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Commentary: Surgery is an art

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Fortunately, surgery is an art. Much of our satisfaction in its performance derives therein. We are taught, and then, through experience, both good and bad, we refine, enhance, and advance beyond what we were originally taught. We eventuate with our own approaches to complex surgical procedures, which in our hands lead to good results. This evolutionary progress leads us all in different directions. Perhaps the surgeon's greatest satisfaction derives from knowing that these personal techniques and habits, which we each have honed over the course of a career, underlie our good results, especially in patients with extremely challenging anatomy and overall scenarios.

The end result of these learning processes is that we each have our own way of approaching surgical problems, often mildly or even profoundly different from those of colleagues (see [Figure 1](#) for various options of aortic arch replacement as an example).¹

Matalanis has reported on multiple occasions regarding his specific technique of “branch-first total aortic arch repair.” He has articulated his technique clearly and explicitly both in words and in diagrams, especially in this useful paper² that each of us should keep handy. He has shown excellent clinical results and identified what he sees as the advantages of this specific technique. This technique involves “serial clamping, reconstruction, and reperfusion” of each of the 3 aortic arch branches—using a specialized trifurcated graft with a perfusion side port.

Elegant simplicity of deep hypothermic circulatory arrest during aortic arch surgery.

CENTRAL MESSAGE

Dr Matalanis' “branch-first” technique for aortic arch replacement has shown excellent clinical results and provides a viable alternative to more traditional approaches.

A similar technique has been used by Spielvogel and others.³⁻⁵

Kim and Matalanis² review, in great detail, Matalanis' time-proven technique on the branch-first technique for the Aortic Symposium 2020. There are many claimed, and certainly real, benefits of this branch-first technique. These are detailed in [Table 1](#). Matalanis' reported results with the branch-first technique have been superb.⁷⁻⁹ In terms of potential demerits, there is isolation of brain vascular distributions for periods of time, susceptibility to incomplete circle of Willis for collateral flow, potential for overperfusion of cerebral vascular beds, and potential for embolization from head vessel manipulation and clamping. Also, the resulting grafts are long and extra-anatomic. One wonders if any late kinking or thrombosis have been noted.

Our strongest concern revolves around the antegrade perfusion that is employed with the branch-first technique. Worrisome in this regard is Leshnower and colleagues' recent demonstration that postoperative magnetic resonance imaging scans revealed a 100% rate of embolic brain events with antegrade perfusion⁶ ([Figure 2](#)). Our profession has not yet had time to digest this sobering finding.

[Table 1](#) compares characteristics of surgery under straight deep hypothermic circulatory arrest, which we have used exclusively at the Aortic Institute at Yale. The elegant simplicity of this technique is represented in [Figure 3](#).¹⁰ Results with this technique have been excellent,

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FIGURE 1. Various techniques for aortic arch replacement. Choice of procedure largely depends on the clinical situation and surgeon's preference. (In part, reprinted with permission from Ziganshin and colleagues.¹)

TABLE 1. Advantages stated for the “branch-first” technique and disadvantages compared with straight DHCA

Advantages of the “branch-first” technique		
Advantage cited ²	Fair statement?	Comment
Avoids global cerebral circulatory arrest	✓	Yes, but at the expense of intermittent regional brain ischemia
Shortens lower body ischemic time	✓	Yes, but does it matter?
Shortens cardiac ischemic time	✓	Yes, but does it matter?
Can be performed at moderate hypothermia (28°C)	✓	True, avoids DHCA (18°C-20°C)
Decreases potential for air/particulate emboli	?	Unclear. Recent study shows 100% rate of embolic stroke from antegrade cerebral perfusion. ⁶
Unobstructed access to full extent of aortic arch	✓	Certainly true for DHCA also
Potential disadvantages of the “branch-first” technique		
“Branch-first” technique	Straight DHCA	
Requires upper and lower body arterial pressure lines	Only radial arterial line required	
Requires separate upper body pump head	No extra pump head required	
Potential for embolization of arch debris (branch vessels cut and oversewn) by perfusion from below	No perfusion at all when branch vessels cut No vessel clamping at all	
Branches of aortic arch dissected before beginning operation, raising potential for emboli.	Minimal to no advance branch vessel dissection required.	
Arch branch vessels must be clamped, raising embolic potential.	Fully no-clamp, no-touch technique	
Flows and pressures via side-arm critical Blood pressure 50-60 mm Hg (mean) Flows 500-1000 mL/min Potential for stroke, edema	No flow during DHCA, no need for monitoring	
Increased complexity	Minimal complexity	
Crowded operative field	Totally unencumbered operative field	
Descending aorta must be controlled by clamp or balloon or DHCA instituted anyway.	No need for any descending aortic control	
Left subclavian may be inaccessible	Left subclavian access not usually problematic	
Relies on intact circle of Willis (and extra-cranial collaterals)	No unbalanced perfusion periods No reliance on circle of Willis or other collateral avenues	
Long, extra-anatomic grafts. Graft closure likely to be lethal.	Short, anatomically positioned grafts. Long-term patency quite secure.	

DHCA, Deep hypothermic circulatory arrest.

FIGURE 2. Axial image of a diffusion-weighted magnetic resonance image lesion (arrowhead) observed in an asymptomatic neurologically intact patient after ascending aortic and hemiarch replacement using moderate hypothermic circulatory arrest with antegrade cerebral perfusion. (Reprinted with permission from Leshnower and colleagues.⁶)

in terms of both survival (short-term and long-term) and stroke.^{1,11} In addition, full preservation of cognitive abilities has been demonstrated—both clinically and quantitatively by detailed neurocognitive testing.^{12,13}

So, the surgeon has multiple options at his or her disposal. Choice of option is largely a matter of taste and experience. We are indebted to Matalanis for his creative refinement of his specific branch-first technique and for his demonstration that his technique leads to superb clinical results.

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FIGURE 3. Elegant simplicity of deep hypothermic circulatory arrest during aortic arch surgery—a completely uncluttered operating field. (Reproduced with permission from Elefteriades and Ziganshin.¹⁰)

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