Revisionist Reintervention: If I Knew Then What I Know Now

Lessons learned about complex aortic aneurysm repair include the importance of meticulous preoperative planning and device design, as well as the need to choose a safe landing zone that provides for durable repair while allowing for future reintervention.

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Ever since the first publication about endovascular repair of aortic aneurysms more than 3 decades ago, the technique has proven to be safe and effective. However, a better understanding of the aortic disease process was necessary to achieve durable results. For infrarenal aortic repair, important emphasis was dedicated to the proximal and distal aortic necks. The literature has demonstrated an increased incidence of type Ia endoleaks in so-called "hostile" necks: severe angulation, heavy calcification, conical shape, large thrombus burden, short distance, etc. This creates a more difficult problem to fix after implantation of the endograft.

Early in his career, Dr. Roy Greenberg envisioned the concept of landing into the healthiest part of aorta possible. He was quoted as saying, "Given an infinite lifespan, the whole aorta will become aneurysmal." Dr. Greenberg was very emphatic and passionate about providing a repair that would last for the patient's life, even if that meant a more difficult procedure, if it was performed safely and without increasing complications. Several surgeons around the world shared the same concept, and that translated into advances that could repair juxtarenal aneurysms with an endograft containing fenestration to the renal arteries.

F/BEVAR: CLINICAL EVIDENCE, TECHNIQUE PROGRESSION, AND DURABILITY DISCUSSIONS

In a similar fashion to infrarenal endovascular aneurysm repair (EVAR), evidence has accumulated regarding the safety and efficacy of fenestrated EVAR. In the United States, Dr. Greenberg and the Cleveland Clinic group published several articles with their results. With specific software dedicated to three-dimensional reconstruction and the ability to use the centerline of flow, it was possible to assess the aortic anatomy better, detect signs of early degeneration, and, consequently, detect risk of aneurysm repair failure. Advances in intraoperative imaging, providing overlay between the preoperative CT and fluoroscopy, also provided the tools to allow the repair to become faster and with less radiation and contrast use, thus improving outcomes for the patient and resulting in less exposure to the team. As the experience and the need to repair more proximal aneurysms (suprarenal, thoracoabdominal) increased, it was a matter of time before endografts with fenestrations/branches were developed to incorporate the superior mesenteric and celiac arteries. Having achieved success in demonstrating the safety and efficacy of fenestrated and branched EVAR (F/BEVAR), the question becomes durability. The more components that are added to the repair, the greater the risk of failure due to component disconnections.

Mastracci et al published 12-year experience with the Cleveland Clinic of complex endovascular aortic aneurysm repair using F/BEVAR and demonstrated excellent results.[1] Although there was a higher rate of interventions related to branches the more proximal the aneurysm extended, the authors observed a significant reduction in the rate of type Ia endoleak for repairs involving three or more vessels compared with those limited to the renal arteries (1.9% vs 10.4%, respectively).

In Europe, Katsargyris et al demonstrated excellent short- and long-term results not only with repair involving the renal arteries but also with more complex repairs that involved superior mesenteric and celiac arteries.[2] Several other aortic centers have replicated excellent results,[3-5] including in populations with more advanced age. We published the results of our experience at the University of North Carolina and found similar outcomes; during a mean follow-up period of 25.5 months, only one patient presented with a type Ia endoleak among the first 150 patients treated with patient-specific F/BEVAR devices.[6]

LESSONS LEARNED ABOUT REINTERVENTION

Given the increasing number of patients requiring complex aortic repair and the complexity of these repairs, we decided to look at our data regarding rates of complication/reintervention according to the number of vessels incorporated into the repair. Our research concluded that adding the superior mesenteric and celiac arteries into the repair did not increase the mortality and morbidity when compared to repair that included the renal arteries only.[7] However, similar to the Cleveland Clinic group,[1] we did observe that outcomes were better when the repair extended < 5 cm of aortic coverage above the celiac artery. Several factors have been shown to be responsible for better outcomes, including the experience of these dedicated aortic centers as well as advancements in device design (eg, lower profiles, incorporating preloaded catheters and wires).

Regarding the decrease of type Ia endoleaks and future reintervention, finding a good sealing zone is crucial to provide the most durable repair possible, even if that means having to incorporate all four visceral vessels. We have learned that infrarenal abdominal aortic aneurysms with large necks (> 28 mm in diameter) are associated with higher failure rates, especially when the more proximal aortic is smaller. When infrarenal EVAR devices are implanted in this fashion and fail, they often lead to a more difficult fenestrated repair and can be problematic if the previous device used suprarenal fixation. In these scenarios, even when there is sufficient neck length, our preference is to use a more proximal aortic sealing zone in either the visceral or descending thoracic aorta. Although the thinking behind this approach is to provide a repair that will last for the patient's life, we also factor in the likelihood that we will have to reintervene at some point. Anticipating these situations is very important, and as part of choosing a good proximal landing zone, our practice has been to extend the aortic coverage up to 5 cm above the celiac artery to provide a good overlap zone in case the patient needs a proximal extension endograft.

We should also emphasize that most reinterventions after F/BEVAR are related to the visceral branches, especially the renal arteries. The literature has demonstrated some predictors of loss of patency and increased risk of type Ic/IIIc endoleak related to the side branches. We have incorporated several of these principles in our practice, and due to the low patency when renal arteries diameters are < 4 mm, patients with small renal arteries have not been offered fenestrated repair. Regarding side branches, we have learned that the gap distance between the fenestration and the visceral branch takeoff from the aorta has a negative impact in terms of branch stability, with increased rates of type IIIc endoleak when the gap is > 5 mm.[8] To avoid these problems, whenever the aortic lumen can accommodate a directional branch (usually > 25 mm), this has been our preference when planning the device design.

CONCLUSION

In summary, several factors are responsible for good outcomes and a decrease in the reintervention rate after complex aortic aneurysm repair using F/BEVAR. However, we would stress the importance of meticulous preoperative planning and device design, always aiming to build a device that will simultaneously provide the most durable repair possible while allowing for reintervention without jeopardizing the original procedure. ■

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