Updated Management of Thoracoabdominal Aortic Aneurysm

An essay
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Master Degree in General Surgery

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Introduction

An arterial aneurysm is a pathologic entity defined by a gross anatomic change in the geometry of the vessel wall, by increasing in arterial diameter of at least 50% compared to a base line ***(Robby et al., 2008).***

Thoracoabdominal Aortic Aneurysm **(TAAA)** is a complex disease with both genetic and environmental factors contributing to the disease processes involving formation, growth and rupture. Aneurysms are often silent without symptoms until rupture occur ***(Helena et al., 2008).***

Most TAAAs occur in association with advanced atherosclerosis as it causes wall weakness and recoil loss with degenerative ischemia. The observed association between atherosclerosis and TAAAs is not causative; however, atherosclerosis may represent a response to vessel wall injury that is induced by multiple factors. Follow-up is warranted if abdominal aorta >3cm in diameter or if any segment is >1.5 times the diameter of an adjacent section. Patients with TAAA 4:4.5 cm in diameter need 2 ultrasounds per year. If the diameter increases by >0.5cm over 6 months, or if it is >4.5cm, interference usually is warranted. TAAA is 2-4% in adult population, with males affected 7 times more than females. It is 11% in males > 65years. It is more frequent in smokers, hypertensives and COPD patients ***(Robert 2010).***

There are many diagnostic methods of TAAAs, which include: Plain X ray, Ultrasound, CT scan, MRA and aortography.

- Plain radiography gives a high false-negative result**.**
- Ultrasound has sensitivity 100% and specificity 96% and its primary role is screening and follow up.
- CT scan has sensitivity about 100% and many other advantages like defining aortic size, rostral-caudal extent, visceral arteries aneurysms, suprarenal aorta extension and retroperitoneum visualization.
- MRA offers superior imaging of branch vessels but less valuable in assessing suprarenal extension and It is preferred in patients who have dye allergy as it doesn't subject patients to dye or ionizing radiation like CT.
- Angiography is useful in determining aortic anatomy but it is an invasive method and has a risk of complications like bleeding.

(Robert 2010).

Any decision to offer a patient with TAAA a procedure, must balance the patient's expected prognosis and life expectancy without intervention against the risk of the procedure. TAAA should have a diameter >5.5cm to have an interference ***(Joseph et al., 2008).***

Management is advocated primarily to prevent rupture. Surgical repair "SR", Endovascular repair "EVAR", Combined Constitute and medical treatment are the lines of treatment. The strongest factor affect death is the aneurysm extent ***(Kathryn et al., 2008).***

In small aneurysms, some medical lines can be used to prevent progression based on our knowledge of aneurysm causes and this can be achieved by using: B Blockers, ACE inhibitors or Ca channel blocker for hemodynamic management and antibiotics, macrolides for inflammation inhibition ***(Baxter et al., 2008).***

Surgical repair "SR" of TAAA was first described in **1955**. The procedure has been improved by the use of adjuncts to limit visceral and lower extremity ischemia and to minimize the risk of spinal cord ischemia, and advances in critical care. However, the operation involves replacing the aorta from above the aneurysm to a healthy distal aorta or iliac arteries, which necessitates re implantation of some or all of the visceral arteries as a patch or with a separate bypass grafts. Although the contemporary results of these extensive operations are acceptable in the context of the untreated risk of rupture ***(Roy and Bruce 2008).***

EVAR is first practiced in the 1990s involving gaining access to the lumen of the abdominal aorta, usually via small incisions over the femoral vessels. An endograft, typically a cloth graft with a stent exoskeleton, is placed within the lumen of the aorta extending distally into the iliac arteries. The graft serves to maintain aortic flow at the diseased part and decrease the pressure on the aneurysm wall, leading to a reduction in size over time and a decrease in the risk of aortic rupture. EVAR has less morbidity, it has long-term morbidity in graft-related complications and the re-intervention is very expensive ***(Robert 2010).***

Aim of the Work

This work aims at evaluation of the updated management of thoracoabdominal aortic aneurysm as it remains a challenging task.

Epidemiology

Anatomy of the Aorta:

Blood flows from the left ventricle into the aortic root. A small portion of this blood flows into the coronary arteries which supply of the heart. The remainder of the blood flows through the aortic valve into the ascending aorta, the aortic arch, and finally the descending aorta. The aorta is the main trunk of a series of vessels which convey the oxygenated blood to the tissues of the body for their nutrition ***(Gray et al., 2008).***

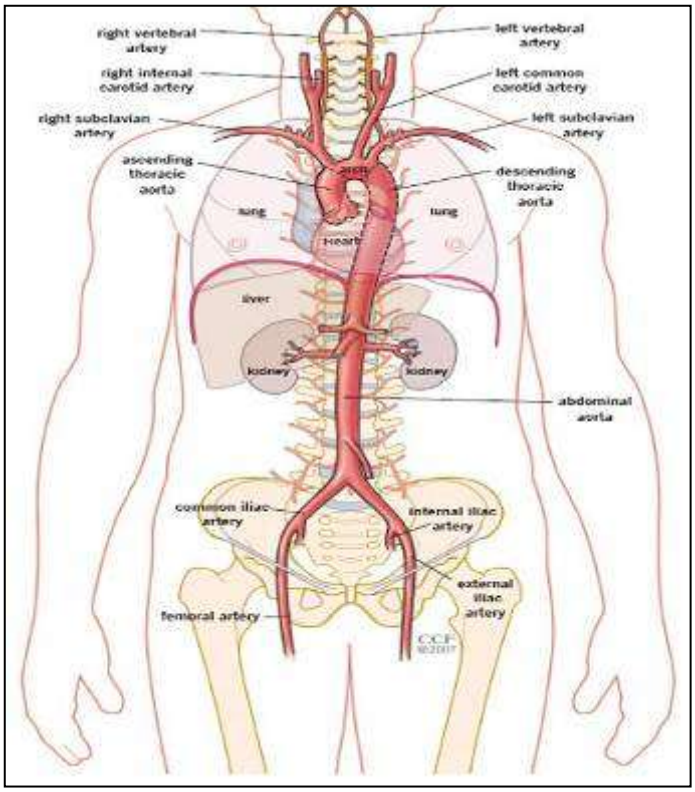

Fig. (1): Normal aortic anatomy ***(Grant's et al., 2009).***

Aortic valve:

The aortic orifice is guarded by the aortic valve, at the entrance to the ascending aorta. It lies at a lower level than the pulmonary orifice, rather to its right side, and is more obliquely placed. It has three semi-lunar cusps named right, left, and posterior. The cusps themselves are folds of endocardium with a central fibrous core. Each cusp has a thick basal border, deeply concave on its aortic aspect, and a horizontal free margin. The aortic surface of each cusp is rougher than its ventricular aspect. The three aortic sinuses of valsalva are anterior, left posterior and right posterior. But as already indicated, widespread clinical terminology links both cusps and sinuses to the origins of coronary arteries. Thus, the anterior is the right coronary, left posterior is left coronary and right posterior is non- coronary ***(Grant's et al., 2009).***

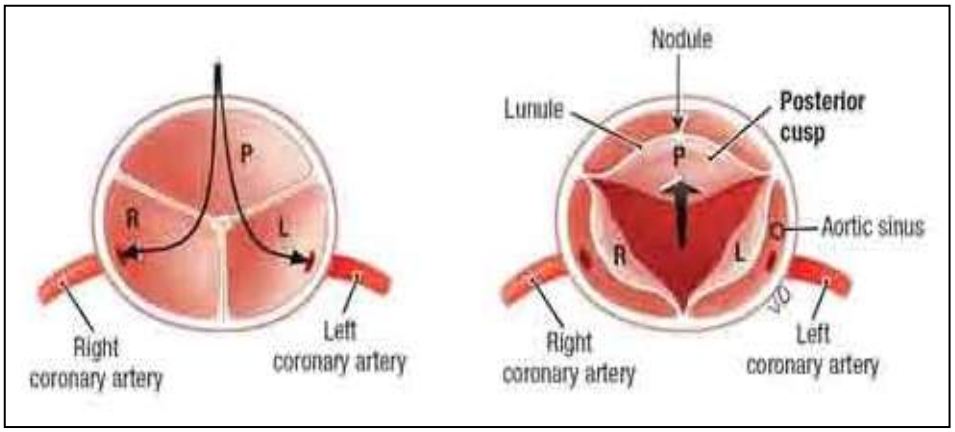

Fig. (2): Superior view of the aortic valve
(Grant's et al., 2009).

Ascending aorta:

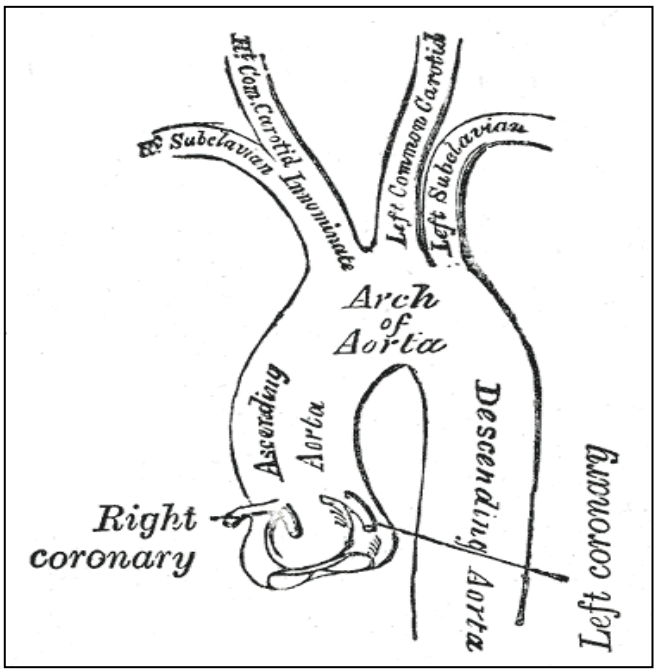

Fig. (3): Ascending aorta and aortic arch ***(Gray et al., 2008).***

Immediately above the aortic orifice the wall of the ascending aorta bulges to make the aortic sinuses, one above each cusp and similarly named. From the anterior sinus the right coronary artery emerges; from the left posterior sinus, the left coronary artery. Above these sinuses the aorta runs to the right of the pulmonary trunk and as it passes upward it slants a little forward towards the manubrium before curving backwards at the commencement of the arch. Here the fibrous pericardium is blended with its wall. The ascending aorta is 5 cm long ***(Gray et al., 2008).***

Relations, The ascending aorta is within the fibrous pericardium, enclosed in a tube of serosal pericardium with the pulmonary trunk. Anterior to its lower part are the infundibulum, the initial segment of the pulmonary trunk and the right auricle. Superiorly, it is separated from the sternum by the pericardium, right pleura, anterior margin of the right lung, loose areolar tissue and the remains of the thymus gland. Posterior are the left atrium, right pulmonary artery and principal bronchus. Right lateral are the superior vena cava and right atrium, and left lateral are the left atrium and, at a higher level, the pulmonary trunk.

Branches, The only branches of the ascending aorta are the two coronary arteries which supply the heart; they arise near the commencement of the aorta immediately above the attached margins of the semilunar Valves.

(Gray et al., 2008).

Aortic arch:

The aortic arch continues from the ascending aorta. Its origin, slightly to the right, is level with the upper border of the second right sternocostal joint. The arch first ascends diagonally back and to the left over the anterior surface of the trachea, then back across its left side and finally descends to the left of the fourth thoracic vertebral body, continuing as the descending thoracic aorta. It ends at the level of the sternal end of the second left costal cartilage. Thus the aortic arch lies wholly in the superior mediastinum. It curves around the hilum of the left lung, and extends upwards to the mid level of the manubrium ***(Gray et al., 2008).***

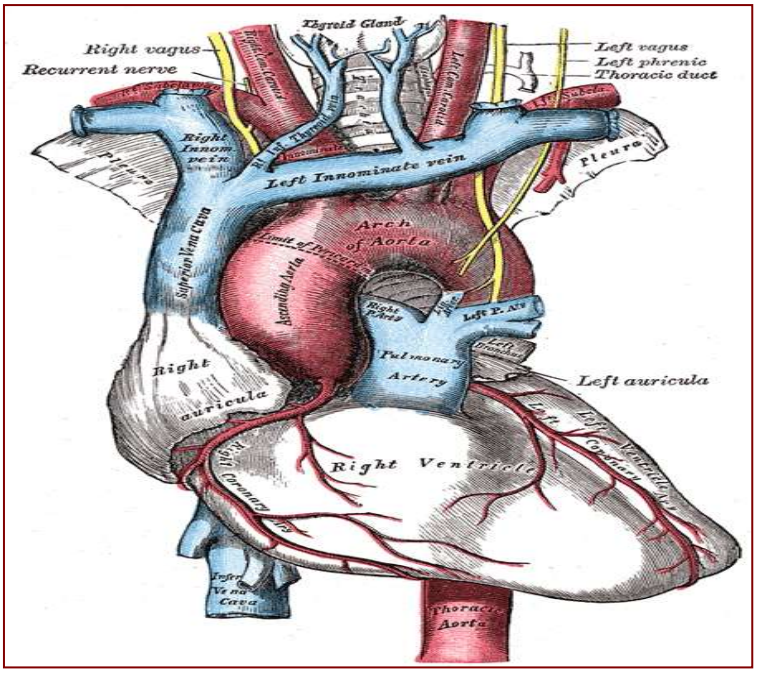

Fig. (4): The aortic arch ***(Gray et al., 2008).***

Relations, Anterior and to the left is the mediastinal pleura, deep to which it is crossed by four nerves; the left phrenic, left lower cervical vagal cardiac branches, left superior cervical sympathetic cardiac branches and the left vagus, in antero-posterior order. As the left vagus crosses the arch its recurrent laryngeal branch hooks below the vessel left and behind the ligamentum arteriosum and then ascends on the arch's right. The left superior intercostal vein ascends obliquely forward on the arch, superficial to the left vagus, deep to the left phrenic nerve. The left lung and pleura separate all these from the thoracic wall. Posterior to the right are the trachea and deep cardiac plexus, the left recurrent laryngeal nerve, oesophagus, thoracic duct and vertebral column. Above, the brachiocephalic, left common carotid and left subclavian arteries arise from its convexity, crossed anteriorly near their origins by the left brachiocephalic vein. Below are the pulmonary bifurcation, left principal bronchus, the ligamentum arteriosum, superficial cardiac plexus and the left recurrent laryngeal nerve ***(Gray et al., 2008).***

Branches, Three branches arise from the convex aspect of the arch: the brachiocephalic trunk, left common carotid and left subclavian arteries. They may branch from the beginning of the arch or the upper part of the ascending aorta ***(Gray et al., 2008).***

Descending thoracic aorta:

The thoracic aorta is the segment of descending aorta confined to the posterior mediastinum. It begins level with the lower border of the fourth thoracic vertebra, continuous with the aortic arch, and ends anterior to the lower border of the 12th thoracic vertebra in the diaphragmatic aortic aperture. At its origin it is left of the vertebral column, as it descends it approaches the midline, and at its termination, it is directly anterior to it ***(Gray et al., 2008).***

Relations, Anterior, from above down, are the left pulmonary hilum, the pericardium separating it from the left atrium, oesophagus and diaphragm. Posterior are the vertebral column and the hemiazygus vein. Right lateral are the azygos and the thoracic duct and below, the right pleura and lung. Left lateral are the pleura and lung. The oesophagus with its plexus of nerves is right lateral above but becomes anterior in the lower thorax and close to the diaphragm it is left anterolateral.

Branches, the thoracic aorta provides visceral branches to the pericardium, lungs, bronchi and oesophagus, and parietal branches to the thoracic wall.

(Gray et al., 2008).