Endovascular treatment of thoracic aortic aneurysms with a short proximal landing zone using scalloped endografts

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Background: **The suitability of the proximal landing zone remains one of the main limitations to thoracic endovascular aortic repair (TEVAR). The advent of custom-made scalloped stent grafts widens the endovascular options for patients with challenging anatomy. The objective of this study was to present our early and midterm results of custom-made scalloped thoracic stent grafts.**
Methods: **Prospectively acquired data relating to patient demographics, procedure details, clinical outcome, and complications were analyzed. In addition, we analyzed preoperative and postoperative computed tomography scans to evaluate aneurysm morphology, graft placement, side-vessel patency, and endoleaks.**
Results: **Twenty-one patients with a median age of 71 years (range, 35-81 years) underwent custom-made scalloped TEVAR, eight of whom had a concomitant hybrid repair. Procedural success was achieved in all cases. Proximal seal was achieved in all cases, with no type I endoleaks. There were no cases of retrograde dissection and no conversions to open repair. The median follow-up period was 36 weeks (range, 3-183 weeks). Two patients died in the hospital. Three patients suffered a stroke. Three patients had a type II endoleak, one of whom had significant sac enlargement requiring reintervention. One patient had a type III endoleak requiring reintervention. There were no cases of graft migration.**
Conclusions: **Our midterm results show that custom-made scalloped TEVAR is an acceptable treatment of thoracic aortic aneurysms with a short proximal landing zone. Longer term outcome data are required to establish wider use of scalloped thoracic endografts. (J Vasc Surg 2014;60:1499-506.)**

Thoracic endovascular aortic aneurysm repair (TEVAR) is an established treatment of thoracic aortic disease in both the acute and elective setting.[1] TEVAR is associated with lower early mortality and morbidity compared with open surgical repair, making it an attractive therapeutic option.[2-4]

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The feasibility of TEVAR is determined by several anatomic factors, including landing zones. Adequate proximal and distal landing zones of healthy aorta are mandatory for endovascular treatment to prevent stent graft migration and to reduce the risk of endoleak.

Scalloped endografts are one strategy in overcoming the problem of a short proximal landing zone. These are custom-made covered stent grafts with a scallop designed to accommodate the origin of a supra-aortic vessel, which would otherwise be covered or require revascularization. Most often, the proximal scallop is to the left subclavian artery (LSCA), but it has also been successfully used to accommodate common carotid and innominate vessels either with extra-anatomic bypass for covered vessels or by use of fenestrated grafts as an alternative.[5-7] Distal celiac and superior mesenteric artery scallops have also been described.[8-10]

In this paper, we discuss our early and midterm outcomes using TEVAR with a proximal scallop or fenestration in treating thoracic aortic disease with inadequate proximal landing zones.

METHODS

All cases were discussed at our specialist vascular multidisciplinary team meeting before their surgery. Our protocol was to select TEVAR with a custom-made scalloped stent graft in patients with a thoracic aortic aneurysm with a proximal landing zone of <20 mm (as measured

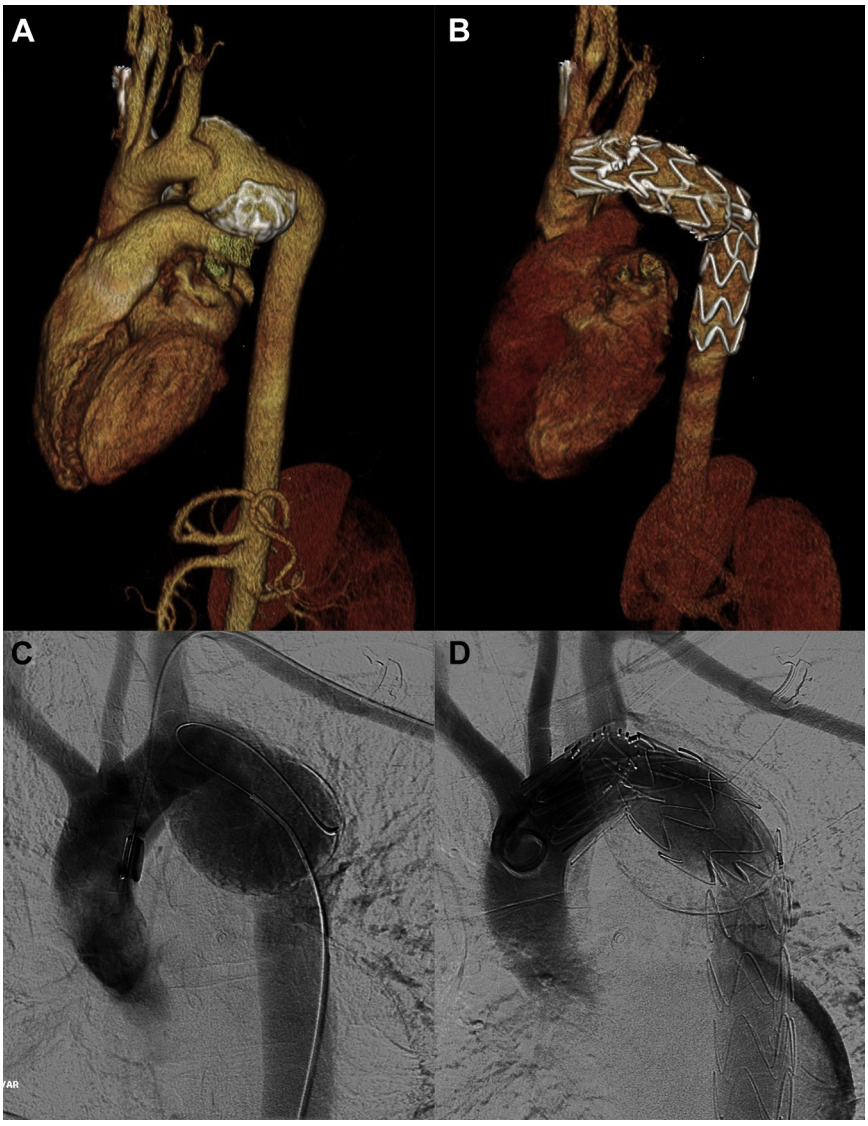

Fig 1. A and **B,** Three-dimensional reconstructions from computed tomography angiography of the aorta before and after (18 months) scalloped thoracic endovascular aortic repair (TEVAR). **C** and **D,** Images from digital subtraction angiography of the aortic arch before and after TEVAR with a scalloped endograft demonstrating isolation of the thoracic aortic aneurysm and patency of the left subclavian artery (LSCA).

from the distal wall of the LSCA) and in cases in which there was significant angulation of the arch necessitating a longer length of landing zone for adequate graft apposition and seal.

Patients with more extensive aortic arch disease underwent scalloped TEVAR with arch vessel extra-anatomic revascularization or, more recently, endograft placement with a fenestration and a scallop.

All patients were entered into our postoperative surveillance program, undergoing follow-up computed tomography angiography at 3 months, 6 months, 1 year, and biannually thereafter in the absence of symptoms and complications. Fig 1 illustrates preoperative and postoperative imaging for a typical patient.

Prospectively acquired data relating to patient demographics, procedure details, clinical outcomes, and complications were analyzed. In addition, two vascular interventional radiologists (M.H. and A.A.) independently analyzed preoperative and postoperative scans to evaluate aneurysm morphology (aneurysm size, morphologic features, type and length of the proximal landing zones), graft placement, migration, supra-aortic vessel patency, and endoleaks.

Ethics approval was not required for this retrospective study.[11]

Stent grafts. We used the CE-marked custom-made Bolton Relay scalloped stent grafts (Relay NBS; Bolton Medical, Barcelona, Spain) (Fig 2). These are self-expanding