Accessory right hepatic artery originating from the superior mesenteric artery: report on three cadaveric cases from Sokoto, North-Western Nigeria and review of literature

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ABSTRACT

Background: The superior mesenteric artery may be the source of the common hepatic, gastroduodenal, accessory right hepatic, accessory pancreatic or splenic arteries.

Objective: To present three cases of accessory right hepatic artery originating from the superior mesenteric artery in black African cadavers as found during routine cadaveric dissections.

Materials and Method: The abdomens of 8 adult male black African cadavers were dissected according to the description and guidance by Romanes (1996). The superior mesenteric arteries, liver (especially the visceral surfaces), gall bladders, cystic ducts, portal veins and gastroduodenal arteries were exposed.

Results: Three cadaveric cases of the accessory right hepatic arteries arising from the superior mesenteric arteries were observed. One of the cases was noticed to give a cystic branch.

Conclusion: Since there are no Nigerian studies on the accessory right hepatic artery arising from the superior mesenteric artery, these reports might contribute useful data to the literature regarding the same.

Keywords: *Accessory, cadaver, right hepatic artery, Sokoto*

INTRODUCTION

In the standard or classic visceral anatomy, the celiac axis gives rise to three branches.[1] The first branch is the left gastric artery, after which the vessel divides into the splenic artery and common hepatic artery. The common hepatic artery then bifurcates into the gastroduodenal and proper hepatic artery, and the proper hepatic artery bifurcates into right hepatic artery and left hepatic artery.[2] The superior mesenteric artery may be the source of the common hepatic, gastroduodenal, accessory right hepatic, accessory pancreatic or splenic arteries.[3]

Michels[4] described his classification scheme for describing anatomic variation in the hepatic arterial blood supply based on the results of dissecting 200 cadavers. Vandamme *et al*.[5] published their experiences with 156 postmortem angiograms that were obtained before anatomic dissection. Suzuki, *et al*.[6] reported on the surgical importance of anatomic variants of the hepatic arteries that was based on findings in 200 patients who were examined with cut-film angiography.

It is important that interventional radiologists who perform hepatic arterial embolization be familiar with both common and rare hepatic arterial variants, because failure to recognize the presence of an aberrant vessel can result in incomplete embolization of liver tumours. Familiarity with these variants can also help one avoid various surgical complications. [2]

The objective of these three case reports is to bring awareness to clinicians about the accessory right hepatic artery arising from the superior mesenteric artery as a hepatic arterial variant. These reports may also be useful to clinicians performing invasive techniques and vascular surgeries.

CASE REPORTS

General Consideration

All the three cadavers in which their respective accessory right hepatic arteries

were found to originate from their respective superior mesenteric arteries, were adult male black African cadavers (exact age and cause of death not known to us). The cadavers were dissected during routine gross anatomy dissections of the abdomen for the undergraduate medical students in the Department of Anatomy, College of Health Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria. The dissection of the abdomen was carried out according to the description and guidance by Romanes (1996).[7] The superior mesenteric artery, liver (especially the visceral surface), gall bladder, cystic duct, portal vein and gastroduodenal artery were exposed. We observed that all the three respective accessory arteries had similar points of origin, courses and relations as seen below (both in the text and figures).

CASE REPORT I

In this cadaver (Figure 1), we observed the presence of an accessory right hepatic artery arising from the superior mesenteric artery. The accessory right hepatic artery arose from the superior mesenteric artery near its origin from the abdominal aorta. The accessory artery ascends to pass upwards and to the right behind the cystic duct and the portal vein, anterior to the inferior vena cava, to finally reach the visceral surface of the right lobe of the liver.

CASE REPORT II

The observation made in this cadaver (Figure 2) was as that in the first case (Figure 1).

CASE REPORT III

In addition to the common characteristics (point of origin, course and relations) observed in all the three accessory right hepatic arteries, we noticed in this cadaver (Figure 3), that this artery gave out a cystic branch just before it finally reached the visceral surface of the right lobe of the liver.

However, we observed in all the three cases the presence of the normal typical right hepatic artery that arises from the proper hepatic artery.

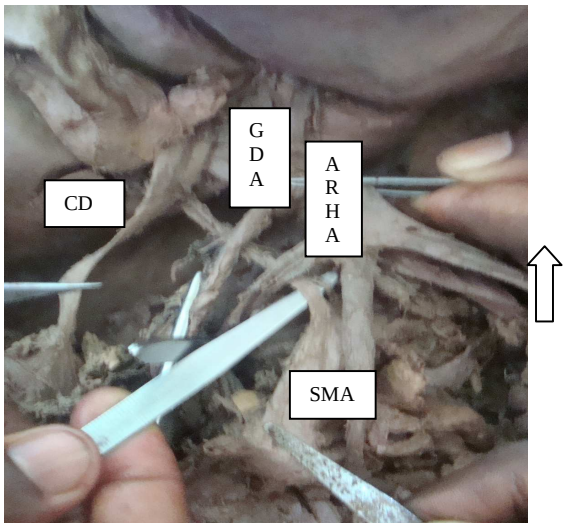

Figure 1: Showing Accessory Right Hepatic Artery (ARHA, elevated with the longest forceps, held with two fingers from the left lower angle of the figure), arising from the Superior Mesenteric Artery (SMA). CD = Cystic duct, GDA = Gastroduodenal artery.

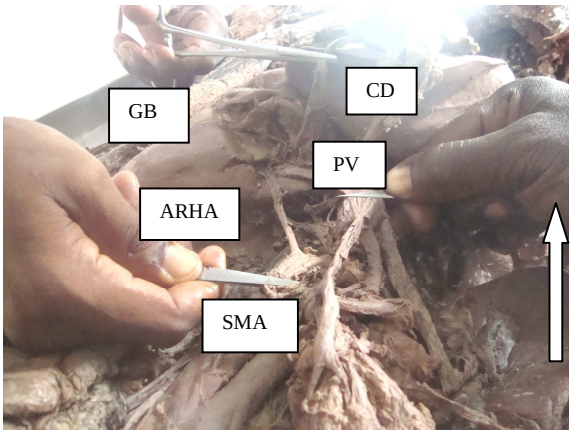

Figure 2: Showing Accessory Right Hepatic Artery (ARHA) arising from the Superior Mesenteric Artery (SMA). *PV = Portal Vein, CD = Cystic Duct and GB = Gall Bladder*

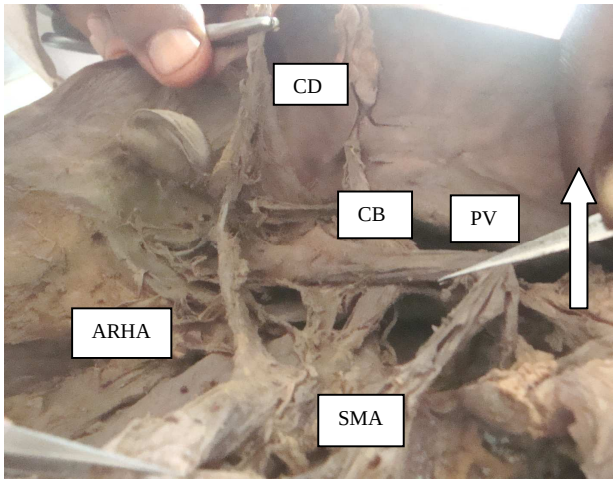

Figure 3: Showing Accessory Right Hepatic Artery (ARHA) arising from the Superior Mesenteric Artery (SMA). The ARHA gives a Cystic Branch (CB). PV = Portal Vein, CD = Cystic Duct

DISCUSSION

Several authors[8,9] have proposed that the word *aberrant* rather than *accessory* be used to describe cases in which one branch that is supplying blood to one side of the liver arises ectopically and remainder of the supply is from the typical location, because such branches almost invariably supply a distinct territory of one side of the liver. Although some use the terms *aberrant* and *accessory* interchangeably, it is recognized that the word *accessory* is the more frequently used descriptive term. The term *replaced* is used to refer to cases in which the entire arterial blood supply to a side of the liver arises from an atypical location.[2]

Our findings from dissection of cadavers revealed that the accessory right hepatic artery originated from the superior mesenteric artery near its origin from the abdominal aorta. This agrees with the report of Anne *et al*;[2] indicating that accessory right hepatic artery could originate from the superior mesenteric artery. We observed that the accessory arteries from the cadavers ascend to pass upwards and to the right, behind the cystic duct and the portal vein, anterior to the inferior vena cava, to finally reach the visceral surface of the right lobe of the liver.

However, standard hepatic arterial anatomy has been reported in approximately 50% of patients on the basis of cadaveric and early angiographic reports.[4-6,10-12] Redman and Reuter[13] reported that "most of the variations of the other 50% have little surgical significance." Because of the advent of the interventional and surgical techniques to treat both primary and metastatic liver tumours[14,15] and the increasing availability of living related liver transplant donors, the accurate depiction and definition of the hepatic arterial anatomy are crucial.[2]

Michels[4], Vandemma *et al*,[5] and Suzuki *et al.*[6] reporting on the anatomic variation in the hepatic arterial blood supply, stated that major technical advances in angiography have occurred; these include the advent of digital subtraction angiography, which has virtually replaced cut-film angiography for most applications in the United States of America. The interventional and surgical options for patients with primary and metastatic liver tumors also have expanded dramatically during this period. Now, more than ever, surgeons and interventional radiologists are relying on accurate imaging and assessment of the hepatic arterial supply.[2]

Computed tomographic (CT) angiography[16-18] and gadolinium-enhanced magnetic resonance (MR) angiography[19-22] are used commonly to assess the visceral anatomy preoperatively. Therefore, it is important that abdominal imagers be familiar with the full gamut of possible hepatic arterial variants.[2] Although the sensitivities of CT angiography and MR angiography for the depiction of hepatic arterial variants are reported in several articles, [16, 19, 20] in general, the variants in these studies are in line with those described by Michels.[4]

Anne, *et al*.[2] reported on the variant hepatic arterial anatomy, using digital subtraction angiography (DSA) performed on 600 patients. In their series, 73 (12.2%) patients had their right hepatic arteries replaced to the superior mesenteric artery. Accessory right hepatic arteries were seen in 15 (2.5%) patients: 11 accessory right hepatic arteries originated from the superior mesenteric artery and one each originated from the gastroduodenal artery, left gastric artery, celiac axis and right phrenic artery.[2]

Although the gross findings in our work are similar to those described in Caucasians by Michels[4] in cadaveric studies, Redman and Reuter[13] in cut film angiography and Anne *et al*.[2] in DSA, the prevalence of ARHA in this study is higher, despite the fact that the number of subjects used in this study is less.

The study done at the University of Iowa[23] revealed good correlation between MR angiography and DSA in the depiction of the degree and length of stenoses in iliac and peripheral vascular disease, but accuracy in the depiction of the visceral arteries was lower.[2] Zeh *et al.*[19] described their observations of hepatic arterial variants in 27 patients who underwent MR angiography for preoperative planning for hepatic arterial infusion pump placement. In their study, 17 patients underwent both MR angiography and DSA. Magnetic Resonance (MR) angiography enabled the correct identification of all 14 patients with standard anatomy and of three with replaced right hepatic arteries. In addition, six accessory left hepatic arteries were identified at MR angiography; five of these were confirmed at DSA.[2]

The largest related series in the MR literature is that from Hamburg, Germany, [20] in which MR angiography was compared with DSA in 60 patients. In that series MR angiography correctly depicted the visceral arterial anatomy in 57 (95%) cases. Anne *et al.* reported that the results of the studies from Germany were encouraging, but the variants reported in them were limited to those described by Michels.[4]

CONCLUSION

To avoid potentially disastrous complications, one must have detailed understanding of common hepatic arterial variants. Since there are no Nigerian studies on the accessory right hepatic artery arising from the superior mesenteric artery, these reports might contribute useful data to the literature regarding the same.

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