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Aortic Dissection

Section 1: Introduction

The aorta is the largest artery in the body and has the vital role of carrying blood from the heart to the rest of the body (White et al., 2023). When aortic dissection occurs, the aorta is no longer able to accomplish this task, and, left untreated, the condition quickly becomes fatal (Cleveland Clinic, 2024). It is difficult to accurately estimate the prevalence of aortic dissection because it is associated with an extremely high mortality rate and is often only diagnosed during autopsy, if an autopsy is performed (Sayed et al., 2021). However, the incidence of aortic dissection is estimated at 3-4 cases per 100,000 persons per year (Alhalaseh et al., 2023).

While aortic dissection may not be common, when it does occur, time is of the essence. If aortic dissection is not quickly identified and treated, the mortality rate worsens by the hour and is as high as 50% in 48 hours (Yin et al., 2022). Since survival following aortic dissection often depends on early interventions, nurses must understand the aorta's role in circulation and recognize the signs and symptoms, including atypical symptoms, of aortic dissection. In addition, nurses must recognize clinical deterioration in these patients and respond appropriately. When nurses promptly identify the signs and symptoms of aortic dissection, the healthcare team can act quickly, patients receive appropriate care, and outcomes improve.

Section 2: Basic Anatomy and Function of the Aorta

The aorta, which develops in the third week of gestation, is a vital part of human anatomy. Once oxygen-rich blood has arrived in the left atrium from the lungs, it flows into the left ventricle. The contraction of the ventricle ejects the blood through the tricuspid aortic valve and into the aorta (White et al., 2023). This

juncture, known as the aortic root, is the widest part of the aorta (Cleveland Clinic, 2022). The coronary arteries are the first branches off the aorta at the cusp of the aortic valve. The coronary arteries supply blood to the heart muscle (White et al., 2023). There is an anatomical transition from the aortic root as the vessel transitions to the ascending aorta. This is called the sinotubular junction (Bhat et al.). From here, blood rich in oxygen, nutrients, hormones, and other vital elements is transported through the aorta to the rest of the body (White et al., 2023).

Understanding the normal anatomy of the aorta can help healthcare workers understand how aortic dissection affects the body. Altogether, the aorta is shaped like a cane and is more than 12 inches long. Since the aorta is so long, different terminology is used to identify the various sections of the vessel. The widest point of the aorta is approximately one inch in diameter, and the vessel narrows as it descends (Cleveland Clinic, 2022). The aorta extends superiorly from the aortic valve approximately 5 cm to the level of the T4 vertebrae. This portion of the aorta is known as the ascending aorta. From the ascending aorta, the vessel curves posteriorly to the left. This directs it over the root of the left lung and anterior to the trachea. There is a transverse cross-section at the T4 vertebrae and second sternocostal articulation known as the Plane of Ludwig. This is often where the superior aspect of the aortic arch is located. From the aortic arch, three large vessels branch off. These are the brachiocephalic, left common carotid, and left subclavian arteries (White et al., 2023). The brachiocephalic artery branches into the right subclavian artery, which supplies blood to the right arm, and the right carotid artery, which supplies blood to the brain and the right side of the head and neck. The left common carotid artery supplies blood circulation to the brain and the left side of the head and neck. The left subclavian artery supplies blood to the left arm and the posterior portion of the brain (Cleveland Clinic, 2022). Following these large vessel branches, the aorta then continues to curve inferiorly and

posteriorly towards the spine as it transitions to the descending aorta (White et al., 2023).

The descending aorta includes the thoracic and abdominal aorta. The thoracic aorta is the portion that is contained in the posterior mediastinal cavity and located just to the left of the spine. It continues downward through the thorax and crosses the diaphragm at the level of the T12 vertebra. This point, known as the aortic hiatus, marks the transition of the vessel from the thoracic aorta to the abdominal aorta. There are several branches from the thoracic aorta that supply vital organs, such as the esophagus, heart, and lungs (White et al., 2023). The abdominal aorta also has several branches, including five main branches: the celiac trunk, the superior mesenteric artery, the left and right renal arteries, and the inferior mesenteric artery. These critical branches continue to branch further and ultimately supply oxygen to structures such as the intestines, kidneys, liver, and colon (White et al., 2023).

The walls of the aorta are composed of three layers: the tunica intima, the tunica media, and the tunica adventitia. The tunica intima is a thin inner layer composed of smooth muscle tissue, connective tissue, and endothelial cells. This specialized layer of tissue can transport blood without absorbing the oxygen and nutrients it carries. The tunica media is the middle elastic layer composed of smooth muscle, elastin, and collagen. This allows the vessel to dilate and constrict as needed to accommodate blood flow. The tunica adventitia is the outer fibrous layer that connects to nearby nerves and tissues, anchoring the aorta in place (Cleveland Clinic, 2022).

Section 2 Personal Reflection

Why do you think the aorta develops so early in fetal gestation? What are the advantages of the first branches of the aorta supplying blood to the heart muscle

and then the areas of the brain before the rest of the body? How do the different walls of the aorta contribute to the necessary function of the vessel?

Section 3: What is Aortic Dissection?

Aortic dissection is considered a cardiovascular emergency. It occurs when the tunica media of the aorta degenerates, allowing blood to infiltrate the vessel's layers and progressively dissect or separate them (Sayed et al., 2021). When a tear occurs in the intima layer of the aortic wall, bleeding within and along the aortic wall occurs. This causes the layers of the aortic wall to separate, forming two or more channels within the vessel that are perfused (Carrel et al., 2023). These channels are usually referred to as the true lumen and false lumen. The true lumen is the original channel of blood flow through the vessel, while the false lumen is the channel created by the aortic dissection (Levy et al., 2024).

There are two main classification systems to describe aortic dissections. The DeBakey system classifies the aortic dissection based on the origin site of the tear in the tunica intima. The Stanford classification system categorizes the aortic dissection based on the involvement of the ascending aorta. The DeBakey classification is considered more precise, while the Stanford system is more useful in the triage setting (Sayed et al., 2021).

The DeBakey classification system divides cases of aortic dissection into three classes: types I, II, and III. A DeBakey type I aortic dissection is defined as one where the lesion in the tunica intima is located in the ascending aorta and progresses towards the aortic arch and descending aorta. A type II dissection occurs when only the ascending aorta is involved. A type III aortic dissection originates in the descending aorta and progresses distally (Sayed et al., 2021).

The Stanford classification system has two main groups, type A and type B. A Stanford type A dissection involves any part of the ascending aorta. This would include both DeBakey types I and II aortic dissections. Stanford type B includes dissections that only involve the descending aorta. The Stanford classification is often used in emergency healthcare settings because it can quickly guide interventions (Sayed et al., 2021).

Rarely, an aortic dissection can occur that does not fit into one of the main classification systems. It may involve a portion of the aortic arch and descending aorta, but does not include the ascending aorta. This rare type of aortic dissection may be classified as “non-A non-B”. The TEM (Type, Entry tear location, Malperfusion) classification system was recently introduced to categorize aortic dissections clinically, based on areas of compromised perfusion. This classification system is still being studied to determine its usefulness for decision-making in the treatment of aortic aneurysms and dissections (Sayed et al., 2021).

Another way to classify aortic dissection is by the timing of symptom onset. Categories include acute, sub-acute, and chronic, though the time frames for each category are not clearly defined. Some research defines acute aortic dissection as diagnosed within 2 weeks of symptom onset, and a diagnosis more than 2 weeks after symptom onset is considered chronic. Another classification system that considers survival rates based on symptom onset defines a hyper-acute period of less than 24 hours since symptom onset, an acute period of 2 days to one week, a sub-acute period of 8 days to 1 month, and a chronic aortic dissection described as a symptom onset of greater than 1 month prior to diagnosis (Sayed et al., 2021).

The cause of aortic dissection is almost always attributed to the degeneration of the tunica media. This layer of the aortic vessel wall is composed of smooth muscle cells, elastic fibers, collagen fibers, and an extracellular matrix. When an

individual experiences chronic hypertension, there can be pathological changes in the structure of this delicate tissue due to decreased perfusion to the outer vessel wall, the tunica adventitia. An individual may also have a genetic predisposition to alterations in this tissue. Mucoid accumulation can occur in the extracellular matrix, increasing the spaces between layers of the vessel wall. This leads to cystic degeneration of the tunica media and a decrease in vessel resistance. Alterations in the elastic fibers that help maintain the aorta's structural integrity can lead to fragmentation, thinning, and disorganization. This weakens the structure of the aorta, decreases its strength and elasticity, and makes the vessel wall of the aorta vulnerable to the high shear forces of blood as it flows through the vessel. When there is increased spacing between elastic fibers of the tunica media, the aorta becomes more susceptible to dilation, aneurysm formation, and dissection. Disorganization occurs when the normal parallel arrangement of elastic fibers is lost, which affects the aorta's ability to withstand pressure, decreases the functional ability of the vessel, compromises structural integrity, and increases the risk for tears in the vessel wall. The smooth muscle cells can become damaged, and the laminar medial, the architecture of the fibers, can collapse. Collagen fibrosis is a rare contributor to degenerative aortic disease, but it can occur when aortic collagen fibers become fibrotic, similar to scar tissue. Together, these changes are known as cystic medial degeneration (Levy et al., 2024).

When an aortic dissection occurs, a septum, or wall, forms within the vessel separating the two spaces. The septum separating the false and true lumen of an aortic dissection is sometimes referred to as a flap (Privitera et al., 2022). On CT imaging, this flap is often visualized and is sometimes referred to as the "tennis ball sign," as the aorta appears similar to a tennis ball on the CT image (Flower et al., 2023).

Section 3 Personal Reflection

What happens during an aortic dissection? What are the two main types of classification systems used for aortic dissections? What are the advantages of the different systems? How is an aortic dissection classified if it is not considered a type A or type B dissection? How do changes in the aortic vessel wall lead to an aortic dissection?

Section 4: Risk Factors

Several risk factors can increase an individual's likelihood of experiencing aortic dissection. Uncontrolled hypertension is the most common risk factor (El Hussein & Green, 2022), accounting for the majority of cases of aortic dissection. It is estimated that hypertension increases the risk by more than 2.5 times compared to those without hypertension (Sayed et al., 2021). Risk factors also include male sex, age greater than 65 years, smoking, aneurysm, congenital heart disorders, genetic conditions, inflammatory disorders, and pregnancy (El Hussein & Green, 2022).

It is estimated that 70% of patients with a distal Stanford type B aortic dissection have co-occurring hypertension. An abrupt, severe increase in blood pressure can also increase the risk of aortic dissection. This severe change in blood pressure can occur due to strenuous weight lifting or the use of certain substances, such as cocaine, ecstasy, or energy drinks (Levy et al., 2024). However, an aortic dissection can occur at any time, including periods of rest. They most commonly occur after an abrupt increase in blood pressure from heavy exertion (Cleveland Clinic, 2024).

A person’s sex affects their risk of aortic dissection and can affect their likelihood of experiencing a positive outcome. Men are three times more likely than women to experience aortic dissection; however, women are more likely to experience a

delayed diagnosis and adverse outcomes (Levy et al., 2024). Women are also more likely to experience atypical symptoms when an aortic dissection occurs (Sayed et al., 2021).

Aortic dissection typically occurs in individuals aged 40 to 70 years, with a peak incidence between 50 and 65 years. It is estimated that 75% of aortic dissections occur in this population (Levy et al., 2024). The mean age of the occurrence of aortic dissection is 63 years (Alhalaseh et al., 2023). In older adults who experience aortic dissection, there is a higher likelihood of co-occurrence of hypertension, atherosclerosis, prior aortic aneurysm, or iatrogenic dissection, which is a tear in the vessel wall as a complication of a surgical procedure or device placement. Those who experience aortic dissection prior to age 40 are more likely to have a connective tissue disorder (Levy et al., 2024).

Ethnicity can affect the risk of aortic dissection. Black patients tend to experience type B thoracic aortic dissections more frequently. They also experience aortic dissection at a younger age. This may be due to the increased likelihood of hypertension in this population (Carrel et al., 2023).

Low socioeconomic status can increase the risk of aortic dissection and affect outcomes. This occurs because those with limited financial resources are more likely to present to a healthcare facility with an acute aortic dissection rather than with a stable aneurysm. Access to routine and prophylactic medical care, including imaging, may be limited. There may also be less knowledge of risk factor management and a higher likelihood of occupations with greater physical and emotional stress among those with lower socioeconomic status (Carrel et al., 2023).

Smoking is a major modifiable risk factor for many cardiovascular diseases, including aortic dissection (Khan et al., 2025). It is estimated that smoking more than doubles the risk of experiencing an aortic aneurysm, which increases the risk

for aortic dissection (Sayed et al., 2021). This is due to multiple factors, including the effects of smoking on circulation, which decreases perfusion to the aortic wall, and tobacco use contributes to the degradation of elastin and collagen. Research has found that the number of cigarettes smoked per day has a positive correlation with risk for aortic dissection. The duration of smoking also increases the risk of aortic dissection. Notably, tobacco use increases the risk of hypertension, which is the leading risk factor for aortic dissection. When an individual quits smoking, their risk of aortic dissection decreases as the years since quitting increase. Former smokers who have not used tobacco in ten years or more had a comparable risk to those who have never smoked (Khan et al., 2025).

The presence of an aortic aneurysm, a bulge in the aorta due to a weak area in the vessel wall, increases the risk of aortic dissection (Mayo Clinic Staff, 2025). Aortic aneurysms are associated with advanced age, atherosclerotic disease, and smoking. Genetic factors also contribute to the development of an aortic aneurysm. Thoracic aortic aneurysms have an increased risk of dissection compared to abdominal aortic aneurysms (Kano & Sun, 2023).

Congenital heart defects increase the risk of aortic dissection. Coarctation of the aorta is a congenital narrowing of the aorta that restricts circulation to the lower body and causes hypertension in the upper body. Left untreated, this condition is associated with a mean age of 34 years at the time of death and significantly increases the risk for aortic dissection and other cardiac events (Kano & Sun, 2023). Individuals with a bicuspid aortic valve are also at increased risk for experiencing aortic dissection (Sayed et al., 2021). A bicuspid aortic valve is a congenital condition in which fetal cardiac development results in an aortic valve with two flaps instead of three. This can lead to health conditions, including aortic valve stenosis, aortic valve regurgitation, and an enlarged aorta, all of which increase the risk for aortic dissection (Mayo Clinic Staff, 2024). Those with a

bicuspid aortic valve have an 8-fold increased risk of aortic dissection and tend to have larger dissections when they occur (Sayed et al., 2021).

The anatomy of an individual's aorta and the flow of blood through their aorta may increase their risk for aortic dissection. Those with a greater vertical distance from the origin of the artery to the top of the arch may exhibit variability in the vessel's angulation and tortuosity. This is associated with more turbulent blood flow and increases the risk for a type B thoracic aortic dissection (Carrel et al., 2023).

Genetic conditions can increase the risk of aortic dissection. Non-syndromic Familial Thoracic Aortic Aneurysm and Dissection (FTAAD) is a condition characterized by a group of gene mutations that increase the risk of aortic aneurysm and dissection. It is estimated that 30% of individuals with FTAAD have a gene associated with the development of an aortic aneurysm or dissection. This genetic variation also alters signaling pathways and the smooth muscle contraction mechanism, directly affecting the risk of aortic dissection (Sayed et al., 2021).

Turner syndrome is another genetic condition that increases the risk for aortic dissection (Cleveland Clinic, 2024). It is estimated that aortic dissection occurs in 1-2% of women with Turner syndrome. This risk is higher when congenital heart anomalies are also present (Nguyen et al., 2023). Due to the increased size of the ascending aorta associated with Turner syndrome, there is a high risk of aortic dissection for women older than 15 years. As the size of the aorta increases, the risk of aortic dissection also increases (Thunström et al., 2023).

Connective tissue disorders, such as Marfan syndrome, Loeys-Dietz syndrome, and type IV Ehler's Danlos Syndrome, all increase the risk for an individual experiencing either an aortic aneurysm or aortic dissection. This increased risk is due to these conditions affecting the structural integrity of the aortic extracellular

matrix. For patients with Loeys-Dietz syndrome, approximately 98% of patients have aortic root aneurysms, significantly increasing the risk for aortic dissection. One study found that aortic dissection was responsible for 89% of deaths in those with Loeys-Dietz syndrome. Type IV Ehlers-Danlos Syndrome causes vascular fragility due to alterations in the genetic code that encode a specific type of collagen. Since this type of collagen is important for the extracellular matrix, the risk of aortic dissection is increased. It is estimated that aortic dissection and dissecting aneurysms are responsible for 48% of vascular complications in those with Type IV Ehlers-Danlos Syndrome (Sayed et al., 2021).

Risk of aortic dissection is increased during pregnancy and in the immediate post-partum period, though it is usually associated with the presence of a connective tissue disorder. This is due to hemodynamic and hormonal changes associated with pregnancy, which can increase the aortic diameter. The rate of aortic dissection during pregnancy associated with connective tissue disorder is 14.5 cases per million individuals. In comparison, those who do not have a connective tissue disorder have a rate of 1.24 cases per million pregnant individuals (Kano & Sun, 2023). These women more commonly experience a type A thoracic aortic dissection during the third trimester. Type B thoracic aortic dissections are more commonly experienced in the post-partum period (Carrel et al., 2023).

Certain medications and other substances can increase the risk of aortic dissection. Sildenafil increases the risk of aortic dissection because it is a vasodilator that can cause tearing of the aortic wall. Cocaine use is also associated with increased risk of aortic dissection due to its likelihood of causing acute hypertension and blood vessel weakness. Aortic dissection due to cocaine use typically occurs within one hour of use and is more likely to occur in young men (Kano & Sun, 2023).

Section 4 Personal Reflection

What is the primary risk factor for aortic dissection? How does hypertension affect the aorta? Why do you think aortic dissection typically affects older adults? How does smoking increase the risk of aortic dissection? How do connective tissue disorders affect the risk of aortic dissection?

Section 5: Signs, Symptoms, and Complications

Aortic dissection is associated with various symptoms depending on the underlying pathophysiology of the injury (Sayed et al., 2021). The most common characteristic is an abrupt onset of chest or back pain. Anterior chest pain is more common in those experiencing a Stanford type A aortic dissection. They may also report a tearing or ripping sensation (El Hussein & Green, 2022). Individuals who experience a type A aortic dissection may also report pain that radiates to their neck (Alhalaseh et al., 2023).

Those who experience a Stanford type B aortic dissection are more likely to report back pain with a migratory quality (Sayed et al., 2021). If the dissection extends into the abdomen, the patient may experience limb or visceral ischemia (Alhalaseh et al., 2023).

Symptoms may also include a discrepancy between the apical and peripheral pulse rates, diaphoresis, pallor, and migratory pain patterns. In some patients, depending on the location of the aortic dissection, blood pressure readings may be asymmetric (El Hussein & Green, 2022). A concerning blood pressure discrepancy is typically defined as a difference of more than 20 mmHg between locations in the body (Levy et al., 2024).

Approximately 20% of individuals with aortic dissection present with neurological deficits, though this depends on the vessels involved (Levy et al., 2024).

Individuals who experience a Stanford type A aortic dissection are more likely to experience neurological symptoms (El Hussein & Green, 2022), especially if the carotid artery is affected (Alhalaseh et al., 2023). This can vary depending on how the dissection affects blood flow to the brain (El Hussein & Green, 2022). Stroke-like symptoms, limb weakness, paresthesia, or syncope are common findings in these patients. Neurological deficits are most often attributed to hypovolemia, arrhythmias, or myocardial infarction (Levy et al., 2024). Approximately 15% of patients who experience type A aortic dissection experience syncope, usually due to cardiac tamponade or aortic rupture. Therefore, syncope in patients with aortic dissection is associated with increased mortality (Sayed et al., 2021).

Hypertension is a common condition that leads to aortic dissection, though hypotension is a more concerning finding when aortic dissection occurs. Patients are at increased risk for hypotension if they experience a type A dissection, are older than 70 years, female, or have symptoms of neurological deficit, syncope, pulse deficits, or altered mental status. The mortality rate for individuals who present to the healthcare facility with hypotension due to aortic dissection is approximately 50%, while the mortality rate of those without hypotension is 10% (Alhalaseh et al., 2023).

Patients experiencing aortic dissection may present with atypical symptoms. They may have abnormal pain patterns, including abdominal, neck, or leg pain. They also may not experience pain (Kanoksirirat & Nithimathachoke, 2025). Atypical symptoms of aortic dissection can include fatigue, dyspnea, and neurological symptoms. The neurological symptoms associated with atypical presentation of aortic dissection vary and can include motor and sensory deficits, depending on the size and location of the dissection (Murdande & Joolhar, 2025). Superior Vena Cava (SVC) syndrome can occur with aortic dissection, which causes patients to present with upper limb venous distention and facial swelling (Sayed et al., 2021). It is possible for patients not to have any symptoms associated with aortic

dissection. Asymptomatic presentations of type A aortic dissections are rare and are difficult to diagnose. This increases mortality due to a delay in treatment. Sometimes this life-threatening condition is incidentally detected during imaging for other reasons (Murdande & Joolhar, 2025). Individuals who do not present with classic symptoms of aortic dissection usually have a complicated clinical presentation, accompanied by stroke, congestive heart failure, or syncope (Sayed et al., 2021).

There are many complications associated with aortic dissection. Cardiac complications are among the most common due to the location of the aorta in relation to the heart. Cardiac complications are more common in those who experience a type A dissection, with the most common cardiac complication being acute aortic regurgitation, affecting 40-75% of patients. Myocardial ischemia and infarction can occur in 10-15% of patients with type A aortic dissection. The most serious cardiac complication that occurs because of aortic dissection is cardiac tamponade. While 33% of patients with aortic dissection present with a stable cardiac effusion, 8-10% are diagnosed with cardiac tamponade (Sayed et al., 2021). Cardiac tamponade is a potentially fatal condition that occurs when a significant amount of fluid accumulates in the pericardial sac, which increases pressure on the heart, impairing the filling of the atria and reducing the cardiac output (Gopal et al., 2026). The occurrence of cardiac tamponade doubles the risk of mortality in patients experiencing an aortic dissection. Congestive heart failure can occur as a result of aortic dissection, but it is not a common complication (Sayed et al., 2021).

Neurological complications most often occur due to decreased cerebral perfusion caused by hypotension. Neurological complications can also occur due to nerve compression, false-lumen development, or thromboembolic events. Stroke affects approximately 10% of patients who experience aortic dissection, and 1% experience spinal cord ischemia (Sayed et al., 2021).

Gastrointestinal complications can occur due to mesenteric ischemia. This complication affects less than 5% of patients who have experienced an aortic dissection and is often misdiagnosed due to the presentation of vague abdominal symptoms. While a relatively rare complication, those who experience mesenteric ischemia have a three times greater risk of mortality than those who do not have mesenteric ischemia (Sayed et al., 2021).

Section 6: Diagnostic Considerations

A timely and thorough physical exam, accompanied by prompt diagnostic imaging, is necessary for optimal outcomes in patients with aortic dissection. A delay in diagnosis is common because symptoms are also consistent with other cardiac events (El Hussein & Green, 2022). Some research studies estimate that over 30% of cases of aortic dissection are initially misdiagnosed. When a misdiagnosis occurs, the patient's condition can be further complicated by treatments that could worsen outcomes after aortic dissection, such as antiplatelet therapy and heparin (Alhalaseh et al., 2023).

The American Heart Association recommends using the Aortic Dissection Detection Risk Score (ADD-RS). This tool includes the evaluation of pain along with consideration of 12 high-risk features (El Hussein & Green, 2022). These features include high-risk conditions, pain features, and exam features. High-risk conditions are Marfan syndrome, family history of aortic disease, known aortic valve disease, recent aortic manipulation, or known thoracic aortic aneurysm. High-risk pain features include chest, back, or abdominal pain that is abrupt in onset, severe in intensity, or with a ripping or tearing quality. High-risk exam features include a pulse deficit or blood pressure differential, focal neurological deficit with pain, a new-onset murmur of aortic insufficiency accompanied by pain, and hypotension or shock (Ren et al., 2024). A score is assigned based on the number of high-risk

features present. Advanced imaging is recommended for patients with an ADD-RS of 1 or greater, a D-dimer greater than 500 ng/mL, or concerning findings on x-ray or other basic imaging. Although the ADD-RS is an accurate screening tool, it is important to remember that some cases of acute aortic dissection can present with atypical symptoms (El Hussein & Green, 2022).

Imaging studies are used to diagnose aortic dissection. They provide valuable information that guides diagnosis and treatment, including the tear's site, size, shape, and severity. Imaging can also be used to identify complications arising from aortic dissection. Providers determine the type of imaging to use based on the imaging's degree of specificity and sensitivity, as well as the patient's clinical condition. A chest X-ray is often the first imaging study used in a patient with chest pain. Widening of the mediastinum can be visualized on an X-ray and can indicate aortic dissection; however, a chest X-ray alone is not sufficient to diagnose aortic dissection. Computed tomography (CT) is considered the gold standard radiographic imaging modality for diagnosing aortic dissection. Advantages of CT include ease of access, lower cost, and faster image acquisition compared to magnetic resonance imaging (MRI). Magnetic Resonance Angiography (MRA) is an incredibly accurate method for diagnosing aortic dissection, with 100% sensitivity and specificity; however, it is significantly slower than a CT scan and can interfere with patient monitoring that is necessary for critically ill individuals. MRA is used for the diagnosis of aortic dissection for patients who are not eligible for a CT scan due to renal insufficiency or iodine dye allergy. Transthoracic echocardiography (TTE) is often used as an imaging modality while awaiting a CT or MRA. TTE is limited in its ability to visualize the dissection; however, it helps assess the heart's condition and the presence of aortic regurgitation. Transesophageal echocardiography is a reliable imaging tool for diagnosing aortic dissection; however, it is typically used for patients who are too clinically unstable to be transported for CT or MRA (Sayed et al., 2021).

The only reliable blood screening test for aortic dissection is the D-dimer. D-dimer is a product of fibrin degradation and is found in specific conditions, including aortic dissection. D-dimer levels increase rapidly during acute aortic dissection compared to other conditions that elevate D-dimer levels. Since elevated D-dimer levels can indicate other conditions, further testing is needed to confirm the diagnosis. Research has found that patients with lower D-dimer levels are associated with more favorable outcomes following aortic dissection (Sayed et al., 2021).

Section 6 Personal Reflection

Why is a prompt diagnosis so important in cases of aortic dissection? How is the ADD-RS tool used? What is the gold standard imaging study? If MRA is the most accurate method for diagnosing aortic dissection, why is it not the gold standard imaging test for this condition? How can a healthcare worker determine if a D-dimer level could indicate an aortic dissection versus another cardiac condition?

Section 7: Nursing Implications

Nurses are essential in promoting optimal outcomes for patients with aortic dissections by accurately taking histories, recognizing concerning symptoms, promptly notifying the provider, and understanding the expected tests and procedures that will likely be ordered. In the emergency care setting, there are distinct phases during which nurses interact with patients and can apply their specialized knowledge and skills to ensure timely recognition and treatment.

During the nursing triage phase, nurses must be able to identify the signs and symptoms often associated with aortic dissection. Because patient outcomes in cases of aortic dissection depend on prompt identification and intervention, rapid

recognition of symptoms can significantly affect patient mortality. The Emergency Severity Index (ESI) is often used in emergency department settings to facilitate rapid identification and appropriate timing of treatment for patients with symptoms of life-threatening conditions. When a high level of acuity is suspected, and the physician has begun their assessment, it is recommended that two large-bore peripheral IVs be started. Lab samples should also be drawn at this time. If vascular access is difficult to obtain, the nurse should use a vascular access team, if available, or ultrasound guidance for PIV placement (Privitera et al., 2022).

While diagnostic imaging and procedures are performed, the nurse can expect to provide close supervision and continuous monitoring of the patient, paying particular attention to changes in vital signs and neurological symptoms. Until continuous blood pressure monitoring can be established, it is recommended that peripheral blood pressures be obtained every 3-5 minutes, along with monitoring of respiratory rate, pulse rate, and oxygen saturation (Privitera et al., 2022). An arterial line should be placed as soon as possible for continuous blood pressure monitoring. A central venous catheter should be placed for hemodynamic monitoring and medication administration (Levy et al., 2024). The use of a femoral artery catheter is not recommended, as the femoral artery is a preferred site for endovascular procedures. It is recommended to apply the pulse oximetry sensor to the most well-perfused extremity to improve accuracy and provide more reliable perfusion monitoring (Privitera et al., 2022). A Foley catheter should also be inserted for accurate urine output monitoring. Oliguria or anuria may indicate poor renal perfusion (Levy et al., 2024).

Nurses can also expect and prepare for the administration of certain medications. A validated pain score tool should be used to assess pain (Privitera et al., 2022). Pain management is essential in the initial interventions for aortic dissection. Morphine is the preferred medication for pain management. Morphine is effective for pain relief and reduces sympathetic tone, lowering blood pressure and heart

rate, and decreasing the risk of complications from aortic dissection (Levy et al., 2024).

Ideally, a stable heart rate is maintained in cases of aortic dissection. Short-acting intravenous beta blockers, such as esmolol or labetalol, are used to maintain a regular heart rate of approximately 60 beats per minute. Careful management of heart rate can reduce the force of left ventricular ejection on the aortic wall, thereby reducing the risk of worsening aortic dissection. In individuals with acute aortic regurgitation, beta blockers should be used with caution, as tachycardia may help maintain cardiac output in these cases. If beta blockers are contraindicated, such as in patients with asthma, alternative medications to manage heart rate and blood pressure may be used (Levy et al., 2024).

Blood pressure must also be carefully managed in cases of aortic dissection. The target systolic blood pressure is 100-120 mm Hg when organ perfusion is not significantly impaired. Patients may require the administration of vasodilators to manage hypertension. For patients experiencing hypotension, fluid resuscitation should be initiated carefully, as excessive fluid can lead to increased pressure on the aortic wall. Vasopressors may be administered to maintain perfusion, but are used with caution, as they can worsen the aortic dissection (Levy et al., 2024).

Nurses should be aware of the various treatment modalities available for aortic dissection. Urgent surgical intervention may be necessary. When a Stanford type A dissection occurs, emergent surgery is warranted due to the high risk of complications. In cases of uncomplicated Stanford type B aortic dissections, aggressive hemodynamic interventions may be used to reduce stress on the aortic wall to reduce the risk of worsening the aortic dissection. Surgical or endovascular intervention may be indicated when this type of aortic dissection leads to malperfusion or ischemia of the kidneys, intestines, or extremities, or when there is a risk of aortic rupture. Endovascular stent-grafting and surgical repair may also

be indicated for a type B dissection, depending on the anatomy, extent of dissection, and complications present. Open surgery for the repair of a Stanford type B aortic dissection is only used when thoracic endovascular aortic repair (TEVAR) is not possible or if there are severe complications. This is because an open repair significantly increases the risk for spinal cord ischemia (Levy et al., 2024).

Nurses can reduce the time to treatment by anticipating potential next steps. Nurses can expect to prepare the patient for surgical intervention when an aortic dissection occurs. This may include requests for compatible blood units (Privitera et al., 2022). If a patient experiences aortic dissection and presents to a healthcare facility that does not have an appropriate specialist, the nurse should anticipate the urgent transfer of the patient to a cardiothoracic center. However, interventions that can be completed should not be delayed while awaiting the transfer (Flower et al., 2023). Nurses should also anticipate that the patient experiencing symptoms of an aortic dissection may be anxious. It is essential that nurses and other members of the healthcare team keep the patient informed and explain procedures (Privitera et al., 2022).

Post-operative care for a patient who has experienced aortic dissection includes pain management, respiratory care, and early physical therapy. Some patients may require rehabilitation after hospitalization in order to reduce the risk of reduced functional ability after surgery. Patient education, including information regarding smoking cessation and guidance on exercise and lifestyle choices, is necessary for improved recovery and to avoid post-operative complications (Flower et al., 2023). Patient education should also emphasize that lifelong follow-up is necessary after aortic dissection, as these patients are at increased risk of aneurysm formation and require careful blood pressure management (Flower et al., 2023).

Nurses can help prevent delays in seeking care when an individual experiences aortic dissection. In the outpatient clinic setting, patients who are at increased risk for experiencing an aortic dissection should be advised of symptoms that may indicate the occurrence of this condition, including the presence of abrupt, severe chest or back pain, loss of consciousness, shortness of breath, or symptoms of poor perfusion in the extremities. Patients should be encouraged to seek medical care immediately if these symptoms occur, rather than self-medicate or wait to see if the symptoms resolve (Levy et al., 2024).

Section 7 Personal Reflection

How can nurses use their knowledge of aortic dissection symptoms to promote optimal outcomes? Why do you think it is critical to obtain IV access as soon as possible? Why is hemodynamic monitoring especially important in cases of aortic dissection? What medications can the nurse anticipate being ordered? What other interventions should nurses anticipate? How can effective patient education improve outcomes?

Section 8: Case Study

Mr. Thomas, a 64-year-old male, presents to the emergency department with complaints of sudden chest pain and lightheadedness. His medical history includes hypertension, GERD, and hypercholesterolemia. His surgical history includes an appendectomy as a child and a knee replacement last year. He reports a family history of aortic aneurysms. Mr. Thomas reports that he consumes 1-2 beverages containing alcohol per week and smokes approximately one pack of cigarettes per day. Initial vital signs include HR 120 bpm, BP 105/65, SpO2 94%.

1. What risk factors does Mr. Thomas have for aortic dissection? Choose all that apply.
    a. Age
    b. Sex
    c. History of hypertension
    d. History of GERD
    e. Hypercholesterolemia
    f. Previous appendectomy
    g. History of joint surgery
    h. Family history of aortic aneurysms
    i. Alcohol consumption
    j. Smoking
2. What signs and symptoms should alert the triage nurse to the possibility of aortic dissection? Select all that apply.
    a. Sudden chest pain
    b. Lightheadedness
    c. Tachycardia
    d. Hypotension
    e. SpO_2 94%

3. After the patient is placed on a bedside monitor, which nursing intervention is most appropriate to initiate next?
    a. Repeat peripheral BP every 15 minutes
    b. Provide education on smoking cessation
    c. Insert two large bore PIVs
    d. Prepare for arterial line insertion for hemodynamic monitoring
4. A CT scan is ordered. What feature on the CT image would confirm a diagnosis of aortic dissection?
    a. “Tennis ball” sign
    b. Presence of an aortic aneurysm
    c. Enlarged aorta
    d. Abnormal gas in the abdomen
5. A Stanford type A aortic dissection is confirmed. What should the nurse expect to do next? Select all that apply.
    a. Discharge home with a Holter monitor
    b. Transfer to ICU or OR
    c. Work on the pre-op checklist until the patient transfer occurs
    d. Anticipate heparin administration
    e. Initiate fluid bolus as ordered
    f. Withhold information from the patient so they do not become anxious

g. Transfer to the cardiac cath lab

h. Initiate medications for hemodynamic stabilization

i. Explain tests and procedures to the patient as they occur

Section 9: Conclusion

Although aortic dissection is associated with high mortality, nurses can make a meaningful impact and improve outcomes. Understanding the anatomy and function of the aorta helps nurses appreciate its importance and think critically about signs and symptoms that may indicate a problem. Understanding the pathophysiology and categories of aortic dissection improves outcomes by helping nurses anticipate problems and recognize the urgency of treatment. By identifying risk factors, nurses can identify patients at high risk for this condition, which guides clinical decision-making. Nurses must recognize the classic signs of aortic dissection and be familiar with atypical symptoms to avoid delayed or missed diagnosis. The nurse must prioritize interventions based on the clinical picture and initiate an appropriate emergency response. Together with the multidisciplinary team, nurses can help improve outcomes in cases of aortic dissection.

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