Author Reply to Commentary: The Scylla and Charybdis of acute type A aortic dissection: Malperfusion and rupture

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We read with great interest and appreciation the commentary by Dr Jean Bachet about our manuscript describing outcomes of immediate operative repair of acute type A aortic dissection (ATAAD) complicated by malperfusion syndrome (MPS). At our institution, we employ a (central) surgery-first approach for all-comers with ATAAD, whether complicated by MPS or not. We do not initially stabilize patients with MPS with endovascular reperfusion of the requisite malperfused vascular bed (via fenestration or stenting), followed by definitive operative repair after metabolic perturbations have been reversed, as some institutions have advocated. Most patients presenting with ATAAD undergo hemiarch replacement, which is the most expeditious repair and can be accomplished approximately 65% of the time in our experience. We perform hemiarch replacement under deep hypothermic circulatory arrest with retrograde cerebral perfusion (RCP). However, when there is an aneurysm or tear of the aortic arch, we perform a total arch replacement (TAR), which involves an arch first approach with sequential debranching and reconstruction of the brachiocephalic vessels, while providing uninterrupted antegrade cerebral perfusion (ACP). We believe that this overall strategy minimizes operative mortality and the incidence of stroke. In a generous review of our manuscript, Dr Bachet affirmed our surgery-first approach, but raised a few interesting concerns, largely surrounding our cerebral protection strategy.

RCP is our preferred method for cerebral protection during hemiarch replacement for several reasons. First, existing observational data suggest that RCP may provide acceptable results, in terms of operative mortality and neurologic deficit, which are comparable with those same outcomes for ACP. However, prospective trials have not directly compared RCP with ACP, which implies that bias may confound the existing data. The Emory group is currently conducting a prospective trial of RCP with deep hypothermia against ACP with moderate hypothermia for hemiarch replacement. With their primary outcome being magnetic resonance imaging evidence of a neurologic lesion, preliminary data support RCP over ACP, although the sample size is extremely small and the clinical significance of magnetic resonance imaging–discovered neurologic injury is far from certain. Second, even though RCP does not provide physiologic oxygenation, RCP may be equally as safe when circulatory arrest times are short, as it aids with uniform cooling and clearance of debris. More importantly, some data suggest that the etiology of most strokes after ATAAD is embolic and do not result from hypoperfusion. Thus, when shorter operations are anticipated, RCP may be more advantageous because it more effectively flushes out gaseous and particulate emboli. Conversely, ACP involves extensive instrumentation of diseased vessels and may worsen the risk of embolic stroke. However, it remains true that ACP is superior when circulatory arrest times are longer because it provides physiologic cerebral perfusion and oxygenation and, hence, our preference for ACP during TAR. Nevertheless, the optimal cerebral protection strategy is an area of active investigation. In this ongoing research, it will be critical to compare apples to apples when assessing the comparative effectiveness of RCP versus ACP. That is to say, patients undergoing hemiarch and TAR should be analyzed separately, whereas patients undergoing deep and moderate hypothermia should also be analyzed separately. TAR involves more extensive instrumentation of diseased vessels than hemiarch replacement, thereby increasing the risk of embolic events, and TAR is a longer operation, which increases operative risks. Moreover, deep hypothermia may induce more inflammation in neural tissue than moderate hypothermia, which may lead to increased risk for stroke. Therefore, the extent of the distal aortic repair and the degree of hypothermia are confounding factors that have plagued much of the retrospective literature evaluating the optimal cerebral protection strategy. Finally, it should be noted that ACP and RCP may be equally as efficient techniques in expert hands, with similar cardiopulmonary bypass, aortic crossclamp, and hypothermic circulatory arrest times having been reported.

Whatever the optimal strategy of cerebral protection, immediate restoration of true lumen perfusion may be the most
essential aspect of managing ATAAD, which our manuscript hopes to convey. In the setting of MPS, some centers advocate upfront endovascular reperfusion of the malperfused vascular bed to improve end-organ dysfunction and correct systemic metabolic abnormalities, which is followed by delayed open surgical repair of the aortic dissection. However, the delayed operative approach also risks allowing aortic rupture, which is arguably the leading cause of death in patients with ATAAD. Data describing the delayed approach for ATAAD complicated by MPS suggest that in-hospital mortality is 33%.2 Conversely, this study found that in-hospital mortality was 22% for patients with MPS, which is lower than the reported 33% for the delayed operative approach.1 By implication, the risk of aggravating systemic metabolic abnormalities under hypothermic circulatory arrest, leading to multisystem organ failure and death, may be overstated when compared with the risk of allowing aortic rupture to occur. While further prospective comparative research is needed, we agree with Dr Bachet that, “even if MPS may be an independent predictor of short-term mortality and reduced mid-term survival for patients with ATAAD, the present study highlights the importance of rapidly restoring true lumen perfusion by addressing first the aortic lesions without operative delay.”10 Rupture is a fatal event that can be avoided by immediate surgery, and malperfusion is often successfully reversed by restoring true lumen perfusion via arch repair. As the data suggest, the only way to navigate the treacherous waters of malperfusion and rupture is immediate operative repair.

References