

Peer Review File

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Reviewer A

The authors present their early single-center experience with the Terumo Relay double inner-branch aortic arch endograft in treating aortic arch pathologies. They describe a cohort of 12 patients with 100% technical success rate and aortic-related death-free survival. In contrast to good early composite outcome (8.1% early stroke/mortality), which is in line with the previous reports from other single or multi-center study, the overall MAE was 33.3% - higher than expected.

This is a retrospective study on prospectively registered data. Despite small sample size, there were various postoperative complications reported, some of which were attributed to the high-risk characteristics of these patients deemed not candidates for open surgical repair. Nevertheless, their experience suggests that endovascular repair remains an alternative to open repair, and the learning curve, like other novel surgical procedures, is likely very steep.

Data was well presented in the manuscript. Their discussion centered on the neurological complications was in general adequate. I have a few comments regarding the study.

Comment 1: Hybrid aortic arch repair is a complex procedure. Please consider adding an illustration about the procedure to help readers understand their approach

Reply 1: Thank you for the recommendation. This issue was also notice by the reviewer B. Illustrations of the graft, courtesy of Terumo Aortic were added as well as angiographic images of one of the procedures. These image have been attached as Figure 1 to 4

Changes in the text: Pages 19 to 22. Figure 1 to 4

Comment 2: It is mentioned briefly in the manuscript that 2 out of the 4 neurological complications were of cardioembolic origin. It would be useful information to know how this was determined e.g., in the setting of atrial fibrillation, no anatomical concerns, pre-existing condition. Expanding discussion pertinent to this would be helpful as well.

Reply 2:

It is a good appreciation. Both of the patients with neurological complications due cardioembolic complications were in the setting of atrial fibrillation. Both of them were under anticoagulation therapy. One had a hemorrhagic transformation and the patient died. The other, had medical optimization and he was alive when the data was collected.

Neurologist or neurosurgeon were the specialist who specified the etiology of the ischemic stroke.

In the two remains patients with neurological complications no other comorbidities were found, so the most probable etiology was the arterio-arterial embolism.

Changes in the text: Page 9. Lines 250-272.

Cardioembolic etiology was defined by either neurologist or neurosurgeon. Both of the patients with the cardioembolic source were under the setting of atrial fibrillation and both of them under anticoagulation therapy.

Comment 3: This manuscript would benefit from language editing to improve readability

Reply 3: Thank you for the suggestion. Some changes have been made trying to improve readability

Changes in the text: Along the text.

Reviewer B

Comment 1: The Figure of custom-made Relay double inner-branch is required necessarily owing to see this system clearly

Reply 1: Thank you for the appreciation. This issue has been also commented by your fellow reviewer.

Changes in the text: Pages 19-20. Figures 1 and 2.

Comment 2: Introduction section, the authors should discuss as more focusing on debranched TEVAR and custom-made TEVAR

Reply 2: Thank you for the comment. The idea of this paper is not to explain both procedures. Both techniques remains important and should be consider when the surgical plan is performed. A brief explanation has been added. We think that expanding the introduction with this different techniques may confuse the objective of the paper and the reader.

Changes in the text: see page 5, paragraph 2, lines 113-126

Arch debranching involves different techniques which can be divided in three types. Type I arch debranching involves brachiocephalic bypass and endovascular repair of the aortic arch. This approach is performed in patients with adequate proximal landing zone in the ascending aorta and an isolated aortic arch aneurysm. Type II involves ascending aorta lesions and the goal is to create a proximal landing zone. Type III reconstructions includes elephant trunk procedure and is an option in patients with “mega aorta-syndrome”. This techniques, and specifically the type I procedure, despite less invasive than total arch replacement, continues to be an aggressive option with the inconveniences of both open and endovascular procedures and no significant improvement of mortality and stroke rates, 11.9% and 7.3% respectively. Advantages for the type I arch debranching remain for patients where iliac access are not feasible so an antegrade TEVAR should be performed.(3) Subsequently, the future of endovascular arch repair points towards specifically tailored endografts with scallops, fenestrations or branches where the aortic clamping is avoided.

Comment 3: The detail of endovascular technique by the custom-made Relay double inner-branch, including wire technique, should be shown

Reply 3: Thank you for the appreciation. Some figures have been added with a brief explanation showing the details.

Changes in the text: Pages 21-22. Figures 3 and 4.

Comment 4: The authors showed a 50% phrenic nerve injury. It's very high. Although I also performed the debranching TEVAR with the left common carotid artery to the left axillary artery bypass, I never experience the phrenic nerve injury. How did the authors undergo the left carotid artery to left axillary artery bypass? Moreover, why did the

author use the Dacron graft for the bypass. Commonly the surgeons use the ePTFE graft for bypass owing to obtain good long-term patency.

Reply 4: Certainly it is a big percentage. Some of the procedures were made in two stages, in order to minimize the morbidity of this complication and due to operation room schedule. Most of the arterial derivations were performed by a single left supraclavicular oblique incision. In all of the patients a polyester graft bypass was performed as opposed to ePTFE (no subclavian transposition).

Polyester graft has been chosen as it is our standard graft for this derivation. We did not observe any occlusion in the arterial supraaortic derivations made in our institution. ePTFE or ringed grafts are sometimes used as well, with good outcomes. ePTFE is the graft we used in cases of left carotid to left axillary artery or for carotid-carotid bypass, due to the possibility of clavicular compression.

Also, polyester graft has been used for this technique as proposed by A. R. Muhammad, G. S. Oderich and A. Pochettino. *Techniques and Results of Aortic Hybrid Repair*. In Springer, Oderich. *Endovascular aortic repair*. Rochester; 2017:555-567.

Debranching TEVAR is a complex procedure with a prolonged surgery time where the retractors can affect the surrounding nerves.

One this revision has been made, and after notice this high nerve injury rate, we have changed our approach. Currently a left carotid to left axillary artery bypass is being made. With this derivation, the phrenic nerve is avoided and the risk of phrenic palsy is very low.

Changes in the text: See page 11. Lines 430-433

For that reason, and after this paper analysis, we have changed our surgical approach. Nowadays we perform a left carotid to left axillary artery bypass, avoiding the need of phrenic nerve mobilization and lowering the phrenic nerve palsy complication

Comment 5: In the Statistical section, the sentence of median and range may be wrong expression. Commonly, median and interquartile range are used for statistical expression.

Reply 5: Thanks for the appreciation. Change has been made.

Changes in the text: Page 7. Line 205

Comment 6: In the Results section, operation time, fluoroscopy time, and blood transfusion volume are important information. Please add these information in the Results section

Reply 6: Thank you for the recommendation. Fluoroscopy time could not be included. Information for this issue is not currently available and was not collected. Data for operation time and blood transfusion volume have been added.

Changes in the text: See Page 8 Lines 233-235

Median operation time was 7.3 [6.1-8] hours. 50% of the patients needed blood transfusion, and none of them more than 3 units.

In Page 17. Table 2. It has been specified the percentage of patients who needed blood transfusion and the median operation time.

Comment 7: The authors showed that the mortality rate at the end of the follow-up period and overall death free survival at 2 years. The authors should unite the expression of long-term results with survival rate or mortality rate because the readers may be confused.

Reply 7: It has been changed to overall death-free survival.

Changes in the text: Page 9. Line 286-287

At the end of the follow-up period an 83% overall death-free survival at 2 years was achieved.

Comment 8: Expression of table should be revised. Generally, we expression as number (%).

Reply 8: Thank you for the revision. It has been changed as proposed.

Changes in the text: Pages 16 to 18. Expressions of the tables 1 to 3

Comment 9: Kaplan-Meier analysis in the Figure 1 and 2 may be wrong because all patients die at 3 years with poor outcomes.

Reply 9: Thank you for the appreciation. Figures has been changed. The small sample size compromises the visibility of the outcomes. Figure 2 has been avoided due to poor data visibility.

Changes in the text: Pages 22. Figure 5.
