CASE REPORT

Treatment of Residual Type A Aortic Dissection With Implantation of the Djumbodis System: Is Purely Endovascular Treatment Becoming a Reality?

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 Purpose: To evaluate the usefulness of a new transfemoral device to avoid major complications related to residual type A aortic dissection following ascending aortic replacement.

Case Reports: Three men (aged 60, 61, and 72 years, respectively) with a residual type A aortic dissection following replacement of the ascending aorta 1, 4, and 5 years prior, respectively, were treated with the Djumbodis Dissection System. The residual dissection developed at the distal anastomosis of the aortic graft and involved all the aortic arch. The Djumbodis Dissection System is an uncovered steel stent, available in 3 lengths (40, 90, 140 mm), pre-mounted on a low pressure (0.3 bars) balloon catheter. The mesh of the device is sufficiently large to bring together the dissected layers without occluding main vital branches. The device was implanted through the femoral artery over a stiff guidewire to exclude the residual false lumen. Satisfactory aortic remodeling was documented in all cases at 1 year.

Conclusion: The Djumbodis Dissection System might be a purely endovascular treatment to replace open surgery for residual type A aortic dissection. More cases and longer follow-up are required.

Key words: thoracic aorta, aortic arch, dissection, false lumen, ascending aortic graft, stent, residual dissection, type A dissection

Acute type A aortic dissection (AAD) remains one of the most serious cardiovascular conditions, with a mortality rate of about 50% within the first 48 hours. Surgical treatment of acute AAD is based on the following 3 steps: first, prompt establishment of cardiopulmonary bypass to prevent malperfusion; second, preservation of the aortic valve whenever possible; and third, replacement of the dissected ascending aorta. Although operative outcomes for this acute disease have improved, the latest report from the International Registry of Acute Aortic Dissection Investigators disclosed a persistently high hospital mortality rate. Unfortunately, surviving the operation does not guarantee freedom from subsequent aortic events, because in many cases the distal intimal tear cannot be removed, and the false lumen frequently remains patent, leading to progressive descending aortic dilatation and rupture.

The problem of this persistent distal false lumen perfusion, a residual type A aortic dissection, has been found in 50% to 100% of

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patients following ascending aorta replacement.\textsuperscript{1–3} Complications of persistent or newly developed dissection of the distal aorta are often fatal and require reoperation, leading to a higher morbidity and mortality rate than with primary surgery.\textsuperscript{3} Numerous attempts have been made to achieve a purely endovascular treatment of residual AAD, but despite these efforts, to date there have been only a few isolated case reports in selected patients with poor clinical impact.\textsuperscript{4}

The present report describes 3 patients with a residual AAD persisting after ascending aortic replacement successfully treated with the Djumbodis Dissection System, thus avoiding major complications of redo open surgery with circulatory arrest.

**CASE REPORTS**

The Djumbodis Dissection System (Saint Come Chirurgie, Marseille, France) is an uncovered bare steel stent specifically designed and approved for aortic dissections. The stent has 3 available lengths: 40, 90, and 140 mm. The stent is pre-mounted on a low pressure (0.3 bars) balloon catheter whose length ranges between 70 and 120 cm. The Djumbodis stent has a sufficiently large mesh (Fig. 1A) and is balloon compliant, which allows the stent to conform to the aortic anatomy, thus bringing together the dissected layers without occluding aortic branches (Fig. 1B).

From May 1 to June 30, 2009, this device was initially used in 3 patients (aged 60, 61, and 72 years, respectively) with residual type A aortic dissection that developed at the distal anastomosis of an aortic graft surgically implanted to replace the ascending aorta. The dissection involved the entire aortic arch in all cases. The 60-year-old patient (Fig. 2A) had an isolated residual AAD; patient 2 (Fig. 3A) had a previous thoracic endovascular aortic repair (TEVAR) followed 2 years later by surgical ascending aorta replacement for an acute AAD not related to the previous TEVAR; and patient 3 (Fig. 4A) presented an extensive residual AAD complicated by clinical signs of malperfusion.

Surgical replacement of the ascending aorta had been performed 1, 4, and 5 years prior, respectively. At this presentation, the aortic arch diameters were 49, 53, and 47 mm, respectively,
which represented increases of 7, 8, and 6 mm, respectively, over the last year.

Three different operative strategies were considered: (1) conventional redo surgery with deep hypothermic circulatory arrest, (2) hybrid treatment consisting of preventive revascularization of the supra-aortic vessels through redo sternotomy followed by TEVAR; and (3) a purely endovascular approach using the Djumbodis Dissection System through a

Figure 2 ◆ Patient 1: (A) CT scan showing a residual type A aortic dissection (arrow) after surgery. (B) The 12-month CT scan shows the Djumbodis Dissection System excluding the false lumen, with remodeling of the thoracic aorta and patency of the supra-aortic vessels.

Figure 3 ◆ Patient 2: (A) CTA showing a dissection of the aortic arch (arrow) involving the origin of the brachiocephalic trunk. Note the stent-graft previously implanted in the descending aorta. (B) The 12-month CT scan shows the Djumbodis Dissection System sealing the false lumen. (C) 3D reconstruction of Djumbodis Dissection System overlapped with the existing stent-graft.
transfemoral access. After much deliberation, the third strategy was selected because of the high risk of bleeding and neurological complications associated with the other procedures.

**Technique**

Under general anesthesia and monitoring of the radial artery and central venous pressures, the procedures were performed by a combined team of cardiologists and cardiac surgeons in an operating room equipped with fluoroscopy (OEC 9900; GE Healthcare, Chalfont St Giles, UK). After surgical exposure of the femoral artery, systemic heparin (70 U/kg) was routinely administrated to obtain an activated clotting time >200 seconds. A super-stiff 0.035-mm Lunderquist guidewire (Cook, Bloomington, IN, USA) was positioned at the aortic valve level, and then an 85-cm delivery system (LeMaitre Vascular, Inc., Burlington, MA, USA) was introduced up to the distal end of the graft in the ascending aorta. Angiography was performed to set the markers of the proximal landing zone in order to overlap the conventional graft with the new device. The Djumbodis Dissection System was introduced into the surgical graft for about 2 cm. When the systolic arterial pressure of 70 mmHg was reached, the balloon catheter was inflated for <30 seconds to obtain a very short time of no-flow in the supra-aortic vessels (Fig. 1C), then a 140-mm Djumbodis dissection stent was positioned so that it overlapped the distal border of the previously implanted conventional graft.

The first patient (Fig. 2B) received two 140-mm stents positioned within the distal end of the conventional graft, extending across the entire aortic arch toward the descending thoracic aorta, just above the T10 thoracic vertebra. In the second patient (Fig. 3B,C), the Djumbodis dissection stent formed a “bridge” between the conventional graft and the covered stent-graft. In the third patient, a different strategy was used (Fig. 4B,C). Since he had widespread dissection involving the entire thoracic aorta, 2 30-mm-diameter Valiant stent-grafts (Medtronic Vascular, Santa Rosa, CA, USA) measuring 200 and 150 mm long, respectively, were placed distal to the left subclavian artery, then the Djumbodis Dissection System was placed in the aortic arch, overlapping the conventional graft in the ascending aorta and the distal stent-grafts just implanted.

In all cases, the residual type A aortic dissection was obliterated, with satisfactory aortic recontouring and complete disappearance of the false lumen documented by intraoperative angiography. No complications were observed. The mean hospital stay was...
All patients were discharged under medical therapy including antiplatelet (aspirin 100 mg/d) and antihypertensive agents. At 1, 6, and 12 months, computed tomography (CT) confirmed exclusion of the false lumen in the short axis view and a very satisfying remodeling of the arch and descending thoracic aorta in the 3-dimensional reconstructions (Figs. 2–4). By the 1-year follow-up, the diameters of the aortic arch on the CT scans were stable, and the patent false lumens were completely closed.

**DISCUSSION**

The impact of a residual patent false lumen on long-term results following surgery for type A aortic dissection is not yet fully understood, and literature on this issue reflects the ongoing controversy. Moreover, Tsai and others have demonstrated that partial thrombosis of the false lumen, compared with complete patency, is a significant independent predictor of post-discharge mortality in patients with dissection of the thoracoabdominal aorta.

Surgical treatment is advocated for patients who develop life-threatening complications or demonstrate a growth rate in the patent false lumen of >5 mm/y. Unfortunately, morbidity and mortality rates for reoperation of the dissected aorta are higher compared with primary surgery, especially when the arch is involved. Moreover, patients unfit for conventional open surgical repair but eligible for a hybrid approach with an endovascular stent-graft, require adjunctive open debranching of the supra-aortic vessels. Such a treatment is necessary for patients with an aortic anatomy that precludes endovascular treatment alone. Thus, to overcome these issues, many efforts have been made to obtain a purely endovascular treatment of residual AAD. Indeed, endovascular stenting of the dissected aorta has shown promising results for patients with type B aortic dissection. On the contrary, such results have not been obtained for treatment of type A dissection. Kato et al. described transluminal stent-graft treatment of type A aortic dissection with an entry tear in the descending thoracic aorta with retrograde involvement of the ascending aorta and arch, but they treated only the descending thoracic aorta with the stent-graft.

The Djumbodis Dissection System is an uncovered stent with sufficiently large mesh that makes it ideally suited for treatment of dissections in the aortic arch. Specifically designed to treat residual type A aortic dissection or type B dissection with retrograde extension, this system might be the ideal solution for treating this aortic disease using a purely endovascular approach. In addition to compressing the false lumen, the stent successfully preserves blood flow into the supra-aortic vessels, overcoming one of the principal limitations associated with endovascular treatment of residual type A aortic dissection. Further studies are needed to evaluate the clinical outcome of these patients at long-term follow-up.

**Conclusion**

Endovascular treatment of residual type A aortic dissection is surely an evolving approach. To date, it is still a technically challenging procedure requiring expert multidisciplinary efforts from experienced cardiologists, cardiothoracic surgeons, and endovascular surgeons. The Djumbodis Dissection System might allow “purely endovascular” management to replace conventional open surgery in treating residual type A aortic dissection.

**REFERENCES**


