

Aortic origin of right hepatic artery and superior mesenteric origin of splenic artery two rare variations demonstrated angiographically

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Abstract

Abstract Anatomical variations of the celiac trunk and superior mesenteric artery are not infrequent. Knowledge of the existing aberrations is important in planning and conducting surgical or radiological procedures. A case of right hepatic artery arising independently from the aorta supplying an hepatocellular carcinoma was identified, through which transarterial chemoembolization was successfully performed. A second case is presented with a common splenomesenteric trunk branching into the splenic and superior mesenteric arteries. These two cases represent exceptional arterial variations in the upper abdomen.

Anatomical variations of the visceral arteries, particularly those concerning the celiac trunk and the superior mesenteric a. (SMA), are well known in medical literature [7, 16]. The most frequent variations encountered in clinical practice involve a right hepatic a. arising from the SMA and a left hepatic a. from the left gastric a. In daily practice, however there are some more exceptional anatomical variations that may puzzle the surgeon or vascular radiologist dealing with intraabdominal disease.

Two such cases are reported here. One involves the right hepatic a. originating from the aorta, and the other the splenic a. originating from a common splenomesenteric trunk.

Case reports

Case 1

A 55-year-old man with long-standing chronic pancreatitis and abdominal pain was referred for angiography to exclude the diagnosis of mesenteric arterial ischemia. Selective celiac trunk angiography revealed an hepatogastric trunk, while superior mesenteric angiography demonstrated a common splenomesenteric trunk giving rise to the SMA and splenic a. (Fig. 1). Inferior mesenteric a. angiography was normal with no apparent variation. Although the first part of the SMA (just distal to the bifurcation) showed a mild degree atherosclerotic stenosis, the patient was considered to have no objective angiographic finding for the diagnosis of symptomatic mesenteric ischaemia. He was referred back to his physician to overcome the abdominal pain attributable to chronic pancreatitis.

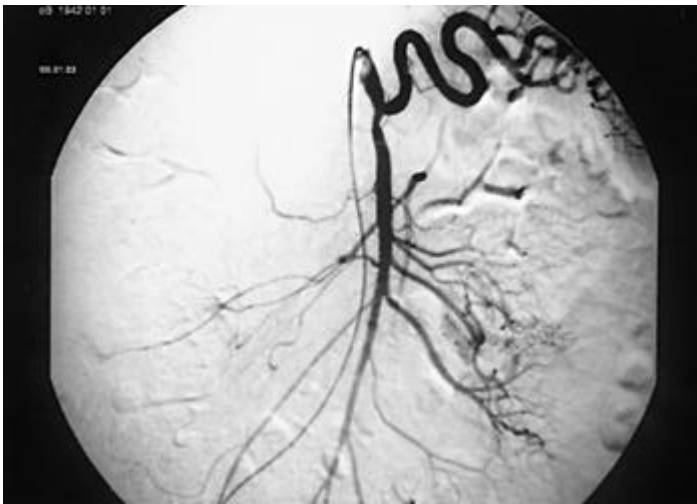
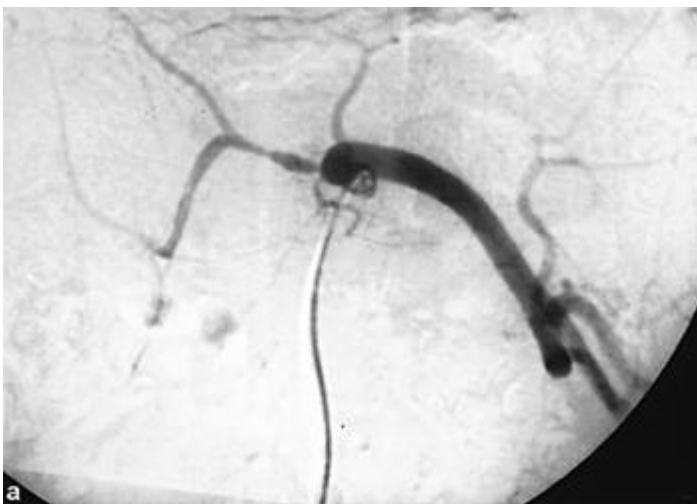


Fig. 1 Case 1. Selective angiography of the superior mesenteric a. shows a common splenomesenteric trunk, which divided into later the splenic and superior mesenteric aa. Note the stenosis in the proximal part of the superior mesenteric a.

Case 2

A 50-year-old man with Child-Pugh B classification viral cirrhosis was found to have hepatocellular carcinoma (right-sided 7 cm main mass and a few satellite lesions). After extensive clinical and laboratory examination, he became a candidate for transarterial chemoembolization and was referred to the Interventional Radiology Department. Selective celiac trunk angiography showed a normal anatomic pattern, except for the common hepatic branch dividing into the left hepatic and gastroduodenal aa. (Fig. 2a-c). Superior mesenteric angiography revealed there was no hepatic branch. Reinterpretation of previous angiograms demonstrated a faintly opacified artery originating from the aorta, between the celiac trunk and SMA (near to the celiac trunk) (Fig. 2b). The aberrant artery was catheterized and injected contrast material revealed that it was the right hepatic a. supplying the right hemiliver, together with the main tumor mass and multiple satellites (Fig. 2d). Transarterial chemoembolization through the aberrant right hepatic a. was accomplished using an iodized oil and epirubicin mixture. The patient went home two days later.



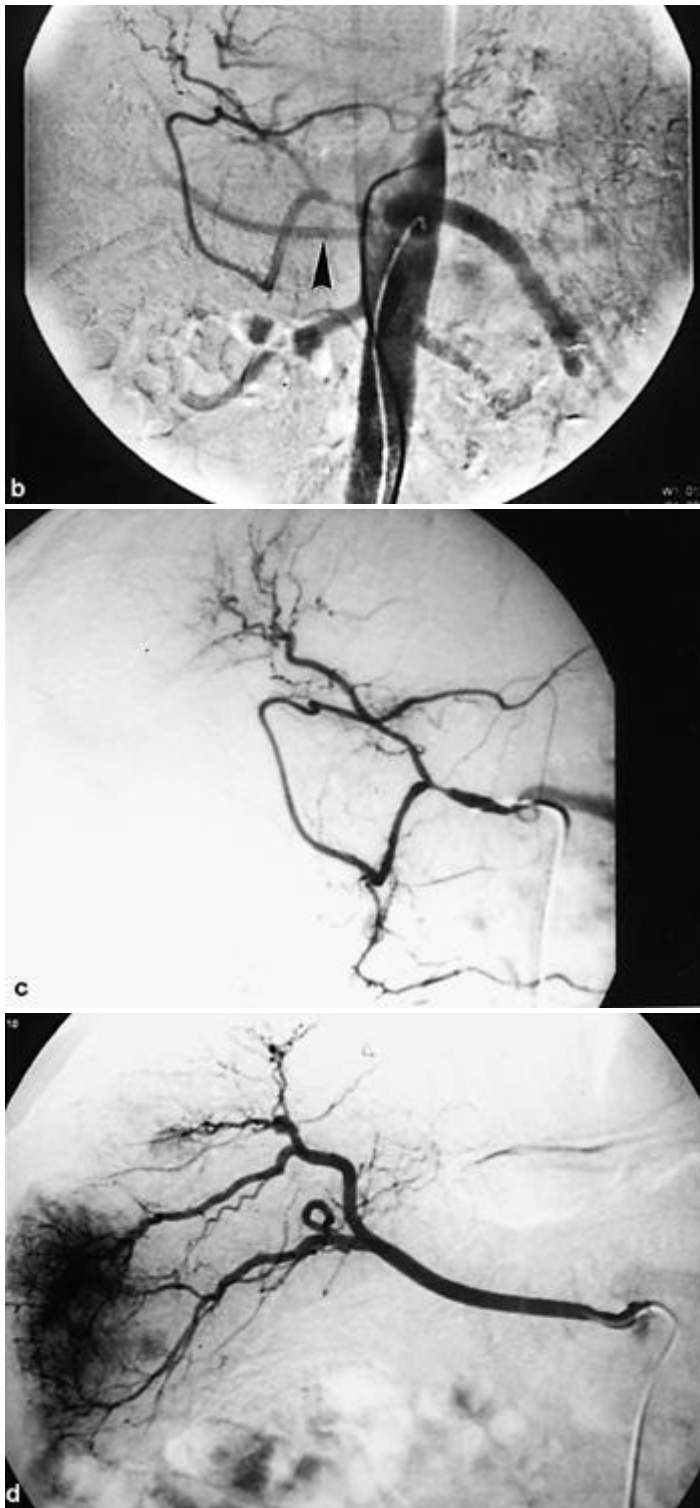


Fig. 2a-d Case 2. **a.** Selective angiography of the celiac trunk. **b.** Sequential film of the same examination as in (a). The celiac trunk has the normal three main branches except for the common hepatic a. dividing into the left hepatic and gastroduodenal aa. Note contrast material regurgitation into the aorta on the celiac trunk angiograms, which faintly showed the aberrant artery (*arrowhead*). **c.** Selective common hepatic a. angiogram shows only two branches gastroduodenal and left hepatic aa. **d.** Selective angiography of the aberrant right hepatic a., which supplied the hepatocellular carcinoma confined in the right hemiliver

Discussion

Vascular aberrations may interfere with several surgical and interventional radiological techniques, however they have to be dealt with. An attempt has been made at classifying the anatomy of the celiac trunk from many reports, both old and recent. van Damme et al. proposed a simple classification in which the hepatic, splenic and left gastric aa. are considered the "main" branches [16]. Trifurcation of the celiac trunk into the hepatic, splenic and left gastric aa. has been accepted as the normal anatomy for many years and can be found in 84-86% of humans [7, 16]. If one of the main branches is absent,

a gastrosplenic trunk (with absent hepatic a.) (3-6%), hepatosplenic trunk (with absent left gastric a.) (5-6%), and hepatogastric trunk (with absent splenic a.) (1%) are formed [7, 16]. If two main branches are absent then the three main branches originate independently, consequently there is no real celiac trunk (1-2%) [7, 16]. A special form of absence of the celiac trunk is the celiacomesenteric trunk where all three main branches of celiac trunk and SMA arise from a common trunk (2%) [7]. Absent branches may originate from the aorta or one of the remaining two main arteries. In the latter situation the common hepatic a. arising from the SMA is a well known example (hepatomesenteric trunk) [7, 16]. A similar situation may occur for the left gastric a. in that it may also originate from the left hepatic a., as shown by Nakamura et al. in 14% of the Japanese [11], although this variation is very rare in other races [16]. Finally, the splenic a. may also show this pattern. A common splenomesenteric trunk, which gives off the splenic a. and SMA, has been reported with an incidence of less than 1% [1, 7, 9, 14]. Some patients with such a variation have been presented as a case report [5].

Tandler provided an embryological explanation for these variations in 1904 [15]. During development, three groups of collateral aa. arise from the abdominal aorta as dorsal, lateral and ventral branches. The latter develop initially as paired vessels, which then coalesce in the median line to form the four roots for the gut the four roots being connected by ventral longitudinal anastomoses. In the majority of cases the first three roots coalesce to form the celiac trunk and separate from the fourth root. The future SMA is developed from the fourth root, which migrates caudally with the ventral migration of the gut. If this separation takes place at a higher level, one of the celiac branches arises from the SMA. The splenic a. arising from SMA (splenomesenteric trunk), as in the present patient, is an example of this exceptional condition.

The common hepatic a. is a branch of the celiac trunk. It arises from the SMA in 1.5-7% of population [6, 7, 16] exceptionally it may arise separately from the aorta (0.2-3%) [7, 11, 16]. The normal pattern of the common hepatic a. is to form the gastroduodenal and proper hepatic a., which then divides distally into right and left hepatic branches. This pattern is present in only 54-75% of the population, the remainder having aberrant hepatic branches from the left gastric a. or SMA [3, 6, 16]. According to van Damme et al. division of the hepatic a. into its right and left hepatic branches may take place at any point between the proper hepatic a. and the aortic origin of the main hepatic trunk [16]. The right hepatic a. may arise from the gastroduodenal a. (no proper hepatic a.), the common hepatic a. or the celiac trunk [16]. In the latter situation, the right and left hepatic branches take their origin from the celiac trunk separately (2-4%) [7, 16]. Therefore, it has been called a duplicated hepatic a. [4]. Direct origin of the right hepatic a. from the aorta, as seen in the present case, is one exception among other rare variations, such as the right anterior hepatic a. arising from the SMA [10] and the right hepatic a. from the right renal a. [2].

The recognition of a variant splanchnic arterial supply has important diagnostic and therapeutic implications. Operational strategies in cases of arterial aberrations interfering with major abdominal surgical techniques, such as liver transplantation and resection, hepatic a. infusion chemotherapy, gastrectomy, biliary reconstruction, and pancreaticoduodenectomy, have been well discussed [16]. Settembrini et al. reported two patients with aneurysms involving the origin of the splenic a. that arose anomalously from the SMA just behind the pancreas [13]. The origin of the splenic a. from the SMA might have been carried downwards by the caudal migration of the SMA behind the head of the pancreas. These authors, therefore modified their surgical technique to reach the neck of the aneurysm and carried out a successful repair.

Aberrant arterial branches may also interfere with interventional radiological procedures. In the case of the left gastric a. arising from the left hepatic a., transarterial chemoembolization through the left hepatic a. may damage the gastric mucosa. In our institution transarterial chemoembolization of hepatocellular carcinoma has been achieved through either aberrant hepatic branches [12] or collateral vessels [8]. Present day catheter and guidewire technologies allow many selective and superselective catheterizations in abdominal interventional procedures to be performed, as in other parts of the body.

In conclusion, different anatomical variations involving the celiac trunk and SMA should be borne in mind during both surgical and radiological evaluations. Knowledge of such variations would result in the accurate interpretation of disease in diagnostic imaging, as well as the optimum elective procedure in surgical or interventional radiological management.

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