

Endovascular treatment of the ascending aorta: new frontiers for thoracic endovascular aneurysm repair?

Chris Klonaris¹, Sotirios Georgopoulos¹, Athanasios Katsargyris²

¹1st Department of Surgery, Vascular Division, LAIKO Hospital, Athens University Medical School, Athens, Greece; ²Department of Vascular and Endovascular Surgery, Paracelsus Medical University, Nuremberg, Germany

Correspondence to: Athanasios Katsargyris, MD. Department of Vascular and Endovascular Surgery, Paracelsus Medical University, Breslauer Strasse 201, 90471, Nuremberg, Germany. Email: akatsargyris@gmail.com; kthanassos@yahoo.com.

Submitted Jun 06, 2016. Accepted for publication Jun 15, 2016.

doi: 10.21037/jtd.2016.07.35

View this article at: <http://dx.doi.org/10.21037/jtd.2016.07.35>

Pathology involving the ascending aorta has been traditionally treated with open surgery. Despite continuous improvement in the operative technique and perioperative care, mortality and morbidity of open surgery for type A aortic pathology remain considerable (1,2). Complications are mainly related to the use of cardiopulmonary bypass, while the risk for neurocognitive alterations should be also considered (3). Less invasive endovascular techniques could, at least theoretically, improve the results of ascending aortic repair.

Endovascular repair has been now established for the descending thoracic and abdominal aorta and expansion of its application to the ascending aorta seems to be a natural evolutionary step (4,5). Nevertheless, endovascular repair of the ascending aorta is not widely applied yet, since it is associated with additional challenges. Stent-grafts should fixate and seal proximally just distal to the sinotubular junction. Distal sealing should be obtained just proximal to the innominate artery, requiring thus a short stent-graft length (50–80 mm) (2). Furthermore migration forces in the ascending aorta are greater in comparison to stent-grafts placed more distally in the aorta (descending and abdominal). Diameters are also larger compared to the descending aorta. Finally, stent-graft delivery may require working within the left ventricle, through the aortic valve, with additional technical difficulties and operative risks.

Despite the above challenges, accumulated clinical experience and technical evolution during the last decade have enabled the use of stent-grafts for the treatment of type A aortic pathology including dissections, aneurysms, pseudoaneurysms, penetrating ulcers, and intramural

hematomas (6,7). The first case of type A dissection treated with a customized stent-graft was reported back in 2000 (8). Since then, other authors have published their experience with endovascular treatment of the ascending aorta (7,9-11). A great variety of indications, techniques, and materials, is noted.

Early results as reported in a limited number of patients up to now (<150 worldwide) seem to be promising. Initial success rates are commonly >95% and 30-day mortality rate approximately 8% (12). Potential serious complications include stroke due to catheter and wire manipulations in the aortic arch, and ventricular trauma and aortic valve insufficiency following imprecise proximal stent-graft deployment (7,13).

Long-term results are scarce. Recently, Piffaretti *et al.* published mid-term data on a total of eight patients with pseudoaneurysms and penetrating aortic ulcers of the ascending aorta (14). Primary clinical success rate was 87.5%, with null in-hospital mortality. During follow-up with a mean duration of 40±33 months (range, 4–93 months) clinical success was maintained in all but one patient. No reintervention was required and no endograft damage or migration was noted.

Strict criteria of anatomical suitability for thoracic endovascular aneurysm repair (TEVAR) in the ascending aorta have not been established yet. Especially for type A dissection, many authors recommend a ≥2 cm distance between the sinotubular junction and the dissection entry tear, ≥0.5 cm distance between entry tear and innominate artery, and absence of cardiac tamponade, and occlusion of

aortic branches.

Stent-graft selection is critical in the ascending aorta. The latter poses several anatomical challenges, such as the mismatch between lengths of the inner and outer curvatures, the short distance from the sinotubular junction to the innominate artery, and the proximity of the coronary arteries. In most published cases standard or customized thoracic or abdominal stent-grafts have been used off-label (2,7,14,15). Other investigators describe the use of two or three abdominal aortic extender cuffs to address the different ascending aorta lengths. This approach however can be associated with stent-graft dislodgment, migration, or endoleak (6). Surgeon-modified thoracic stent-grafts (intraoperative cut of the stent-graft after partial deployment on the operating table, and recapturing into the sheath) have been also used to address length discrepancies (7). Recently, a dedicated stent-graft (Zenith Ascend TAA Endovascular Graft, William Cook Europe, Bjaeverskov, Denmark) for the ascending aorta with a short length (6.5 cm) has shown promising early results in selected high-risk patients (16). Finally, fenestrated and branched stent-grafts for the aortic arch could also be useful to enable endovascular repair of the ascending aorta in cases of inadequate distal landing zone before the innominate artery. Incorporating the aortic arch branches with fenestrations or branches could help to achieve sealing in a more distal healthy aortic segment (17).

Cardiac revascularization procedures could pose an important limitation for ascending aorta endografting. Previous aortocoronary bypass can preclude stent-grafting of the ascending aorta and vice versa; a stent-graft in the ascending aorta could preclude an aortocoronary bypass graft. For such patients coronary revascularization will have to be performed with alternative inflow vessels (e.g., innominate artery, subclavian artery etc.)

In conclusion, increasing evidence suggests that endovascular repair could potentially expand in the ascending aorta. Clinical benefits could be of great impact especially for high-risk patients. The absence of dedicated stent-grafts to address the special anatomical context of the ascending aorta is still an important limitation. Lack of long-term outcomes is also crucial and it will be important to see whether conventional stent-grafts can withstand the challenging environment of the ascending aorta for a long time.

Acknowledgements

None.

Footnote

Provenance: This is an invited Editorial commissioned by the Section Editor Lei Zhang (Department of Vascular Surgery, Changhai Hospital, Second Military Medical University, Shanghai, China).

Conflicts of Interest: The authors have no conflicts of interest to declare.

Comment on: Piffaretti G, Galli M, Lomazzi C, et al. Endograft repair for pseudoaneurysms and penetrating ulcers of the ascending aorta. J Thorac Cardiovasc Surg 2016;151:1606-14.

References

1. Kazui T, Washiyama N, Muhammad BA, et al. Improved results of atherosclerotic arch aneurysm operations with a refined technique. J Thorac Cardiovasc Surg 2001;121:491-9.
2. Moon MC, Morales JP, Greenberg RK. The aortic arch and ascending aorta: are they within the endovascular realm? Semin Vasc Surg 2007;20:97-107.
3. Selnes OA, McKhann GM, Borowicz LM Jr, et al. Cognitive and neurobehavioral dysfunction after cardiac bypass procedures. Neurol Clin 2006;24:133-45.
4. Verhoeven EL, Katsargyris A, Oikonomou K, et al. Fenestrated Endovascular Aortic Aneurysm Repair as a First Line Treatment Option to Treat Short Necked, Juxtarenal, and Suprarenal Aneurysms. Eur J Vasc Endovasc Surg 2016;51:775-81.
5. Verhoeven EL, Katsargyris A, Bekkema F, et al. Editor's Choice - Ten-year Experience with Endovascular Repair of Thoracoabdominal Aortic Aneurysms: Results from 166 Consecutive Patients. Eur J Vasc Endovasc Surg 2015;49:524-31.
6. Kato N, Shimono T, Hirano T, et al. Transluminal placement of endovascular stent-grafts for the treatment of type A aortic dissection with an entry tear in the descending thoracic aorta. J Vasc Surg 2001;34:1023-8.
7. Kolvenbach RR, Karmeli R, Pinter LS, et al. Endovascular management of ascending aortic pathology. J Vasc Surg 2011;53:1431-7.
8. Dorros G, Dorros AM, Planton S, et al. Transseptal guidewire stabilization facilitates stent-graft deployment for persistent proximal ascending aortic dissection. J Endovasc Ther 2000;7:506-12.

9. Preventza O, Henry MJ, Cheong BY, et al. Endovascular repair of the ascending aorta: when and how to implement the current technology. *Ann Thorac Surg* 2014;97:1555-60.
10. Roselli EE, Brozzi N, Albacker T, et al. Transapical endovascular ascending repair for inoperable acute type a dissection. *JACC Cardiovasc Interv* 2013;6:425-6.
11. Ronchey S, Serrao E, Alberti V, et al. Endovascular stenting of the ascending aorta for type A aortic dissections in patients at high risk for open surgery. *Eur J Vasc Endovasc Surg* 2013;45:475-80.
12. Mestres G, Yugueros X, Brinster C, et al. Endovascular Techniques for Treating Ascending Aortic Pathology. *Endovasc Today* 2014;13:60-6.
13. Bernardes RC, Navarro TP, Reis FR, et al. Early experience with off-the-shelf endografts using a zone 0 proximal landing site to treat the ascending aorta and arch. *J Thorac Cardiovasc Surg* 2014;148:105-12.
14. Piffaretti G, Galli M, Lomazzi C, et al. Endograft repair for pseudoaneurysms and penetrating ulcers of the ascending aorta. *J Thorac Cardiovasc Surg* 2016;151:1606-14.
15. Lu Q, Feng J, Zhou J, et al. Endovascular repair of ascending aortic dissection: a novel treatment option for patients judged unfit for direct surgical repair. *J Am Coll Cardiol* 2013;61:1917-24.
16. Tsilimparis N, Debus ES, Oderich GS, et al. International experience with endovascular therapy of the ascending aorta with a dedicated endograft. *J Vasc Surg* 2016;63:1476-82.
17. Haulon S, Greenberg RK, Spear R, et al. Global experience with an inner branched arch endograft. *J Thorac Cardiovasc Surg* 2014;148:1709-16.

Cite this article as: Klonaris C, Georgopoulos S, Katsargyris A. Endovascular treatment of the ascending aorta: new frontiers for thoracic endovascular aneurysm repair? *J Thorac Dis* 2016;8(8):1901-1903. doi: 10.21037/jtd.2016.07.35