Traumatic Aortic Rupture

Traumatic aortic rupture, also called traumatic aortic disruption or transection, is a condition in which the aorta is injured, torn or ruptured as a result of trauma to the chest wall or deceleration injury. This condition is commonly seen in motor vehicle accidents or falls and is most often lethal. It is commonly due to blunt thoracic trauma and patients usually present in a severe or critical state like hemorrhagic shock. Quick diagnostic tests are important and include chest x-ray, ultrasound, and CT angiography. Management starts immediately with fluid resuscitation and blood pressure control. Surgery should be considered if the injury is amenable. However, most cases result in death within a few hours as this type of injury has a grave prognosis.

PLAY PICMONIC

ETIOLOGY

Blunt Thoracic Trauma

Blunt Thor-Axe and Trauma-Spike

Blunt trauma, also called non-penetrating trauma or blunt force trauma, is an injury to the body caused by forceful impact, injury, or physical attack with a dull object or surface. Note that although there is impact, the skin is not necessarily broken. Blunt trauma may be the result of severe deceleration, falling from heights, blast injuries, or being struck by a firm object such as a fist, weapon, or ball. Traumatic aortic rupture is most commonly caused by blunt trauma of the chest wall, as in motor vehicle accidents or falls. Less commonly, traumatic aortic rupture can be due to penetrating trauma, such as a gunshot wound or stab wound. In particular, penetration that traverses the mediastinum (between the nipples or scapulae).

Presentation

Hemorrhagic Shock

Hemorrhage-hammer Shocked

Hemorrhagic shock is the depletion of intravascular volume due to blood loss; to the point of being unable to perfuse tissue appropriately, resulting in tissue hypoxia, ischemia, and death. It can result in death if left untreated. Traumatic aortic rupture is thus commonly fatal, as blood in the aorta is under great pressure and can quickly escape the vessel through a tear, resulting in rapid hemorrhagic shock, exsanguination, and death.

Diagnosis

Chest X-Ray

Chest X-Ray

The initial diagnostic evaluation for patients with suspected traumatic aortic injury is a chest x-ray. Although it lacks reliable sensitivity, its availability and ease of use makes it a useful diagnostic tool in patients who are too unstable to receive CT. Features on plain chest x-ray that suggest aortic injury include obliteration of the aortic knob, rightward deviation of the trachea/esophagus, depression of the left main stem bronchus, left pleural or apical cap, and/or evidence of hemothorax, pneumothorax, or pulmonary contusion. Also, widening of the mediastinum (greater than 8 cm) has a reported sensitivity of 81% to 100% and a specificity of 60%, although may not be as sensitive in older patients. Suggestive chest x-ray findings may not be present immediately. It is recommended that aortic imaging for all patients who have had a severe deceleration injury be done, even in the absence of suggestive findings on examination or chest x-ray.

Ultrasound

Ultrasound-Machine

Transesophageal echocardiography (TEE) is another imaging modality used to evaluate and diagnose damage to the aorta. It can be performed quickly, at the bedside, and has a low complication rate. For this reason, it may be preferred in unstable patients. A skilled operator can detect associated injuries, although accuracy can be operator-dependent and so is not always the best option.

CT Angiography

Cat-scan Angel with Angiography

The diagnostic test of choice for blunt thoracic aortic injury. It is immediately available in most trauma centers, rapid, and cost effective. In addition, it is highly sensitive (86% to 100%) and specific (40% to 100%). CTA findings indicative of an aortic rupture include active extravasation of intravenous contrast dye from the aorta, pseudo-aneurysm formation, an intimal flap, luminal filling defects, periaortic hematoma formation, as well as aortic contour abnormalities.

Management

Fluid Resuscitation

IV Fluid

In patients with traumatic aortic disruption, fluid resuscitation is indicated to help prevent or reverse hemorrhagic shock.

Blood Pressure Control

BP-Cuff Control Station

Initial management (perioperative) requires aggressive blood pressure control, to reduce the risk rupture progression. In addition to directly reducing blood pressure, heart rate control is also required in order to decrease tension on the aortic wall. Targets are heart rate ≤ 90 beats/minute and systolic blood pressure ≤ 120 mm Hg; and patients should not perform a Valsalva maneuver. Intravenous beta blockers (labetalol or esmolol) are the mainstays of therapy. Vasodilators have also demonstrated effectiveness in decreasing shear forces on the aortic wall.

Surgery

Surgeon

If patients are not stable enough to undergo imaging studies and traumatic aortic rupture is suspected, immediate surgery is indicated. Treatment has traditionally been immediate operative (surgical) repair. Repair can be done using either an open or endovascular technique. Open surgical repair (OSR) poses a significant surgical risk, with high rates of morbidity and mortality. In contrast, endovascular stent placement, or endovascular repair (EVAR), is now the treatment of choice. In this procedure, grafts cover the damaged portion of the aorta and prevent further blood loss, with improved morbitity and mortality (as compared to OSR). Surgical repair can be delayed, while evaluating and treating other potentially life-threatening injuries, in certain patients and while controlling blood pressure.

Considerations

Grave Prognosis

Gravestone

80% of patients with traumatic aortic rupture die before reaching a trauma center for treatment. For those individuals who survive the initial injury and reach an emergency department, 30% succumb to their injury within the first 24 hours.