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ANATOMICAL VARIANT OF THE LIVER BLOOD SUPPLY

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Abstract

Vascular variations are significant for liver transplantations, radiological procedures, laparoscopic method of operation and for the healing of penetrating injuries, including the space close to the hepatic area. These variants are very common in the abdominal region, and their description will be useful. During a routine dissection of a 73 year old female cadaver, we found in the subhepatic region that the blood supply of the liver differed from a normal one. The difference was found in the absence of the right liver branch and the cystic artery, which normally arises from the common hepatic artery. After a detailed dissection of the superior mesenteric artery we distinguished a branchthat was routed to the right lobe of the liver. The diameter of this vessel was 3.7 mm and the length 8.2 cm. In the artery pathway, three consecutive branches were observed. The first branch was found about 2.02 cm before the portal region of the liver. The second one became visible after another millimeter and finally the artery made one little curve and became a cystic artery.

Keywords: celiac trunk, common hepatic artery, accessory right hepatic artery, cystic artery

Introduction

The variations of hepatic vascular structures are of great importance for general surgery, particularly hepatic surgery. Vascular variations are significant for liver transplantations, radiological procedures, laparoscopic method of operation and for the healing of penetrating injuries, including the space close to the hepatic area. The anatomical knowledge of liver vascular variants is essential for reducing operative and postoperative morbidity and mortality in donors and recipients. Recently, due to the increase in the number of liver transplants, the importance of the hepatic artery anatomy has become obvious. The lack of normal blood supply to the liver is usually asymptomatic, until it is also interrupted to the visceral organs. We can find these variants of blood supply during diagnostic angiography. Vascular variants are very common in the abdominal region, and their description and study will be useful.

The pattern of the normal vascular system of the liver comes from the common hepatic artery (CHA), originating from the celiac trunk. The gastroduodenal artery (GDA), right gastric artery (RGA) and propria hepatic artery (PHA) are the main branches of the CHA. After that, the division of the PHA composes the left and right hepatic branches. The main variant is the origin of the right hepatic artery or replacement of this artery with accessory hepatic arteries. The lobes of the liver may receive nutrition from the superior mesenteric artery (SMA), left gastric artery (LGA), directly from the aorta or from the renal artery [1,2,4,7]. The size of the accessory artery is often smaller but their function and specific distribution are interesting for each case. The main purpose of this case report is to describe one different pattern of the hepatic artery branching from the classically explained. This case may also open the way in the future for thinking about the origin of such hepatic variants.

Case report

During a routine dissection with medical students from the Department of Anatomy, Histology and Pathology - Medical Faculty at the University of Sofia, we found on

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the cadaver that the blood supply of the liver differed from a normal one. The following variations occurred in another case of a 73 year old female cadaver during a subhepatic region dissection. Unfortunately, the medical history of the cadaver was not known. At the level of the T12 vertebra, the celiac trunk, which arises from the abdominal aorta, was observed. The branches of this trunk showed normal trifurcation and formed the left gastric, main splenic and the common hepatic arteries. The first branch of the common hepatic artery (CHA) was the right gastric artery; after the process of separation CHA gave two branches - first one of the SMA and ascended the portal region of the liver. The diameter of this vessel was 3.7 mm and the length 8.2 cm. In the artery pathway, three consecutive branches were observed (Figure 2). The first branch was found about 2.02 cm before the portal region of the liver. The second one became visible after another millimeter and finally the artery made one little curve and became a cystic artery. The first two branches entered the right lobe of the liver and replaced the absent RHAs. In summary, we can say that the absence of the RHP and CA were replaced by accessory right artery and its branches.

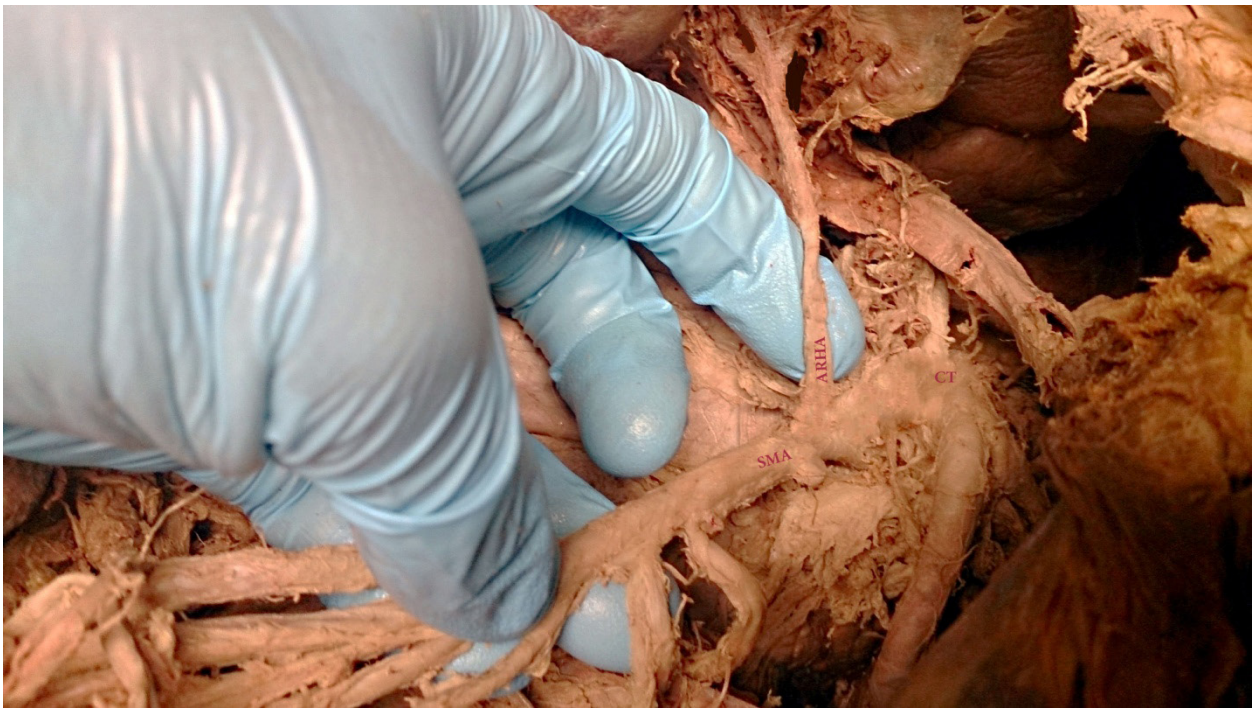

Figure 1. Superior mesenteric artery variant of the right liver lobe nutrition.
CT - celiac trunk
SMA – superior mesenteric artery
ARHA – accessory right hepatic artery

propria hepatic artery (PHA) and gastroduodenal arteries. The vascular system of the celiac trunk and the branches which originated from there were normal and we did not find any deviation. The difference was found in the absence of the right liver branch, which normally arises from the PHA. In our case the PHA closer to the portal region of the liver did not divide and we couldn't see the right hepatic artery (RHA) and the cystic artery (CA). This raised our interest to investigate where the blood supply of the right lobe of the liver came from. We focused our attention on another branch of the abdominal aorta – SMA, which was 3.4 cm below the celiac trunk (Figure 1). The course and the branching pattern of the SMA were documented and recorded using a digital camera. In this region we found a lot of iliac arteries, which feed the same name intestine. After a detailed dissection we distinguished a branch, which was routed to the right lobe of the liver. This branch was the

Discussion

This type of liver blood supply is already known. An international classification describing the vascular variation of the liver was observed by many authors, like: Adachi [2], Michels [7], Hiatt et al. [6], and Abdullah et al. [1]. These investigations were suitable for inquiry studies based on large groups of subjects. However, some variants of liver blood supply were not found in these classifications. This is one of the reasons why every type of abnormal feeding of the liver is helpful for the development of future classifications. Galen was the first anatomist who researched the arterial system from the celiac trunk and observed the arteries leading to the liver, stomach and spleen. Later on Andreas Vesalius gave anatomical descriptions of the Galen's discoveries in the sixteenth century, commenting the CHA and splenic artery. Hepatic artery variation described by Michels et al. in the 1966 [7] was based on dissection of

Figure 2. Divisions of the accessory right hepatic artery.
ARHA - accessory right hepatic artery
CA - cystic artery
GB - gallbladder
rRHA – replacement of right hepatic artery

200 cadavers. These authors explain 10 basic anatomical variations which were reduced to 6 types by Hiatt et al. in 1994 [6] after the observations of 1000 donors at the time of transplantation between 1983 to 1993. According to the observations, 60% represent classical variations of blood supply and 40% show different anatomical variations.

The variants of the hepatic artery have their origins in the embryo development. At the time of angiogenesis of the celiac trunk (CT), the most important vessels include the ventral splanchnic arteries which start directly from the embryonic aorta. The splanchnic arteries sprout 4 individual branches and many longitudinal anastomoses at different levels. The first main branches, the primitive celiac axis, originate the normal branches of CT such as spleen, left gastric and common hepatic arteries. The next 2 branches are obliterated and the last one become SMA. The variation of hepatic artery when the RHA is absent and is totally replaced by an accessory right hepatic artery from the SMA is a rarer variant [2,7]. This is because the embryology does not explain the origin of this anomaly and this variant, as is our case study, which is a riddle for science.

As mentioned previously, according to the Adachi [2] classification, our case belongs to group 17. This group includes variations with extant accessories: left or right artery arising from SMA. This anomaly according to Adachi was present in 0.4% of observed cadavers. Another classification by Michels [7] shows that approximately 9% which belong in class 3 originating from the Superior Mesenteric Artery, like our case. Considering the De Cecco [4] classification, the variants with the availability of the accessory right artery are very rare and occur in only 4%. From the above listed facts, it is obvious that the accessory right artery arising from the SMA is very rare. We cannot give the real answer in embryo development vision. The variation percentage of this variation according to Adachi, Michel and De Cecco is a big exception. At the end of our case report we have come to think that every type of the vessel variation will be helpful for the next investigation and for the surgeons' practice and liver transplantation.

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