

Vascular cognitive impairment

Vascular cognitive impairment is a decline in thinking abilities caused by disease that damages the brain's blood vessels. Vascular disease may cause cognitive impairment on its own, and can also contribute to impairments in thinking and behaviour in a person with another brain disease such as Alzheimer's. This help sheet describes the causes, consequences, diagnosis and treatment of vascular cognitive impairment.

How does vascular disease affect brain function?

The brain relies on a healthy vascular system (the network of blood vessels in our body) for optimal functioning. While accounting for only around 2% of body weight, the brain uses 20% of total blood supply. This provides brain cells with the oxygen and nutrients they need to be healthy and function properly.

Cerebrovascular disease is a process that causes the blood vessels supplying the brain or within the brain to become blocked or damaged. When this restricts blood flow, brain cells can die, leading to deficits in brain function. When cognitive function (the thinking functions of the brain such as language, attention, reasoning and memory) is affected by cerebrovascular disease, we call this vascular cognitive impairment (VCI).

VCI is a variable condition, with the type and degree of cognitive problems depending on the type, location and extent of the underlying cerebrovascular disease and brain damage. The most severe form of VCI is vascular dementia, which is associated with cognitive deficits significant enough to interfere with daily social or occupational functioning.

VCI can occur on its own, or it can be a contributing factor to cognitive impairment in someone who also has another brain disease such as Alzheimer's or Lewy body disease. The cognitive impairment may be mild, or may be severe enough to warrant a diagnosis of dementia. Pure vascular dementia is not common. Often, vascular damage occurs alongside other brain disease and exacerbates the dementia. When more than one brain disease contributes to dementia, we call this mixed dementia.

The term VCI includes the spectrum of severity of cognitive impairment caused by cerebrovascular disease, from mild impairment that has little impact on daily function, to fully developed dementia. It also includes the contribution of cerebrovascular disease to cognitive impairment in the presence of additional brain disease such as Alzheimer's.

What causes vascular cognitive impairment?

There are many different forms of cerebrovascular disease. Each of these can result in restricted blood flow to the brain which damages brain cells. The location and size of this brain damage determines which brain functions are affected and how severely. VCI can be caused by stroke (one large stroke or several mini-strokes) affecting large blood vessels, but is more commonly caused by small vessel disease.

Small vessel disease

The most common cause of VCI is disease affecting the small blood vessels deep within the brain, causing damage to deep (subcortical) areas of the brain. This can be a consequence of untreated high blood pressure or diabetes leading to vascular disease, especially damage to blood vessel walls. The resulting brain damage can include lacunes (small strokes resulting in fluid-filled spaces) and white matter lesions (small areas of damage to the brain's nerve fibres), which can be detected on brain scans. Other changes with small vessel disease include microscopic strokes and bleeds (microinfarcts and microbleeds). These are also common and may be clinically-important but may be less easily seen on conventional brain scans.

There are a few rare hereditary causes of small vessel related VCI. The most common of these is CADASIL (cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy), caused by mutations in the Notch3 gene on chromosome 19. Symptoms can include migraines, mood disturbances, recurrent subcortical strokes, and cognitive impairment.

Symptoms of subcortical VCI often include deterioration of planning, reasoning and thinking skills, mild memory problems, walking and movement problems, behavioural changes and lack of bladder control. Subcortical vascular disease is also associated with high rates of depression. Subcortical VCI is usually progressive, with cognitive symptoms beginning gradually and getting worse over time as more vascular damage occurs, although people's abilities fluctuate. When cognitive impairment is severe, subcortical vascular dementia, sometimes called Binswanger's disease, may be diagnosed.

Stroke

A stroke is a disruption of blood flow through the brain that subsequently damages brain cells. There are two main types of stroke. Haemorrhagic stroke occurs when a blood vessel leaks or ruptures. Ischaemic stroke results from blockage in an artery restricting blood flow.

Ischaemic stroke

Almost 90% of strokes are ischaemic strokes. They occur when arteries to the brain are narrowed or blocked, causing severely reduced blood flow (ischaemia). Lack of blood flow deprives the brain cells of oxygen and nutrients, and cells may begin to die within minutes. Lasting brain damage is usually the result.

Ischaemic stroke may result when a blood clot (thrombus) forms in one of the arteries that supply blood to the brain. A clot usually forms in areas damaged by atherosclerosis, a disease in which the arteries are clogged by fatty deposits (plaques).

Ischaemic stroke may also result when a blood clot or other debris (embolus) forms in a blood vessel away from the brain and then becomes lodged in narrower brain arteries. This is often caused by atrial fibrillation, an abnormal heart rhythm that can lead to pooling of blood in the heart and the formation of blood clots that travel elsewhere in the body.

Transient ischaemic attack (TIA)

A TIA or 'mini-stroke' is caused by a temporary decrease in blood supply to part of the brain. Many TIAs last less than five minutes and do not last more than an hour. Like an ischaemic stroke, a TIA occurs when a clot or debris briefly blocks blood flow to part of the brain. Unlike an ischaemic stroke, TIAs do not typically show any evidence of brain injury and should not have any ongoing symptoms beyond 24 hours.

Haemorrhagic stroke

Haemorrhagic stroke occurs when a blood vessel in the brain leaks or ruptures. Brain haemorrhages can result from a number of conditions that affect blood vessels, including uncontrolled high blood pressure and weak spots in blood vessel walls (aneurysms).

In intracerebral haemorrhage, a blood vessel within the brain bursts and bleeds into the surrounding brain tissue, damaging cells. Brain cells beyond the leak are deprived of blood and are also damaged. High blood pressure is the most common cause of this type of haemorrhagic stroke. Over time, high blood pressure can cause small arteries in the brain to become brittle and vulnerable to rupture.

In subarachnoid haemorrhage, bleeding occurs in the space between the surface of the brain and the skull. This type of stroke is commonly caused by the rupture of an aneurysm. After the haemorrhage, irregular widening and narrowing of blood vessels may occur, further limiting blood flow to parts of the brain and causing brain cell damage.

Stroke and vascular cognitive impairment

Not all strokes lead to cognitive impairment. Whether cognitive impairment develops depends on the location and volume of the subsequent brain damage, and on other factors affecting the person's health and cognitive function. With both haemorrhagic and ischaemic strokes, the risk of VCI increases with the number of strokes that occur over time. Around 10% of people develop vascular dementia after a first stroke. The risk rises to 30% after a second stroke.

A single stroke can be enough to cause dementia if it is large enough and affects areas of the brain important for cognitive function. This type of vascular dementia is called strategic infarct dementia or single infarct dementia (infarct means the area damaged by the lack of blood supply). Vascular dementia can also result from many small strokes, and this is called multi-infarct dementia and is associated with disease of the brain's large blood vessels. Over time, as more strokes occur, more damage is done to the brain. Multi-infarct dementia can have a step-wise progression, where cognitive symptoms worsen after a new stroke, then stabilise for a time.

The symptoms of stroke related VCI depend on the location of the stroke/s and what brain functions are affected by the damage. Provided no further strokes occur, the person's symptoms may remain stable or even get better over time with recovery from the stroke. However, if there is other vascular disease also affecting the brain or additional strokes occur, symptoms may get worse.

How is vascular cognitive impairment diagnosed?

There is no one specific test that can diagnose VCI. A diagnosis is based on the presence of cognitive impairment and cerebrovascular disease being the most likely cause of the symptoms or a contributing factor. If VCI is suspected, a number of tests will likely be performed. These may include:

- An assessment of the person's problems with thinking and behaviour and how they are affecting daily function
- A full medical history (especially for stroke or disorders of the heart or blood vessels)
- Laboratory blood tests
- A neurological examination (testing reflexes, senses, coordination and strength)
- Brain imaging (to detect abnormalities caused by strokes or cerebrovascular disease)
- Neuropsychological tests (to assess changes in thinking abilities)
- Carotid ultrasound (to check for damage in the carotid arteries)

Neuropsychological tests that assess executive (planning and reasoning) and subcortical brain functions, not just memory, are important for the diagnosis of VCI. Determining the type and location of brain damage, and whether this is the likely cause of symptoms, requires brain scanning techniques such as magnetic resonance imaging (MRI) or computerised tomography (CT).

VCI can be very difficult to distinguish from other forms of cognitive impairment, because the symptoms of each type overlap. Also, many older people with cognitive impairment have both cerebrovascular disease and other brain disease such as Alzheimer's. So VCI may be a contributing factor rather than the primary diagnosis.

How is vascular cognitive impairment treated?

There is no one specific treatment, or a cure, for VCI. For stroke-related VCI, treatment to prevent additional strokes is very important.

Controlling conditions that affect the underlying health of your heart and blood vessels can sometimes slow the rate at which VCI gets worse, and may also sometimes prevent further cognitive decline.

Medications to control high blood pressure, high cholesterol, atrial fibrillation, heart disease and diabetes can be prescribed. Sometimes aspirin or other drugs are prescribed to prevent clots from forming in blood vessels. A healthy diet, regular exercise and avoidance of smoking also lessen the risk of further strokes or vascular brain damage.

Research suggests that the medications available for the treatment of Alzheimer's disease are also effective for some people with vascular dementia. These drugs can improve memory, thinking and behaviour for a time but they do not cure the disease or prevent eventual deterioration. These drugs include cholinesterase inhibitors (donepezil, rivastigmine and galantamine) and memantine. Further information about these medications is available in **Dementia Q&A sheets 1 (cholinesterase inhibitors) and 6 (memantine)**.

Who gets vascular cognitive impairment?

Anyone can be affected by VCI, but the risk increases with age, so the condition mostly affects older people. This is because vascular damage in the brain is more likely to occur the older you are. Factors that increase your risk of heart disease and stroke also raise your risk of VCI. Controlling the factors that you can do something about can help lower your chances of developing VCI.

Several factors increase the risk of someone developing cerebrovascular disease and therefore VCI. These include:

- Older age
- Personal or family history of stroke or heart disease
- History of transient ischaemic attacks or silent strokes
- High blood pressure
- High cholesterol
- Diabetes
- Obesity
- Heart rhythm abnormalities
- Blood vessel disease
- Smoking or exposure to second-hand smoke
- Physical inactivity or poor diet
- Very heavy or binge drinking of alcohol

Can vascular cognitive impairment be prevented?

Knowing your risk factors, following your doctor's recommendations and adopting a healthy lifestyle are the best steps you can take to prevent VCI, but of course there are no guarantees. For those who have had a stroke or a TIA, these measures may also help them avoid having another one.

Many of the risk factors for VCI are also associated with an increased risk of developing Alzheimer's disease, and with poorer cognitive function in older people. So a healthy lifestyle and controlling vascular risk factors may help protect brain health and cognitive abilities on a number of different fronts.

- Control high blood pressure. Exercising, managing stress, maintaining a healthy weight, and limiting salt and alcohol can all help to reduce high blood pressure. In addition to recommendations for lifestyle changes, your doctor may prescribe medications to treat high blood pressure. It is very important to take these as prescribed even if you feel well.
- Control high cholesterol. Lowering the amount of saturated fat and trans fats in your diet may help lower total cholesterol levels and reduce plaques in your arteries. If cholesterol cannot be controlled through dietary changes alone, your doctor may prescribe a statin or another type of cholesterol-lowering medication.
- Control diabetes. You can manage diabetes with diet, exercise, weight control and medication.
- Don't smoke. Smoking raises the risk of cerebrovascular disease for both the smoker and others exposed to secondhand smoke.
- Maintain a healthy weight. Obesity contributes to other risk factors such as high blood pressure, diabetes and heart disease. Weight loss can help lower your blood pressure and improve your cholesterol levels.
- Eat a diet rich in fruits and vegetables. A diet containing five or more daily servings of vegetables and two of fruit is recommended.
- Exercise regularly. Exercise can lower your blood pressure, increase your level of HDL or 'good' cholesterol, and improve the health of your blood vessels and heart. It also helps you lose weight and control diabetes. At least 30 minutes of activity on most days of the week is recommended.
- Drink alcohol in moderation, if at all. Alcohol can be both a risk factor and a preventive measure for VCI. Binge drinking and heavy alcohol consumption increase your risk of high blood pressure and stroke. However, drinking small to moderate amounts of alcohol can increase your HDL cholesterol and decrease your blood's clotting tendency, both of which can contribute to a reduced risk.

This sheet is provided for your information only and does not represent an endorsement of any assessment or treatment by Dementia Australia.

Thanks to Dr Paul Yates – Austin Health for reviewing this material.

Further Information

Dementia Australia offers support, information, education and counselling. Contact the National Dementia Helpline on **1800 100 500**, or visit our website at **dementia.org.au**



For language assistance phone the Translating and Interpreting Service on **131 450**