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<Short title>Invited Commentary

INVITED COMMENTARY

A New Computed Tomography Classification for Acute Mesenteric Ischaemia: More Than a "Gut Feeling"?

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Knowledge of the anatomy remains a cornerstone in medicine; accordingly, a proper understanding of anatomical variations is essential in the treatment of (acute) mesenteric ischaemia (AMI). In this issue of *EJVES*, Tual *et al*. propose an anatomical classification based on computed tomography angiography (CTA) that may help to describe occlusions of the superior mesenteric artery (SMA) in patients with AMI better.[1] Over the last few decades, CTA has replaced the "gold standard" of intra-arterial angiography in the evaluation of the mesenteric circulation in patients with chronic and acute mesenteric ischemia. With current scan technology, that is able to provide isotropic imaging, three dimensional images in multiple planes can be obtained, which are useful in the depiction of the complex mesenteric vasculature.[2] The mesenteric vascularisation is characterised by a significant variation in anatomy and the presence of various collateral pathways.

For example the "standard" coeliac trunk branching pattern occurs in only 70% of cases, the right colic artery that can arise from the SMA is absent in up to 80% of individuals, and the number of jejunal arteries may vary from four to six.[2]

When developing a new anatomical classification, given the significant number of anatomical variants, it is important to include as many patients as possible. The authors have chosen to limit the study to patients presenting with mesenteric ischaemia, thus eliminating the possibility of establishing a large pool of (variant) anatomies. Although it is important to have a cohort of patients with mesenteric ischaemia to allow for a correlation with the clinical outcome, the evaluation of anatomical segments can also be done on patients with non-related disease (e.g., abdominal aneurysms). It is also remarkable that the diagnosis of AMI was not confirmed clinically, but on radiological grounds only. Furthermore, it is not clear whether all CTAs were evaluated interactively on a three dimensional workstation (using all possible reconstruction planes). This may be an issue as a significant number of examinations was obtained from external institutions, with a heterogeneous protocol, as indicated by the authors, and it is known that three dimensional evaluation of a CTA increases the diagnostic accuracy.[2]

Looking specifically at the SMA variations of the colic patterns, another group has proposed a classification identifying four patterns for the SMA anatomy.[3] This (purely anatomical) study was based on a cadaveric (n = 50) and a radiological sample (n = 560; CTA performed for various pathologies, not specifically related to mesenteric ischaemia), and showed a huge difference in incidence of the various patterns in both samples. The sample size as used by Tual *et al*. (n = 95)[1] may therefore not be sufficiently large to allow for application in the general population. This issue could have been overcome by developing the classification on a larger cohort of patients that underwent CTA for other indications then mesenteric ischaemia and would also have overcome the problem of eliminating patients because of an insufficient quality (lack of arterial phase enhancement) of the CTA examination.

As the authors rightfully state, in other vascular territories (e.g., cerebral) the benefit of an anatomical description/classification of collateral pathways is well known. These descriptions typically include all arteries that contribute to the supply of the "end organ", which is not done in this study having excluded the contribution of the coeliac trunk and inferior mesenteric artery.

As mentioned, this anatomical classification should be validated in a larger cohort ("real world" scenario) with multiple observers, preferably in "all comers" (not necessarily related to mesenteric ischaemia). The classification should then also be applied to CTAs in patients with mesenteric ischaemia where an arterial phase is not available (as is oftentimes the case), in order to make this a valuable addition to the work up of patients with AMI. Of even more importance is to correlate the findings with clinical outcomes and establish whether this classification can be used in a decision tree to define optimal management. This should be the goal of a very "granular" classification as described.

The gold standard in this study was a single, specialist observer, with a verification of the interobserver agreement with only one, junior, observer. This incurs a risk of the apprentice emulating the same methodology, which in the absence of a correlation with angiography (still considered the gold standard)[4] may not be a proper methodology.

Although the incidence of various patterns is reported differently in several studies, the mere fact of the huge anatomical variation is important to keep in mind: depending on the distal ramification patterns and connections of SMA branches with coeliac trunk, inferior mesenteric arteries, or internal iliac arteries, clinical presentation and therapy may differ.

A classification needs to be simple, reproducible, and allow for a rapid learning curve, and this seems to be the case for the classification described given the outcomes of the second reading session. In the current classification a correlation with surgical and/or endovascular treatment and subsequent outcome is lacking. This will be the main question that needs to be answered as an occlusion at the same level and of the same extent in a patient with an "acute on chronic" occlusion may not have the same clinical course as a patient with an embolic occlusion given the potential lack of collaterals in the latter as it is not clear what to do with multiple segment and multiple level occlusions. Given the small sample size, and the significant variability of anatomy, it will probably be difficult to determine the true value of this classification in daily practice. The proof of the pudding will therefore be in the eating.

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