A Case of the Inferior Mesenteric Artery Arising from the Superior Mesenteric Artery in a Korean Woman

INTRODUCTION

There are three unpaired visceral branches of the abdominal aorta, the celiac trunk (CT), the superior mesenteric artery (SMA) and the inferior mesenteric artery (IMA), proceeding in a cranio-caudal direction. The two upper unpaired visceral branches originate from the aorta in a prefixed site at the level of the first lumbar vertebra, whereas the lower one has more variable points of origin. This is true for all ages and for both genders (1). On the other hand, the IMA is diverged generally at the level of the third lumbar vertebra, considerably below the origin of the SMA and the CT (2). Thus, there have been many reports on the variations between CT and SMA, but the variations of the IMA are found to be extremely rare.

The abdominal vessels, especially the CT and SMA, frequently show diverse anomalies in their origin and course to date (3-7). Either component of the CT sometimes arises directly from the abdominal aorta or independently from the aorta. In addition, the CT unites with the SMA at their origins to form a common trunk, the celiacomesenteric trunk (CMT) (3). The rare occurrence of CMT at the level of the first lumbar vertebra is stated to be 1%-2.7%. According to report and review on other abdominal arterial anomalies associated with the CMT, a left colic artery arises from the distal portion of the CMT, corresponding to the SMA (4).

The left colic artery arising from the SMA has been reported to occur at a low frequency of 1%. The prevalence of the variation on the IMA, such as the absence of the IMA or the formation of a common mesenteric artery in which the IMA joins the SMA, is extremely rare (8). We encountered a rare variation of the IMA branching out of the SMA during a routine dissection of an 82-yr-old female cadaver at our university in 2011.

CASE DESCRIPTION

During a routine dissection carried out at Jeju National University Medical School in 2011, we found a case in which the IMA arose from the SMA. This variation was observed in an 82-yr-old Korean woman cadaver, whose cause of death was ‘unknown.’ The protocol for the current report did not include any specific issue that needed to be approved by the institutional review board of the Jeju National University and it conformed to the provisions of the Declaration of Helsinki in 1995. Gross dissection was performed in the customary fashion. In order to indicate the arteries, the veins were removed. All arterial branches supplying the gastrointestinal tract were examined. The distance between two branches of the abdominal aorta and the external caliber of the main arteries at their origin were also measured.

The typical vascular network (Fig. 1A, B, and B1) of abdominal aorta was absent, and the CT and the SMA were the only unpaired visceral branches out of abdominal aorta (Fig. 1C, and C1). Since the IMA did not arise from the abdominal aorta, the SMA can be also named as the common mesenteric artery or bimesenteric trunk. The CT and the SMA arose at a distance of...
14.3 cm and 12.5 cm respectively from the bifurcation of the abdominal aorta to the right and left common iliac arteries, which correspond to the level of the first lumbar vertebra. The SMA had a caliber of 8 mm, and was approximately 18 mm below the CT (10 mm in external caliber at its origin). The SMA gave off its first (inferior pancreatico-duodenal artery) and second branch 27 mm and 35 mm away from its origin, respectively (Fig. 2B). The second branch (3 mm in external caliber), corresponding in course and distribution to the IMA, gave rise to the classical branches of the IMA, the left colic artery, the sigmoid, and the superior rectal arteries (Fig. 2A). After the second branch, the SMA indicated classical branching pattern which proceeded inferiorly and laterally to be attached to the right and middle colon.

DISCUSSION

This is the first report on the common mesenteric artery, which the IMA arises from the SMA, of a Korean. Among a total of ten cases including the present case, the occurrence of common mesenteric artery were observed in cadavers (2, 9-14) except for the case of a common arterial trunk among the CT, SMA and IMA in a radiological description (15). All reports were on male, but the variation observed in the case of Yamasaki et al. (13) had been the only female case until the current case was discovered. All reported cases were associated with an artery that shared the same characteristics of the ordinary IMA, even though it arose from the SMA instead of the abdominal aorta. In all cases, the IMA always diverged as the first branch of the SMA, except for a Gwyn and Skilton (10). In the present case, the IMA arose as a
second branch 35 mm away from the origin of the SMA, and the first branch (inferior pancreaticoduodenal artery) was 27 mm distal to the SMA. Besides, Katagiri et al. (4) reported that a left colic artery arose from the CMT and that the sigmoid and the superior rectal arteries branched out of the original IMA.

Although the presence of a CMT is rare (3, 5), the occurrence of the IMA arising from the SMA, rather than the abdominal aorta, is even rarer. Benton and Cotter (16) reported a variation of the double IMAs, which arose independently from the abdominal aorta. Other researchers rarely described any other variation of IMA (17, 18), and thus Lippert and Pabst (8) mentioned the frequency of the variation in which the IMA arises from the SMA to be less than 0.1%. Kitamura et al. (12) suggested the embryological explanation for the development of the celiac-mesenteric system (Fig. 1). Namely, the seven primitive splanchnic branches arising from the abdominal aorta in embryo are connected by the ventral longitudinal anastomosis among the roots of the omphalomesenteric artery, of which some disappear and the classical branches—the left gastric, common hepatic, splenic, of CT, the SMA and the IMA—are formed. The longitudinal anastomosis vessels disappear between the SMA and IMA during the process of development. The common mesenteric artery can be regarded as an anomaly of the arterial convergence like in this case (2, 12, 14).

Clinically, the functional results after sigmoid colectomy following ligation or preservation of the IMA was reported (19). Ligation of the IMA caused a higher rate of fecal incontinence; on the other hand, preservation of the IMA during sigmoid colectomy lowered the frequency of postoperative impaired anorectal function. Since both the SMA and IMA supply the whole colon, identification of the IMA is particularly important when performing surgical and radiological procedures. Obstructive diseases such as thromboembolism of the common mesenteric artery (2) and en bloc resection of the head of the pancreas including the superior mesenteric vessels (20) can cause fatal colonic degeneration, associated with the area requiring the blood supply of the IMA.

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