Aortic Dissection: Causes, Investigations, and Treatment

Abstract

Background: Recently, new concepts have been developed for the diagnosis, classification, and treatment of aortic dissection. The purpose of this article is to explain the current state of knowledge on this topic and discuss related topics. New data on the etiology of aortic dissection focus on excision surgery, biomarkers, and 4D magnetic resonance imaging. A new stage of aortic division (TEM, STS / SVS) has been proposed. Finally, the latest advances in treatment options for aortic dissection were presented. For example, the frozen elephant trunk, intravascular correction of the thorax, and the concept of Endo-Bentall as a discovery of future options.

Conclusion: The International Registry of Acute Aortic Dissection confirms that patient selection plays an important role in determining the outcome of surgery in patients with severe aortic dissection. Knowledge of the important risk factors for active mortality may contribute to better management and more detailed risk assessment of patients with severe aortic dissection.

Keywords*: Aortic dissection; Aortic endograft; Classification system; Dissection type.*

Introduction

Although rare, acute aortic dissection (AAD) is a rare but devastating problem. Aortic bifurcation is caused by the separation of the layers of the aortic wall. The rupture of the inner lining leads to further disruption between the intima and the blood entering the media. Dangerous aortic dissection is associated with high mortality. Most die before reaching the emergency department. Diagnosis is slightly better in patients with chronic aortic dissection (more than two weeks). According to patients who complained of sudden severe 'broken' chest pain, his presentation can often be subtle. Doctors doubt the diagnosis in 15% to 43% of confirmed AAD cases. If left untreated, the mortality rate in the first 48 hours is close to 50%. Despite the wealth of literature, a large number of aortic dissections are missing in the emergency department. There are two main body types used to differentiate aortic dissection (1).

The Stanford system is widely used. He classifies the divisions into two types, depending on whether the ascending or descending part of the aorta is involved. Type A is associated with the ascending aorta, independent of intimal lacerations. Type A dissection is defined as a dissection near the brachiocephalic artery. Dissection of Type B aorta which extends to the leftmost artery of the subclavian artery and contains only the descending aorta. Type 1 originates from the ascending aorta and is limited to the arch of the aorta. Type 2 is internal and is confined to the ascending aorta. Type 3 begins in the descending aorta and extends far beyond the diaphragm (type 3a) or below the diaphragm (type 3b). The increase in aortic dissection is almost doubled by the descending division (figure 1) (1).

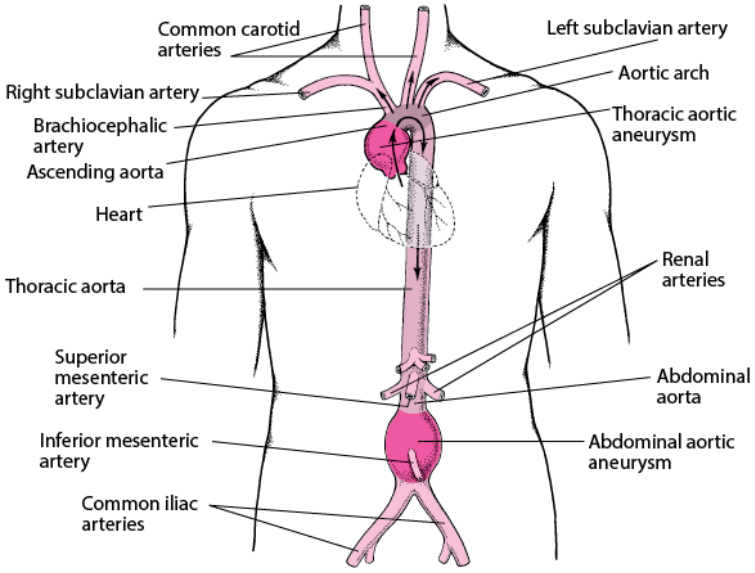

Figure 1 Overview of Aortic Dissection (1)

Causes of Aortic Dissection

Factors that contribute to an increased risk of non-invasive aortic dissection include hypertension. Sudden, temporary, and severe increases in blood pressure (eg, strenuous weight lifting and use of sympathetic agents such as cocaine, ecstasy, or energy drinks). Marfan syndrome, Ehlers-Danlos syndrome, Turner syndrome, bicuspid aortic valve, inherited conditions including aortic aneurysm. In patients with Marfan syndrome, cystic medial degeneration occurs in the muscle. Pre-existing aortic aneurysm. Atherosclerosis Pregnancy and childbirth (additional risk in pregnant women with tissue-related problems, such as Marfan syndrome). Family history. Aortic surgery (coronary artery bypass, aortic or mitral valve replacement, and placement of a percutaneous catheter or stent). Inflammatory or infectious diseases that cause vasculitis (syphilis, cocaine use) (figure 2) (2).

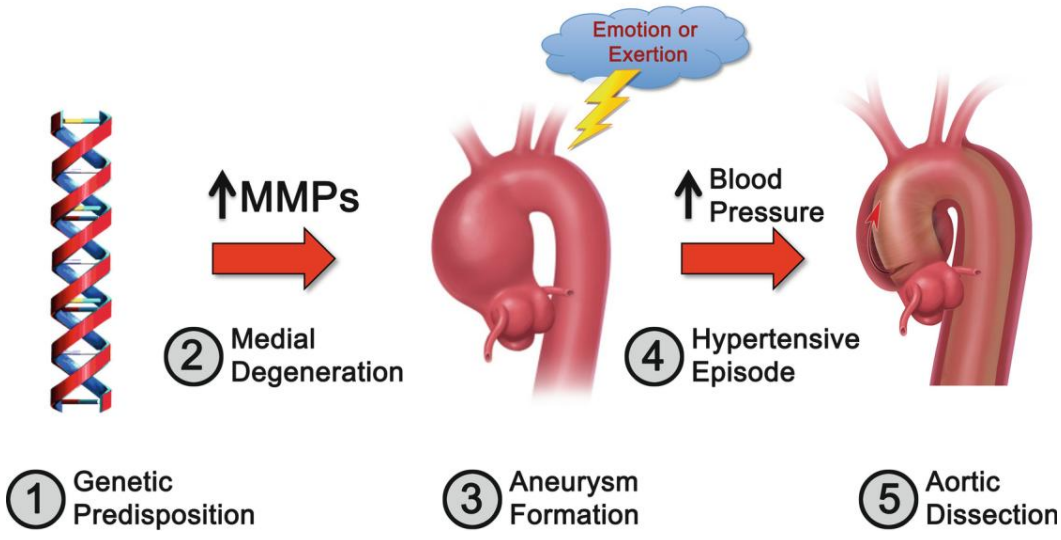

Figure 2 Causes of Aortic Dissection (2)

Symptoms

Symptoms of aortic dissection vary. Many patients complain of sudden onset of severe pain in the chest, back, or abdomen. Some people experience shortness of breath, pain in the arms and legs, weakness, and loss of consciousness (fainting). The separation affects the arteries that supply the heart and can lead to a heart attack. Patients can have a stroke if the dissection interferes with the blood supply to the brain. Because aortic dissection can mimic many other conditions, clinicians should include aortic dissection in the list of possible diagnoses so as not to overlook patients who complain of chest pain (3).

Mechanism of Aortic Dissection

The wall of the aorta consists of three layers: the intima, media, and adventitia. Repeated exposure to high shear pressure ruptures the wall of the aorta, resulting in intense pain. After this set, blood flows into the intima-media space, forming a false lumen. Most of these ruptures occur in the ascending aorta, usually at the right wall, where there is a greater shear force in the aorta. Aortic Aneurism can spread anterograde and/or reversibly, and depending on the course of the dissection, cause branch obstruction that causes ischemia of the affected area (coronary, cerebral, dorsal, or visceral), and Type A aortic dissection can be dangerous in the vicinity and can lead to recurrence or rupture of the aorta. In AAD, the true lumen is intact and the false lumen is inside the host. In most cases, the true lumen is less than the false one. Over time, blood flow through the false lumen leads to the development of a severely ruptured aneurysm. The three most common AAD sites are approximately 2-2.5 cm above the aortic root (the most common area). Immediately distal at the base of the left subclavian artery. in the aortic arch (Figure 3)(4).

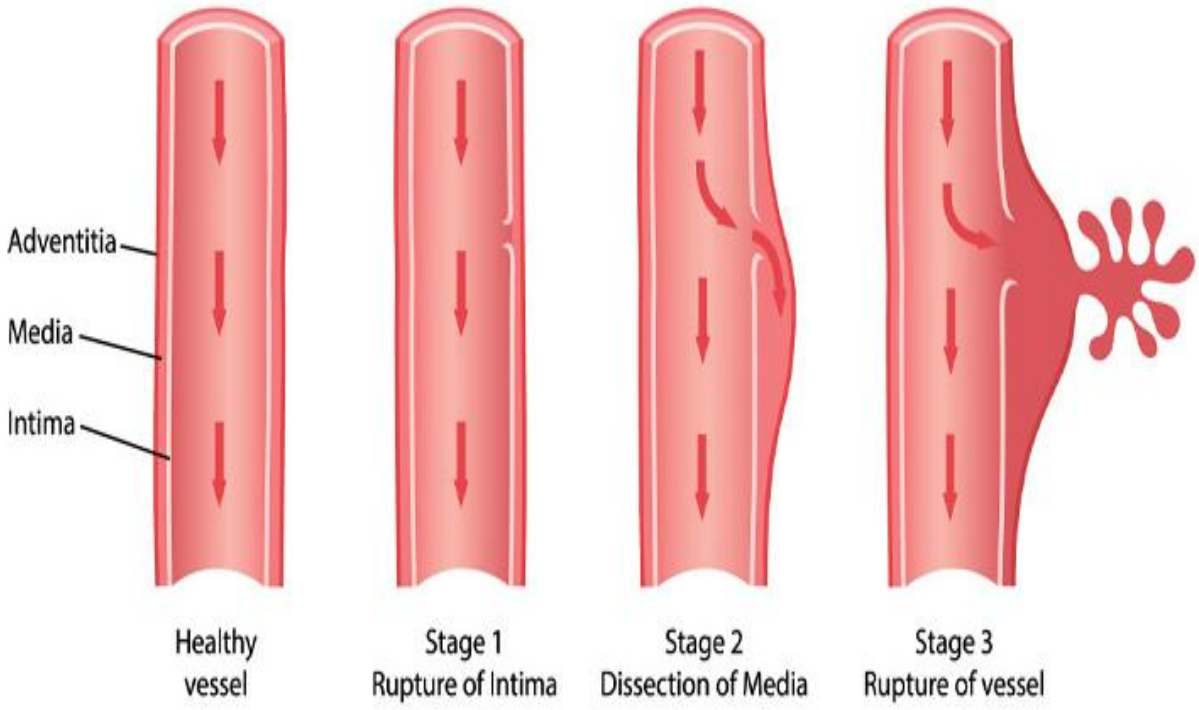

Figure 3 Stages of Aortic Dissection (4)

Classification

In DeBakey's category of aortic dissection: Type I includes the ascending aorta, arch, and descending thoracic aorta and can develop to involve the abdominal aorta. Type II is trapped in the ascending aorta. Type III involves narrowing of the thoracic aorta distal to the left subclavian artery and adjacent to the celiac artery. Class IIIb classification includes the thoracic part of the left subclavian artery and the distal abdomen of the aorta. In the Stanford stage of aortic bifurcation: Type A involves the ascending aorta and can involve the arch and thoracoabdominal aorta. Type B involves narrowing of the distal thoracic or thoracoabdominal aorta in the left subclavian artery without compromising the ascending aorta (figure 4) (5).

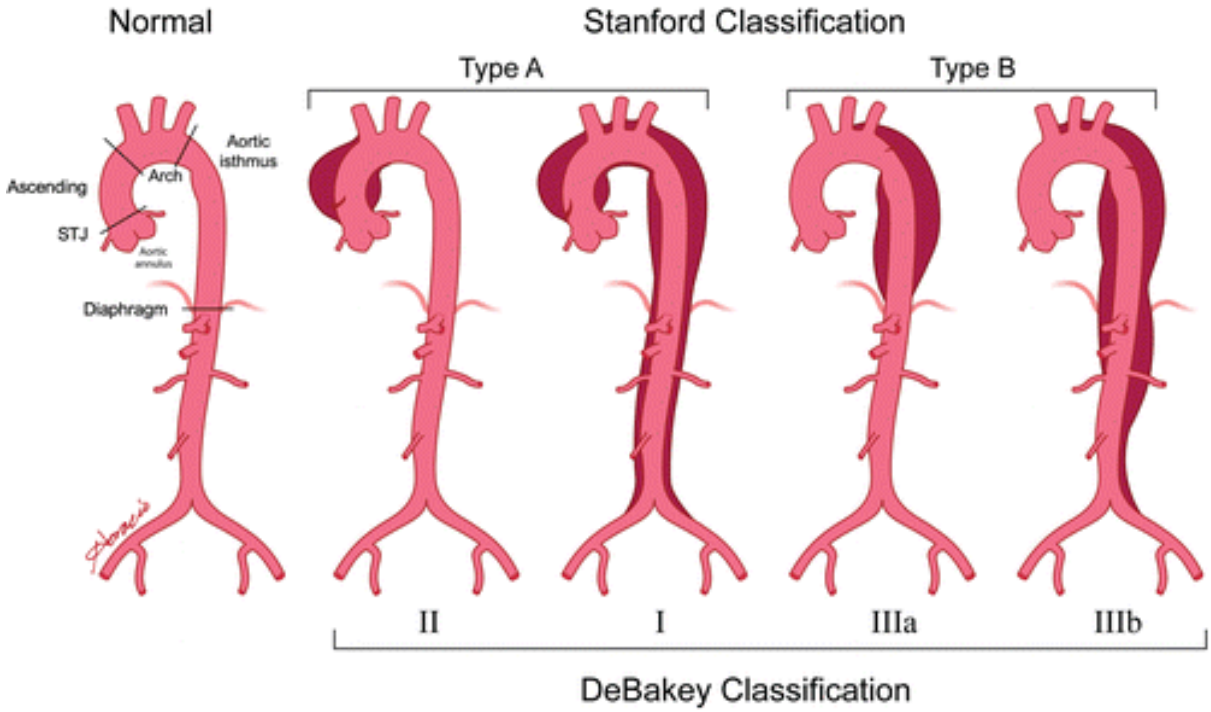

Figure 4 Classification of Aortic Dissection (5)

Investigations

Factors such as heartburn, which indicates an aortic valve leak, and abnormal pulse rates can cause the doctor to suspect a disconnect. An electrocardiogram (ECG) can indicate physical complications, including heart disease. A chest X-ray may show an enlarged aorta. However, an ECG and chest radiograph can be completely normal for aortic dissection, and aortic dissection cannot be diagnosed or ruled out (6).

Common tests used to diagnose aortic dissection and its complications include computed tomography (CT), transesophageal echocardiography, and magnetic resonance imaging (MRI). All three tests are very accurate in diagnosing aortic dissection. Specific diagnostic tests are usually based on the availability and training of a certain hospital and the characteristics of each patient. CT scans should use intravenous dyes to reveal lesions in the real and false lumens and branches of the aorta. Transesophageal echocardiography can be

performed near the patient's bedside and requires an ultrasound probe to be placed in the patient's throat to align the heart with the aorta. Although the diagnosis of aortic dissection is more accurate, MRI scans take longer than other tests and are generally not the first choice. Note that aortic dissection can be detected by transthoracic echocardiography, an ultrasound of the chest wall. Some patients may need several tests to confirm the isolation of the aorta and its complications. Currently, there are no blood tests available for acute aortic dissection (figure 5) (7).

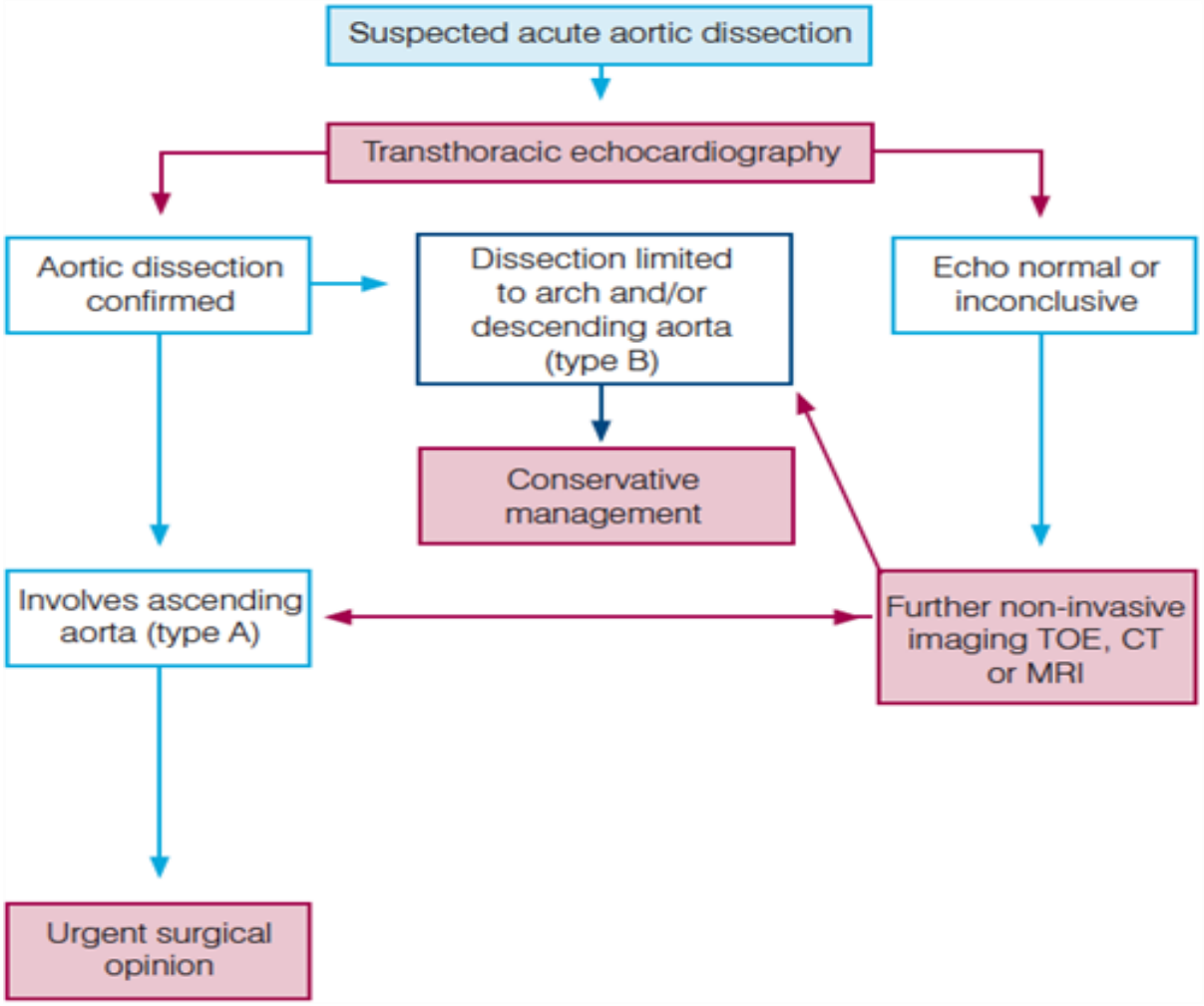

Figure 5 Aortic Dissection Investigations (7)

Radiological Evaluation of Aortic Dissection

Plain radiograph

Chest X-rays may be normal or show some recommended results, such as mediastinum dilatation more than anterior-posterior chest radiograph diameter by about 8.0-8.8 cm above the surface of the aortic knob. However, the upper limit of this normal intensity depends on X-ray, abnormal aortic contour, internal transfer of atherosclerotic calcification (1 cm from the end of the aorta), etiology. Symptoms of hematoma may include: unclear aortic knob, mediastinal deviation, left and/or right paratracheal line extension, apical capping, especially left (figure 6) (8).

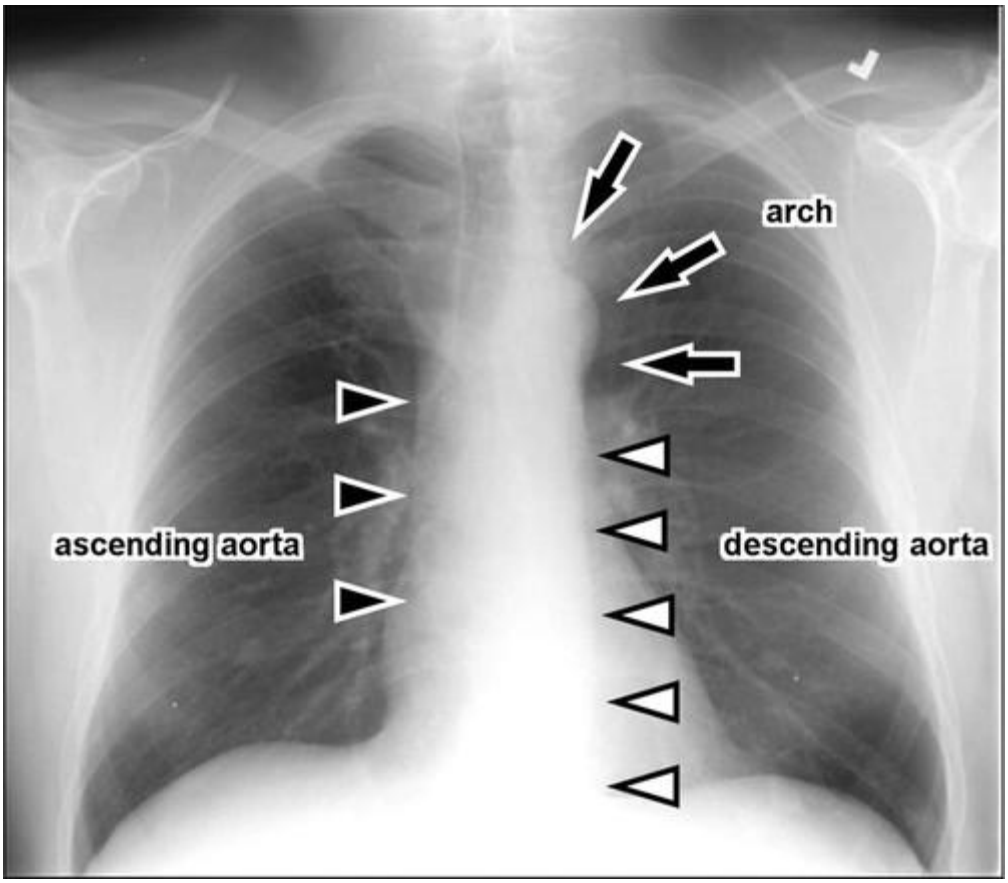

Figure 6 Plain radiograph of Aortic Dissection (8)

CT

CT is a particularly preferred study that not only detects and differentiates anatomical structures but also detects distant disorders. Approximately 100% sensitivity and specificity have been reported. CT alone may reveal subtle results. However, high-density wall hematomas are common. Calcification of the lumen's atherosclerosis is also frequent. Ablation associated with aortic origin should be carefully assessed using ECG Gate CTA. This eliminates most flutter artifacts. Pulsating artifacts can mimic fragmentation and are more common and occur in 92% of non-portable CTA subjects. Advanced CT (preferably CTA) provides excellent information. The findings include intimal flaps, double-lumen representing true and false lumen, potentially differentiated intra-aortic hematoma that characterizes the problem of aortic enlargement and aortic dissection due to aortic dysfunction (10).

Identifying the true lumen is the most important part of the aortic dissection test, as placing the endoluminal stent in the false lumen can have negative effects. The difference between the two is usually straight, but in some cases, not a single lumen. In such cases, several features are useful: real lumens which are often narrower than the false lumen of the upper and lower layers, consist of the outer wall are connected to SMA and right renal artery stenosis which are usually true, false positives, usually due to tear-shaped false positives, at least included in the CTA X-ray report. Degree of separation, location of internal tears, other related types of

AAS, size of the aorta (largest orthogonal measurement), supply of wound and aortic branches (from true or false lumens), presence of thrombosis in false lemons, and symptoms of limb ischemia (figure 7) (11).

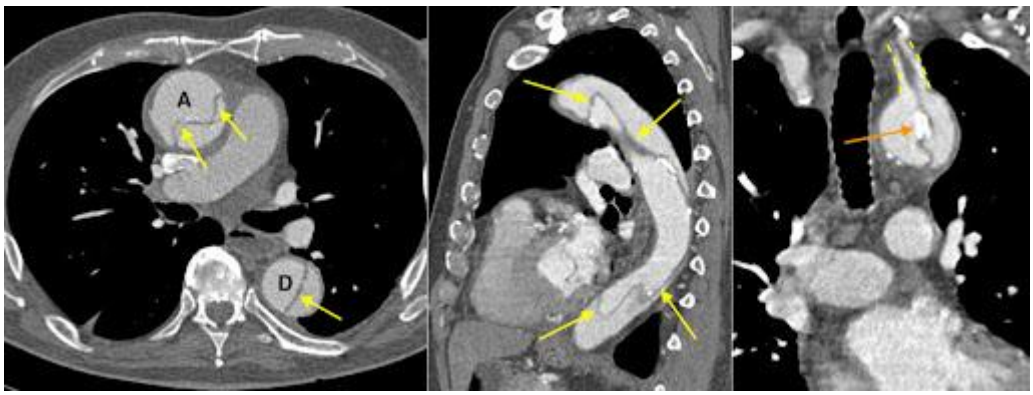

Figure 7 CT of Aortic Dissection (11)

Transesophageal Echocardiography

Transesophageal echocardiography has greater clarity to aortic dissection testing, However due to limited access, it is often substituted by CTA (or in some cases MRA) (figure 8) (12).

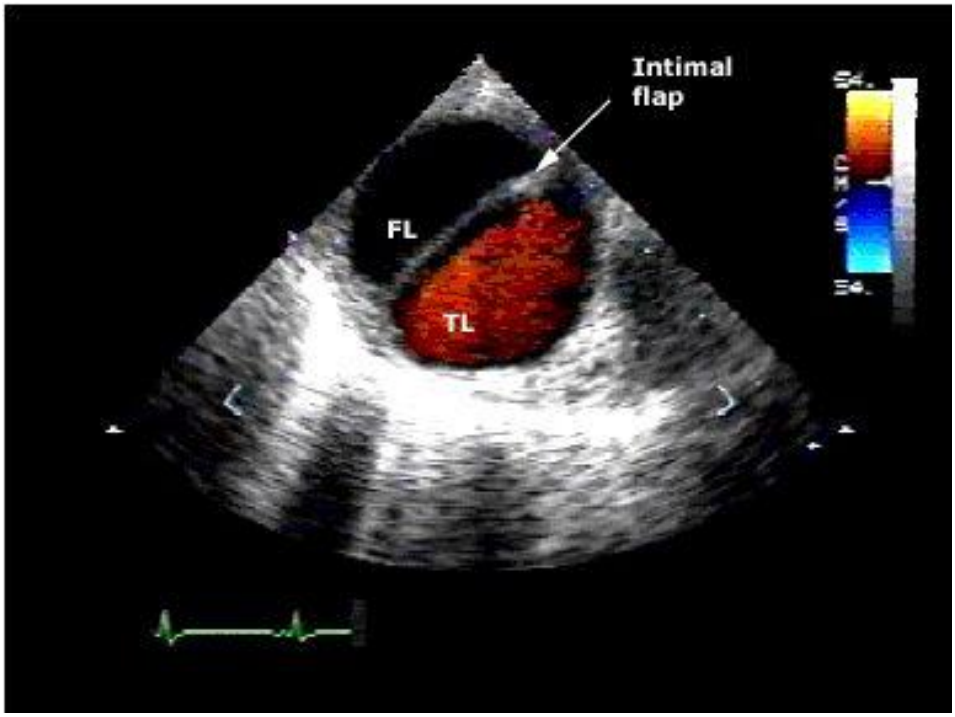

Figure 8 Transesophageal Echocardiography of Aortic Dissection (12)

MRI

Although MRI is generally reserved for non-invasive rapid imaging techniques (eg, true FISP), it can be considered to have an important role in the critical diagnosis of MRI. It has similar specificity and sensitivity to CTA and TOE but has limited availability and difficulty in performing MRI in patients with pain (Figure 9) (13).

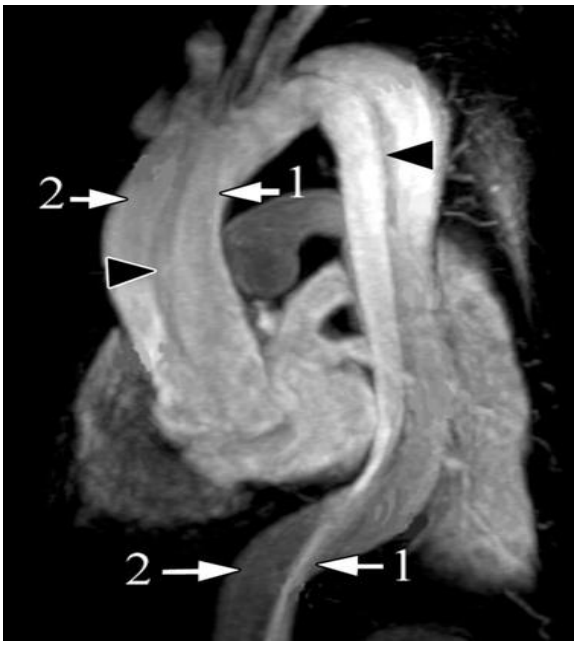

Figure 9 MR Angiography of Aortic Dissection (13)

DSA - angiography

Angiography is required for endometrial repair. Risks of angiography include the usual risks of angiography, and the risk of false ligament insertion and aortic rupture (figure 10) (14).

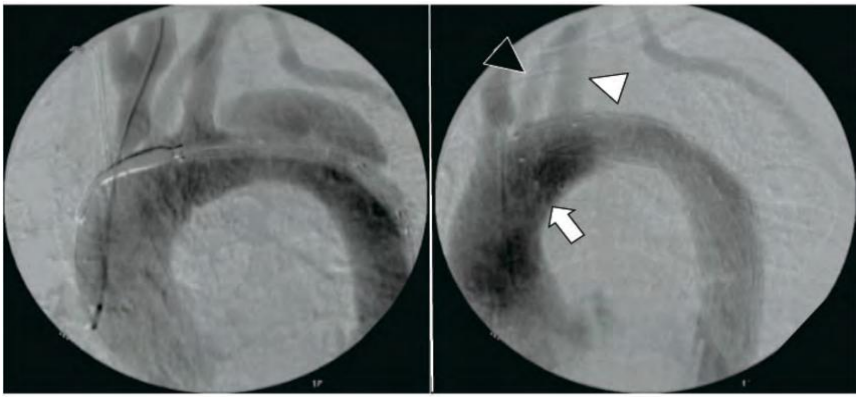

Figure 10 Digital subtraction angiography (14)

Prevention

Patients can reduce their risk of coronary artery disease by taking steps to prevent chest injuries and keep them heart-healthy. Check your blood pressure. If the patient's blood pressure is high, get a home sphygmomanometer to monitor the blood pressure. Patients should take steps to quit smoking if they smoke and maintain proper weight. Eat a low-salt diet with plenty of fruits, vegetables, and whole grains, and exercise regularly. Please wear a seat belt. This reduces the risk of chest injury from a car accident. The patient should tell the doctor if he has a family history of aortic dissection, connective tissue, or bicuspid aortic valve. If the patient has an aortic aneurysm, find out how often it is monitored and whether surgery is needed to repair the aneurysm. If the patient has a genetic predisposition at high

risk of aortic dissection, the doctor may prescribe medication, even if your blood pressure is normal (16).

Treatment in General

When a patient is diagnosed with aortic dissection, the goal is to treat any problems. Blood pressure is as low as possible. Surgery will be considered and any issues will be resolved. Beta-blockers, which control blood pressure (drugs that lower heart rate and blood pressure), are usually prescribed as the first medication to lower blood pressure. When beta-blockers are not used, calcium channel blockers such as diltiazem or verapamil are often used. Because pain raises a patient's blood pressure, painkillers such as morphine are often needed. If these drugs do not control blood pressure, other drugs are usually needed, such as angiotensin-converting enzymes or angiotensin receptor inhibitors and/or drugs for intravenous hypertension (Figure 11) (17).

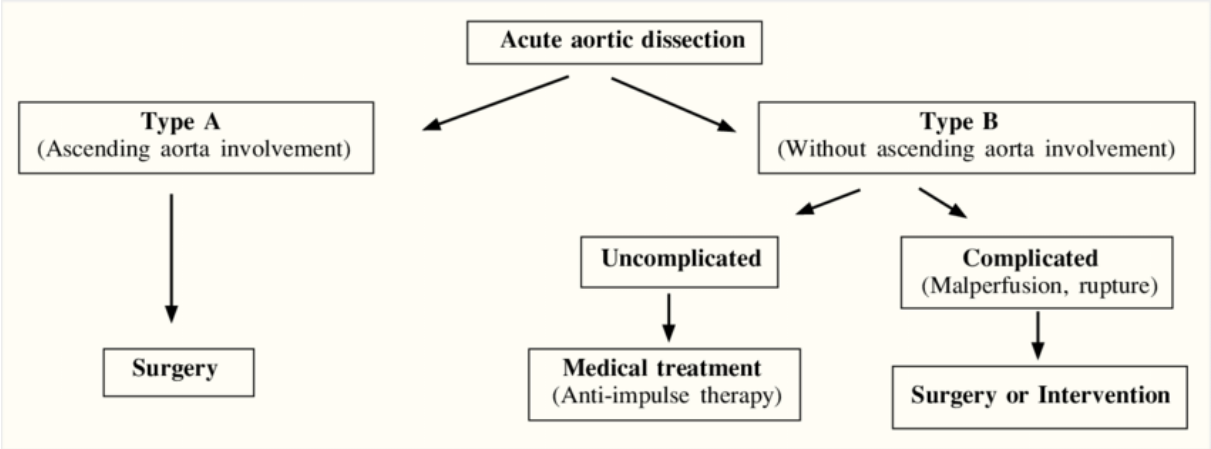

Figure 11 Algorism for Intervention in Case of Aortic Dissection (17)

Surgical Treatment

All patients with aortic dissection should be diagnosed by a cardiothoracic surgeon. Ascending aorta (type A dissection) is indicated for immediate surgery. If the dissection only affects the lower aorta (type B), treatment is needed and surgery is not generally recommended. However, if the dissection proceeds rapidly, there is a risk of inadequate blood flow (improper perfusion) due to rupture of the aorta and vital organs. Radiologists or surgeons may use catheter-based procedures to correct vital arterial organ destruction or emergency aortic surgery (19).

Emergency surgery to repair a dislocated aorta is very invasive and difficult. This usually requires a Dacron graft (an artificial material) that occupies part of the aorta to stop the flow of blood into the false lumen. On average, the risk of dying from severe aortic dissection is about 20%. The risk is very high in some patients with serious complications. Other options, such as endovascular stenting, are currently being evaluated as options for some patients with type B dissection. This procedure repairs the aorta by inserting a stent from the lower limb artery into the aorta. Research is underway to explore this approach (Figure 12) (20).

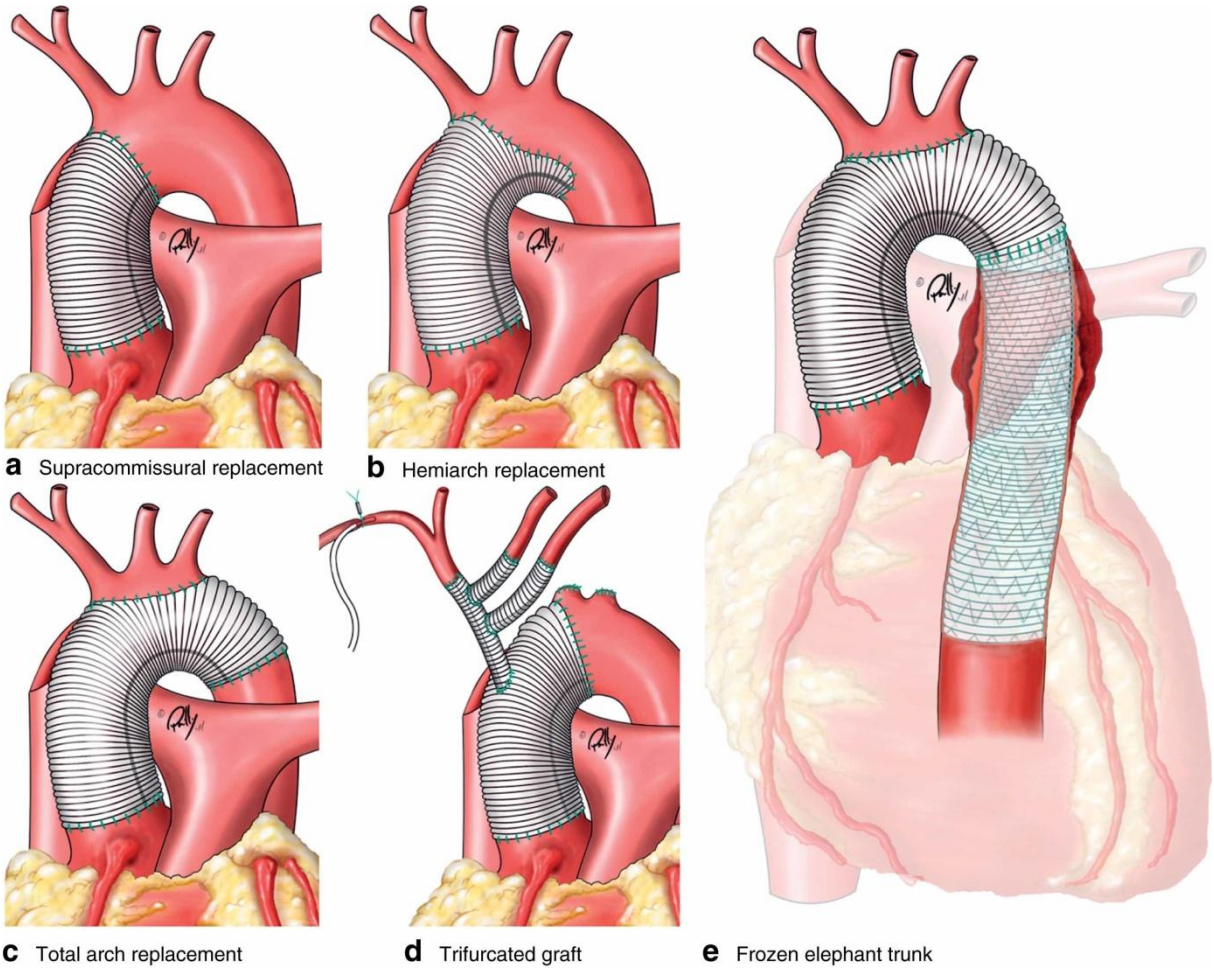

Figure 12 Surgical Interventions in Case of Aortic Dissection (20)

Treating Complications

Some arteries may be affected by the discussion. If the coronary arteries are at risk, they may need to be repaired during surgery (which may require coronary artery bypass). The aortic valve, a one-way valve that allows blood to flow from the heart to the aorta, may need to be repaired or replaced with an artificial valve if the isolation causes severe leakage of the valve. After surgery, patients often stay in the intensive care unit for close monitoring. It usually takes 7 to 10 days to recover from surgery. Before discharging the patient, another CT or MRI is usually performed as a preliminary examination, confirming that there has been no progress in dissection (21).

Results

The death toll at the hospital was 25.1%. Group I mortality was 31.4% compared to 16.7% in group II (P <.001). Independent predictors of preoperative mortality surgery were a history of aortic valve replacement (average imbalance = 3.12), migratory chest pain (average = 2.77), hypotension as a symptom of severe aortic dissection (aortic ratio = 1.95), shock or tamponade (complications average = 2.69), preoperative heart tamponade (incontinence = 2.22), and preoperative ischemia (odd ratio = 2.10) (22).

Discussion

Aortic dissection is uncommon but usually manifests itself as a severe illness with severe chest or back pain and severe hemodynamic congestion. Early diagnosis and treatment are essential for survival. Aortic dissection may be associated with cardiac tamponade, and aortic dissection results in acute aortic reflux and coronary occlusion. Closure of abdominal aortic blood vessels. The International Registry of Acute Aortic Dissection (IRAD) is a site that predicts and approves tests for medical models, providing current observations from patient groups around the world. Mortality associated with aortic dissection was high, historically up to 30 percent. However, advances in cardiac surgery have reduced the expected mortality associated with type A dissection by approximately 20% (23).

Conclusion

Several studies show that the best way to manage patient outcomes is to bring in a team of healthcare professionals, consisting of a cardiologist, general practitioner, pulmonologist, nephrologist, cardiologist, radiologist, and an anesthesiologist. In addition, the pharmacist should educate the patient on the importance of blood pressure control and medication adherence.

Conflict of Interest

There is nothing to disclose

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