

Advantages of combined distal-first and visceral branch-first technique: A universal fit for extensive thoracoabdominal aortic aneurysm?

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Minimization of end organ ischemia is a key tenet in successful thoracoabdominal aortic aneurysm (TAAA) surgery. In recent years various techniques have been inspired and refined to reduce the duration and risk of visceral ischemia such as mild, moderate, or deep hypothermic repair with left heart bypass, or complete or partial cardiopulmonary bypass combined with selective perfusions to vital viscera, the lower extremities and the spinal cord. (1) (2) (3) Despite advances in surgical technique and organ protection strategies, open surgical repair for TAAA remains associated with considerable levels of morbidity and mortality. Moulakakis and colleagues conducted a meta-analysis which summarized the surgical outcomes of 9963 patients in experienced surgical centers and found that the mortality after repair of extent I-IV TAAA was 11.3%. (4) These results can be attributed to the nature of open surgical repair of TAAA, which represents the pinnacle of invasive cardiovascular surgery and comes with the burden of a relatively high association of comorbidities.

Estrera and colleagues reported the “distal first approach” assumes the advantage of providing a distal fenestration and ensuring adequate antegrade blood flow at an early stage for patients with chronic aortic dissection. (5) Previous reports have described the utility of “visceral branch-first techniques” in reducing visceral ischemic time with minimal reperfusion injury. (6) (7) Marchenko and colleagues also successfully devised a novel “iliac branch first” strategy combined with the distal-first approach for Crawford extent II

TAAA using a “neo-graft.” (8) A bifurcated graft of the neo-graft was anastomosed to the common iliac arteries first, followed by reattachments of the left renal artery, superior mesenteric artery and celiac axis without aortic cross-clamp. Ischemic time was no longer than 7 minutes for each anastomosis and extremely short compared to previous reports from experienced centers. This may minimize the risk or degree of ischemia-reperfusion injury even if no selective organ perfusion was applied. Since the right renal artery is located on the bottom of the aneurysm, the reconstruction was performed after initiating a left heart bypass (LHB). During these reattachments, antegrade pulsatile blood flow to the spinal cord was guaranteed not only via the Adamkiewicz artery but also the collateral network, which ultimately minimizes spinal cord ischemia. Next, the thoracic intercostal arteries were reimplanted using the island technique followed by proximal anastomosis of the main graft at the aortic isthmus. Overall LHB time was merely 32 minutes. The “iliac branch first” strategy eliminated the need for femoral artery exposure, which is particularly beneficial in obese patients.

At a glance, these procedures appear to be a highly promising addition to the existing armamentarium of TAAA surgical techniques; however, the question remains whether they are applicable to all types of aortic pathologies? Starting with the simplest answers, the branch reconstructions prior to aortic decompression made it difficult to adjust the length of the branches, particularly in huge aneurysms. Longer branch grafts—in particular those to the left renal artery—the may cause kinking. Secondly, some iliac arteries are not always healthy and there unsuitable for end-to-side anastomosis, which may obstruct the establishment of the primary inflow source. Third, the current procedure is indeed suitable for chronic dissecting aortic aneurysms. By ligating the visceral branches prior to the aortic procedure, this technique not only reduced visceral ischemic time but also avoided the embolization of debris or thrombi. Therefore the “branch-first” technique appears to be a desirable option in terms of preventing embolic complications in the visceral organs. But let’s suppose that the aortic pathology is an atherothrombotic one (e.g. shaggy aorta). Yokawa and colleagues reported on thoracoabdominal repair in patients with shaggy aorta (atherothrombotic aorta)—a significant risk factor for organ infarction—and showed the relationship with spinal cord injury (SCI), acute kidney injury and perioperative mortality. (9) A shaggy aorta does not always allow segmental aortic cross-clamping such as at the levels of the diaphragm and the middle third of the descending aorta for reimplantation of the intercostal arteries. Furthermore, it may be difficult to reattach the major targeted intercostal arteries if the Adamkiewicz artery exists at lower levels such as Th12 or L1. Marchenko and colleagues used the current approach in 29 patients, but the aortic pathology of the patients is unknown. Therefore, the question remains whether the incidence of spinal cord ischemia in patients with atherothrombotic aorta could be reduced by the current technique.

The approach comes with inherent advantages and we eagerly await the next series of evolution along with a report on the long-term results.

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