



Melbourne Vascular Imaging CAROTID ARTERIES

One of the most common scans in a Vascular Lab is the examination of carotid arteries.

The carotid and vertebral arteries supply blood to the brain. The brain consumes 25% of inspired oxygen and receives 15% of the total cardiac output. The common carotid arteries are found on each side of the neck and bifurcate into two main arteries. The ECA (External Carotid Artery) supplies blood to the organs and muscles of the face and head. The ICA (Internal Carotid Artery) supplies blood to the brain. Branches of the ECA can also supply collateral circulation to the brain in the event of an ICA occlusion. The vertebral arteries join together to form the basilar artery in the posterior part of the brain also supplying cerebral blood flow. Normal blood flow in the brain is about 50ml/100g of brain per minute.

Arteries in older people can become narrowed due to **ATHEROSCLEROSIS** (Greek *athere*; gruel and *sclerosis*; hardened). This is a common condition where deposits of plaque (atheroma) containing cholesterol, lipid material, and lipophages are formed within the intima and inner media of large and medium sized arteries.

Atheroma typically forms in the carotid bifurcation extending into the proximal ICA and ECA, causing narrowing of the lumen. When the narrowing exceeds 50%, blood velocity increases through this section. The increased turbulence and velocity of the blood can dislodge particles of atheroma (emboli) which can travel distally into the brain, blocking small arteries and causing a stroke. When the cerebral blood flow falls below 20ml/100g of brain per

minute brain tissue becomes ischaemic. The neurologic deficit could be temporary and is known as a transient ischemic attack or TIA. TIAs can cause motor and/or sensory loss or weakness in the contralateral (or opposite) limb to the affected side of the brain (hemiplegia). The patient could become dysphasic or aphasic with complete or partial loss of speech. The patient could suffer from Amaurosis Fugax. This is when emboli travel up the ophthalmic artery (a branch of the ICA), causing complete or partial blindness on that side. TIAs by definition, fully resolve within 24 hours.

When the cerebral blood flow falls below 10 ml/100g of brain tissue per minute, irreversible cell death (cerebral infarction) occurs. The patient suffers from a stroke which causes symptoms similar to those mentioned above, but which do not resolve over a few hours. These patients may experience complete or partial recovery within 3 months or the stroke may be permanent.

The majority of strokes are ischaemic in nature. 40% of these embolic strokes are caused by carotid artery disease, 30% by emboli from the heart, (especially in younger people) and 30% from other sources. A small number of strokes are caused by intracerebral hemorrhage or bleeding. It is important to differentiate between these two causes of stroke as the treatment is very different (Hemorrhagic stroke patients are not anticoagulated). C.T. or magnetic resonance imaging is used to confirm whether the stroke is ischaemic or hemorrhagic.

Lacunar strokes can also occur. These are ischaemic strokes caused by small occlusions in the end arterial branches in the brain associated with hypertension or diabetes.

A patient suffering from a stroke that is caused by carotid artery stenosis may be operated on by the vascular surgeons 2 to 6 weeks following the stroke, depending on clinical circumstances.

Sometimes the internal carotid artery may become completely blocked. In this case no surgery is performed.

Using B Mode ultrasound we can see the narrowed walls of the artery and using Doppler we can measure the exact speed of the blood in the narrowed section. We can estimate the extent of the narrowing based on set velocity criteria; i.e.; blood speeds between 150 and 260 cm/sec indicate a 50 to 59% stenosis (narrowing). If the stenosis exceeds 70% in symptomatic patients and 80% in asymptomatic cases, surgery is considered depending on clinical details. Occasionally a patient with a greater than 50 % stenosis is operated upon depending on the symptoms. Surgeons operate on the carotid artery using an operation called a carotid endarterectomy. The internal carotid artery is opened up and the plaque removed. A Dacron or vein patch can be sewn into the artery to prevent re-stenosis. The surgeons will operate depending mostly on the results of the Vascular Lab tests, which demonstrates the accuracy of vascular ultrasound. We also test the vertebral arteries to assess the direction of blood flow (Vertebral blood can flow in the opposite direction to supply the arm in the event of subclavian artery stenosis). Following surgery patients will be scanned routinely once a year to check for a re-stenosis in the operated artery or an increased stenosis on the contralateral side.