

# Commentary: The ascending aorta and arch in the sights of transcatheter therapy. A time for reappraisal.

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## Abstract

The ascending aorta and arch have until recently been one of the last bastions of cardiovascular surgery, where life-threatening diseases impose the need for prompt correction and reversal of the impending adverse prognosis. Though a disease where dogmatic recommendations prevail, with upfront surgical intervention in the mind of every physician, type A acute aortic dissection (AAD) is a subject still blurred by many uncertainties. Endovascular intervention for the treatment of type A AAD are rapidly progressing and utilization of transcatheter therapies in the ascending aorta for treating type A AAD has demonstrated technical success in small studies, low early mortality rates, and relatively acceptable aorta-related mortality rates in the long-term. These findings strengthen the preponderant role of the endovascular heart surgeon on the management of these procedures, where a combination of wire skill training and surgical proficiency encompassing all technical options available makes it distinctive and resourceful, able to provide complete resolution to each multicomponent of this disease in one setting, besides the promptness to repair the inherent complications that are to accompany these interventions. Transcatheter procedures and open surgery are to coexist side by side and to be regarded as complementary rather than competing. Substantial more refinement and technological innovation will be necessary before endovascular repair of type A AAD comes to widespread use, the ideal timespan for cardiovascular surgeons to be involved, and prepared to take on the challenges of leading this new enterprise.

## Commentary

### **The ascending aorta and arch in the sights of transcatheter therapy. A time for reappraisal.**

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The ascending aorta and arch have until recently been one of the last bastions of cardiovascular surgery, where life-threatening diseases impose the need for prompt correction and reversal of the impending adverse prognosis [1].

However, the article from Ahmed and colleagues in this issue reveals the incipient but steadily venturing of transcatheter therapies in this so far untouchable domain of cardiovascular surgery [2].

Though a disease where dogmatic recommendations prevail, with upfront surgical intervention in the mind of every physician, type A acute aortic dissection (AAD) is a subject still blurred by many uncertainties [1]. No randomized trial has ever been performed; many shreds of evidence used for recommendation are decades old. From the latest International Registry of Acute Aortic Dissection (IRAD) report, the in-hospital mortality rate of patients presenting with type A AAD dropped over time, significantly from 31% to 22% in top reference centers located in the USA and Europe [1]. These mortality numbers are obviously higher in low-volume centers and with less well-trained surgeons, which comprises the vast majority worldwide. Major predictors of death, such as tamponade and shock, forced the surgeon to operate sooner on the most critical patients, and type A AAD complicated by hypotension and its consequences increased mortality to 55% [3]. The mortality of patients with pericardial tamponade remains significantly high, even after adjustment for baseline clinical characteristics (44% versus 20%,  $P < 0.001$ ) [4]. From the IRAD data, type A AAD in-hospital mortality was highly dependent on patient risk profiles before surgery, patients classified as unstable had much higher in-hospital mortality, 31% versus 17% in those without unstable features. Independent preoperative predictors of mortality were age  $> 70$  years, previous cardiac surgery, hypotension, or shock at presentation, migrating pain, cardiac tamponade, any pulse deficit, and myocardial ischemia or infarction. [IRAD] Not surprisingly, in up to 20% of patients with type A AAD surgery is withheld [5,6] and that makes the need for an alternative treatment in this cohort even more relevant.

Clearly, there are subgroups where urgent surgery is not beneficial and indeed harmful, and recent evidence brings paradoxical findings, where in acute type A AAD the watch-and-wait strategy was employed in a selected cohort of patients with intramural hematoma (IMH) and acute aortic dissection with thrombosed false lumen of the ascending aorta, and showed outcomes even superior to emergency surgery [7]. Kitamura et al. reported that the watch-and-wait strategy was selected in 46 patients, 10 of them underwent emergency pericardial drainage for cardiac tamponade at the time of presentation. In-hospital mortality occurred in 4% of patients, during follow-up the survival at 1 and 2 years was 95% and 92%, respectively [7]. These results have been reproduced by other centers and Kitai et al reported long-term clinical outcomes of 66 patients with type A IMH who were treated with emergent procedure or medical therapy and timely operation. The 30-day mortality rate was 6% with emergent surgery and 4% with supportive medical therapy. The actuarial survival rates of patients were  $96 \pm 3\%$ ,  $94 \pm 3\%$ , and  $89 \pm 5\%$  at 1, 5, and 10 years, respectively [8,9]. Initial medical treatment in selected cases is now classified as recommendation class IIa in the Japanese Circulation Society guidelines [10].

These figures frontally challenge the ingrained and long-lasting notion of the near-fatal outcome related to the type A AAD if left untouched. And suggests that in carefully selected patients and properly medically managed, the results would be less deadly than previously believed by older and outdated evidence.

Surgeons too are in search of less invasive procedures in high-risk patients with type A AAD. An approach consisting of wrapping the dissected ascending aorta has been performed as an alternative in high-risk or aged patients requiring emergent surgical treatment, with in-hospital mortality of 6.6% and the follow-up mortality rate being 13.3% with a median follow-up of 15 months [11]. This experience has been replicated by other surgeons and Lopez et al described a series of six patients with a poor functional status, and no severe neurologic complications or deaths occurred during the postoperative period [12]. Suematsu et al reported the utilization of this technique in 82 patients since January 2015 and describe the new surgical approach which entails “stepwise external wrapping” using a zero-porosity artificial graft and applied in extremely high-risk patients. Patient outcomes after external wrapping were excellent with zero in-hospital mortality, successful aorta remodeling, and no aorta-related death during three years of follow up, thus very encouraging results of a feasible alternative to conventional graft replacement surgery [13,14].

While medical management is emerging as a reasonable approach in selected patients who are not surgical candidates, endovascular intervention for the treatment of type A AAD are rapidly progressing. Utilization of transcatheter therapies in the ascending aorta for treating type A AAD has demonstrated technical success in small studies, low early mortality rates, and relatively acceptable aorta-related mortality rates in the long-term [15].

The systematic review from Ahmed et al. shows that the procedure is feasible, however shortcomings were frequent, and to this date evidence of long-term effectivity is elusive. Collecting a total of 31 articles, of which 19 were case reports and 12 case series, resulting in 92 patients, the median follow-up was 6 months for case reports and the average follow-up was 14 months for case series. Overall technical success was 95.6% and 30-day mortality of 9%. Stroke and early endoleak rates were 6% and 18%, respectively. Two patients (2%) required intraoperative conversion to open surgery and reintervention was required in 14 patients (15%), of which four patients underwent endovascular repair and five patients underwent open repair [2].

These findings strengthen the preponderant role of the endovascular heart surgeon on the management of these procedures, where a combination of wire skill training and surgical proficiency encompassing all technical options available makes it distinctive and resourceful, able to provide complete resolution to each multicomponent of this disease in one setting, besides the promptness to repair the inherent complications that are to accompany these interventions [16].

Conventional surgery and its technical variants are to remain the treatment of choice for a large proportion of patients with type A AAD, however ongoing progress points that interventional transcatheter procedures will continue to evolve, a share of cardiovascular diseases may become amenable to this treatment approach. This underscores the importance of surgeons to become familiar and be involved with these percutaneous procedures. The further trend towards referring patients with aorta diseases to centers of excellence, a policy aimed at achieving better outcomes and cost reduction, will add elements favoring the insertion and role of the surgeon in this multidisciplinary program. A pending issue is to determine which patient could most benefit from the emerging assorted array of therapeutic options, from surgical delay or permanent deferral of surgery to interventional transcatheter procedures with transfer to specialized centers [16,17]. Given the complexity of designing a randomized controlled trial in a disease with a multivariate presentation like the type A AAD, a scoring system derived from a large dedicated database would be effective to predict the 30-day mortality rate for patients undergoing surgery for type A AAD and provide recommendation for procedure selection [18].

Transcatheter procedures and open surgery are to coexist side by side and to be regarded as complementary rather than competing. In this way, the role of the Cardiovascular Surgery Societies worldwide, partnering with medical device companies, and establishing ongoing educational and training programs, with certification for heart surgeons who complete training, should support the prospect of acquiring these ground-breaking and complementary new skills [16,17].

Substantial more refinement and technological innovation will be necessary before endovascular repair of type A AAD comes to widespread use, the ideal timespan for cardiovascular surgeons to be involved, and prepared to take on the challenges of leading this new enterprise.

## References

1. Evangelista A, Isselbacher EM, Bossone E, Gleason TG, Eusanio MD, Sechtem U, IRAD Investigators. Insights from the International Registry of Acute Aortic Dissection: A 20-year experience of collaborative clinical research. *Circulation*. 2018;137(17):1846-1860.
2. Ahmed Y, Houben IB, Figueroa CA, Burris NS, Williams DM, Moll FL, et al. Endovascular ascending aortic repair in type A dissection: A systematic review. *J Card Surg*. 2020.
3. Tsai TT, Bossone E, Isselbacher EM, Nienaber CA, Evangelista A, Fang J, et al; International Registry of Acute Aortic Dissection. Clinical characteristics of hypotension in patients with acute aortic dissection. *Am J Cardiol*. 2005; 95:48–52.

4. Mukherjee D, Evangelista A, Nienaber CA, Sechtem U, Suzuki T, Trimarchi S, et al. Implications of periaortic hematoma in patients with acute aortic dissection (from the International Registry of Acute Aortic Dissection). *Am J Cardiol.* 2005; 96:1734–1738.
5. Saw LJ, Lim-Cooke MS, Woodward B, Othman A, Harky A. The surgical management of acute type A aortic dissection: Current options and future trends [published online ahead of print, 2020 Jun 29]. *J Card Surg.* 2020;10.1111/jocs.14733. doi:10.1111/jocs.14733
6. Gomes EN, Dias RR, Rocha BA, Santiago JAD, Dinato FJS, Saadi EK, et al. Use of 3D printing in preoperative planning and training for aortic endovascular repair and aortic valve disease. *Braz J Cardiovasc Surg.* 2018;33(5):490-495.
7. Kitamura T, Torii S, Miyamoto T, et al. Watch-and-wait strategy for type A intramural haematoma and acute aortic dissection with thrombosed false lumen of the ascending aorta: a Japanese single-centre experience. *Eur J Cardiothorac Surg.* 2020;58(3):590-597.
8. Kitai T, Kaji S, Yamamuro A, Tani T, Tamita K, Kinoshita M et al. Clinical outcomes of medical therapy and timely operation in initially diagnosed type A aortic intramural hematoma: a 20-year experience. *Circulation* 2009;120:S292–8.
9. Song JK, Yim JH, Ahn JM, Kim DH, Kang JW, Lee TY et al. Outcomes of patients with acute type A aortic intramural hematoma. *Circulation* 2009;120:2046–52.
10. JCS Joint Working Group. Guidelines for diagnosis and treatment of aortic aneurysm and aortic dissection (JCS 2011). *Circ J.* 2013;77(3):789-828.
11. Demondion P, Ramadan R, Azmoun A, Raoux F, Angel C, Nottin R, Deleuze P. Aortic wrapping for stanford type A acute aortic dissection: short and midterm outcome. *Ann Thorac Surg.* 2014 May;97(5):1590-6.
12. Lopez S, Roux D, Cazavet A, et al. Wrapping procedure for Stanford type A acute aortic dissection: is there an indication for surgery without a cardiopulmonary bypass? *Ann Thorac Surg.* 2012;94:990-991.
13. Suematsu Y. Is an off-pump wrapping procedure for Stanford type A acute aortic dissection low invasive surgery? *Ann Thorac Surg.* 2020;110(2):750.
14. Suematsu Y, Nishi S, Arima D, Yoshimoto A. Stepwise external wrapping procedure for Stanford type A aortic dissection in extremely high-risk patients: case reports. *J Cardiothorac Surg.* 2020 Jun 12;15(1):138.
15. Sabe AA, Percy E, Kaneko T, Plichta RP, Hughes GC. When to consider deferral of surgery in acute type A aortic dissection: a review. *Ann Thorac Surg.* 2020:S0003-4975(20)31425-9. doi: 10.1016/j.athoracsur.2020.08.002.
16. Saadi EK, Tagliari AP, Almeida RMS. Endovascular treatment of the ascending aorta: is this the last frontier in aortic surgery? *Braz J Cardiovasc Surg.* 2019;34(6):759-764.
17. Hossne NA, Gomes WJ. Transcatheter procedures in structural heart disease: The surgeon stepping-in. *J Card Surg.* 2020 Sep 16. doi: 10.1111/jocs.14992.
18. Czerny M, Pacini D, Aboyans V, Al-Attar N, Eggebrecht H, Evangelista A, et al. Current options and recommendations for the use of thoracic endovascular aortic repair in acute and chronic thoracic aortic disease: an expert consensus document of the European Society for Cardiology (ESC) Working Group of Cardiovascular Surgery, the ESC Working Group on Aorta and Peripheral Vascular Diseases, the European Association of Percutaneous Cardiovascular Interventions (EAPCI) of the ESC and the European Association for Cardio-Thoracic Surgery (EACTS). *Eur J Cardiothorac Surg.* 2020:ezaa268. doi: 10.1093/ejcts/ezaa268. Epub ahead of print.