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Prehepatocholedochal Proper Hepatic Artery. Rare Anatomical Variant. Surgical Considerations. Case Report

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Rezumat

Arteră hepatică proprie prehepatocoledociană. Variantă anatomică rară. Implicații chirurgicale

În varianta anatomică clasică, artera hepatică proprie (AHP) continuă artera hepatică comună (AHC), după desprinderea arterei gastroduodenale (AGD), şi dă la rândul său arterele hepatice dreaptă (AHD) şi stângă (AHS), AHP fiind situată la stânga canalului hepatocoledoc (CHC). În lucrarea de față se prezintă o anomalie de poziționare a AHP, care era dispusă în fața CHC, cu un diametru mărit, de circa 5-7 mm, care putea fi confundată cu CHC. Este vorba despre o pacientă în vârstă de 57 de ani, diagnosticată cu colecistită acută litiazică, şi care asociat mai prezenta hipersplenism şi hipertensiune arterială. Literatura de specialitate aminteşte de numeroase variante anatomice de vascularizație arterială a ficatului, inclusiv a AHP, motiv pentru care lucrarea de față reprezintă şi o scurtă trecere în revistă a literaturii de specialitate. Cazul de față prezintă o raritate topografică a AHP care ar putea fi confundată uşor cu CHC, mai ales în timpul unor intervenții chirurgicale celioscopice, fapt important de cunoscut de către medicii chirurgi.

Cuvinte cheie: arteră hepatică proprie, variante topografice, colecistectomie

Abstract

In classical anatomic variants, the proper hepatic artery (PHA) continues the common hepatic artery (CHA) after the gastro duodenal artery (GDA) detaches itself and divides into the right hepatic artery (RHA) and left hepatic artery (LHA), the proper hepatic artery being located to the left of the hepatocholedochal duct (HCD). This paper presents an abnormal positioning of the PHA placed before the HCD with an increased diameter of about 5-7 mm, which could be confused with the HCD. We present the case of a 57 year-old woman diagnosed with acute lithiasic cholecystitis, associated with hypersplenism and hypertension. The literature mentions manifold anatomical variants of arterial liver vascularization, including PHA. For this reason, this paper presents an overview of similar cases that can be found in medical literature. The aforementioned case is a rare topographic anatomy for the PHA that can easily pass for HCD especially during celioscopy, therefore it is crucial for this to be acknowledged by all surgeons.

Key words: proper hepatic artery, topographic variants, cholecystectomy

Introduction

Most times the PHA continues the CHA after branching the GDA, penetrating between hepatoduodenal ligament foils with an ascending trajectory up to the hepatic hilum placed in the posterior and lateral side of the portal vein and to the right of the HCD.

On its trajectory, the PHA divides into collateral branches with the RHA and cystic artery (CA), the latter originating

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mostly in the RHA. Near the hepatic hilum, the PHA divides into two terminal branches, namely the RHA and LHA (1).

The literature mentions manifold anatomical variants of arterial liver vascularization, one of the most common being the origin of the CHA from the superior mesenteric artery (SMA), but we could not find any cases of PHA positioned in front of the HCD, approaching the hepatic hilum in front and to right side of the HCD.

Case report

The patient is a 57 year-old woman diagnosed with acute lithiasic cholecystitis. This diagnosis was sustained by clinical symptoms (pain in the right hypochondriac side, fever, shivers with fever, local muscular defence), paraclinical echography examination (distended gallbladder with walls of about 5-7 mm in thickness, presenting numerous calculi with sizes ranging between 3 mm and 20 mm) and biochemical tests (leukocytic elements counted up to 18,000, hepatic cytolysis syndrome and mild cholestasis). The patient had presented hypertension and hypersplenism as well.

According to symptoms, clinical examination and complementary tests, but also due to the patient's refusal for celioscopy, we decided to perform a laparatomic investigation.

Results and Discussions

The PHA was found during surgery. It was anterior to the HCD, positioned slightly oblique to it from left to right. PHA origin was found inside the CHA and this was observed during the laparatomy. The PHA was approaching the front side of the hepatic hilum to the right side of the HCD. The diameter of this artery was about 6-7 mm rendering it quite easy to be confused with the HCD. In addition, the presence of an accessory spleen located in the gastro-hepatic ligament was also found, probably due to hypersplenism. During the intervention, the two PHA terminal branches, RHA and LHA (*Fig. 1*) were found.

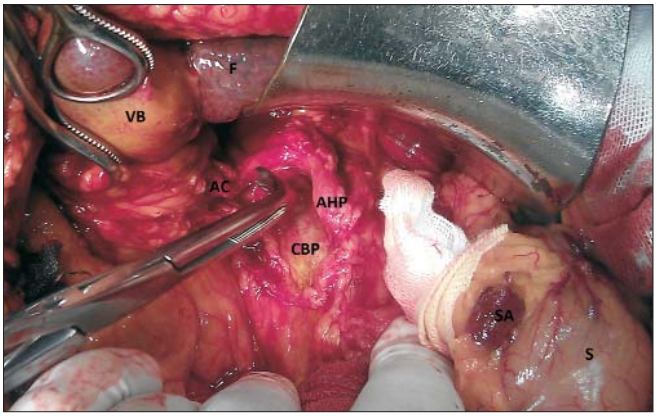

Figure 1. *intraoperative: VB - Gall Bladder; F-liver; AC - Cystic Artery (CA); AHP-Proper Hepatic Artery (PHA); CBP - Hepatocholedocha Duct (HCD); SA - Accessory Spleen (AS); S-Stomach*

There was no evidence of any other PHA, therefore we could not consider it an aberrant hepatic artery.

The literature mentions a various number of anatomic variants of hepatic vascularisation that may also be encountered in practice. Over time variations in arterial blood supply were observed. These variations could be found by means of dissections, necropsies, surgery or imaging. The most sensitive technique is angiography.

Popescu I. et al state that the usual variant of hepatic vascularisation is found in about 50% of cases and the rest of cases are vascular abnormalities (1).

In 1756 Haller published for the first time a report on the presence of an aberrant hepatic artery (2), and in 1928 Adachi published the results of a study performed, by means of necropsies, on the liver vasculature (3). In 1958, the first study of hepatic vascularisation achieved by selective angiography (4) was published. In 1966 Michels published a study on 200 dissections, and defined the anatomical variations for hepatic vascularisation. According to this study, in over 45% of cases anatomic variants of vascularisation occur. He also defined the accessory aberrant arteries or replaced arteries and classified hepatic vascularisation variants in ten types (5). In 1989, on the basis of a study on 172 hepatic donors, Brems modified Michels' classification and re-classified the types of vasculature into 5 new types (the most frequent) and 6 types of rare cases. These types are defined as follows: type I (CHA originating from the celiac trunk dividing into GDA and PHA, which will transform subsequently in RHA and LHA), type II (the presence of accessory or replaced arteries for LHA originating from the LGA), type III (the presence of accessory or replaced arteries for RHA originating from the SMA), type IV (RHA and LHA originating from SMA respectively from LGA), type 5 (CHA originating from SMA) (6). Subsequently, numerous other studies have approached the study of liver vasculature, especially after the increase in liver transplantation procedures (7, 8, and 9). In 1994 Jonathan Hiatt published the results of a study on liver vasculature. It was conducted on 1,000 cases of donors for liver transplantation. This study was performed during 1984-1993. According to it and based on Michels' modified classification, Hiatt reports the following results: in 76% of cases, he found the presence of vascular type I, in 10% of cases he found vascular type II, in 11% of cases he found vascular type III, 2.5% of cases with vascular type IV, in 0.5% he found the type V and 0.2% of patients were vascular type VI (CHA originating from the aorta) (10). Hyatt has also the merit of modifying the Michels classification. In 2004 Koops et al published the results of a study on liver vasculature. The study was performed by selective angiographies on CT and SMA on a total of 604 cases. According to this study 478 cases were classified as type I (79.1%) and 126 cases (20.9%) presented vascular abnormalities (10). However, percentages on the incidence of vascular anomalies vary from one study to another. For example, according to a study that was conducted in 2006 on 932 cases, of which 487 by dissections and 445 by surgery, 68.1% of cases were classified as type I, 31.9% of cases being found with vascular abnormalities (11).

According to the aforementioned studies, we can observe

anatomical variants of CHA, PHA or for PHA terminal branches. Thus, CHA origin abnormalities were detected and the medical literature presents numerous cases where its origin lies in the SMA (12,13). That would include the Hyatt-Michels classification (1994). That is why we were trying to intraoperatively find the origin of the CHA, which in this case was to be found in the celiac trunk. According to the same classification, the CHA can originate from the left gastric artery (LGA) in some cases. Such cases have been reported alone or in studies (10).

Another study performed by means of selective angiography on a total of 200 patients showed that in 80% of cases it meets the classical anatomical distribution (type I); in 11.5% of cases the presence of an accessory RHA or with its origin in the SMA was found and in 5.5% of cases the LHA originated from the LGA. Just 1% of the discovered anatomic variants cannot fit the classification of Michels (15).

In fact, the medical literature presents three main anatomic variants: the first variant, the "classic" one presents three arterial branches derived from the celiac trunk (splenic artery (SA) + CHA + LGA); the second variant represented by the presence of celiac trunk with only two terminal branches, subdivided into three anatomic variants, known as: gastrosplenic trunk (6%), hepatosplenic trunk (6%) and hepato-gastric trunk; a third anatomic variant with complete absence of celiac trunk and separation of the three branches from the aorta or from the superior mesenteric artery, described as a celiac-mesenteric trunk (1,16).

Thus, in the medical literature different similar variations were reported, such as a retro portal PHA and SMA anastomosis by the so-called Bühler anastomotic artery (17) or the presence of middle hepatic artery (MHA) coming together with (GDA) from a common hepatogastric trunk (HGTr) originating in the PHA (17).

According to previous references in the medical literature (18,19), the PHA can be completely absent. Thus, Daghfous reported in 2011 an imaging study on 33 cases. He found that in 6% of cases, three branches are detached from the CHA: GDA, RHA and LHA, with lacking PHA (18). Gurgacz also reported two cases in 2011. In these cases, the PHA was missing. The LHA originated from the LGA (in this case it was a branch of the abdominal aorta) and the RHA originated directly from the SMA (19).

RHA variants are also mentioned and they can pass in front of either the HCD or the gallbladder and can be easily confused with the CA (10). Such cases are described in the literature or discovered during surgery or even celioscopy, a fact that makes it more difficult to interpret the regional anatomy (20,21). For this reason we observed the PHA trajectory from its origin up to the hepatic hilum where it divides into the RHA and LHA. In such cases, the risk of confusion with the CA is increased and secondary consequences of the RHA possible ligatures can lead to liver lobe infarction - cases reported also in the literature (22); it is also possible to damage the right hepatic duct by cholangitis or secondary strictures, also with disastrous results for the patient (22). The presence of an accessory LHA is not new either- such cases were also cited in the literature (23). The importance of anatomic variants in hepatic vascular systems is extremely useful in liver surgery (24-27), liver cancer (28,29,30), liver transplantation (31) or liver trauma (32).

Conclusions

There are many anatomic variations of arterial vascularization of the liver, which include both PHA and CHA or RHA and LHA, and these anatomical variations are reported in the literature in different rates. This case study presents a rare anatomic topography for the PHA that could easily be confused with a HCD, especially in celioscopies, and this is an important fact that should be well known by surgeons. However, the presence of this anatomic variant draws attention to the possibility of the existence of other anatomic variants, for which we consider careful preparation of the cystic duct and cystic artery, especially during celioscopic cholecystectomy, to be very useful, as well as careful preparation of the main bile duct during a surgery using an open approach, especially for internal biliary derivations.

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