accurate identification of patients who will benefit from preventative surgical intervention is within reach.

While Wang and colleagues did not provide a tool that is ready for practical clinical application, their findings suggest a nuanced relationship between wall tension and aortic size. We believe that this is a step in the right direction toward using technology-enabled patient-specific risk scoring for patients at risk for aortic emergencies.

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See Article page 1452.

Commentary: Diameter alone is not precise enough but wall stress analysis may facilitate decision-making for indications for prophylactic aortic repair

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Current guidelines mainly rely on aortic diameter with regard to indications for surgery. In patients without any additional risk factors, the 2010 American Heart Association, as well as the 2014 European Society of Cardiology guidelines for thoracic aortic disease, recommend surgery at 5.5 cm.^{1,2}

However, clinical observations show that aortic dissection often occurs in a normal-sized aorta. Therefore, additional biomechanical knowledge to better understand the relationship between wall strength and wall stress is welcome.

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CENTRAL MESSAGE

Clinicians would be grateful to obtain the best possible accurate value for risk assessment of aortic rupture based not only on diameter but also on mechanical properties of the aortic wall.

In an era of “personalized medicine,” it is time to revisit the current global assumption that a size of 5.5 cm or more is a safe recommendation for prophylactic aortic repair. For smaller patients and those still in growth, indexed diameters, such as Svensson’s index for children and adolescents, have been proposed as refined parameters for a more precise indication. Attempts are made to further lower the threshold for prophylactic surgery.³ However, this is not without drawbacks. The more we lower the threshold, the more

patients are potential candidates for surgery. This may lead to an unpleasant situation in which patients who have a very low risk of dissection undergo surgery and develop complications. The upper limit of normal (z score of 2) for a 1.80-m, 80-kg, 40-year-old man patient is 4 cm. But is it justified to operate on everyone above these diameters? The vast majority of studies on diameters in type A dissection do not take into account the denominator—the number of patients in the population with a given diameter that did not dissect. There is no doubt that size alone is not a good indicator for the risk of dissection in any given patient. Knowledge of risk factors such as specific mutations or family history are important risk modifiers that have to be included in the decision-making process. We are in desperate need for more data how to deal with those patients who have a pathologic diameter of the aorta but have not yet reached the accepted thresholds for surgery.

More modern methods than simple imaging—like computational modeling and biomechanics—may provide important information regarding aneurysm geometry in general and how material properties may affect wall stress in particular since a weak aortic wall and/or an increased wall stress may indicate an increased risk of dissection.

Cheng and colleagues⁴ are to be congratulated for providing us the first steps of a new methodology to address these characteristics of the aortic wall, which still cannot be assessed in a noninvasive way in vivo. Because of this, the authors introduce the notion of finite element analysis, which is a widely used engineering tool to assess wall stress. However, the processing of data is still challenging because several paths using different computed models are necessary so far. The methodology is still difficult to understand and requires specialist knowledge about different programs needed for processing. In addition, this limitation challenges the concept for an unrestricted daily routine use.

The authors did not discuss whether there was a specific reason behind evaluating circumferential and longitudinal wall stresses instead of principal stress distributions, which are independent of the local coordinate systems. In addition, the study is based on many assumptions, such as similar aortic wall composition, a prespecified physiologic diastolic, and systolic pressure and similar flow dynamics. It remains questionable if these assumptions are representative for the majority of patients.

Average peak circumferential and longitudinal wall stress were smaller when the aneurysm size was below 5 cm than above 5 cm but the spreading was considerable and major differences were registered between different

anatomic regions. The new technology did not allow finding close correlation between wall stresses and size of the dilated aortic segment and, as a major finding, there was no diameter threshold at which a sharper correlation between wall stresses and size of the aneurysm could be observed.

It is not clear what correlation the authors intend to evaluate. Peak longitudinal wall stress is a single value for the entire thoracic aorta and hence a single global value, whereas curvature is a local value and is evaluated at every element or node or integration point. The inconsistency arises when the authors claim “no differences were found between greater and lesser curvature regions for peak longitudinal wall stresses.” The authors attempt to correlate a single global value (peak stress) to a spatially varying local value (curvature), which is inconsistent. It is not completely clear if the authors wanted to evaluate the correlation between surface curvature and wall stress distributions. Again, this claim cannot be made without presenting a mapping (qualitative or quantitative) between curvature and wall stress distributions.

Finally, there might be some concern regarding the estimation of material properties. It is known that patients with connective tissue diseases are at greater risk, but this was not taken into consideration in the present model. It would have been helpful to get the best reasonable cut-off diameter for repair. This remains the major demand to the authors when they will be able to refine their model: the clinicians will be grateful for obtaining the best-possible accurate value for risk assessment.

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