

## AN ACCESSORY RIGHT HEPATIC ARTERY ARISING FROM SUPERIOR MESENTERIC ARTERY AND ITS CLINICAL SIGNIFICANCE

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### ABSTRACT

**Background:** Knowledge of hepatic arterial vascularization and its variations have a significant relevance for the daily practice of hepato-biliary surgeon as well as radiologists and anatomists. The right hepatic artery normally arises from the hepatic artery proper, the continuation of the common hepatic artery which is a branch of celiac trunk. Sometimes the anatomical arterial variations are also very common in human beings especially in hepatic region. During routine dissections for undergraduate medical students at Department of Anatomy, in a 75 -year-old male cadaver, we found the right accessory hepatic artery arises from the superior mesenteric artery which supplied the right lobe of the liver along with normal right hepatic artery. In addition, a direct branch to the left lobe of the liver was seen arising from common hepatic artery. The arterial anomaly can be enlightened by embryonic development. The knowledge of existence of aberrant hepatic arteries, either accessory or replacing, is important because they may influence surgical and interventional radiological procedures.

**KEY WORDS:** Accessory right hepatic artery, Common hepatic artery, Right hepatic artery, Superior mesenteric artery

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### INTRODUCTION

Knowledge of Hepatic arterial vascularization and its variations have a significant relevance for the daily practice; basically the classic arterial anatomy is seen in 55 to 77% of the population. Anatomical variations of the arterial supply of the liver are reported to occur in 25-50% of the total population<sup>1</sup>.

The common hepatic artery constitutes one of the three branches of the celiac trunk. It gives rise to the right gastric, and gastro duodenal arteries continuing as proper hepatic artery. At the level of the porta hepatis this artery divides into left and right branches, the latter providing a cystic branch as well. They enter the parenchyma of the liver and supply the left and right hepatic lobe respectively.

Deviations of the above-described normal arterial pattern are not rare. In a sample of 426 operated individuals, a report a total percentage of variations reaching 13% (55/426). One of the most common and well-described variations of the hepatic artery is the so-called aberrant hepatic arteries which occur in approximately 42% of the individuals<sup>2</sup>.

There are two types of aberrant hepatic arteries, the accessory and the replacing ones. The accessory hepatic artery is defined as a vessel that supplies a lobe in addition to its normal one, while the replaced hepatic artery is a vessel that provides the sole supply to that lobe, but originates from other than the orthodox position. More commonly, an accessory or replaced right hepatic artery is reported to emerge from the superior mesenteric artery, while accessory or replaced left hepatic arteries seem to be branches of the left gastric artery. Other, rarer locations of origin might be the gastro duodenal artery, the celiac artery or the abdominal aorta<sup>3</sup>.

Congenital deviations are thought to occur because of the persistence of vitelline arteries during embryologic development. These deviations can cause difficulties during surgery of the upper intestinal tract, pancreas, gallbladder and biliary tract, or during percutaneous Trans arterial procedures and all surgeons should be aware of these variations. Arterial anomalies near the pancreas and liver are an especially important consideration during pancreatico duodenectomy (PD), with accessory right hepatic arterial anatomy (ARHA) being the most common and relevant anomaly<sup>4</sup>.

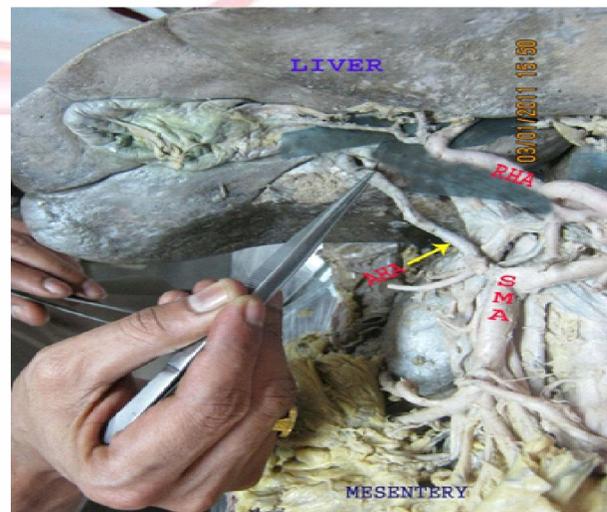
This variant can be attributed to the abnormal persistence or regression of an embryonic artery. During embryonic development, the aorta gives off ventral segments, four of which become the celiac, splenic, common hepatic, and superior mesenteric arteries. A longitudinal ventral artery anastomoses these segments. The Accessory right hepatic artery originates from the persistence of the longitudinal ventral arterial segment connected to the superior mesenteric artery<sup>5</sup>.

The accessory right hepatic artery that is being reported here may have a radiological and surgical importance.

## CASE REPORT

During routine dissection of the Abdominal region for undergraduate teaching in the Department of Anatomy, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, Andhra Pradesh, India, and an accessory right hepatic artery arising from the superior mesenteric artery was observed on the abdomen of a 75-year-old male cadaver. An accessory hepatic artery arose from the proximal part of the superior mesenteric artery (Figures 1). It then coursed obliquely upward and to the right behind the head of the pancreas and the first part of the duodenum and entered the right free margin of the lesser omentum. In the lesser omentum the artery ascended behind the bile duct. Due to the presence of this abnormal artery the epiploic foramen was reduced in size. The artery entered the liver through the right end of the porta hepatis.

**FIG. 1.** Right accessory Hepatic Artery arising from the Superior Mesenteric Artery



AHA: Accessory hepatic artery  
RHA: Right hepatic artery  
SMA: Superior mesenteric artery

## DISCUSSION

Anatomical variations of the arterial supply of the liver are not uncommon. Only half of the cases in anatomical studies have the typical normal anatomy of the hepatic artery. Some of the variations such as the presence of a right or left hepatic branch arising from superior mesenteric-

artery and left gastric artery respectively are more common, but others also relating to blood supply of the liver are extremely rare <sup>6</sup>.

A replaced right hepatic artery has been documented in 5-25% of reported cases. Previous literature has defined a right hepatic artery as replaced, if the artery supplies the right lobe in place of the typical celiac hepatic anatomy, but if the artery merely serves as an additional branch it would be referred to as aberrant <sup>4</sup>.

Variations in the branches of coeliac trunk are very common. Yuksel and Sargon (1992) have reported a case of inferior phrenic trunk arising from the coeliac trunk <sup>4</sup>. Cavdar, Gurbuz, Zeybek et al. (1998) have reported the presence of a common trunk formed by the left gastric and left inferior phrenic arteries. This common trunk was a branch of the coeliac trunk <sup>7</sup>.

A separate origin of splenic, left gastric and common hepatic arteries from the abdominal aorta has been reported by Bordei and Antohe (2002).

Presence of a coeliaco-mesenteric trunk reported by Cavdar et al., (1997) and a coeliaco-mesenteric-phrenic trunk (Nayak, 2006) has also been reported<sup>7, 8</sup>.

Variations in the origin of the hepatic artery are also common. Abdullah, Mabrut, Garbit et al. (2006) have found variations in the origin of hepatic arteries in 31.9% of cases. In their study involving 932 patients, the variations were divided into three groups describing 48 common hepatic artery anomalies, 236 left or right hepatic artery anomalies and 13 rare variations including one case of right hepatic artery stemming from the inferior mesenteric artery <sup>3</sup>.

Origin of common hepatic artery from the left gastric artery has been reported by Uva, Arvelakis, Rodriguez-Laiz et al. (2007)<sup>9</sup>.

Inferior phrenic arteries normally arise from the abdominal aorta just below the aortic opening of the diaphragm. Abnormal origins of these arteries including their origin from the celiac

trunk are known. (Cavdar, gurbuz, zeybek et al., 1992; yuksel and sargon, 1992; nakamura, miyaki, hayashi et al., 2003) <sup>7</sup>.

## CONCLUSION

The origin of accessory hepatic artery from the superior mesenteric artery is very rare. Its close relationship with the head of the pancreas, first part of duodenum and the portal vein makes it vulnerable during surgeries in this area. The knowledge of this kind of vascular variation may be useful for surgeons doing liver transplants, pancreatic mobilizations and gastro-jejunosomies. The knowledge about this artery passing through the lesser omentum behind the bile duct and the portal vein may be important for radiologists and surgeons removing gall stones from the bile duct. The accessory hepatic artery that we are reporting here may also be called right hepatic artery and the proper hepatic artery in this case can be called left hepatic artery since we could not find any branches from the hepatic artery proper other than cystic artery.

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