic artery (0.9%). The 14 cases of accessory left hepatic arteries originated from the common hepatic artery (5 cases), right hepatic artery (3 cases), gastroduodenal artery (2 cases) or the coeliac trunk (4 cases). An extrahepatic branch to the quadrate lobe of the liver, also known as the middle hepatic artery, was observed in 47.3% arising mainly from the right or left hepatic arteries (20% each), the superior mesenteric artery (2.7%) and from the gastroduodenal artery (4.6%). The cystic artery mainly arose from the right hepatic artery (75.5%) but also took origin from the middle hepatic artery (12.7%), gastroduodenal artery (7.3%) or the left hepatic artery (4.5%).

Sultana et al. [10] founded that the typical origin of the right and left hepatic artery from hepatic artery proper was 75% and in 25% cases it was found to arise from other sources. The right hepatic arteries those were not originating from hepatic artery proper, 18% was found to arise from common hepatic artery and 7% from superior mesenteric artery. But in case of left hepatic artery, remaining 15% was originating from common hepatic artery.

Due to the rapid increase in the number of liver transplants and laparoscopic cholecystectomy the importance of hepatic artery anatomy has become apparent. In clinical practice the in-depth knowledge of not only "standard" anatomy but knowledge the variations in anatomical origin is essential to minimize morbidity encountered during hepato-biliary surgeries.

This study was aimed to determine the variations of hepatic arterial system and the variations branches of the hepatic artery.

**Material and Methods**

A cross sectional study was conducted in the University of Medical Science & Technology, Ahfad University for Women, Om-durman Islamic University, University of Almoghtarbeen, Alrazi Medical College & Yarmouk Medical College. The sample size was 39 cadavers (36male and 3 female).

To reach the hepatic artery. Reflect the skin from medial to lateral, detach it along the midaxillary line, and place it in the tissue container. Clean the hepatic artery proper And also to reach the superior mesenteric artery which it arises from the anterior surface of the abdominal aorta approximately 1 cm inferior to the celiac trunk at its origin the Superior mesenteric artery lies posterior to the neck of the pancreas the superior mesenteric artery emerges from posterior to the neck of the pancreas, it passes anterior to the uncinate process third part of the duodenum, and left renal vein. The superior mesenteric artery then enters the mesentery within the mesentery the superior mesenteric artery courses toward the terminal end of the ileum. And also to reach the celiac trunk arises from the anterior surface of the abdominal aorta approximately 1 cm superior to the superior mesenteric artery.

The data collected by using a data collecting sheet and were analyzed electronically by using SPSS (statistical analyzer) version 17. Ethical considerations and permission was taken from the mentioned above institutes.

**Result**

The hepatic artery originate as common hepatic (by common stem) in 76.9% of cases and the left and right hepatic are separate (by division) in 23.1% of cases see Table 1 The hepatic artery originate as common hepatic from celiac trunk in 76.9% of cases (Tables 2-4).

**Table 1:** Site of origin of hepatic artery by common stem and division.

Origin of Hepatic artery by	Frequency	Percent	Valid percent	Cumulative percent
Common Stem	30	76.9	76.9	76.9
Division	9	23.1	23.1	100.0
Total	39	100.0	100.0	

**Table 2:** Site of origin of the hepatic artery by common stem.

Origin of Hepatic artery by	Frequency	Percent	Valid percent	Cumulative percent
Celiac trunk	30	76.9	76.9	100.0

The hepatic artery originate as common hepatic from celiac trunk in 76.9% of cases.

**Table 3:** Site of origin of the right hepatic artery.

Origin by	Frequency	Percent	Valid Percent	Cumulative Percent
Common hepatic	30	76.9	76.9	76.9
superior mesenteric	7	17.9	17.9	94.9
abdominal aorta	2	5.1	5.1	100.0
Total	39	100.0	100.0	

The right hepatic originates from celiac trunk in 76.9% of cases and from superior mesenteric in 17.9% of cases and from abdominal aorta 5.1% of cases see Table 3.

**Table 4:** Site of origin of the left hepatic artery.

Common hepatic	Frequency	Percent	Valid Percent	Cumulative Percent
Common hepatic	30	76.9	76.9	76.9
celiac trunk	6	15.4	15.4	15.4
left gastric	3	7.7	7.7	7.7
Total	39	100.0	100.0	

The left hepatic artery divide from common hepatic in 76.9% of cases or originate from celiac in 15.4% of cases and from left gastric in 7.7% of cases see Table 4.

**Discussion**

The hepatic artery, a branch of the celiac trunk, may be divided into the common hepatic artery, from the celiac trunk to the origin of the gastroduodenal artery, and the hepatic artery proper; from the origin of the gastroduodenal artery to the bifurcation of the hepatic artery at or close to the porta hepatis, the hepatic artery and hepatic portal vein terminate by dividing into right and left branches; these primary branches supply the right and left lobe of liver respectively [1].

A small number of normal variants are important to demonstrate by angiograph because they may influence surgical and interventional radiological procedures. A vessel that supplies a lobe in addition to its normal vessel is defined as an accessory artery [2].

A replaced hepatic artery is a vessel that does not originate from an orthodox position and provides the sole supply to that lobe. Rarely a replaced common hepatic artery arises from the superior mesenteric artery and is identified at surgery by a relatively superficial portal vein (reflecting the absence of a common hepatic artery that would normally cross in front of the vein). More commonly a replaced right hepatic artery or an accessory right hepatic artery arises from the superior mesenteric artery In this case they run behind the portal vein and bile duct in the lesser omentum and can be identified at surgery by pulsation behind the portal vein).

Sultana et al. [10] reported that the typical origin of the right and left hepatic artery from hepatic artery proper was 75% and

in 25% cases it was found to arise from other sources. The right hepatic arteries those were not originated from hepatic artery proper, 18% was found to arise from common hepatic artery and 7% from superior mesenteric artery. But in case of left hepatic artery, remaining 15% was originating from common hepatic artery.

Our finding in the present study is like this observation this study demonstrated that the common hepatic artery usually arises from the celiac trunk 76.9% of cases. The right hepatic originate from celiac trunk in 76.9% of cases and from superior mesenteric in 17.9 of cases and from abdominal aorta 5.1% of cases and The left hepatic artery divide from common hepatic in 76.9% of cases or originate from celiac in 15.4% of cases or from left gastric in 7.7% of cases. Similar to the earlier study.

Rare finding was observed in present study which was an astomosis between the left and right hepatic artery and this variation was not mentioned in the earlier studies.

## Conclusion and Recommendation

The study findings the common hepatic artery usually arises from the celiac trunk 76.9% of cases and the right hepatic artery arises from abdominal aorta in (5.1%) of cases or from superior mesentery artery in (17.9%) of cases or divide from hepatic proper in (76.9%) of cases and the left hepatic artery arises from left gastric in (7.7%) of cases or from celiac trunk in (15.4%) of cases or divide from hepatic proper in (76.9%) of cases. Further studies are needed about this topic in the Sudan. A small number of normal variants are important to clinically to radiologist and Surgeons because they may influence surgical and interventional radiological Procedures Knowledge and variation anatomy of hepatic system of is essential to minimize morbidity encountered during hepato-biliary surgeries.

## Acknowledgment

The authors would like to thank all who volunteered to participate in the study.

## Ethical approval

The study was approved by the Institutional Ethics Committee

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DOI: [10.19080/APBIJ.2017.03.555612](https://doi.org/10.19080/APBIJ.2017.03.555612)

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