Introduction

Carotid and vertebrobasilar are the two arterial systems supply the brain with blood.

As the carotid arteries deliver blood to the brain, carotid artery disease can make serious complication by reducing the flow of oxygen and nutrients to the brain *(Sadat et al, 2008).*

Ninety percent of all extracranial carotid lesions are due to atherosclerosis. The disruption of atherosclerotic plaques is responsible for TIA and/or stroke, which is the third most common cause of death after coronary disease and cancer; also, it is the major cause of neurologic disability.

Other nonathermatous etiologies for carotid lesions include Carotid dissection, trauma, arteritis, Fibromuscular dysplasia, anurysm *(Kloska et al, 2004).*

Vertebrobasilar ischemia is certainly less common than that of carotid arteries, yet it must be diagnosed appropriately, as it is a treatable vasculopathy. The most common disease affecting the vertebral artery is atherosclerosis. Less common pathologic processes include trauma, dissections, fibro muscular dysplasia (FMD), Takayasu disease, osteophyte compression, aneurysms, and other arteritides.

Vertebral artery dissection (VAD) is an increasingly recognized cause of stroke in patients younger than 45 years *(Beletsky et al, 2003).*

Posterior circulation stroke accounts 20% of all strokes however; vertebral artery stenosis accounts approximately 20% of posterior circulation stroke, so accurate diagnostic imaging is important *(Khan et al, 2007).*

Multidetector computed-tomography angiography (MDCTA) is increasingly used for imaging of the carotid and vertebral arteries, tending in many cases to replace conventional angiography; MDCTA has further benefits over conventional angiography.

This method evaluates not only the entire carotid arterial lumen, from the aortic arch up to the intracranial segment, but also the surrounding tissues and their relationship with the arterial lumen.

Additionally, MDCTA offers a lack of invasiveness, especially in inflamed vessel walls, rapid examination and interpretation time, and capability for reconstruction in any plane and even the three-dimensional reconstruction (*Tsolakis, 2007).*

The examination is safer and much less discomfort because contrast material is injected into an

arm vein rather than into a large artery in the groin. High-rate/high-pressure delivery of contrast is essential but only venous access is required and the patient is spared the potential complications of conventional catheter angiography *(Duddalwar, 2004).*

MDCTA has a high sensitivity and negative predictive value for carotid stenosis.

Also, it is the recommended evaluation tool for stroke, thus, symptomatic carotid disease could be identified immediately, and treatment decisions could proceed more rapidly.

The accepted gold standard for evaluation of carotid artery stenosis is catheter angiography; however, this technique is expensive and invasive and has substantial risks," MDCTA imaging during acute evaluation of stroke could expedite diagnostic evaluation *(Barclay, 2004).*

Overall accuracy for carotid CTA exceeds 95% *(Allie et al, 2006).*

MDCTA is a reliable noninvasive method for the evaluation of carotid and VA pathologies providing a good image quality *(Puchner et al, 2007).*

Aim of Work

To evaluate the role of multidetector computed tomographic angiography in assessment of the extracranial carotid and vertebral arteries.

Normal Anatomy of the Extra Cranial Carotid and Vertebral Arteries

Vascular Supply of the Brain

The brain is a highly vascular organ, its profuse blood supply characterized by a densely branching arterial network (Fig.1). It has a high metabolic activity due in part to the energy requirements of constant neural activity. It demands about 15% of the cardiac output and utilizes 25% of the total oxygen consumption of the body. The brain is supplied by two internal carotid arteries and two vertebral arteries, which form a complex anastomosis (circulus arteriosus, circle of Willis) on the base of the brain. Vessels diverge from this anastomosis to supply the various cerebral regions. In general, the internal carotid arteries and the vessels arising from them supply the forebrain, with the exception of the occipital lobe of the cerebral hemisphere, whereas the vertebral arteries and their branches supply the occipital lobe, the brain stem and the cerebellum. Venous blood from the brain drains into sinuses within the dura mater. Acute interruption of the blood supply to the brain for more than a few minutes causes permanent neurological damage. Such ischemic strokes along with intracranial

hemorrhage are major contemporary sources of morbidity and mortality *(Crossman, 2005).*

Arterial supply of the brain

The arterial supply of the brain is derived from the internal carotid and vertebral arteries, which lie, together with their proximal branches, within the subarachnoid space at the base of the brain.

Fig. (1): Resin cast of the arterial supply of the brain.

Anatomy of Carotid System of Arteries

The principal arteries supplying the head and neck are the two common carotids; they ascend in the neck and each divides into two branches, (1) the external carotid, supplying the exterior of the head, the face, and the greater part of the neck; (2) the internal carotid, supplying great parts within the cranial and orbital cavities (Fig. 2).

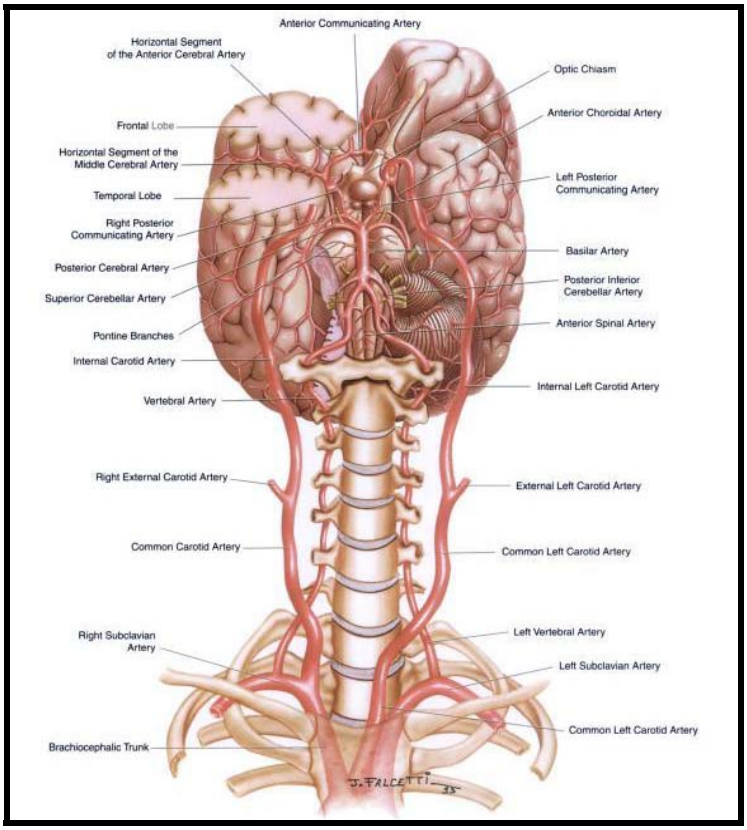

Fig. (2) Frontal view of a schematic drawing of the carotid arteries, vertebral arteries and intracranial vessels and their relationships with the brain.

The Common Carotid Artery (A. Carotis Communis)

The common carotid arteries differ in length and in their mode of origin. The right begins at the bifurcation of the innominate artery (brachiocephalic trunk) behind the sternoclavicular joint and is confined to the neck. The left springs from the highest part of the arch of the aorta posterolateral to the innominate artery, and therefore consists of a thoracic and a cervical portion *(Crossman, 2005).*

The thoracic portion of the left common carotid artery ascends from the arch of the aorta through the superior mediastinum to the level of the left sternoclavicular joint, where it is continuous with the cervical portion.

Relations in front, it is separated from the manubrium sterni by the Sternohyoideus and Sternothyreoideus, the anterior portions of the left pleura and lung, the left innominate vein, and the remains of the thymus; behind, it lies on the trachea, esophagus, left recurrent nerve, and thoracic duct. To its right side below is the innominate artery, and above, the trachea, the inferior thyroid veins, and the remains of the thymus; to its left side are the left vagus

and phrenic nerves, left pleura, and lung. The left subclavian artery is posterior and slightly lateral to it *(Crossman, 2005).*

The cervical portions of the common carotids resemble each other so closely that one description will apply to both Each vessel passes obliquely upward, from behind the sternoclavicular articulation, to the level of the upper border of the thyroid cartilage, where it divides into the external and internal carotid arteries (Fig. 3).

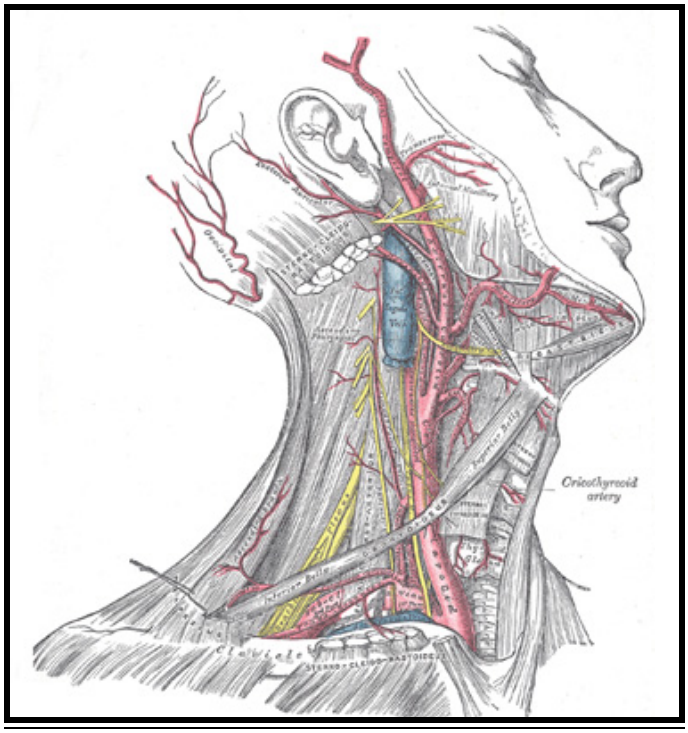

Fig. (3): Superficial dissection of the right side of the neck, showing the carotid and subclavian arteries.

At the lower part of the neck the two common carotid arteries are separated from each other by a very narrow interval which contains the trachea; but at the upper part, the thyroid gland, the larynx and pharynx project forward between the two vessels. The common carotid artery is contained in a sheath, which is derived from the deep cervical fascia and encloses also the internal jugular vein and vagus nerve, the vein lying lateral to the artery, and the nerve between the artery and vein, on a plane posterior to both. On opening the sheath, each of these three structures is seen to have a separate fibrous investment *(Crossman, 2005).*

Relations: At the lower part of the neck the common carotid artery is very deeply seated, being covered by: the skin, superficial fascia, Platysma, deep cervical fascia, Sternocleidomastoideus, Sternohyoideus, Sternothyreoideus, and Omohyoideus; in the upper part of its course it is more superficial, being covered by the skin, the superficial fascia, Platysma, deep cervical fascia, and medial margin of the Sternocleidomastoideus. When the latter muscle is drawn backward, the artery is seen to be contained in a triangular space, the carotid triangle, bounded behind by the Sternocleidomastoideus, above by the Stylohyoideus and posterior belly of the Digastricus, and below by the superior belly of the Omohyoideus. This part of the artery is crossed obliquely, from its medial to

its lateral side, by the sternocleidomastoid branch of the superior thyroid artery; it is also crossed by the superior and middle thyroid veins which end in the internal jugular; descending in front of its sheath is the descending branch of the hypoglossal nerve, this filament being joined by one or two branches from the cervical nerves, which cross the vessel obliquely. Sometimes the descending branch of the hypoglossal nerve is contained within the sheath. The superior thyroid vein crosses the artery near its termination, and the middle thyroid vein a little below the level of the cricoid cartilage; the anterior jugular vein crosses the artery just above the clavicle, but is separated from it by the Sternohyoideus and Sternothyreoideus. Behind, the artery is separated from the transverse processes of the cervical vertebræ by the Longus colli and Longus capitis, the sympathetic trunk being interposed between it and the muscles. The inferior thyroid artery crosses behind the lower part of the vessel. Medially, it is in relation with the esophagus, trachea, and thyroid gland (which overlaps it), the inferior thyroid artery and recurrent nerve being interposed; higher up, with the larynx and pharynx. Lateral to the artery are the internal jugular vein and vagus nerve *(Crossman, 2005).*

At the lower part of the neck, the right recurrent nerve crosses obliquely behind the artery; the right internal jugular vein diverges from the

artery, but the left approaches and often overlaps the lower part of the artery.

Behind the angle of bifurcation of the common carotid artery is a reddish-brown oval body, known as the glomus caroticum (carotid body)

Occasional Branches: The common carotid usually gives off no branch previous to its bifurcation, but it occasionally gives origin to the superior thyroid or its laryngeal branch, the ascending pharyngeal, the inferior thyroid, or, more rarely, the vertebral artery *(Shoja et al., 2006).*

Collateral Circulation: After ligature of the common carotid, the collateral circulation can be perfectly established, by the free communication which exists between the carotid arteries of opposite sides, both without and within the cranium, and by enlargement of the branches of the subclavian artery on the side corresponding to that on which the vessel has been tied. The chief communications outside the skull take place between the superior and inferior thyroid arteries, and the profunda cervicis and ramus descendens of the occipital; the vertebral takes the place of the internal carotid within the cranium.

The External Carotid Artery (A. Carotis Externa)

The external carotid artery begins opposite the upper border of the thyroid cartilage, and, taking a slightly curved course, passes upward and forward, and then inclines backward to the space behind the neck of the mandible, where it divides into the superficial temporal and internal maxillary arteries. It rapidly diminishes in size in its course up the neck, owing to the number and large size of the branches given off from it. In the child, it is somewhat smaller than the internal carotid; but in the adult, the two vessels are of nearly equal size. At its origin, this artery is more superficial, and placed nearer the middle line than the internal carotid, and is contained within the carotid triangle *(Shoja et al., 2006).*

Relations: The external carotid artery is covered by the skin, superficial fascia, Platysma, deep fascia, and anterior margin of the Sternocleidomastoideus; it is crossed by the hypoglossal nerve, by the lingual, ranine, common facial, and superior thyroid veins; and by the Digastricus and Stylohyoideus; higher up it passes deeply into the substance of the parotid gland, where it lies deep to the facial nerve and the junction of the

temporal and internal maxillary veins. Medial to it are the hyoid bone, the wall of the pharynx, the superior laryngeal nerve, and a portion of the parotid gland. Lateral to it, in the lower part of its course, is the internal carotid artery. Posterior to it, near its origin, is the superior laryngeal nerve; and higher up, it is separated from the internal carotid by the Styloglossus and Stylopharyngeus, the glossopharyngeal nerve, the pharyngeal branch of the vagus, and part of the parotid gland *(Shoja et al., 2006).*

Branches: The branches of the external carotid artery may be divided into four sets.

1- Anterior branches: superior thyroid , lingual and external maxillary arteries.

2- Posterior branches: occipital and posterior auricular arteries.

3- Ascending branch: ascending pharyngeal artery.

4- Terminal branches: superficial temporal and internal maxillary arteries.

1. The superior thyroid artery (a. thyreoidea superior):

Arises from the external carotid artery just below the level of the greater cornu of the hyoid bone and ends in the thyroid gland.

Relations:

From its origin under the anterior border of the Sternocleidomastoideus it runs upward and forward for a short distance in the carotid triangle, where it is covered by the skin, Platysma, and fascia; it then arches downward beneath the Omohyoideus, Sternohyoideus, and Sternothyreoideus. To its medial side are the Constrictor pharyngis inferior and the external branch of the superior laryngeal nerve *(Shoja et al., 2006).*

Branches:

It distributes twigs to the adjacent muscles, and numerous branches to the thyroid gland, anastomosing with its fellow of the opposite side, and with the inferior thyroid arteries. The branches to the gland are generally two in number; one, the larger, supplies principally the anterior surface; on the isthmus of the gland it anastomoses with the corresponding artery of