
AORTIC DISSECTION: DIAGNOSTIC APPROACH AND ITS TREATMENT IN EMERGENCY ROOM

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Aortic dissection is a relatively uncommon catastrophe which requires prompt diagnosis and treatment beginning in the emergency room. At least 2000 new cases are diagnosed in the USA each year. It is estimated that at least 500 cases should be diagnosed despite the fact that no reliable statistical data are available in Turkey. The natural course of the disease is almost always fatal unless treated properly. In a metaanalysis of survival in patients with untreated proximal aortic dissections, more than 25% of all of the patients died within the first 24 hours, more than 50% within the first week, more than 75% within the first month, and more than 90% within 1 year.

Key words: Aortic dissection, aortography, magnetic resonance imaging, echocardiography, computerized tomography

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Aortic dissection usually occurs with a tear in the intimal layer of the aortic wall. Very rarely aortic dissection follows a spontaneous hemorrhage within the aortic media which is defined as intramural hematoma or intramural hemorrhage. Stanford investigators classified aortic dissections as type A and B dissections. Type A dissections involve proximal aorta, while type B lesions involve only descending aorta. It is generally accepted that surgical treatment in type A lesions is superior to medical treatment^{2,3}. Early mortality rates are lower in type B lesions as compared to type A lesions. Recent investigations have shown that medical and surgical treatments of uncomplicated distal lesions are equally effective⁴. As a result, medical treatment is preferred by many groups for type B lesions. Nevertheless, without a proper treatment mortality is very high for both types of aortic dissections.

The most commonly encountered presenting symptom is pain. The pain of aortic dissection is defined as an excruciating pain with tearing or stabbing quality. The pain starts abruptly and it is most severe just at the beginning, unlike, the pain of myocardial infarction which starts slowly and culminates to its peak within several minutes to hours. Pain starts just over the area of dissection, and tends to radiate in the direction of the continuing tear. Findings related to congestive heart failure, syncope, cerebrovascular accident, ischemic peripheral neuropathy, paraplegia and sudden cardiac death are less commonly observed as the presenting symptoms. Acute congestive heart failure along with the findings of acute aortic insufficiency usually point out for type A dissection⁵. Physical findings may be quite variable ranging from sudden death to subtle findings. Symptoms may even be absent in some cases. In 80-90% of the cases with distal dissections hypertension accompanies the dissection. Hypotension and shock are the usual mode of presentation for type A dissection. Cardiac tamponade, rupture to the intrapleural or intraperitoneal cavity are the causes of hypotension. Partial or complete occlusion of the aorta may lead to pseudo hypotension in lower extremities. Murmurs due to aortic insufficiency are heard in 16-67% of the cases⁶. Neurological deficits, are reported in 3-19% of the cases. Acute myocardial infarction occurs in 1-2% of the cases^{7,8}. Some authors deny that trauma can be a cause of aortic dissection while some others believe that such cases exist.

Investigators report that blunt chest trauma can lead to dissection and this possibility must not be overlooked in cases with chest trauma and unexplained shock or congestive heart failure. Aortic rupture and/or aortic dissection can be seen in one sixth of patients due to acute chest trauma caused by traffic accidents^{9,10}.

Physicians should always be alert about the relationship between pregnancy and aortic dissection. Almost half of all aortic dissections reported in women below 40 years of age were detected in the last trimester of pregnancy. Any pregnant women presenting with chest pain, should bring aortic dissection in mind^{11,12}.

EMERGENCY APPROACH

Urgent treatment is needed for patients with aortic dissection, and these patients should be triaged equal to first degree trauma patient. The patients vital findings should be promptly evaluated. Blood pressure should be measured from both arms. Immediate ECG recordings, and portable chest X-ray should be obtained. At least two IV catheter should be set in two different large caliber veins. Radial artery (right radial is preferred in order to be able to continue monitorization during aortic cross-clamp when surgical intervention is realized) should be cannulated, and arterial pressure should be monitorized. Femoral artery cannulation is best avoided since these arteries provide access sites to cardiopulmonary by-passing if it is needed. If femoral cannulation is unavoidable, only a single site should be attempted and the other femoral artery should be reserved for a possible cardiopulmonary by-pass. Swan-Ganz monitorization is required in patients with hypotension and/or congestive heart failure. Prompt medical treatment should also be implemented synchronous to these efforts.

DIAGNOSIS

The aortic shadow is enlarged in chest X-Ray when compared to the patients previous films. Pleural effusion may be seen. Calcium sign may be a clue for aortic dissection.

ECG findings are non-specific. However standart ECG recordings are very useful for ruling ischemic heart disease out and following the progression of aortic dissection up. Technological developments have ironically created the problem of choosing the most appropriate laboratory method in the process of diagnosis. Four different methods are available:

- a. aortography
- b. computerized tomography (CT)
- c. magnetic resonance imaging (MRI)
- d. echocardiography (Trasthoracic and transesophageal) (Table I and II)¹⁴.

Aortography was once widely accepted as the gold standart diagnostic method. However,

Table I: Diagnostic value of 4 different imaging techniques in Aortic Dissection:

	Aortography	CT	MRI	TEE
Sensitivity	++	++	+++	+++
Specificity	+++	+++	+++	++,+++
Showing intimal tear	++	+	+++	++
Thrombus detection	+++	++	+++	+
Aortic insufficiency	+++	-	+	+++
Pericardial effusion	-	++	+++	+++
Major branch assesement	+++	+	++	+
Coronary artery assesement	++	-	-	++

CT: Computerized tomography, MRI: Magnetic resonance imaging, TEE: Transesophageal echocardiography

+++ : Excellent; ++: good, +: poor, -: no information

Table II: Feasibility of four diagnostic methods.

Advantage	Aortography	CT	MRI	TEE
Availability	few	many	few	many
Rapidity	no	yes	no	yes
Bed-side	no	no	no	yes
Non-invasive	no	yes	yes	yes
IV contrast	no	sometimes	no	yes
Cost	high	acceptable	medium	acceptable

CT: Computerized tomography, MRI: Magnetic resonance imaging, TEE: Transesophageal echocardiography

recent investigations showed that both MRI and transesophageal echocardiography (TEE) are superior in terms of sensitivity, and at least equal in terms of specificity^{15,16}. Aortography is 88% sensitive, and 94% specific in the diagnosis of aortic dissection. Aortography shows the involvement of large arteries, aortic insufficiency and coronary involvement while, sometimes fails to show the presence of trombi in the false lumen and the exact location of the intimal tears. It is a time consuming invasive method and requires the usage of contrast media.

CT has 83-94% sensitivity, and 87-100% specificity. Conventional CT detects 2/3 of intimal flaps, and rarely shows the ostium of intimal tear¹⁷. This method is not reliable for the detection of aortic insufficiency, and requires contrast agents. The new generation CTs are capable of spiral imaging and have considerably fast scanners. It is widely

believed that the diagnostic accuracy of this type of CTs will be comperable to MRI.

Transthoracic echocardiography (TTE) has 59-85% sensitivity and 63-96% specificity⁵. However when we compare type A and B dissection sensitivity reaches to 78-100% for type A dissections while, decreases to 31-55% for type B dissections.

On the other hand, sensitivity and specificity of TEE for both types of dissections are 98-99% and 77-97% respectively^{15,16}. The major advantage of this method is that its availability for bedside diagnosis. TEE shows both intimal tears, and the thrombi present in anywhere in the artery. Both aortic insufficiency and pericardial effusions can be accurately assessed. TEE is sensitive 73%, 68%, and 100% for these situations respectively. These rates are lower in series where monoplane imagings were performed. It is evident that multiplane imaging

considerably improves these numbers. If the intimal flap can be demonstrated in at least two planes, and if the colour Doppler shows the connection between both lumens, the specificity reaches to 97%. Esophageal varices, tumors, and strictures limits the usage of TEE.

MRI is the most sensitive method, and its sensitivity and specificity reaches to 98%¹⁸. Intimal tears, thrombus in the false lumen, pericardial effusion and aortic insufficiency can be diagnosed with 88%, 98%, and 85% sensitivity with MRI. However, presence of permanent pace-makers, some vascular clips, and some of the old models of prosthetic valves are contraindications for MRI. Patients requiring mechanical ventilation. I.V. pumps and intra-aortic pumps etc. and unstable patients can not be sent for MRI.

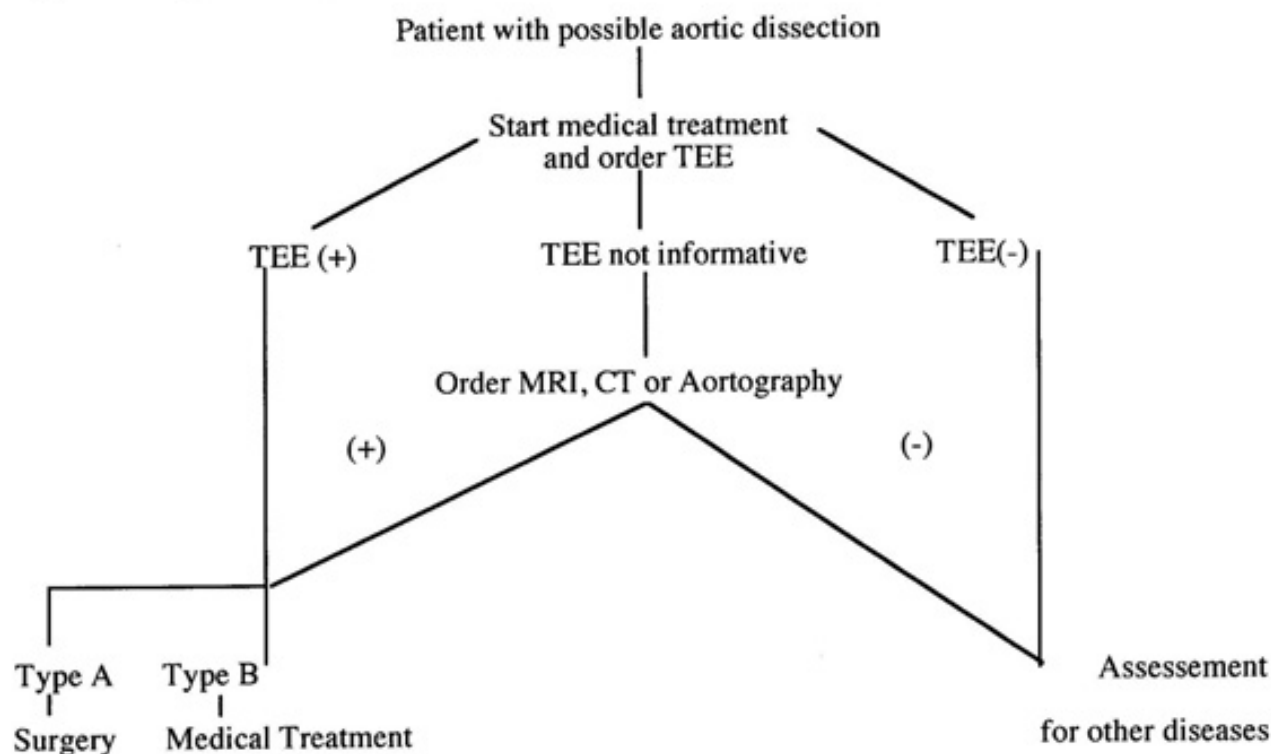
The physician should always consider all the factor for choosing among these methods. MRI, TEE might not be available in all centers. Can the patient survive 20-30 minutes without any nursing care? How long does it take to organize the angiography team? What

is the preference of the surgeons at a given center? The emergency physician should always consider these factors.

All of these four major diagnostic methods have advantages and disadvantages, and TEE are the most sensitive and specific ones. Some authors consider MRI as the procedure of choice. However MRI is not a practical choice in emergency room setting in most of the time, and may not even be available in all centers. Patient care is also hindered during the procedure. Emergency aortography is very rarely feasible in most of the centers and requires contrast media. TEE is preferred among all for the diagnosis of aortic dissection^{19,20}. CT is preferred if TEE is not available. CT is widely available almost in the majority of centers and gives accurate results especially in type A dissections. However, if the surgeon's preference is aortography before the surgery, aortography alone should be performed without any delay.

The algorithm presented in Figure 1 should be followed in centers with all four modalities readily available²¹. Prompt treatment should

Figure 1. Diagnostic algorithm for the patients suspicious of aortic dissection.



be started in any patient suspicious of aortic dissection, and TEE should be ordered. If TEE shows type A dissection in the absence of any major contraindication for surgery, the patient should be immediately sent to the operating room. If type B dissection is detected, then the medical treatment should be continued. However when a type B dissection starts to cause end-organ dysfunction due to ischemia, the patient should be sent for surgery without any delay. Very rarely, TEE fails to diagnose aortic dissection, and a second diagnostic method is required. Physician should individualize his or her choice considering the above discussed factors. Following this algorithm shortens the period before the surgery²¹.

MEDICAL TREATMENT

There are two major goals of medical treatment:

- a. To lower the systolic blood pressure
- b. to reduce the left ventricular ejection force (dp/dt). Left ventricular ejection force is considered both a the cause of aortic dissection and its progression. IV beta-blockers are the major drugs to be used for this purpose (Table III). Nitroprusside can be added to the treatment when necessary. The end point is to reduce systolic blood pressure below 100-120 mmHg. Beta blockers are the first choice to reduce dp/dt in the absence of any contraindication such as heart rate below

Table III: Recommended drugs for hypertension

Nitroprusside	
initial dose	20 microgram/min
infusion	800 microgram/min (with BP control)
Beta-Blockers	
Esmolol	
initial dose	30 mg bolus (500 microgr/kg)
infusion	30 mg/min (50-200 mgr/kg/min)
Labetalol	
initial dose	10 mg (within > 2 min)
infusion	20-80 mg IV / 10-15 minutes, 2-20 mg/min
Propranolol	
initial dose	1 mg / 3-5 min (IV), (Max 0.15 mg/kg)
maintenance	2-6 mg/ 4-6 hours (IV)
Metoprolol	2-5 mg / 2-5 min (IV)
Calcium Channel Blockers	
Diltiazem (IV)	
initial dose	20 mg (0.25 mg/kg) IM > 2 min
infusion	5-15 mg/ hour
Verapamil (IV)	
initial dose	5-10 mg in > 2 min
maintenance	5-10 mg/ 30 min (If needed)
Nifedipin	
Initial dose	5-10 mg sublingual
Angiotensin converting enzyme Inhibitors	
Enalapril *	
Initial dose	0.625 mg/ 4-6 hours IV (If needed)

* Not available in Turkey

60/minute, second and third degree A-V block, overt heart failure and bronchospasm, for these drugs. Calcium channel blockers can also be considered.

Medical approach differs significantly if the patient is hypotensive. Measuring blood pressure from all four extremities is the first step to be taken in order not to overlook a pseudo-hypotension situation which is the case when the dissection involves one or more of the major branches in the aortic arch. Prompt replacement of large amounts of volume is essential especially in cases with probable cardiac tamponade or aortic rupture. Vasodepressors can be added if the patients continue to be hypotensive. Levofed and phenylephrine are the preferable vasodepressors in this setting. Hemodynamically stabilized cardiac tamponade should not be punctured since pericardiosynthesis can lead to hemodynamic collapse and death by decompressing the pericardial cavity, leading to exanguination¹³. These patients should be promptly taken into operating room, and the aorta should be repaired while the hemopericardium is surgically drained.

RESULTS

Acute aortic dissection is a very serious condition which requires prompt diagnosis and treatment. Whenever an emergency physician considers aortic dissection as a possibility in a given patient he or she should immediately start medical treatment and order proper diagnostic methods. All type A dissections should be sent for surgery without any delay or transferred to a tertiary center if a cardiothoracic surgeon is not available at that center.

REFERENCE

1. Anagnostopoulos CE, Prabhaker MJS, Kittle CF: aortic dissections and dissecting aneurysms. *Am J Cardiol* 1972;30: 263-273.

2. Doroghazi RM, Slater EE, DeSanctis RW, et al: Long-term survival of patients with treated aortic dissection. *J Am Coll Cardiol* 1984;3:1026-1034.
3. Masuda Y, Morooka N: Prognosis of patients with medically treated aortic dissections. *Circulation* 1991;84(supplIII):III-7-11.
4. Glower DD, Fann JI, Spier RH, et al: Comparison of medical and surgical therapy for uncomplicated descending aortic dissection. *Circulation* 1990;82 (Suppl, IV): IV-39-43.
5. Isselbacher EM, DeSanctis RW: Diseases of the aorta. In Braunwald, ed: *Heart disease: A Textbook of Cardiovascular Medicine*. 4th ed. WB Saunders Company, Philadelphia, 1995. p.1538.
6. Spittell PC, Spittel JA, Joyce JW: Clinical features and differential diagnosis of aortic dissection: Experience with 236 cases, 1980-1990. *Mayo Clin Proc* 1993; 68:642-651.
7. Fann JI, Sarris GE, Mithell RS: Treatment of patients with aortic dissection presenting with peripheral vascular complications. *Ann Surg* 1990;212: 705-713.
8. Glower DD, Speier RH, White WD, et al: Management and long-term outcome of aortic dissections. *Ann Surg* 1991;214:21-41.
9. Greendyke RM: Traumatic rupture of aorta: Special reference to automobile accidents *JAMA* 1966;195:527-530.
10. Shorr RM, Crittenden M, Indeck M: Blunt thoracic trauma: Analysis of 515 patients. *Ann Surg* 1987;206:200-204.
11. Purphrey CW, Fay T, Weir I: Aortic dissection during pregnancy. *Br Heart J* 1986;55:106-119.
12. Williams GM, Gott VL, Brawley RK: Aortic disease associated with pregnancy. *J Vasc Surg* 1988;8:470-473.
13. Isselbacher EM, Cigarroa JE, Eagle KA: Cardiac tamponade in aortic dissections complicating proximal aortic dissection: Is pericardiocentesis harmful. *Circulation* 1994;90:2375-2378.
14. Cigarroa AR: Diagnostic imaging in the evaluation of suspected aortic dissection. *N Engl J Med* 1993;328:1-7.

15. Erbel R, Daniel W, Visser C: Echocardiography in the diagnosis of aortic dissection. *Lancet* 1989;1:457-461.
16. Nienaber CA, Von Kodolitsch Y, Nicolas V: Definitive diagnosis of thoracic aortic dissection: The emerging role of noninvasive imaging modalities. *N Engl J Med* 1993;328:1-9.
17. White RH, Lipton MJ, Higgins CB: Noninvasive evaluation of suspected thoracic aortic disease by contrast enhanced computed tomography. *Am J Cardiol* 1986;57:282-290.
18. Nienaber CA, Spielmann RP, Kodolitsch Y: Diagnosis of thoracic aortic dissection: Magnetic resonance imaging versus transesophageal echocardiography. *Circulation* 1992;85:434-437.
19. Blanchard DG, Kimura BJ, Dittrich HC: Transesophageal echocardiography of the aorta. *JAMA* 1994;272:546-551.
20. Rizzo RJ, Aranki SF, Aklog L: Rapid noninvasive diagnosis and surgical repair of acute ascending aortic dissection. *J Thorac Cardiovasc Surg* 1994;108:567-574.
21. Bernard J, Gros MD: Aortic Dissection: Acute diagnosis and management. *Cardiol Rev* 1996;4:2,112-118.