Editorial Commentary

Striking a balance when operating for acute type A aortic dissection

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Acute type A aortic dissection (ATAAD) continues to be associated with high morbidity and mortality (1,2). These patients, if they don't die before arriving at a hospital, often suffer from concomitant life-threatening pathology such as malperfusion syndromes (including stroke, acute myocardial infarction, renal/visceral ischemia and limb ischemia), aortic regurgitation, or cardiac tamponade. Though surgical intervention, the gold standard treatment, has reduced mortality compared to non-operative management (3,4), the optimal type and extent of repair continue to be debated and remain dependent on the surgeon and surgical center a patient is brought to. Depending on the extent of the dissection, the location of the entry tear, and the patency of the false lumen, patients who undergo repair of a type A dissection are at risk for aneurysmal degeneration over time, which could lead to the development of a thoracoabdominal aneurysm—a factor that should be considered when determining the extent of the repair at the time of the initial operation. These sequelae may require subsequent intervention such as an endovascular stent placement, or in more complicated situations, an open repair of the aneurysm. More recently, total arch replacements with or without concomitant elephant trunks (conventional and frozen) have been implemented to promote false lumen thrombosis and to reduce the risk of distal aneurysm formation.

The article titled "Proximal vs Extensive Repair in Acute Type A Aortic Dissection Surgery" by Liu *et al.* analyzed 5,510 patients who presented with ATAAD from 13 hospitals over a 5-year period to create a risk scoring model to help direct the type of repair that should be performed (5). Before delving into this article, it is important to note the excellent results of this series in context. There is a large disparity in the literature regarding surgical outcomes of repair for ATAAD as well as controversies regarding the optimal extent of repair—one that optimizes operative mortality and minimizes re-operative intervention—to achieve the ideal result. Whether one supports a more conservative surgical approach or an aggressive technique such as total arch reconstruction, few series are able to report mortality rates such as these, consistently below 10% (6-8).

The authors' propensity score matched patients and implemented the eXtreme Gradient Boosting machine learning library to create a risk prediction model to predict operative mortality in patients. Their alphabet risk model includes parameters of age, body mass index, platelet-to-leukocyte ratio, albumin, hemoglobin, serum creatinine, and preoperative malperfusion to predict operative mortality.

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Their key finding is that beyond a certain risk probability threshold (4.5%), extensive repair is associated with higher mortality than proximal repair [odds ratio (OR), 2.164; 95% confidence interval (CI): 1.679–2.788], indicating that although a certain subset of patients may benefit from more extensive repair, a tailored strategy for repair of ATAAD leads to more favorable outcomes.

Similar to this study, our group previously studied the association between the extent of aortic replacement and the outcomes of the procedures (9). We found that distal extension of an aortic procedure is independently associated with a higher complication rate, whereas proximal extension is not. Our multivariate logistic regression further supported this finding by demonstrating that partial or total arch replacement was an independent risk factor for post-operative complications. Like the study published by Liu *et al.*, our work also suggests that the immediate post-operative risk associated with aortic replacement should be balanced against the suspected future risk of an aortic event.

Like the Society of Thoracic Surgeons (STS) risk calculator, which serves as a tool to aid in the prediction of a patient's overall risk of mortality and morbidity when undergoing coronary and/or valve surgery, the model proposed by Liu *et al.* may provide the initial groundwork for the development of a risk calculator for patients who require surgery for ATAAD. However, it is important to acknowledge that, unlike coronary and valve surgery, for which indications and approaches are standardized and overall mortality is much lower (10-12), outcomes of surgical repair of ATAAD depend much more on the team performing the procedure due to the highly variable presentation and the technical challenges surgical teams face in the operating room. The subgroup analysis (*Tab. S2*) comparing outcomes of low (<100 cases annually) *vs.* high volume centers (>100 cases annually) highlights this difference. In other countries, having a volume of <100 cases per year would certainly not be considered low volume. Nonetheless, this comparison demonstrated a significant reduction in mortality at high volume centers compared to low volume centers (8.1% *vs.* 11.5%, P=0.02). Literature suggests the outcome could be dependent even on surgeons (13), and thus it may be worth considering surgeon case volume in the final model.

While the authors included patients who underwent the full spectrum of aortic surgery repairs for ATAAD, one approach that is highly debated among aortic experts but was not examined in the present study is an endovascular approach first for patients presenting with malperfusion—also known as fenestrated endovascular aortic repair. Additionally, not analyzed is the Zone II arch reconstruction, where the distal anastomosis is sewn proximal to the left subclavian artery at a level of the aortic arch, which is more easily accessible than a total arch approach, decreases clamp time and bypass time, and minimizes dissection around the recurrent laryngeal nerve (14). This middle ground for repair of ATAAD, which has become the preference at our center for appropriately selected patients, not only simplifying the index operation while still replacing most of the arch, but it also creates a landing zone for further endovascular repair.

Finally, follow-up studies are warranted on long-term mortality or the need for re-intervention for a follow-up staged endovascular repair for subsequent descending aneurysm formation or a type B dissection and associated morbidity from that follow-up procedure.

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