Toward Uniformity in Reporting of Thoracic Aortic Diameter

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The well-documented virulence of thoracic aortic aneurysm (TAA)¹ calls for improved patient identification and selection for therapy to prevent death and debility. Our best current indications for aortic resection to prevent catastrophic rupture are based on aortic size.^{2–5} Accurate sizing of aortic diameter in patients with TAA is essential to enable pre-emptive surgical intervention before rupture and other complications occur. In practice, despite the importance of accurate and consistent measurements, a lack of uniform measurement protocols has produced common discrepancies in imaging studies.⁶ In this letter, we briefly review the literature regarding the importance of sizing of aortic aneurysms and we propose a system to enhance uniformity in reporting measurements.

Studies have shown that for both TAA and abdominal aortic aneurysm (AAA), the risk of complications increases with increasing aneurysm diameter.^{2–6} Data collected at the Aortic Institute at Yale-New Haven show that as TAAs grow toward particular “hinge points,” there is an increase in the overall likelihood of dissection, rupture, or death. The risk of rupture or dissection is greatest for aneurysms approaching the “hinge points” of 6.0 cm for the ascending thoracic aorta and 7.0 cm for the descending thoracic aorta. These patients have a cumulative lifetime risk of rupture or dissection of 34% or more by the point that the hinge diameters are reached.⁴ Similar dimensional dependence has been established in patients with AAA, with rupture rates for AAA patients with diameters of ≥ 6.0 cm reported as 2.5-fold greater than for AAA patients with initial diameters of ≤ 6.0 cm.⁷ These data, when taken together, highlight the importance of measuring the correct aneurismal diameter in managing patients with TAA or AAA.

Of course, normal aortic size varies based on body size. A Yale nomogram, the aortic size index, relates aortic size to body surface area, thus providing a more accurate aortic risk estimate for specific patients.³

These clinical tools require accurate aortic measurements and would benefit dramatically from the institution of a uniform system for measuring the aorta. Measuring the aorta

is challenging for many reasons.⁶ The geometry of the aorta is complex, and, in some cases, tortuous, which makes it difficult to identify the appropriate cross-sections in imaging studies. The aortic arch, which may appear oblong in axial images, is especially challenging. Different imaging modalities (echocardiography, computed tomography scan, or magnetic resonance imaging) are better suited for certain regions of the aortic anatomy and may provide discrepant measurements at the same level of the aorta. Finally, if the aortic diameter is asymmetrical, inconsistencies may arise if different imaging studies do not report on the same specific diameter line.

It is challenging to reconcile the discrepancies between different sizing reports, and this has an adverse impact on clinical practice and research. As a result, we propose that a system be implemented to encourage uniformity in reporting aortic measurements. This system would measure the aorta at eight levels: (1) aortic annulus, (2) sinuses of Valsalva, (3) sinotubular junction, (4) widest portion of the vertical ascending aorta (at any specific level), (5) the widest diameter in the aortic arch region between the take-off of the innominate artery and the distal margin of the left subclavian artery, (6) widest portion of the vertical descending aorta (at any specific level), (7) suprarenal portion of the abdominal aorta, and (8) infrarenal portion of the abdominal aorta (**Fig. 1**). For any specific level, the largest true diameter (among those in a plane perpendicular to the long axis of the aorta) would be taken as the true dimension. Each of the eight measurements should be included in any aortic imaging study report.

One key difference of this proposed paradigm is that, for the vertical portions of the ascending aorta and the descending aorta, it takes the largest diameter anywhere over the entire vertical span. We feel this system has advantages over giving dimensions at prescribed anatomic points (e.g., at the level of the pulmonary arteries). The maximal dilatation may not be at those predetermined sites. It is the maximal diameter that predicts outlook.

There are several potential advantages to using a uniform system. Taking measurements at the same eight levels, each

Fig. 1 Eight locations for uniform measurement and reporting of aortic diameter.

time the aorta is imaged, encourages reporting of diameters at consistent levels from one study to the next. This should enhance clinical care. This type of reporting would enable easier and more meaningful comparison of measurements at each of the eight locations over time. Using the widest portions of the ascending and descending thoracic aorta allows clinicians to track changes in maximal aortic diameter, particularly as aneurysms are usually fusiform rather than saccular and may encompass a long span of the aorta. Ultimately, use of such a system, if adopted widely, would also serve to reduce discrepancies between imaging specialists within one medical center and between medical centers. Research involving growth rates and complication rates at different diameters would be facilitated and rendered more accurate.

Based on the clinical importance of careful measurement of the aorta, in monitoring patients over time and deciding when to intervene surgically, we recognize the need for a uniform system of reporting aortic measurements. Our suggestions would help work toward the mandates for care recommended by the 2010 Guidelines for the Diagnosis and Management of Patients with Thoracic Aortic Disease, which states, "Measurements of aortic diameter should be taken at reproducible anatomic landmarks... and reported in a clear and consistent format."⁸ We suggest the standardized locations in the attached figure for establishing uniformity in

reporting. Such a standardized measurement protocol would aid in combating this virulent disease, both to benefit clinical research and the individual patient.

Disclosures

The authors have no conflicts of interest to disclose.

Dear Readers,

This Letter to the Editor will serve as an excellent guideline for those who treat patients with conditions, and researchers to further expand their studies. Dr. John A. Elefteriades, Co-Editor-in-Chief of the *International Journal of Angiology*, and his team have been performing outstanding clinical and basic research on this subject. We appreciate their leadership and contribution.

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