Staged, hybrid approach to acute DeBakey Type I aortic dissection

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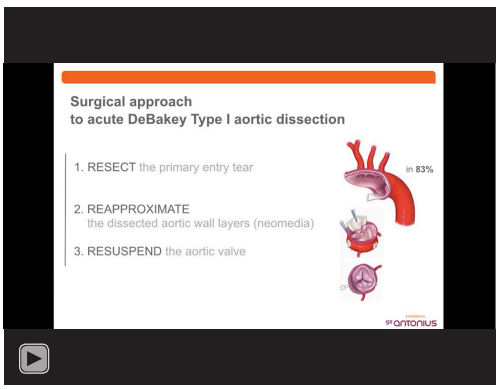
Defining the optimal surgical treatment for acute DeBakey type I aortic dissection remains challenging. Prompt surgery is indicated to prevent acute mortality due to cardiac tamponade, aortic valve insufficiency, or myocardial infarction due to coronary involvement. The classic principles of surgery for DeBakey type I dissection consist of (I) resection of the primary entry tear, (II) re-approximation of the dissected aortic wall layers [in our approach using the 'neomedia' technique using Teflon felt (1)], and (III) resuspension of the aortic valve. In case of an extensively dissected aortic root, presence of a pre-existent dilatation (>45 mm), known connective tissue disease, or unrepairable aortic valvulopathy, it is advised to also replace the aortic root lowering the risk of future proximal re-operations (2). Such an approach simplifies a complex problem, resulting in hemi-arch resection in the vast majority of patients (83%, at our centre). In DeBakey type I patients, however, the downstream aorta usually remains residually dissected, risking late, distal aortic sequelae and, hence, leaving the patients at risk for future complex redo surgery. Whether a more extended distal repair at the index procedure (i.e., frozen elephant trunk) improves long-term outcome, and outweighs the associated surgical complexity and risks at the index procedure is currently being debated on (*Video 1*). Recent analysis of our institutional data using the aforementioned 'protocolized' approach (with the use of bilateral antegrade selective cerebral perfusion at 25degrees Celsius core temperature) in >250 DeBakey type I aortic dissection patients in a 10-yrs period (2005–2015) demonstrated a 12% 30-days mortality, 9% stroke rate, and 0.8% permanent spinal cord injury. Data that are in line with previously reported operative results in the IRAD Registry (3). At a mean follow-up of almost 70 months (99.6% complete), we observed an acceptable survival-rate



Video 1 Presentation elucidating on the concept of staged, hybrid treatment of DeBakey type I dissections.

of 86% at 5-yrs, and 74% at 10-yrs. Focusing on the need for redo surgery due to distal aortic sequelae, we observed a 13% overall reoperation rate (mainly post-dissection aneurysm). An additional 7% of patients in follow-up was considered too high risk for redo distal surgery of refused intervention. The magnitude of the downstream aortic problem is therefore larger than only the reported rate of redo distal surgery. As an alternative, we therefore focused on the late occurrence of post-dissection dilatation distally (≥50 mm). We observed a freedom of late dilatation of 81% at 5-yrs, and 71% at 10-yrs). So, roughly one in every 5 surviving patients dilated up to 50 mm or more in the downstream aorta. In parallelity to stent grafting in DeBakey type III aortic dissection, it is conceivable that immediate extended distal repair using the frozen elephant trunk technique may induce false lumen thrombosis and remodeling, thereby preventing late downstream dilatation. The aforementioned seems to occur, but comes with an increased risk of stroke, spinal cord injury, and above all

increased surgical complexity, which is especially important considering the fact that these patients typically require emergent surgery in non-ideal timing, often performed by non-aortic surgeons. Since not all patients survive to late follow-up (30-days mortality of hemi-arch repair at our centre is 12%), or have a residual dissection downstream after hemi-arch repair, a frozen elephant trunk strategy in all acute patients will put more patients at immediate risk (and costs) than that may benefit on the longer-term.

We, therefore, consider the frozen elephant trunk technique a too complex, risky, and costly procedure to be applied routinely to all our acute DeBakey type I patients (performed by all our (also non-aortic) surgeons). Nonetheless, we very much like the reported final result of such an extended repair, that excludes the false lumen at the upper thoracic aorta, which has the highest risk of late dilatation. Whether is really reduces the rate of late redo surgery distally is still studied. As an alternative approach to both the limited hemi-arch resection and the extended frozen elephant trunk technique, we favor a staged, hybrid approach. Already reported by Glauber and co-workers in 2011 (4). More recently Bavaria focused on this hybrid approach, which consists of a two-thirds aortic arch repair with separate branches to the brachiocephalic and left common carotid artery leaving a 3-cm long Zone 2 landing zone, that enables future endovascular repair when considered necessary (5). Either by a single-branched stented device, or simple stent grafting plus left subclavian artery revascularization. The proposed index procedure (stage 1, two-thirds branched arch repair) may be technically more feasible for a wider range of surgical arch expertise and, more importantly, may dismiss the patient from the risk of spinal cord ischemia at probably also a lower stroke rate, when compared to a frozen elephant trunk procedure in the acute setting.

Postoperatively, all patients are followed by regular CT-scanning. Only in (younger) patients surviving the index procedure, with residual distal dissection and signs of early (false lumen) dilatation or predictors of poor outcome (cfr DeBakey type IIIb dissection), the second stage is offered consisting of simple stent grafting from Zone 2 to mid-descending aorta after LSA-revascularization, within 3 to 6 months after index repair to induce false lumen thrombosis and aortic remodeling (within the so-called 'window of plasticity'), and hence preventing late aneurysm formation, necessity for late redo distal surgery, and consequently improved late outcome.

Recently branched devices are being introduced and studied for total endovascular aortic arch repair. It is conceivable that in the (far) future a 3-cm Zone 0 landing zone after 'simple' hemi-arch repair may suffice for staged, hybrid repair in DeBakey type I aortic dissection. Currently, however, we consider both the routine use of the complex frozen elephant trunk technique as single stage by the surgeon, as well as the complex total branched endovascular repair of the aortic arch by the interventionalist yet too complex, too risky, and too costly when compared to the staged, hybrid repair as described in this report.

Conclusions

In this manuscript we propose a staged, hybrid approach to DeBakey type I aortic dissection. The proposed procedure may be technically more feasible for a wider range of surgical arch expertise and, more importantly, may dismiss the patient from the risk of spinal cord ischemia at probably also a lower stroke rate, when compared to a frozen elephant trunk procedure in the acute setting.

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Footnote

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