See Article page 2025.

Commentary: Accurate prediction of aortic dissection and rupture: The elusive holy grail

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The quest to discover the optimal criteria for prophylactic aortic aneurysm repair to minimize the risk of aortic dissection has been a long and winding road. The journey began with aortic diameter,¹ which has served admirably, yet imperfectly, for quite some time. The use of diameter is based on Laplace's law, which uses pressure and radius to derive a measure of tension ($T = p \times r$). However, it does not take into account other physical and mechanical properties of the wall itself, which play a part in the risk of rupture or dissection. Notably, Laplace's law pertains to a perfect cylinder but the aorta is an expansible structure, which can absorb some kinetic energy-associated systolic ejection.

Czerny and colleagues² discuss the need to use additional parameters to predict the occurrence of acute type A aortic dissection (ATAAD). Their reasoning for the need for this discussion is the commonly stated, but somewhat misperceived, notion that most ATAAD now occur at <5.5 cm so we need to consider operating at smaller sizes. However, the main reason that most ATAAD now occur at smaller sizes is that most aneurysms are repaired prophylactically before they reach larger sizes. Only a natural history study could tell us whether aneurysms are more likely to dissect at smaller diameters and the closest available evidence refutes this.³

Although the authors are correct that a more accurate prediction model would benefit patients at risk of ATAAD at smaller diameters, their proposed solution raises concerns. The authors provide a brief review of several parameters such as indexing to body surface area, aortic length, and aortic

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CENTRAL MESSAGE

Risk of aortic dissection depends on a multitude of factors. Multi-variable predictive models may be ideal, but their use must not be too cumbersome.

height index⁴ and found that all of these are potentially flawed. Although their review was not completely inclusive, even in our recently published detailed review of currently available aortic parameters used to predict adverse aortic events, we were not able to identify any single well-proven parameter to use.⁵ The authors then mention the significance of aortic morphology, genetic conditions, and complex imaging findings using 4-dimensional flow magnetic resonance imaging, computational fluid dynamics, and finite element analysis. They propose that a multifactorial predictive nomogram based on aortic length is the solution. However, it would be impossible for a nomogram to incorporate the amount of data that the authors propose to be included. A complex multivariable risk calculator would be more appropriate. Additionally, for any tool to work in real-world practice, it cannot be overly cumbersome. Many of the elements of the authors' proposed model would require specialized imaging or measurements that are not reported in normal practice. It would require the surgeon to make specific measurements and reanalyze every imaging study. This would be an arduous task at best and would be impossible in a busy aortic practice. Although we agree that the field can do better than simple aortic diameter, the authors' vision of the solution may be more of a wish than an attainable reality at this time.

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