

Peer Review File

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Reviewer A

A well-written and well-referenced review of thoracoabdominal aortic disease. I have no suggestions for change.

Reply: Thank you for your supportive comments.

Reviewer B

This is a review article on open and endovascular repair of thoracoabdominal aortic aneurysm (TAAA).

It is a good research; however, a few points must be revised.

Major points:

Comment 1: Abstract is too short. Authors should summarize their research and revise the abstract according to the contents of the article. Major data (percentages or patients' numbers) from the research must be shown.

Reply 1: Thank you for your comment. In response, we have amended the abstract to include a more robust overview of our work including rates of relevant operative outcomes. As this is a narrative review of the literature, we do not report our own outcomes in terms of patient numbers and percentages. Instead, we have summarized those numbers from the publications that were reviewed.

Changes in the text: “Key Content/Conclusions: Indication for surgical repair includes symptomatic aneurysms and those at a size or growth threshold. Open repair is the gold standard for surgical management of TAAA and remains so, however, endovascular repair has an increasingly broad applicability, and technology has correspondingly improved in the two decades since its introduction to clinical practice. Reported contemporary operative mortality has ranged from less than 5% to over 20%. The primary adverse complication of open and endovascular repair is ischemic injury, including renal injury, with reported incidence ranging from 2.8%-12.5% in contemporary series, and spinal cord injury, with reported incidence ranging from 2.5% to 7.3% in contemporary series. Cerebrospinal fluid drainage has been shown to be the best-proven mechanism to date to prevent spinal cord injury in both open and endovascular repair. Endovascular repair is associated with a higher reintervention rate than open repair. Surgeon and center volume and expertise are related to clinical outcomes and should be taken into consideration when deciding on surgical repair.”
(Page 3, Lines 6-18)

Comment 2: Even though it is a narrative review, tables in the article are helpful for the

readers to understand. Especially for the outcomes of treatment and adverse complications, tables will be helpful to directly compare each study.

Reply 2: Thank you for your comment. In Table 2, we have included updated recommendations for management of TAAA according to the most recent 2022 AHA/ACC Clinical Practice Guidelines. However, in light of your comment and to improve clarity for readers, we will include an additional Table of studies discussed in the paper with their reported outcomes.

Changes in text: Please see addition of Table 3.

Comment 3: Conclusion is rather weak. Readers are expecting to get the answer to choose open repair or endovascular repair. The authors say "significant consideration should be given to the choice of a high-volume center and a surgeon with expertise in TAAA repair". Then, the readers will wonder what the standard of high-volume center and expertise surgeon would be. The standard level or definition must be provided.

Reply 3: Thank you for your comment. We have amended the text and added the available evidence to clarify what is meant by high-volume and low-volume surgeons and centers. Regarding the conclusion, we respectfully believe that the best choice of approach for TAAA management must take into account individual patient and anatomic factors. The goal of our review is to summarize and clarify the existing evidence to facilitate decision-making for patients and physicians. We have made the conclusion more robust, and feel that while open repair is preferred for its superior durability, we believe that both options are acceptable in the correct context and it is more important that the surgeon is experienced with their chosen technique whether open or endovascular.

Changes in the text:

“Rocha et al.²⁵ found that institutional volume of over 60 cases in a 10-year study period (approximately 6 cases per year) was associated with a significant lower operative mortality after open TAAA repair compared with all other centers (13.8% versus 36.0%; $p < 0.01$). In a 2003 retrospective study of 1542 patients undergoing TAAA repair by Cowan et al.,²³ high-volume surgeons (performing three to eighteen cases per year, median seven cases per year) had significantly lower operative mortality than their low-volume counterparts (11.0% versus 25.6%; $p < 0.001$); the same was true for high-volume centers (five to 31 cases per year, median twelve cases per year) when compared with low-volume institutions (15.0% versus 27.4%; $p < 0.001$) low surgeon volume (defined as one to two cases per year) was a significant predictor of mortality: OR 2.6; $p < 0.001$), as was low institution volume (one to three cases per year) (OR 2.2; $p < 0.001$). Therefore, surgeon and institutional volume have an important relationship to clinical outcomes and should be part of the decision-making process regarding whether, where, and how to undergo repair.” (Page 9, lines 13-22 and Page 10, lines 1-4)

“TAAA has an increasing incidence over the last two decades, rendering a knowledge

of its pathophysiology, surveillance, and management increasingly important. Open repair remains the standard of care, and is the preferred method of repair in appropriate risk patients given the comparable perioperative outcomes and reduced risk of reintervention. Advancements in endovascular repair have expanded the patient population to whom this approach may be offered and it is an acceptable option at centers experienced in these techniques. Ischemic injury remains a primary concern of both endovascular and open TAAA repair, and strategies for prevention of spinal and visceral ischemia continue to evolve, with spinal cord drainage and cold renal perfusion having the most evidence to supporting their use. Continued improvements in technique and innovations in endovascular technologies may further improve outcomes in the future. Irrespective of the approach chosen for TAAA repair, the relationship between surgeon and center experience and clinical outcomes cannot be understated, and significant consideration should be given to the choice of a high-volume center and a surgeon with expertise in TAAA repair, regardless of whether an open or endovascular technique is utilized.” (Page 21, lines 10-22 and Page 22, lines 1-2)

Minor points:

Figure 1 does not show Extent V.

Reply: We have amended Figure 1 to include Extent V.

Changes in text: Please see revised Figure 1, and addition of Extent V to Figure 1.

Reviewer C

The authors should be congratulated for a well-written, comprehensive narrative review on the literature. My principal concerns are as follows:

Comment 1: What does your narrative review offer the current body of evidence in comparison to the most recent systematic review and meta-analysis on the topic? This should be made explicitly clear in the introduction and in a paragraph at the end of the discussion to highlight the utility of the review.

Reply 1: Thank you for your comment. We believe that this was addressed in the introduction, when we describe that we will review both the pathophysiology and natural history of the disease (Page 4, lines 8-11), which are missing from the excellent meta-analysis by Rocha et al. that the reviewer has mentioned. In addition, we discuss recently updated recommendations for management of TAAA in the 2022 ACC/AHA Clinical Practice guidelines (released November 2022), along with a review of the evidence underlying these novel recommendations, which we have highlighted in the introduction (Page 4, lines 11-14).

Changes in text: “We further discuss the most recent ACC/AHA Clinical Practice Guidelines for management of TAAA, changes in the current recommendations compared with prior iterations, and the evidence that forms the basis of these updated recommendations.” (Page 4, lines 11-14).

Comment 2: Given it has been 2 years since the last SR, why conduct a narrative review? Rocha did provide a comprehensive review of the literature in their 2020 SRMA - how does your review stand out from theirs?

If these concerns can be addressed, it should proceed to publication (as it is of high quality and is comprehensive).

Reply 2: Thank you for your supportive comments. The Rocha et al. meta-analysis is an excellent and comprehensive review of contemporary evidence on short-term outcomes after TAAA repair. However, it lacks review of the natural history of the disease and pathophysiology, lacks discussion of how the evidence compares with current practice guidelines, does not discuss the recent evidence forming the basis for practice guidelines and does not discuss how or why recommendations have changed in the last decade. The aforementioned topics are beyond the scope of the Rocha et al. meta-analysis but are within the scope of our narrative review. In addition, our review offers commentary on disease prevalence and surgical outcomes in women and the elderly (Page 5, lines 4-15; Page 11, lines 6-16), groups that are traditionally underrepresented in cardiovascular surgery literature. Lastly, JTD invited the authors to perform a narrative review.

Rocha RV, Lindsay TF, Friedrich JO, Shan S, Sinha S, Yanagawa B, Al-Omran M, Forbes TL, Ouzounian M. Systematic review of contemporary outcomes of endovascular and open thoracoabdominal aortic aneurysm repair. *J Vasc Surg.* 2020 Apr;71(4):1396-1412.e12. doi: 10.1016/j.jvs.2019.06.216. Epub 2019 Nov 2. PMID: 31690525.

Reviewer D

Comment 1: Page 12, lines 4-8: Long-term results of open repair could be more extensively described, including incidence rate. Infectious complications should be mentioned due to its severe prognosis.

Reply 1: Thank you for your comment. In light of your comment, we have added relevant text on infectious complications.

Changes in text: "Graft infection represents a serious but rare late complication of TAAA repair, with Coselli et al. reporting just eighteen instances at fifteen-year follow up; 12 other series have reported a similarly low incidence of graft infection at long-term follow-up, ranging from 0.42% to 2.32%.^{36,37}" (Page 12, lines 15-18).

Comment 2: Page 12, lines 18-19: Fenestrated and branched grafts also have endoleak limitations. "Reduction" would be better word than "absence".

Reply 2: Thank you for your comment. The text has been amended as suggested.

Changes in text: "Fenestrated and branched grafts have replaced parallel grafts given the reduction of these limitations." (Page 13 line 10)

Comment 3: Endoleaks are main mid- and long-term complications of endovascular treatment, that could cause further aneurysm growth and may need reintervention. It is barely mentioned in manuscript. I suggest to add a paragraph and shortly describe this area including some statistics.

Reply 3: Thank you for your comment. We agree that endoleak merits more discussion and we have added relevant text (Page 14, lines 16-22 and Page 15, lines 1-2). We would also respectfully note that in the section on comparison between the endovascular and open approaches, we do include discussion of the need for vascular re-intervention as a drawback of the endovascular technique when compared with the open approach (Page 15, lines 11-12, and Page 17, lines 13-15).

Changes in text: “Endoleak represents a primary mid- and long-term complication of endovascular TAAA repair, with the reported incidence of ranging from 15-66.7% and the reported incidence of re-intervention for endoleak ranged from 3-33% in prior series.^{49–51} Management of endoleak varies depending upon the surgeon, the type of endoleak, and its features; for instance, aneurysm sac growth may suggest the need for intervention, while regression of sac size or endoleak volume may favor observation.^{49,51} In prior series,^{49–51} type I endoleak was managed with cuff extension for proximal or distal seal, type II endoleak was most common and was managed either with observation or with glue embolization, and type III endoleak was managed with repeat stenting into the visceral or renal arteries to seal the modular joints.” (Page 14, lines 16-22 and Page 15, lines 1-2).

Reviewer E

The authors present a comprehensive narrative review of approach to repair of thoracoabdominal aortic aneurysms, outcomes after surgical intervention, and recommended strategies for prevention of common complications. They prioritized randomized trials and publications in PubMed with the term “thoracoabdominal aortic aneurysm” “endovascular thoracoabdominal aortic aneurysm repair” “open thoracoabdominal aortic aneurysm repair” or their combination in the title or abstract from the last 15 years. The authors conclude that open repair is the gold standard, while endovascular repair has an increasingly and may improve outcomes in the future. The authors also concluded that surgeon and center volume and expertise are related to clinical outcomes and should be taken into consideration when deciding on surgical repair

The topic is of potential interest to the readers of the journal. The paper is generally well written and presented in a timely fashion. Novel preoperative intervention for the prevention of spinal cord ischemia is also described.

Reply: Thank you for your supportive comments and summary of our work.

However, I have only a few minor comments for clarifying some aspects of the manuscript before publication, explained below

Minor comment:

Comment 1: The statement that “surgeon volume was a significant predictor of mortality (low-volume surgeons: OR 2.6; $p < 0.001$), as was low-volume institution (OR 2.2; $p < 0.001$).” is correct, but it would be informative to include criteria of the low-volume or high-volume surgeons or institution.

Reply 1: Thank you for your comment. We agree that further clarity on what should be considered low-volume and high-volume would be helpful and of interest to readers. We have added the relevant text.

Changes in text: “Rocha et al.²⁵ found that institutional volume of over 60 cases in a 10-year study period (approximately 6 cases per year) was associated with a significant lower operative mortality after open TAAA repair compared with all other centers (13.8% versus 36.0%; $p < 0.01$). In a 2003 retrospective study of 1542 patients undergoing TAAA repair by Cowan et al,²³ high-volume surgeons (performing three to eighteen cases per year, median seven cases per year) had significantly lower operative mortality than their low-volume counterparts (11.0% versus 25.6%; $p < 0.001$); the same was true for high-volume centers (five to 31 cases per year, median twelve cases per year) when compared with low-volume institutions (15.0% versus 27.4%; $p < 0.001$) low surgeon volume (defined as one to two cases per year) was a significant predictor of mortality: OR 2.6; $p < 0.001$), as was low institution volume (one to three cases per year) (OR 2.2; $p < 0.001$). Therefore, surgeon and institutional volume have an important relationship to clinical outcomes and should be part of the decision-making process regarding whether, where, and how to undergo repair.” (Page 9, lines 13-22 and Page 10, lines 1-4)

Comment 2: The algorithm shown in figure 2 is well designed, but it would be easier for the reader to understand if the diagram were simplified a bit.

Overall, this is an informative and useful review.

Reply 2: Thank you for your comment. We have consolidated one branch point to streamline and simplify the figure.

Changes in text: Please see revised Figure 2.