

AORTIC DISSECTION

WHAT IS THE AORTA AND WHAT IS ITS FUNCTION?

The aorta is the largest blood vessel within the body and carries oxygenated blood from the heart to the rest of the body. It has three layers. The inner layer is known as the tunica intima, the middle layer is known as the tunica media and the outer layer is known as the tunica adventitia.⁴ The ascending aorta in a normal adult is about 3 cm wide at its origin from the base of the heart and extends 5-6 cm upward toward the head to join the aortic arch.⁴ Its proximal portion is within the pericardial cavity.⁴ The arch of the aorta gives rise to feed the brachiocephalic vessels while the descending thoracic aorta is a continuation of the aorta beyond the arch.⁴ The abdominal aorta forms the continuation of the thoracic aorta and ends at the bifurcation at the level of the 4th lumbar vertebra.⁴

WHAT IS AN AORTIC DISSECTION?

An aortic dissection is a sudden development of a tear in the intima, thus opening the way for a column of blood driven by the force of the arterial pressure to enter the aortic wall, destroying the media and stripping the intima from the adventitia for variable distances along the length of the aorta.⁴

The DeBakey classifications of aortic dissections include:

TYPE I	TYPE II	TYPE III
Type I begins in the ascending aorta beyond the aortic arch and down the entire length of the aorta to the bifurcation. ^{4,5}	Type II begins and is confined to the ascending aorta. ^{4,5} (a.k.a. Stanford Type A)	Type III begins in the descending thoracic aorta and extends distally for a variable distance. ^{4,5} (a.k.a. Stanford Type b)

WHAT CAUSES AORTIC DISSECTION?

Weakening of the aorta's layers leads to higher wall stress which can cause dilatation, aneurysm formation, hemorrhage, dissection, or rupture. Causes of aortic dissection are either acquired or hereditary. Hereditary causes include inherited connective tissue disorders such as Marfan's Syndrome or Ehler's-Danlos Syndrome. Acquired causes include trauma (specifically deceleration injuries sustained in car accidents and falls from heights),⁶ advanced age, smoking, previous aortic or valve surgery, crack cocaine use, and hypertension.^{5,6}

WHAT ARE THE SIGNS AND SYMPTOMS OF AN AORTIC DISSECTION?

The more common signs and symptoms of aortic dissections include:

1. acute chest discomfort and pain, which is blunt/severe/or radiating. This is the #1 sign or symptom^{1,4,5,9,10}
2. murmurs that wax and wane^{3,4,5}

3. mild dizziness¹.
4. lower limb paresthesia¹.
5. paraparesis (partial paralysis of the lower extremities) and paraplegia, which can be seen when the spinal artery perfusion is compromised.⁵
6. hoarseness^{1,9}
7. TIA (transient ischemic attack)¹.
8. Chest pain worsening from previous days¹
9. Lower limb ischemia⁹, however, isolated lower limb ischemia due to aortic dissections are rare¹²
10. Renal failure¹
11. Severe chest and back pain described as searing, tearing, ripping or stabbing^{4,5,10}
12. Drenching sweat ^{4,5}
13. Apprehension ^{4,5}
14. Nausea and vomiting ^{4,5}
15. Faintness at onset ^{4,5}
16. Pulsating neck mass ^{4,5}
17. Wide pulse pressures ^{4,5}
18. Pulse deficits usually present in 50% of the proximal aortic dissection and in 15% of distal dissections^{5,9}
19. Aortic regurgitation is seen in 16% to 67% proximal dissection cases.⁵
20. Pleural effusions ^{4,5}
21. Heart block ^{4,5}
22. Ischemic paraparesis ^{4,5,9}
23. Ischemic peripheral neuropathy ^{4,5,9}
24. Hypertension is seen more in distal aortic dissections whereas hypotension is seen more in proximal dissection. True hypotension usually is the result of cardiac tamponade, intrapleural rupture or intraperitoneal rupture.^{5,9}
25. Patient's without pain usually have suffered some disturbances of consciousness that renders them unable to perceive pain.⁴
26. The peak incidence of aortic dissection is in the 6th to 7th decade of life. ^{4,5}
27. Afflicts males 2:1 over females ^{4,5}

Less common signs and symptoms of aortic dissections include:

28. CVA (cerebrovascular accident)
29. Neurological manifestations occur in 6% to 19% of aortic dissections but are more common with proximal dissections.⁵
30. Syncope without focal neurological signs, in 4% to 5% of aortic dissections may be an ominous sign suggesting a surgical emergency. It is associated with a rupture of the proximal aorta into the pericardial cavity with resultant cardiac tamponade. ⁵
31. Paraplegia
32. Loss of pulse with or without ischemic pain
33. Syncope without focal neurological signs occurred in 6 of 24 patients and in each of these cases there was evidence of rupture into the pericardial cavity with cardiac tamponade.⁴
34. Strenuous physical exertion and emotional stress is seen in only 14%. ^{4,5}

HOW IS AN AORTIC DISSECTION DIAGNOSED?

Because of the variable extent of aortic dissections, the signs and symptoms associated with the condition, it is often mis-diagnosed. Aortic dissection often occurs sporadically and cannot be diagnosed on the basis of the symptoms and clinical findings alone.^{1, 5}

A careful history enables the clinician first to consider and then to order the appropriate test to diagnose this catastrophic disorder.¹ The patient's medical history is important. Long-standing hypertension is found in well over half of all cases especially in distal dissections.⁴

The key to successful treatment is to: 1) consider the diagnosis 2) diagnose 3) perform surgery prior to complications.³

In a series from Spittel et al, of all aortic dissections presenting without known diagnosis the clinical diagnosis was aortic dissection in only 62% and the other 38% was thought to initially have MI, CHF, non-dissecting aneurysms of the thoracic and abdominal aorta, symptomatic aortic stenosis, pulmonary embolism and so forth.⁵ In the 38%, nearly two-thirds of the aortic dissections were diagnosed incidentally while undergoing diagnostic procedures.⁵ One third of the patients with aortic dissection are not diagnosed as having an aortic dissection prior to death.¹¹ Given the clinical challenge that detection of aortic dissections present, physician's should remain vigilant in assessment of risk factors, signs and symptoms which are consistent with aortic dissection if a timely diagnosis is to be made.⁵

RADIOLOGY EXAMS USED TO DIAGNOSE AORTIC DISSECTIONS

Unfortunately no single imaging modality provides all of the anatomical detail, therefore, the choice of diagnostic modalities should be guided by the clinical presentation and by targeting information that will best assist in managing the patient.⁵

The following radiology exams are used in diagnosing aortic dissections:

1. Chest X-ray^{4,5,6}
2. CT Scan ^{1,2,4,5,6,9,10,11}
3. MRI^{1,2,4,5,6,9,10,11}
4. Angiography ^{1,2,4,5,6,9,10,11}
5. Transthoracic or transesophageal echocardiography ^{1,2,4,5,6,9,10,11}
6. Aortography²

The chest x-ray may first raise clinical suspicion of an aortic dissection because of a widening of the aortic silhouette or localized bulge over the site of origin.⁵ Chest x-rays are abnormal in 60-90% of suspected aortic dissection; however, acute disease, particularly Type A, may present with a normal chest x-ray.

The sensitivity, specificity and predictive accuracy of the CT scanning are as good and in most instances better than those of aortography.² CT scans have been acclaimed as the diagnostic method of choice but they are not always immediately available, and may not demonstrate details of the aortic root and valve or of the left ventricular function or it may fail to demonstrate the dissection.³ Other disadvantages to the use of CT scanning include the lack of mobility of the equipment, inability to provide hemodynamic information such as the degree of aortic regurgitation, use of IV nephrotoxic contrast agents, and often the inability to visualize any branch vessel involvement.³

Aortography is not as sensitive as previously thought⁵ and should be avoided, particularly if Type A dissection is suspected. There is a 77% to 88% sensitivity and false-negative readings occur.⁵ Aortography is an invasive procedure using contrast material. The procedure is long and the patients must go to the angiography suite.⁵; therefore, it is not preferred in emergent situations. The advantage of aortography is its ability to stage the advancement of dissection in chronic phases and can view branch vessel involvement.⁵ It is also widely available and surgeons are comfortable with its use.

Angiograms are risky in patients with aortic dissections and often prolongs the time to repair the aorta by several hours.⁵

MRI affords better anatomic delineation of the aorta² and can identify the site of entry with a very high specificity.¹¹ MRI is further capable of identifying fluid in the pleural or pericardial space.

The disadvantages of MRI's include:

1. MRI's cannot be performed in patients with pacemakers or metallic prosthesis in any body organ.²
2. MRI's are not available in all facilities,
3. MRI's have high maintenance costs, and
4. MRI patients are inaccessible during scanning. ²

Ultrasound and in particular echocardiography is well suited for the evaluation of patients with suspected aortic dissection.² Echocardiography allows visualization of the full length of both coronary arteries.

The advantages and disadvantages of transthoracic echocardiography are as follows:

ADVANTAGES	DISADVANTAGES
Non-invasive imaging ²	Lower sensitivity and specificity ^{2,5}
Widely available ²	Inability to visualize the thoracic aorta in its entirety ²
Does not require use of IV contrast agents ²	Poor quality of images in 10 % of the patients, especially in patients with chronic lung disease and obesity ^{2,5}
Offers portability B can be done in the ER at the bedside ²	The lack of coronary artery visualization ²
Shown to have a diagnostic value ²	
Can also evaluate pericardial effusions, global and regular systolic function and valvular insufficiency. ²	

The following are advantages and disadvantages for the Transesophageal Echocardiography (TEE).

ADVANTAGES	DISADVANTAGES
Safe ^{2,3}	Inability to visualize the entire thoracic aorta. ²
Provides very high sensitivity and specificity in the diagnosis of aortic dissection. ^{2,3}	Semi-invasive nature of the technology contraindicated in patients with esophageal lesions. ²
Performed at the bedside ⁵	Typically required 10-15 minutes to complete ⁵
Test of choice in the unstable patient ¹⁰	Lack of widespread availability. ²

Electrocardiographic findings in aortic dissection are non-specific and often misleading.. Nevertheless, obtaining an electrocardiogram is important because

in the absence of ischemic ST and T wave changes may rule out myocardial infarction; thereby prompting a consideration for an aortic dissection diagnosis.

MANAGING AORTIC DISSECTIONS

As with most cardiovascular phenomena, medical and surgical therapies are both viable options. Risk/benefit ratios should always be considered. Therapy for aortic dissections is to halt the progression of the dissecting hematoma because lethal complications can arise.⁵ For any patient in which an aortic dissection is suspected he should be placed in an acute care setting for hemodynamic stabilization, pain management, and monitoring of blood pressure, cardiac rhythm and urine output.⁵ If profound hemodynamic instability is encountered, patients may require intubation and mechanical ventilation. Once the medical therapy has been initiated then the patient should undergo a TEE, because it can be done at the bedside in the ER or ICU; or a CT scan, depending on which is available first,¹¹. When patients present with EMD or marked hypotension, an attempt to resuscitate the patient with pericardiocentesis is warranted.⁵ Pericardiocentesis is aspirating fluid from the pericardial cavity with a needle and syringe and is considered risky as it can cause accelerated bleeding which leads to shock.

When the patient is or becomes unstable he should go directly to the operating room.⁵ The aim of surgery is to prevent rupture or development of pericardial effusion which will lead to cardiac tamponade and death. The key is rapid surgical intervention prior to hemodynamic instability or deterioration. Surgical interventions may include stent/graft placement or PTCA balloon angiography. Both are highly desirable if performed swiftly, as they relieve malperfusion injuries.

The following are indications for definitive surgical and medical therapy in aortic dissections:

SURGICAL THERAPY	MEDICAL THERAPY
Treatment of choice for acute proximal dissection ⁵	Treatment of choice for uncomplicated distal dissection
Treatment of choice for acute distal dissection complicated by: <ul style="list-style-type: none"> • progression with vital organ compromise • rupture or impending rupture • aortic regurgitation • retrograde extension into the ascending aorta • dissection in Marfan syndrome patients⁵ 	Treatment for stable, isolated arch dissection ⁵

	Treatment of choice for stable chronic dissection uncomplicated and presenting 2 weeks or later after onset. ⁵
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MORTALITY

Mortality is largely dependent on the severity and duration of ischemia prior to surgical intervention. Operative mortality of aortic dissection is 15-35%. For those who survive surgery, post-operative survival at 30 days is 81%, 74% at one year, and 63% at 5 years.

Long-term follow up is required for all survivors of aortic dissection. The aortic dissection predisposed the entire aorta to future dissection, aneurysm, or rupture. Nearly 1/3 of those who survive the initial injury will experience a dissection extension, aortic rupture, or aneurysm re-formation within 5 years. The greatest risk of these occurrences is within the first 2 months following initial treatment.

Extremely aggressive medical therapy, follow up visits, and serial imaging are required. Meticulous attention to blood pressure control is paramount and usually includes administration of Beta blockers. Serial imaging of the entire length of the aorta is recommended at one month, six months, nine months, and 12 months with annual exams after that time.

END OF SUMMARY