An unusual origin of the right colic artery from the right branch of middle colic artery - case report

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Oliveira KMD, Scheffer AM, Romualdo DM, et al. An unusual origin of the right colic artery from the right branch of middle colic artery - case report. Int J Anat Var. 2020;13(4):17-19.

ABSTRACT

Vascular variations are common and disseminated in the specialized literature, for practical reasons due to semiological and surgical possibilities, which provides safe procedures, innovative techniques and minimal iatrogenic. The arterial variations of the abdomen, mainly the visceral, are a chapter apart from the descriptive anatomy and are highly complex. The arterial variant this article consisted of the origin of the right colic artery from the right branch of the middle colic artery. This led us, at first, to consider, by misinterpretation of this distribution architecture, as a common arterial trunk between the middle colic artery and the right colic artery. Thus, considering the various interpretations and their possible intercurrences in surgical procedures associated with this type of finding, we concluded the need for comprehensive studies that can more accurately assess the variations associated with the right colic artery and massify the terminologies related to it.

Key Words: *Vascular anatomic variation; Right colic artery; Middle colic artery; Superior mesenteric artery*

INTRODUCTION

The superior mesenteric artery (SMA), in the pattern literary conditions, emits the middle colonic artery (MCA), the ileocolic artery (ICA) and the right colonic artery (RCA), which are its largest branches and are related to the supply of the middle intestine derivatives [1,2-7]. In addition, SMA emits the jejunal and ileal branches, 12 or 15 branches, next to the inferior pancreaticoduodenal branches that stand out from their left (convex) side [8,9-14,]. This pattern of vascular knowledge and, above all, its possible variations are essential to the medical practice of diagnosis and surgery [1,2,4,15-21]. The vessels of the abdomen are severely subject to anatomical variations, as attested by Nelson et al. (1988) who reported only 24, 22 and 16% of their findings coinciding with the pattern in the literature, respectively, for the celiac trunk (CTA), superior mesenteric artery (SMA), inferior mesenteric artery (IMA) and its branches. Steward & Rankin (1933) argued that RCA is the most inconstant of the colic arteries and their studies observed for RCA the following frequencies of origins: 40% from the SMA, 30% from the MCA, 12% from the CTA and in 18% of the cases there was no arterial structure that identified as typical RCA. Thus, in this study we indicate an unusual origin of the RCA of the right branch from the MCA (Figure 1). However, due to the arterial position and non-convergence in the studies, with very variable incidence rates; the finding, depending on one or other criterion, could be considered agenesis of the RCA or even, due to the configuration, a common trunk for the RCA and MCA. Moreover, we also agreement with Haywood et al. (2017) who reported, above all, difficulties in the uniformity the publications of variant vascular discrimination and its terminologies.

MATERIALS AND METHODS

This work is based on the findings from a dissection, by the academic league of human anatomy of UFJF-GV, on a cadaver fixed and not injected, of an unusual occurrence of the origin of the RCA from the right branch of MCA. The dissection and previous information about the cadaver did not show surgeries and/or abdominal traumas and the cause of death. The individual was mesomorph, male, of unknown age and of black ancestry. The body preserved in 10% formaldehyde solution, belongs to the Federal University of Juiz de Fora of Governador Valadares campus, Minas Gerais, Brazil. The dissections and analyses were performed by direct macroscopic inspection under the aid of bench lighting (Solver-Hikari® articulated arm magnifier, HI500 LED circular luminaire, 5-inch glass lens - 127 mm and 8 diopters). The morphometries, despite the recognized fibroelastic tissue contractions determined by the cadaveric preservation conditions, were measured with a millimeter ruler in stainless steel from Rhosse® and a JON® stainless steel dry-tipped compass.

RESULTS

After complete dissections of the right division of the infra-mesocolic floor starting from the entire extent of the transverse mesocolon, the right mesentery slide (from its root), the right paracolic groove, and the retroperitoneum, an atypical vascular configuration of the traditional arterial anatomic pattern was noted. Thus, from the left margin of the mesenteric vessels the distributions

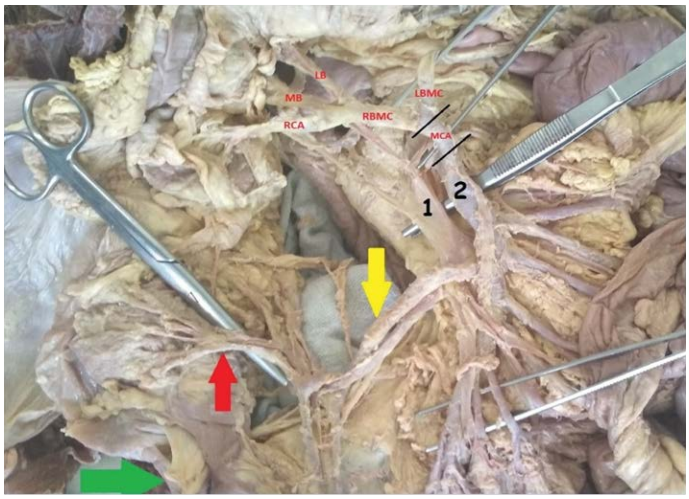

Figure 1) *No. 1, superior mesenteric vein; No 2, superior mesenteric artery; yellow arrow, the ileocolic artery; red arrow, anterior cecal branches of the ileocolic artery and green arrow, vermiform appendix. MCA - middle colic artery; LBMC - middle colic artery left branch; RBMC - middle colic artery right branch; RCA - right colic artery; LB - Left branch; MB - middle branch.*

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Received: Jul 21, 2020, Accepted: Sep 10, 2020, Published: Sep 17, 2020

followed the jejunal and ileal vascular pattern, however, from the anterior face and right concave margin of the superior mesenteric artery the vascular distribution was notably variable. At 1.5 cm from the lower margin of the pancreas at the level of its incisura, we watch what could be a short trunk (considering the visualization of all vascular distributions of SMA) type II 'a' of Gamo et al, (2016) (trunk between RCA and MCA) or even agenesis of RCA with vascular compensations by ICA and MCA. However, the reanalysis corroborated by findings and considerations such as those of Haywood et al. (2016) what was in favor of the origin of the RCA of the right branch of the MCA (Figure 1). This condition in the studies by García-Ruiz et al. (1996) would be recognized as a right colic branch and not the RCA, as the authors would consider the colic arteries as coming directly from their respective mesenteric vessels. We prefer the use of the term RCA to the term "right colic branch" to avoid terminological confusion. Thus, from the branches of the MCA, in our finding, the right branch was more calibrated compared to the left branch and divided into 3 minor branches, the one located more to the right was of larger extension, larger diameter, applied to the colic flexure and at a shallow angle with the right branch of the MCA. This branch has been recognized as the RCA. The other two branches were referred to as the MCA right and medium branch. The anterior and posterior inferior pancreaticoduodenal vessels were preserved and did not vary and the ICA was also within the patterns as to its origin and branches and crossing anteriorly the superior mesenteric vein. Another rare occurrence associated to the same cadaver, in supramesocolic dissection, was the origin of the left hepatic artery directly from the left gastric artery, being classified as type II of Michels [15] or type II of Hiatt [7]. The superior mesenteric vein revealed with its tributaries in a pattern near 45% of the occurrences, as described by Jin et al. (2006). Thus, in our dissection, the middle colonic vein tributed close to Henle's gastrocolic trunk in which we detected, in its direct formation, the right superior colic vein and, by proximity, the right colic vein [1,16,22,23].

DISCUSSION

Vascular variations are common and sometimes unexpected such as the description by Manyama et al. (2019) of the appearance of a supernumerary mesenteric artery denominated by the authors as a middle mesenteric artery, which originated directly from the aorta, in the space between the SMA and IMA arteries, and emitting the RCA and the left colic artery (LCA). Another important unusual and impact variation for a possible surgery was the one described by Jain & Motwani (2013) in which the authors report an accessory splenic arterial formation originated from the LCA that emerged of the SMA. Wu et al. (2019) from high resolution images of 60 cases of laparoscopic surgeries, indicated variations of the branches of the superior mesenteric vessels (position variation) and the occurrence of RCA which was shown in 55% (33 cases) in contrast to the right colic vein (RCV) which was present in 93.3% of the findings. Alsabilah et al. (2017) reported from an extensive study of publications related to ascending colon vascular variations and their potential clinical implications, incidences of inconsistencies for the RCA ranging from 10 to 63%, while the presence of the MCA was found in 98 to 100% of publications. Nelson et al. (1988) in a sample of 50 cadavers, reported the pattern described as that in the literature, for all the vessels investigated in only 3 specimens, that is, in 94% the samples exhibited variants. And as for the superior mesenteric branches, they observed that ICA was present in most cases (70%) and without variations such as those of relations with RCA and MCA. The authors also reported RCA and MCA separately from SMA, respectively, in 34 and 58%. In a study also with 50 cadavers, conducted by Nirmaladevi & Seshayyan (2015) the authors reported a trunk between the arteries MCA and RCA in 12% of the specimens, another trunk between the RCA and ICA in 2%, the ICA originating from the right colic artery in 12% and the agenesis of the arteries RCA and MCA, respectively, in 14% and 4%. García-Ruiz et al. (1996) in a study of 56 cadavers reported a high incidence of agenesis of RCA (frequency of 10.7%) as a direct branch of SMA. Moreover, the ileocolic artery was present in all cases with results similar to the middle colonic artery (98.2%), while the "right colic branch" originated from the ICA in 66% or the MCA in 23.3%. Haywood et al., (2016) reported, in 25 dissections, the occurrence of RCA in 96% of the specimens, 32% directly from the SMA and 36% from the right branch of the middle colonic artery, in this case, differentiating from the RCA that originated from the root of the MCA. Batra et al. (2013) in 30 dissections, observed an incidence of 63.3% of RCA originating directly from SMA, 30% of a common trunk with MCA and 6.7% of a trunk formed with ICA and MCA. Nelson et al. (1988) reported that the most common variation of RCA was the origin of this artery with the MCA of a common trunk in 40% of the cases; other compositions were the origin of RCA from the middle colic artery in 10% of the cases, and originating as a branch of ICA in 30%. The authors also verified the RCA and MCA originating from ICA and the agenesis of the arteries RCA and MCA in distinct cadavers with vascular substitution by the marginal arteries. Negoi et al. (2018) in a comprehensive study of systematic literature review with 40 studies involving 6090 specimens, CTs and angiographies, with relevance for colic and pancreatic resection surgeries, reported that the most constant vessels were the ICA and the homonymous vein. The most inconstant vessels were the right colics (RCA and RCV), which was observed by Alsabilah et al. (2017) and Haywood et al. (2016). Jongue et al. (2018) reports an unusual arterial formation of the MCA and RCA from a common trunk from the SMA, however, the authors considered the need for studies that provide information on the incidences between the arteries MCA and RCA for safety in procedures and reviews of operative techniques. Ye et al. (2017) consider essential, for surgical reasons, the detailed knowledge of vascular variations, considering the formation of the trunk between the RCA and MCA arteries as being of great importance in the maintenance of blood supply in resections of primary cancers of the colon. Gamo et al. (2016) describe that the variations of superior mesenteric vessels and their branches are known and largely disseminated, but there is no consensus on classifications, a view corroborated by Haywood et al. (2017) who analyzed, by a systematic review of 1073 cadavers, the elevated variability related to RCA, indicating its origins in 36.8%, 31.9%, 27.7%, respectively, of SMA, ICA and MCA. Furthermore, RCA is demonstrated, in minor expressions, from the right branch of the MCA (2.5%) and from a common trunk with the middle colic artery and ileocolic artery (1.1%); in 8.9% of the cases there was agenesis of RCA. García-Ruiz et al. (1996) positioned themselves regarding the difficulty of uniformity the nomenclature in relation to variations and considered reserving the term colic vessel when they originate directly from the mesenteric vessels, thus any other vessels, even those directed to the colon, were designated as branches. However, we chose to designate colic vessels even though they do not originate directly from the mesenteric vessels and we considered the three-dimensional vascular distributions, such as the vascular extensions and their origins and the relative calibers of their branches, pondering, from Hess-Murray's law [11,13,24] to judge our finding as a branch originating from the right branch of the MCA and not from a trunk with the MCA. Gamo et al. (2016) in a work with 50 cadavers (28 men and 22 women) and 600 CT images (452 men and 148 women) proposed a classification of four types (I, II, III and IV) and 3 subtypes associated with type II, in respect to variations of the colic vessels related to the superior mesenteric artery. Thus, in their evidence, in the anatomical aspect, they noted to the type I, the MCA, RCA and ICA appeared distinct from SMA. That condition was noted at 40%. In type II, the branches arise from a common trunk, and are subdivided into a, b and c. In type II a, the MCA forms a trunk with the RCA and the ICA appears independent in 20% of cases. In type II b, ICA forms a trunk with RCA and MCA in 32% of the cases and in type II c, the three vessels (ICA, RCA and MCA) originate from a common trunk (not found in dissections). In type III there is absence of the RCA in 8% of the cases and in type IV, where the RCA is an accessory branch, it was not found in cadaveric specimens. In the studies of Jain & Motwani (2013) the authors organized a classification, based on the branches from SMA, into 3 groups of a sample of 20 cadavers. Thus, they reported the origin of RCA directly from SMA in 70% (group I), in 25% (group II) the formation of a trunk from SMA between ICA and RCA and a rare formation, group III, in which the left colic artery and the accessory splenic artery emerged from SMA, in 5% of the cases.

CONCLUSION

We agree with Batra et al. (2013) that vascular variation is the norm and not the exception. Thus, we reinforce the need for a better understanding of the incidences in these variations to reduce the dangers in surgical procedures, since the nature of the visceral organization in the abdomen, its structural complexities and susceptibilities to pathological formations and to injuries require a solid knowledge of the vascular variations.

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