

Treatment of Thoracic Aortic Aneurysm: Role of Earlier Intervention

Bulat A. Ziganshin, MD,^{*,†} and John A. Elefteriades, MD^{*}

For this article, we are asked to make a case for early surgery in thoracic aortic aneurysm (TAA) disease. We are able to accumulate arguments in favor of early surgery. Specifically, (1) it is impossible to predict the onset of aortic dissection with complete accuracy. (2) Aortic dissection that is allowed to occur has high early mortality and impaired late survival. (3) Aortic surgery is very safe in the present era. (4) Living with a TAA, the inherent risk of aortic dissection has a high emotional burden. For these reasons, a case for early prophylactic surgery in TAA disease can fairly be made.

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INTRODUCTION

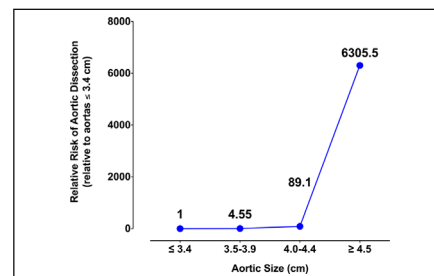
Aortic diseases are a significant contributor to the mortality of the population, causing as many as 13,000 deaths annually in the United States, which consistently places aortic disease among the top 20 causes of death.^{1,2} The mortality is primarily driven by such aortic catastrophes as aortic rupture and dissection, which can take a person's life within minutes of occurrence. However, rupture and dissection occur primarily in the setting of an existing aortic aneurysm, the insidious, virulent, and silent nature of which make them extremely difficult to detect.³

Once detected, prophylactic surgical treatment is the management of choice for aneurysms of the ascending aorta, aortic arch, and descending aorta, and the latter is also commonly treated with endovascular techniques in recent years.^{4,5} The appropriate timing of prophylactic intervention for thoracic aortic aneurysm (TAA), stipulated in the European and US guidelines,^{4,5} is determined primarily by aortic size criteria, derived from studies on the natural history of thoracic aortic disease.^{6–11} These criteria have withstood the test of time and have been shown to be effective for preventing aortic complications and aorta-related deaths in patients with TAA.¹²

^{*}Aortic Institute at Yale-New Haven Hospital, Yale University School of Medicine, New Haven, Connecticut

[†]Department of Surgical Diseases #2, Kazan State Medical University, Kazan, Russia

Address reprint requests to John A. Elefteriades, MD, Aortic Institute at Yale-New Haven Hospital, Yale University School of Medicine, 789 Howard Ave, Clinic Building, CB317, New Haven, CT 06519. E-mail: john.elefteriades@yale.edu



Relative risk of aortic dissection is 6000-fold higher for large aortas than for small ones.

Central Message

Imperfect prediction of aortic dissection, its high early and late mortality, and the safety of aortic surgery argue in favor of early prophylactic intervention.

However, there are certain circumstances in which prophylactic surgery might be beneficial before the size of an aortic aneurysm reaches the intervention criterion threshold. These special situations include patients with specific genetic syndromes, strong family history of aortic dissection, and associated conditions, which increase the risk of adverse aortic events. Such patients would benefit from an earlier intervention than recommended by the current guidelines. Also, it may well be that our guidelines are too conservative as the risk of aortic surgery decreases through advances in surgical technique, in graft technology, in hemostasis, and in anesthetic and postoperative care.

In this article, we have been asked by the Editors to make a case for earlier intervention in patients with TAA. This is the goal of the current article. The following are the points we muster in support of early surgery for TAA.

AORTIC DISSECTION IS NOT ENTIRELY, ACCURATELY PREDICTABLE

Dissection Does Occur at Small Aortic Size

Studies on the natural history and progression of TAA provide powerful information regarding how fast the thoracic aorta grows and how likely aortic rupture and dissection would be at different aortic sizes—with a good degree of accuracy.^{6–11} However, owing to inherent limitations of these studies, there remains a small percentage of patients who develop an aortic dissection at a small aortic size, before size criteria are met. This

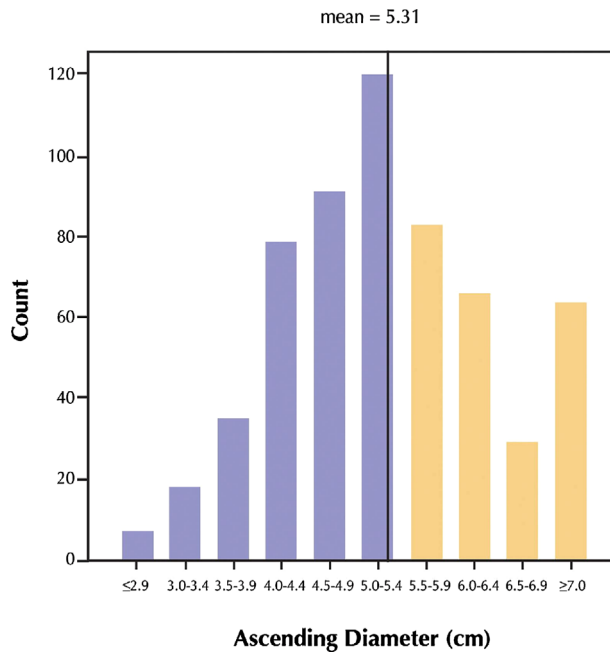


Figure 1. Distribution of aortic sizes at the time of presentation with acute Type A aortic dissection (cm). Purple bars indicate patients with diameters < 5.5 cm. Data from IRAD by Pape et al.¹³ (Adapted with permission from Elefteriades and Farkas.¹²) (Color version of figure is available online at <http://www.semthorcardiovascsurg.com>.)

phenomenon was very well demonstrated by a study from the International Registry of Acute Aortic Dissections (IRAD),¹³ which showed that a significant number of Type A dissections occur at aortic sizes smaller than 5.5 cm (Fig. 1). However, the IRAD investigators wisely did not recommend a change in the intervention criteria based on their findings. This IRAD database study could not relate the number of observed dissections at a certain size to the number of individuals at risk with an aorta of that size. Our group recently focused on the IRAD “size paradox”—that some dissections do occur at very small sizes.¹⁴ We found that, in the general population, the size of the aorta is extraordinarily small and its distribution approaches a bell-shaped curve (Fig. 2). As we move toward the right tail of the curve, the number of individuals with large aortic sizes diminishes dramatically. Figure 2 shows that there are many more individuals with 4 cm aortas than individuals with 5 cm aortas, which makes the relative risk of developing an aortic dissection at such a small size very low. In fact, the relative risk of developing an aortic dissection in individuals with aortic sizes ≥ 4.5 cm is more than 6000 times greater than the risk for a person with a 3.5 cm aorta (Fig. 3).

The huge number of patients with small aortas makes it impractical to recommend prophylactic surgical treatment for such a large cohort, especially

because the risk is quite low and most of these people never develop any aorta-related complications. However, identifying those few patients at risk of dissecting at small aortic size and treating them with early prophylactic surgery would be extremely beneficial. The fact is, simply put, that we cannot currently predict susceptibility to aortic dissection with complete accuracy.

Family History Can Produce Early Dissection

It is now well recognized that genetics plays an important role in thoracic aortic disease (to be discussed in detail in a later section), especially in predicting which patients might benefit from earlier intervention. This is where accurate family history taking is very important. Earlier studies on the Mendelian inheritance patterns of TAA have shown that approximately 20% of patients with TAA have 1 or more family members with an aortic or aneurysm condition and are, thus, familial (Fig. 4).¹⁵⁻¹⁷ Patients with familial TAA tend to present significantly younger (mean = 58 years) than those with sporadic TAA cases (mean = 66 years), and their aortas grow significantly faster than aortas of the nonfamilial patients (0.21 vs 0.16 cm/y, respectively).¹⁷ Therefore, these individuals are at higher risk of aortic events, for whom earlier prophylactic surgery may be advisable. Also, based

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