

EDITORIAL COMMENT

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Hybrid arch repair: still learning when to use it

Aortic pathologies are increasing in prevalence and complexity, essentially due to advanced age, accrued comorbidities and diagnostic availability. Increasing surgical expertise with open surgical management and advances in cerebral and spinal cord protection techniques have made these procedures undeniably safer, more effective and reproducible¹. It is, however, impossible to ignore the various comorbidities that these patients often have, which imply a potential increase in the risk of surgical mortality, irreversible complications and associated health care and social costs. These factors thus contribute to the uncertainty as to the benefit of this procedure for the individual patient and even for society. In this context, percutaneous or hybrid alternatives have been increasingly proposed especially for the higher risk categories². These contemporary hybrid approaches are broadly classified into 3 types. Types 1 and 2 repairs consist in rerouting the supra-aortic branches into the native ascending aorta or an ascending aortic prosthesis, followed by endovascular exclusion of the transverse and proximal descending thoracic aorta, usually during the same operative moment. Type 3 hybrid arch repair usually consists of total arch replacement using the frozen (or classical) elephant trunk technique followed by staged TEVAR extension into the thoracic or thoracoabdominal aorta². This myriad of available techniques allows an appropriate tailoring of treatment to each individual anatomy and risk profile.

This is precisely the context of the publication of the work "Hybrid aortic arch surgery to create a landing zone in the ascending aorta". In a retrospective analysis,

Tomás AC et al. report their single-center experience with a series of 15 cases of type 1 and 2 hybrid aortic arch repairs. Although it is a small series and purely descriptive study, these investigators show an impressively low rate of periprocedural complications, including neurological events and mortality, in a sample that includes several different pathologies and settings. Short and mid-term mortality is reported at the expected rate for this high-risk population, and endoleaks are observed in one third of patients during early and late postoperative periods. Regarding the applied techniques, in this study most patients were submitted to a type 2 repair, which requires cardiopulmonary bypass and aortic cross clamping. In all cases the endoprosthesis was implanted at a later stage via transfemoral route.

The standard of care in aortic arch pathology is still the conventional open replacement, which offers complete elimination of the diseased aortic segment and the most durable solution of all. However, the trade-offs for these long-term advantages are the almost ubiquitous need for increased surgical manipulation, significant hypothermia, circulatory arrest, and complex perfusion strategies. Even though promising approaches have been published which permit a lesser degree of invasiveness³, those prerequisites will set the bar high for candidacy, as a significant amount of patients will simply show prohibitive surgical risk or are not expected to benefit in the long run. Using both type 1 and 2 repairs most of the drawbacks of the classical procedures are avoided, especially in the case of type 1 repair, which is performed off-pump. Despite these advantages, the high-

risk profile of the patients submitted to hybrid-type repairs is still determinant. In a recent systematic review, Zlatanovic et al. report pooled 30-day and 2-year mortality rates of 10.9% and 18.95%, respectively⁴. However, no statistically significant differences in short and mid-term mortality were found between hybrid and open arch repairs in a propensity score matched study by Hiraoka et al., despite a numerical tendency towards worst outcomes in the hybrid group⁵. The greatest Achilles heel of these less invasive techniques is the neurological risk. A significant number of patients will suffer a permanent stroke, generally attributed to the greater atherosclerotic burden of these older and comorbid patients⁴. The present study by Tomás AC et. al, shows promising results in this regard, which leads us to believe that with a better patient selections and device refinement, indications for hybrid aortic arch repair might be expanding in the future.

REFERENCES

1. Leone A, Beckmann E, Martens A, Di Marco L, Pantaleo A, Reggiani LB, Haverich A, Di Bartolomeo R, Pacini D, Shrestha M. Total aortic arch replacement with frozen elephant trunk technique: Results from two European institutes. *J Thorac Cardiovasc Surg.* 2020 Apr;159(4):1201-1211. doi: 10.1016/j.jtcvs.2019.03.121. Epub 2019 May 11. Erratum in: *J Thorac Cardiovasc Surg.* 2020 Jun;159(6):2571. PMID: 31208809.
2. Sultan I, Bavaria JE, Szeto W. Hybrid Techniques for Aortic Arch Aneurysm Repair. *Semin Cardiothorac Vasc Anesth.* 2016 Dec;20(4):327-332. doi: 10.1177/1089253216659701. Epub 2016 Jul 13. PMID: 27418027.
3. Tsagakis K, Osswald A, Weymann A, Demircioglu A, Schmack B, Wendt D, Jakob H, Ruhparwar A. The frozen elephant trunk technique: impact of proximalization and the four-sites perfusion technique. *Eur J Cardiothorac Surg.* 2021 Aug 11:ezab295. doi: 10.1093/ejcts/ezab295. Epub ahead of print. PMID: 34378023.
4. Zlatanovic P, Koncar I, Sladojevic M, Tomic I, Mutavdzic P, Trailovic R, Ducic S, Vujcic A, Davidovic L. Hybrid repair of aortic arch with zone zero endografting-Case series with review of the literature. *J Card Surg.* 2021 Oct;36(10):3805-3816. doi: 10.1111/jocs.15811. Epub 2021 Jul 15. PMID: 34268799.
5. Hiraoka A, Chikazawa G, Totsugawa T, Tamura K, Ishida A, Sakaguchi T, Yoshitaka H. Objective analysis of midterm outcomes of conventional and hybrid aortic arch repair by propensity-score matching. *J Thorac Cardiovasc Surg.* 2017 Jul;154(1):100-106.e1. doi: 10.1016/j.jtcvs.2016.12.060. Epub 2017 Feb 10. PMID: 28314530.