

## Thoracic Aortic Aneurysm

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An arterial aneurysm is a localized pathological dilation of the artery with a diameter of 1.5 times that of the normal artery [1]. The histopathology of some aortic aneurysms includes medial degeneration with elastic fiber loss from the medial layer, loss of vascular smooth muscle cells, and proteoglycan deposition [2]. Dissection of the thoracic aorta involves disruption of the medial layer with intramural hemorrhage causing propagation and tracking of blood within the media [2].

The DeBakey classification system states that a type I dissection originates in the ascending aorta and propagates distally to the aortic arch and typically to the descending aorta with surgery usually recommended [3]. Type II dissection originates in and is confined to the ascending aorta with surgery usually recommended [3]. Type III dissection originates in the descending thoracic aorta and propagates most often distally with nonsurgical treatment usually recommended [3]. The Stanford classification system is divided into type A dissections which involve the ascending aorta and type B dissections which do not involve the ascending aorta [3]. Surgery is usually recommended for all dissections involving the ascending aorta [3]. Surgery is usually not recommended for dissections that do not involve the ascending aorta. [3]. At median follow-up of 25 months of 257 patients with unrepaired descending thoracic aortic aneurysm, the risk of aortic dissection/rupture and sudden death was 7.4% for definite events and 12.1% for possible events [4].

The mortality in type A aortic dissection is estimated to be 1% to 2% per hour during the first 48 hours [5]. Therefore, all patients with type A dissection should be considered for urgent surgical repair. The in-hospital mortality in the International Registry of Acute Aortic Dissection was 27% for patients managed surgically and 56% for those managed medically [5]. For the surviving patients, the 1-year survival was 96% for surgically treated patients and 89% for medically treated patients [6]. The 3-year survival was 91% for surgically treated patients and 69% for medically treated patients [6].

End-organ cardiovascular complications from acute dissection of the ascending aorta include aortic regurgitation, syncope, pericardial tamponade, myocardial ischemia or infarction, and congestive heart failure [3]. Neurologic complications include ischemic stroke or transient ischemic attack, peripheral neuropathy, paraplegia/paraparesis, and pleural effusion [3]. Pulmonary complications include pleural effusion and aortopulmonary fistula with hemorrhage [3]. Gastrointestinal complications include mesenteric ischemia or infarction and aortopulmonary fistula with hemorrhage [3]. Renal complications include renal failure and renal ischemia or infarction [3]. Limb ischemia may also occur [3].

Genetic disorders that are associated with thoracic aortic aneurysms and dissection include the Marfan syndrome, the Loeys-Dietz syndrome, the vascular form of the Ehler-Danlos syndrome, the Turner syndrome, bicuspid aortic valve, and the familial thoracic aortic aneurysm dissection syndrome [3]. Inflammatory diseases that are associated with thoracic aortic aneurysms and dissection include Takayasu arteritis, giant cell arteritis, Behcet disease, ankylosing spondylitis, and infective thoracic aortic aneurysms [3].

The most important risk factor for increasing aortic wall stress precipitating dissection of a thoracic aortic aneurysm is hypertension [3,7]. Other risk factors for increasing aortic wall stress precipitating dissection of a thoracic aortic aneurysm include pheochromocytoma [3], cocaine or other stimulant use [3,8], weight lifting [3,9], trauma [3], deceleration or torsional injury [3], coarctation of the aorta [3], and smoking [2].

Measurements of the thoracic aortic diameter can be made by cardiac computed tomographic imaging, magnetic resonance imaging, or echocardiography [3,10,11]. Patients with the Marfan syndrome, the Loeys-Dietz syndrome, or a confirmed genetic mutation known to predispose to aortic aneurysms and aortic dissections should have measurement of the ascending thoracic aorta diameters at initial diagnosis and at 6 months thereafter to determine if enlargement is occurring [3].

Patients with a thoracic aortic aneurysm should stop smoking and avoid exposure to environmental tobacco smoke at work and at home [3]. Antihypertensive drug therapy should be administered to patients with hypertension to reduce the blood pressure to less than 140/90 mm Hg [7]. Blood pressure should be reduced with beta blockers and angiotensin converting enzyme inhibitors or angiotensin receptor blockers [3,7]. Beta blockers [3,12] and an angiotensin receptor blocker such as losartan [3,13] should be given to patients with the Marfan syndrome to reduce the rate of aortic dilatation. Patients with an atherosclerotic thoracic aortic aneurysm should be treated with atorvastatin 40 to 80 mg daily or rosuvastatin 20 to 40 mg daily [14].

Patients with symptoms suggestive of an expansion of a thoracic aortic aneurysm should be evaluated for surgical intervention unless comorbid conditions limit life expectancy or quality of life is markedly impaired [3]. Asymptomatic patients with a degenerative thoracic aortic aneurysm, chronic aortic dissection, intramural hematoma, penetrating atherosclerotic ulcer, mycotic aneurysm, or pseudoaneurysm who are surgical candidates in whom the ascending aorta or aortic sinus diameter is 5.5 cm or greater should be evaluated for surgical repair [3]. Asymptomatic patients with the Marfan syndrome or other genetically mediated disorders should undergo elective operation at diameters of 4.0 to 5.0 cm depending on the condition to avoid acute dissection or rupture [3,15,16]. Asymptomatic women with the Marfan syndrome considering pregnancy should have the aortic root and ascending aorta replaced if the diameter exceeds 4.0

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cm [3]. Asymptomatic patients with the Marfan syndrome should have surgery if the ascending thoracic aortic diameter is 5.0 cm or greater and less than 5.0 cm if there is a family history of dissection or increase more than 0.5 cm per year [3]. Asymptomatic patients with the Loeys-Dietz syndrome should be referred for surgery if the aortic diameter is 4.2 cm or more by transesophageal echocardiography or 4.4 to 4.6 cm by cardiac computed tomography or cardiac magnetic resonance [3]. Asymptomatic patients with a growth rate of more than 0.5 cm/year in an aorta with a diameter less than 5.5 cm should be referred for consideration of surgery [3]. Patients with a bicuspid aortic valve should be referred to repair the aortic sinuses or replace the ascending thoracic aorta if the diameter of the aortic sinuses or ascending thoracic aorta is greater than 5.5 cm or greater than 5.0 cm if there is a family history of dissection or if the rate of increase in diameter is 0.5 cm or more per year [17]. The ascending thoracic aorta should also be replaced in patients with a bicuspid aortic valve undergoing aortic valve surgery because of severe aortic stenosis or regurgitation if the diameter of the ascending thoracic aorta is greater than 4.5 cm [17].

If dissection of the thoracic aorta occurs, initial treatment is directed at limiting propagation of the false lumen by reducing aortic shear stress and determining which patients will benefit from surgical or endovascular repair [3]. The velocity of ventricular contraction, the ventricular rate, and the blood pressure should be reduced with the ventricular rate reduced to less than 60 beats per minute and the systolic blood pressure reduced to 100 to 120 mm Hg [3,18]. Intravenous propranolol, metoprolol, labetalol, or esmolol is an excellent choice for initial treatment [3]. In patients unable to tolerate beta blockers, intravenous verapamil or diltiazem may be used [3,18]. If additional antihypertensive therapy is needed, intravenous sodium nitroprusside, nicardipine, nitroglycerin, and fenoldopam may be used [3,19]. Pain should be controlled by intravenous opiate therapy [3]. Hypotension and shock should be treated and indicate a need for immediate operative management [3]. Hemopericardium and cardiac tamponade should be treated with pericardiocentesis [3]. Other cardiac and noncardiac complications need treatment [3].

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