Perspective

Should the dissected aortic arch be replaced in acute type A dissection? The Mayo Clinic perspective

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There continues to be controversy as to which is the best operation in acute DeBakey type I dissection. Although significant improvements in outcomes have been reported during the last decade, the morbidity and mortality of the repair remains high. The most accepted intervention consists of aortic valve re-suspension, ascending aortic replacement, and variable aortic arch repair. This procedure leaves a residual "type B" dissection beyond the aortic arch. Residual patent false lumen is a well-known risk factor for progressive aortic dilatation, with the risk of rupture or re-intervention limiting the long-term benefit of the initial intervention.

To address this late aortic risk, the performance of a total arch replacement at the time of acute dissection repair was proposed. The theory was that this additional aortic replacement would decrease the patency of the false lumen with its late aortic complications (1-3).

Despite the hope that such radical proximal dissection treatment would improve results, experience has shown that total arch replacement at the time of acute dissection increases operative time, morbidity (especially neurological), and mortality without significant improvement in long-term outcome (4,5). The proximal descending aorta remains the major site of aneurysm formation following surgery for acute DeBakey type I aortic dissection regardless of the extent of arch replacement. The diameter of the proximal thoracic aorta on initial chest CT predicts the risk of late aneurysm formation, suggesting that adjunctive procedures on the descending aorta, in addition to some form of arch repair, are needed to prevent the late aneurysm (6). We have reserved total arch replacement for patients with non-repairable arches, usually with primary arch tears or with extension of ascending tears into the aortic arch. Another indication for total arch replacement may be the presence of Marfan syndrome or other specific connective tissue disorders, as the expectation is that the majority of the residual dissected aorta will need to be replaced in short order, regardless of what is done first.

At the same time as the controversy over the extent of optimal arch replacement in DeBakey type I dissection surgical repair was debated, advances occurred in management of acute type B dissection. It has become clear that, while the short-term morbidity from uncomplicated type B aortic dissection is minimal, over the five-year post dissection period upward of 80% of these patients experience aneurysmal degeneration of their descending aorta (7). The reported rate of aneurysmal degeneration of the residual descending thoracic dissections averages 4.1 mm per year and the risk of rupture becomes significant beyond 6 cm in maximal diameter (8). The morbidity and mortality associated with an open repair of these thoracoabdominal dissecting aneurysms is significant, with mortality between 8% and 15% in an age-dependent manner. In survivors, significant perioperative pulmonary or renal failure, as well as concomitant spinal cord ischemia or cerebral vascular accidents, are all too frequent.

Combining the known long-term outcomes of well performed standard proximal repairs of DeBakey type I dissection with the emerging data on improved long term outcomes following stenting of acute type B dissections, we theorized that adding stabilization of the thoracic aorta with an appropriate stent graft to a standard hemiarch resection at the time of the acute dissection repair would decrease or eliminate the risk of future dissecting thoraco-abdominal aortic aneurysm, while keeping a low early operative mortality. We initiated this new approach in patients whose primary tear started or extended into the aortic arch, or in patients with distal malperfusion syndromes. We had encouraging results that prompted us to consider the use of antegrade stent-grafting technique in almost all patients with DeBakey type I dissection, even those without specific malperfusion syndromes or arch tears.

The surgical technique has been previously described (9). After a median sternotomy, an arterial cannula (femoral, axillary, ascending aorta or arch), a right atrial cannula, and a superior vena cava (SVC) cannula are placed. Core cooling is carried out for 50 minutes or until no cerebral activity is present on the electroencephalogram. Circulatory arrest is initiated with retrograde cerebral perfusion through the snared SVC cannula to achieve jugular venous pressures of 20-25 mmHg. Selective antegrade cerebral perfusion (through axillary cannula or direct cannulae into the innominate and the left common carotid arteries) is performed after aortic resection is completed. The entire ascending aorta and majority of the lesser curvature of the arch are usually resected. A Gore TAG stent graft is chosen according to the diameter of the proximal thoracic aorta, determined by preoperative CT scan or intra-operative echocardiogram. The length of the graft is usually 15 cm to reach at least the mid descending thoracic aorta. The deployment into the true lumen is done under direct vision. The proximal scallops of the stent are deployed at the origin of the left subclavian artery on the greater curve and into the residual arch along the lesser curvature. The stent is gently balloon-dilated. The layers of the remaining dissected arch are repaired with a Teflon-felt neo-media, obliterating the false lumen. A Dacron graft is sewn in a beveled fashion to the repaired arch to include the stented lesser curvature. Once the distal repair is done, the hemiarch Dacron graft is cannulated directly to resume antegrade cardiopulmonary bypass. The reconstruction of the proximal aorta is then completed during rewarming.

We have treated 60 patients using this technique with a mortality of 10%, a CVA rate of 5%, and no paraplegia. There has been a complete follow up of 53 patients for up to 5 years. Two patients required re-intervention of the aorta proximal to the stent graft secondary to dilatation, with no mortality. 11 patients required secondary endovascular procedures. No patients required open thoracoabdominal surgery.

Other groups have since corroborated our experience. In one report, the use of the frozen elephant trunk (FET) technique up to the mid-portion of the descending thoracic aorta effectively obliterated the residual false lumen in all patients (10). In another report, total arch replacement with the FET technique in type A dissection repairs showed similar operative mortality compared to hemiarch replacement alone, but a significant improvement in 5-year survival and event-free survival. All patients in the FET group had evidence of thrombosed thoracic false lumen (11).

We have concluded that the antegrade stent-graft deployment associated with a hemiarch procedure during an acute DeBakey type I dissection repair is a safe method to obliterate the thoracic aortic false lumen, with equivalent peri-operative morbidity and mortality to the standard repair. Obliteration of thoracic false lumen using FET techniques leads to lower distal reoperation and improved long term survival.

In the ultimate analysis, accumulating data suggests what we had suspected all along: what is done to the arch is less important to long-term outcome, and possibly even to acute mortality, than what is done to the descending thoracic aorta. A surgeon should deal with the arch in the manner that is safest in his hands at the time of the acute event, as long as he is prepared to address the thoracic aorta with a suitable form of frozen elephant trunk.

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