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Case Report

ABNORMAL ORIGIN AND COURSE OF HEPATIC ARTERIES

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ABSTRACT

The present study describes a rare variation which celiac trunk is divided into four branches instead of three, in addition to a retro-portal pathway of the right hepatic artery. This variation was observed in a male adult cadaver. In this article, we also review the literature to make a brief discussion of the clinical and embryological relevance of these variations. The identification of that kind of variations in the celiac trunk and hepatic arteries is extremely important for surgeons and radiologists since multiple variations can lead to unexpected complications.

KEY WORDS: Anatomical Variation, Celiac Trunk, Hepatic Artery.

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INTRODUCTION

The human liver has a double blood supply. The portal vein and the hepatic arteries share the vascularization of that organ. Therefore, for a better comprehension of these arteries, it is necessary study the embryology of the liver, which can be easier to understand if we consider its division into three parts during the embryonic period: left lateral, right lateral and median, which would function as a bridge between the previous ones [1]. Each one of them receives a primitive artery responsible for its blood supply. The left lateral portion receives the left hepatic branch, which, in a later time, deviates its development and forms the left gastric artery. The median portion receives the medial hepatic branch, responsible for the formation of the proper hepatic artery. The right lateral portion receives the right hepatic branch, which ascends retro-portal, originating from the omphalomesenteric artery, which will later become the superior mesenteric artery. This right hepatic branch, however, involutes in normal development [2].

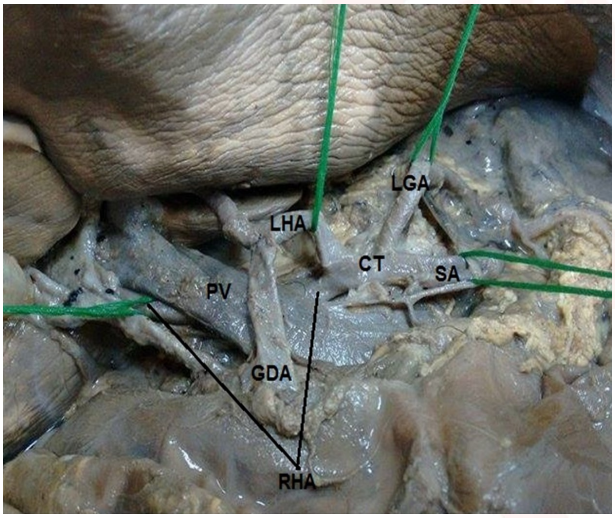
Besides that, in the normal division pattern, the celiac trunk originates the common hepatic artery that divides itself forming the gastroduodenal artery and the proper hepatic artery. The proper hepatic artery divides into right and left hepatic arteries. However, variations in this distribution are not uncommon. They were classified in many ways since Michaels [3] to Abdullah et al [4], always highlighting the most common patterns of division, such as accessory hepatic arteries from the superior mesenteric or from the left gastric artery [5]. In addition, several articles showing more uncommon findings can be found in the literature. It is

the case of absence of celiac trunk with its branches originating directly from the aorta, described by Iacob et al [6] and by Olewnik et al [7], or the hepato-spleno-mesenteric trunk described by Sridhar Varma et al [8], which brings together two of the main branches of the celiac trunk (hepatic and splenic arteries) with the superior mesenteric artery, the left gastric being a direct branch of the aorta in this case.

With the knowledge of this vast number of variations, it can be inferred that the study of the anatomy of this region must be continuous and always in search for patterns not yet seen that can prevent a surprise in surgery or image exam. The present case intends to show a pattern in which abnormalities of origin and path overlap, thus being of great importance for delicate procedures such as liver transplant.

CASE REPORT

Fig. 1: Celiac trunk division and retro-portal right hepatic artery.



PV-Portal vein; GDA- Gastroduodenal artery; RHA- Right hepatic artery; LHA- Left hepatic artery; CT- Celiac trunk; LGA- Left gastric artery; SA: Splenic artery

During routine dissection in the anatomy laboratory of the Fluminense Federal University, an anomalous pattern of division of the celiac trunk and also of the right hepatic artery pathway were observed in an adult male caucasian cadaver fixed in 10% formaldehyde (tamponade). This cadaver's cause of death had no relation with the vascular system and its dissection was performed according to the Declaration of Helsinki of 1995 (revised in 2000). The dissection was aimed at preparing the cadaver to study the vascularization of the upper abdomen from a xipho-pubic midline incision and, after the section of the hepatogastric ligament near the small curvature of the stomach, it was found that the celiac trunk was divided into four branches in Instead of three.

The left gastric artery and splenic artery were normal, but there were no proper or common hepatic arteries. The right and left hepatic arteries were direct branches of the celiac trunk, with the gastroduodenal being a branch of the left hepatic artery. In addition, the right hepatic artery makes a posterior path to the portal vein and, after passing through it, it is directed anteriorly to give origin to the cystic artery at the arrival in the hepatic hilum, as it would in its normal course.

DISCUSSION

The anatomical variations of the celiac trunk and the hepatic arteries occur frequently from 20.9% to 50% (Koops et al [9]; Ugurel et al [10]) according to different studies. Its classification in well-established standards is difficult because of the great difference of frequency found in different studies and, moreover, by the extremely variable division pattern.

Despite the high different frequency found by the authors, there are also some similarities. Hiatt et al, analyzed 1000 liver transplant patients and classified the hepatic vascularization into 6 types [11]. Among the 5 types with variations, the most common was the anomalous origin of the right hepatic artery arising from the superior mesenteric artery (10.6%), which was also found by Gruttadauria et al in 14.98% of the 701 cases studied [5] and Koops et al in 8.6% of the 604 angiograms that compose the study [9]. On the other hand, Koops et al found only 3% of left hepatic artery variations, while Hiatt et al and Gruttadauria et al found 9.7% and 11.5%, respectively [5,9,11]. An early bifurcation of the hepatic artery in right and left as direct branches of the celiac trunk was found in two cases in the study by Koops et al, but in only one of them the gastroduodenal artery originates from the left hepatic artery as presented on the current report [9].

When it comes to the path of these arteries, the variations are not so common. Makisalo (1993) describes as a rare variation the passage of an

accessory right hepatic artery from the superior mesenteric artery posterior to the portal vein [12]. Polguj (2010) reports a case of accessory right hepatic artery coming from the common hepatic artery that also makes a posterior path to the portal vein [13].

In view of such variations, the presence of the right retro-portal hepatic artery can be justified by the maintenance of the right hepatic branch of the hepatic vascularization in the embryonic period. This right hepatic artery may remain as a branch of the superior mesenteric artery or present different origins, considering that the formation of the celiac trunk and the mesenteric arteries is made by the fusion of several embryological abdominal vessels at a later time. It can be the only right hepatic artery or an accessory one while the middle branch forms only the left hepatic [2]. Therefore, this is, probably, the embryological alteration that resulted in the case reported here. The maintenance of the right hepatic branch as a single right hepatic artery and its subsequent fusion with the celiac trunk.

CONCLUSION

The study of the hepatic vascularization anatomy is quietly important for the accomplishment of surgeries, endovascular procedures and understanding of imaging exams of the region. Given the wide range of variations present, knowledge of the possibilities to be found is even more relevant, especially for hepatic transplant surgery [(14)], in which each branch can have a direct impact on the success of the surgery. In addition, there were no reports in the literature of the combination of variations of origin and division of hepatic arteries and variation of the right hepatic artery pathway reported here, showing the importance of the current report.

Conflicts of Interests: **None**

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