◆ COMMENTARY ◆

Multiple Chimney Grafts for Total Endovascular Revascularization of the Visceral Arteries in the Setting of Ruptured TAAA: Inventive but Let's Wait for the Smoke to Clear on This One

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Endovascular repair of thoracic and abdominal aortic aneurysms is safe, durable, and effective but only when there is adequate sealing and fixation at the attachment sites. The introduction of fenestrated and branched stent-grafts has made it possible to perform endovascular aneurysm repair (EVAR) when the presence of an aortic arch or visceral artery branches do not have an adequate proximal or distal sealing zone. However, both fenestrated and branched stent-grafts are expensive, time-consuming to manufacture, and unavailable for routine use in the US.

Greenberg et al.¹ first described preservation of renal perfusion during EVAR using the "snorkel" or "chimney graft" technique, with placement of an adjunctive stent into the renal artery alongside the stent-graft to treat a juxtarenal aortic aneurysm. Since then, others have expanded on this technique to treat juxtarenal, pararenal, and aortic arch aneurysms to preserve or restore flow to aortic branches that were intentionally or accidentally covered during EVAR.²⁻⁶

The report by Lachat et al.⁷ in this issue of *JEVT* describes the successful treatment of a ruptured type IV thoracoabdominal aortic aneurysm (TAAA) using a completely endo-

vascular approach, with revascularization of all 4 visceral arteries through chimney grafts. The particular chimney technique described in the article is feasible only when the aneurysm is relatively short. If the aneurysm involves much of the descending thoracic aorta (types II and III), the proximal margin of the stent-graft is far above the visceral artery orifices, requiring either multiple overlapping covered stents or a sandwich of covered stents between multiple overlapping thoracic aortic stent-grafts. If the aneurysm involves the distal infrarenal aorta, as it usually does, the distal margin of the stent-graft is far below the renal artery orifices. In theory, the renal branches can extend cranially to the proximal margin of the stent-graft (alongside the mesenteric branches) or caudally to the distal ends of a bifurcated graft in the iliac arteries. However, one has to wonder whether additional covered stents in these locations would compromise the seal and cause an untreatable type I endoleak, leading to continued hemorrhage and death.

Type I endoleak is the Achilles' heel of any chimney graft technique, especially in the presence of aneurysm rupture. Not only does the covered stent provide a route through its

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lumen to the branch artery, but it also creates a potential avenue for leakage between the wall of the aorta and the outer aspect of the stent-graft into the aneurysm; if the aneurysm is ruptured, the blood flows through the rupture into the abdomen. In theory, the more grafts there are, the greater the potential for leakage.

There are no good alternatives for the treatment of a patient with severe cardiopulmonary disease and a ruptured TAAA. The 4-chimney technique was clearly lifesaving in this patient, but it is too early to estimate the likelihood of success in other cases of this type. In my opinion, this combination of off-label techniques is technically demanding, applicable in relatively unusual circumstances, and of unpredictable efficacy.

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