EDITORIAL

Fenestrated versus Chimney Endovascular Aortic Aneurysm Repair

Reparación endovascular de aneurisma aórtico mediante endoprótesis fenestradas o en chimeneas

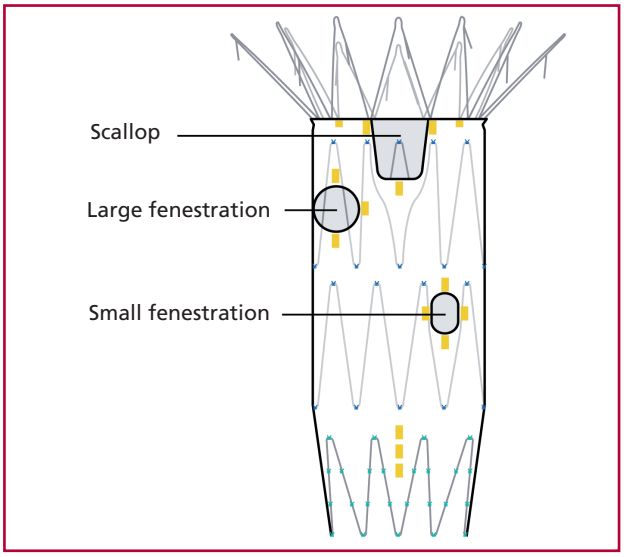
THOMAS S. MALDONADO, M.D. FACS

In 1991, Parodi et al. described the first endovascular repair of an infrarenal abdominal aortic aneurysm (EVAR).(1) The endovascular approach was initially reserved for the sickest patients, whose comorbidities posed a prohibitive risk for open repair. However, as devices improved along with endovascular training, EVAR largely came to replace open surgery as the preferred treatment for most infrarenal abdominal aortic aneurysms (AAA).(2) Not surprisingly, the endovascular revolution has led to successful treatment of more complex aortic anatomy using this minimally invasive approach. Indeed, juxta-renal and thoraco-abdominal aortic aneurysms are more commonly treated with endovascular techniques.

In their single-center study of 21 patients, Ferreira and colleagues(3) have demonstrated the safety and efficacy of endovascular treatment of juxta AAA using a combination of fenestrated (FEVAR; n=15) and chimney (Ch-EVAR; n=4) techniques. Over a mean 15-month follow-up, they encountered a 30-day mortality of 4.7% with no other major adverse events (myocardial infarction, stroke, or spinal cord ischemia) noted.

The use of a fenestrated stent graft to treat juxta-renal aneurysms in an animal model was first described by Browne et al in 1999.(4) Subsequently, the Cook Zenith fenestrated stent graft (Cook Medical, Inc., Bloomington, IN) became the first commercially available fenestrated device. The proximal body of this device contains up to three precisely located holes (fenestrations) or scallops to accommodate the renal arteries and the superior mesenteric artery (Figure 1). These must be precisely aligned with the respective vessel and require custom-made devices specific to each patient's anatomy.

Branch vessel patency following FEVAR has been shown to be durable. Results of the US prospective trial evaluating the Zenith fenestrated graft showed, at 5 years, that primary and secondary patency of targeted renal arteries was 81% and 97%, freedom from renal function deterioration was 91%, and freedom from secondary interventions was 63%.(5, 6)



Use of the Zenith fenestrated AAA endovascular graft is limited to juxta-renal aneurysms and, as per instructions for use (IFU), requires a minimum of 4 mm infrarenal seal zone. As such, in this single center experience, Ferreira and colleagues reserved the use of Ch-EVAR for those patients with <5mm infrarenal neck but who had normal juxta/suprarenal aorta. Nonetheless, real-world experience with the Zenith FEVAR has shown that post-approval outcomes may be no worse than those in the clinical trial despite more liberal use outside IFU parameters. A multicenter study of 52 consecutive patients treated with FEVAR found that 62% of patients did not meet the anatomic criteria of >4mm infrarenal neck. Despite higher comorbidities and more challenging anatomy in this group, 30-day outcomes compared well to data from the United States Fenestrated Trial.(7)

In practice, FEVAR requires significant perioperative planning and sizing. Moreover, fenestrated devices are custom-made and can take up to one month for production; therefore these devices are rarely applica-

Rev Argent Cardiol 2018;86:153-154. http://dx.doi.org/10.7775/rac.v86.i3.13425
SEE RELATED ARTICLE: Rev Argent Cardiol 2018;86:185-189. http://dx.doi.org/10.7775/rac.v86.i3.11905

Schwartz-Buckley Professor of Surgery, Director of Aortic Center. New York University Langone Medical Center

ble in the setting of rupture and/or need for an urgent solution. This has led some authors to advocate for the use of Ch-EVAR to treat para-renal aneurysms, which may require more urgent repair, thus allowing for an 'off the shelf' solution which has been shown to be safe and efficacious, at least in the short term. (8) The PERICLES registry of 517 patients treated with Ch-EVAR showed a primary patency of 94%, with secondary patency of 95.3% at a mean follow-up of 17.1 months. Nevertheless, Ch-EVAR may have a unique set of potential complications compared to FEVAR. Some authors have described a higher 30-day mortality of 4.9% for Ch-EVAR compared with 2.1% for FEVAR. (8, 9) There are also concerns regarding long-term patency of Ch-EVAR compared with FEVAR. In fact, in their single center experience reported here, Ferreira and colleagues report two branch occlusions in only four patients, albeit both managed successfully. Finally, the ch-EVAR technique requires brachial access and may lead to guttering and subsequent endoleaks. Gutter leaks are unpredictable and difficult to treat. They can result from either insufficient or excessive device oversizing or due to inadequate seal zone length. (10) In the present study by Ferreira and colleagues, two type 1 endoleaks were encountered and treated successfully at the time of surgery with a limb extension for the type 1b leak and re-ballooning of the type 1a leak. Nevertheless, Katsargyris and colleagues found early proximal type I endoleak was lower after FEVAR compared with Ch-EVAR (4.3% vs. 10%, respectively, p=0.002), likely due to gutter leaks associated with Ch-EVAR. (11)

In a recent review of the literature comparing open, FEVAR and Ch-EVAR for the treatment of juxta-renal aortic aneurysms, the incidence of ischemic stroke was 0.3% following FEVAR, but 3.2% after Ch-EVAR (FEVAR vs. Ch-EVAR: p=0.012). This likely reflects the need for brachial access to accomplish Ch-EVAR and its associated stroke risk.(11)

In conclusion, Ferreira and colleagues have demonstrated the safe and efficacious use of endovascular techniques (Ch-EVAR and FEVAR) for the treatment of complex juxta-renal aortic aneurysms in their center. Choice of the endovascular technique for treating such complex anatomy is often physician dependent with both FEVAR and Ch-EVAR, offering comparable results although long-term data is lacking for Ch-EVAR. Until a readily accessible 'off the shelf' device becomes available, Ch-EVAR and physician modified FEVAR remain important options for treatment of urgent/ruptured repairs and should be considered, especially in higher risk patients.

CONFLICTS OF INTEREST

None declared.

(See authors' conflicts of interest forms on the website/Supplementary material).

REFERENCES

1. Parodi JC, Palmaz JC, Barone HD. Transfemoral intraluminal graft implantation for abdominal aortic aneurysms. Ann Vasc Surg 1991;5:491-9. http://doi.org/b99fts

2. Greenhalgh RM, Brown LC, Kwong GP, Powell JT, Thompson SG, participants Et. Comparison of endovascular aneurysm repair with open repair in patients with abdominal aortic aneurysm (EVAR trial 1), 30-day operative mortality results: randomised controlled trial. Lancet 2004;364:843-8. http://doi.org/bgnvqm

3. Ferreira LM, Ferrer M, Zambrano A, La Mura R. Endovascular Treatment of Aortic Aneurysms with Complex Proximal Anatomy. Rev Argent Cardiol 2018;86:185-9.

4. Browne TF, Hartley D, Purchas S, Rosenberg M, Van Schie G, Lawrence-Brown M. A fenestrated covered suprarenal aortic stent. Eur J Vasc Endovasc Surg 1999;18:445-9. http://doi.org/dqpkk3

5. Oderich GS, Greenberg RK, Farber M, Lyden S, Sanchez L, Fairman R, et al. Results of the United States multicenter prospective study evaluating the Zenith fenestrated endovascular graft for treatment of juxtarenal abdominal aortic aneurysms. J Vasc Surg 2014;60:1420-8 e1-5.

6. de Souza LR, Oderich GS, Farber MA, Haulon S, Banga PV, Pereira AH, et al. Editor's Choice - Comparison of Renal Outcomes in Patients Treated by Zenith((R)) Fenestrated and Zenith((R)) Abdominal Aortic Aneurysm Stent grafts in US Prospective Pivotal Trials. Eur J Vasc Endovasc Surg 2017;53:648-55. http://doi.org/f98r5t

7. Vemuri C, Oderich GS, Lee JT, Farber MA, Fajardo A, Woo EY, et al. Postapproval outcomes of juxtarenal aortic aneurysms treated with the Zenith fenestrated endovascular graft. J Vasc Surg 2014;60:295-300. http://doi.org/f6gsrg

8. Donas KP, Lee JT, Lachat M, Torsello G, Veith FJ, investigators P. Collected world experience about the performance of the snorkel/chimney endovascular technique in the treatment of complex aortic pathologies: the PERICLES registry. Ann Surg 2015;262:546-53; discussion 52-3. http://doi.org/f785nj

9. Linsen MA, Jongkind V, Nio D, Hoksbergen AW, Wisselink W. Pararenal aortic aneurysm repair using fenestrated endografts. J Vasc Surg 2012;56:238-46. http://doi.org/fznhvq

10. Donas KP, Criado FJ, Torsello G, Veith FJ, Minion DJ, Collaborators PR. Classification of Chimney EVAR-Related Endoleaks: Insights From the PERICLES Registry. J Endovasc Ther 2017;24:72-4. http://doi.org/cpxf

11. Katsargyris A, Oikonomou K, Klonaris C, Topel I, Verhoeven EL. Comparison of outcomes with open, fenestrated, and chimney graft repair of juxtarenal aneurysms: are we ready for a paradigm shift? J Endovasc Ther 2013;20:159-69. http://doi.org/crfg