

## Secondary Prevention and Rehabilitation after a Stroke

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### ABSTRACT

After an acute stroke, consideration of secondary prevention and rehabilitation should start as soon as possible. The risk of recurrent stroke is high but it can be reduced by pharmacological or even surgical interventions. Stroke rehabilitation concentrates on addressing neurological deficits, preventing complications, maintaining health and addressing the psychological impact the event may have had. Stroke management in this phase of care requires multidisciplinary team input and may take place over days, weeks, months or even years. The interventions required should be personalised for the individual's needs.

**Key Words:** stroke; rehabilitation; prevention

### Introduction

After an acute stroke, consideration of secondary prevention and rehabilitation should start as soon as possible. The risk of recurrent stroke is high but it can be reduced by pharmacological or even surgical interventions. Stroke rehabilitation concentrates on addressing neurological deficits, preventing complications, maintaining health and addressing the psychological impact the event may have had. Stroke management in this phase of care requires multidisciplinary team input and may take place over days, weeks, months or even years. The interventions required should be personalised for the individual's needs.

### Secondary Prevention

The risk of recurrent stroke following a first event is significant<sup>1</sup> (fig 1). Thus, the task of secondary prevention should start immediately. This includes clot prevention, blood pressure and cholesterol control, specific therapies around carotid or cardiac disease and lifestyle measures. The implementation of any secondary prevention measure should be balanced with the needs of the individual and patients should understand the goals of these therapies to encourage future concordance.

**Figure 1: Risk of Stroke Recurrence prior to optimal treatment**

Time from first stroke.	Risk of recurrence.
30 days	3-10%
1 year	5-14%
5 years	25-40%

## Clot Prevention

In the first fourteen days following an ischaemic stroke, high dose aspirin (300mg daily) is most effective at preventing further events. It inhibits platelet aggregation and therefore clot formation. After this time, aspirin can be stopped and clopidogrel 75mg commenced. Previously, aspirin was used in conjunction with dipyridamole and this regimen is still used when clopidogrel is not tolerated due to allergy. All antiplatelet regimens carry an increased risk of bleeding.

Antiplatelet agents aim to prevent in situ thrombus formation or embolic events arising from carotid artery disease. Alternative agents are required for stroke occurring from cardio-embolic disease. Atrial fibrillation carries an increased risk of stroke due to the development of thrombus within the left atrial appendage. All patients should be screened for atrial fibrillation following a stroke with ambulatory ECG monitoring. For young patients with no cardiac history this can be completed over twenty-four hours however older patients or those with structurally abnormal hearts may benefit longer periods of monitoring<sup>2, 3</sup>. An echocardiogram can inform the risk of atrial fibrillation by looking for atrial enlargement and valvular disease.

The CHA<sub>2</sub>DS<sub>2</sub>Vasc score<sup>4</sup> was developed to help guide treat patients who had atrial fibrillation, and has superseded the CHADS<sub>2</sub> score in some centres. The components of this scale and points tally are as follows:

**Congestive heart failure** – 1 point

**Age** ≥75 years – 2 points / 65-74 - 1 point

**Diabetes Mellitus 2** – 1 point

**Gender** – female 1 point / male 0 points

**Hypertension** consistently above 140/90 mmHg (or treated hypertension) – 1 point

**Previous stroke or TIA** – 2 points

**Vascular disease** (such as peripheral vascular disease) – 1 point

The total score correlates with the annual risk of a stroke, and can help guide treatments of atrial fibrillation (Fig 2).

**Figure 2: CHA<sub>2</sub>DS<sub>2</sub>Vasc score and the annual risk of stroke in patients with atrial fibrillation**

CHA <sub>2</sub> DS <sub>2</sub> -VAsc Score	Annual Stroke Risk %
0	0
1	1.3
2	2.2
3	3.2
4	4.0
5	6.7
6	9.8
7	9.6
8	6.7
9	15.2

Patients scoring 2 or more should be considered for oral anticoagulant therapies. Historically this has been coumarin therapy, usually warfarin, monitored with international normalised

ratio (INR) measurements (target range 2-3). In recent years, other anticoagulants have emerged. Dabigatran is a direct thrombin inhibitor and Rivaroxaban and Apixaban are direct factor Xa inhibitors. These drugs require no monitoring and data suggest a reduced likely of bleeding complications<sup>5, 6, 7</sup>. However if bleeding does occur they do not have a specific antidote. The risk of bleeding can be quantified to some extent using the HAS-BLED<sup>8</sup> score but other factors such as co-morbidities, dependency and falls may play a role in rationalising therapy and decisions should be individualised. In some patients conversations with stroke physicians may be advisable. Anticoagulant therapy is usually commenced 14 days after an acute stroke.

Echocardiograms carried out to look for cardiac sources of emboli occasional identify patent foramen ovale (PFO). This is not uncommon in the general population and the role of these lesions in stroke is not entirely clear. The possibility of paradoxical embolus, emboli arising from thrombus in the deep venous circulation and crossing the atrial septum to reach the arterial circulation, must be considered. In the absence of confirmed venous thrombus, antiplatelet rather than anticoagulant therapy is the mainstay of secondary prevention and the role of closing these PFOs is unclear. Valvular lesions seen on echocardiogram may also need specialist intervention and the guidelines above for atrial fibrillation relate to non-valvular disease.

## **Blood Pressure**

In the acute phase following a stroke, control of hypertension is guarded as cerebral perfusion may rely on a degree of systemic hypertension. Levels above 180 / 110mmHg however, may carry an increased risk of enlargement of an intra-cerebral haemorrhage or haemorrhagic transformation of an infarct and should be addressed. Long-term blood pressure control should be aimed at maintaining readings at <140/90mmHg, or <130/80mmHg for those patients with diabetes or chronic kidney disease and has been shown to reduce the risk of further events<sup>9, 10</sup>. The choice of antihypertensive agent is probably not important, it is the lowering of blood pressure that is significant, however often other indications for specific agents may exist. Selection of hypertensive agents is usually selected based upon national or local guidelines. The benefit of lowering blood pressure is seen in older age groups though over-treatment of hypertension may increase the risk of orthostatic hypotension and falls.

## **Cholesterol**

The role of hyperlipidaemia on the pathogenesis of vascular disease, include stroke, is well documented and there is good evidence that statin therapy reduces stroke risk<sup>11</sup>. LDL cholesterol is a more specific target for reduction than total cholesterol though both can be used to guide therapy. An LDL level <2.0mmol and total cholesterol <3.5mmol is ideal. Patients sometimes wish to try dietary measures to reduce cholesterol before starting treatment. If statin therapy is not tolerated, other lipid lowering agents can be used, such as ezetimibe, though the evidence base is less clear. In haemorrhagic strokes, the role of statins is contentious.

## **Carotid Disease and Intervention**

In patients suffering an ischaemic stroke or TIA, the source of embolus may be atherosclerotic disease in the internal carotid artery. If this disease causes significant stenosis then surgery may be indicated in the form of carotid endarterectomy (CEA). This

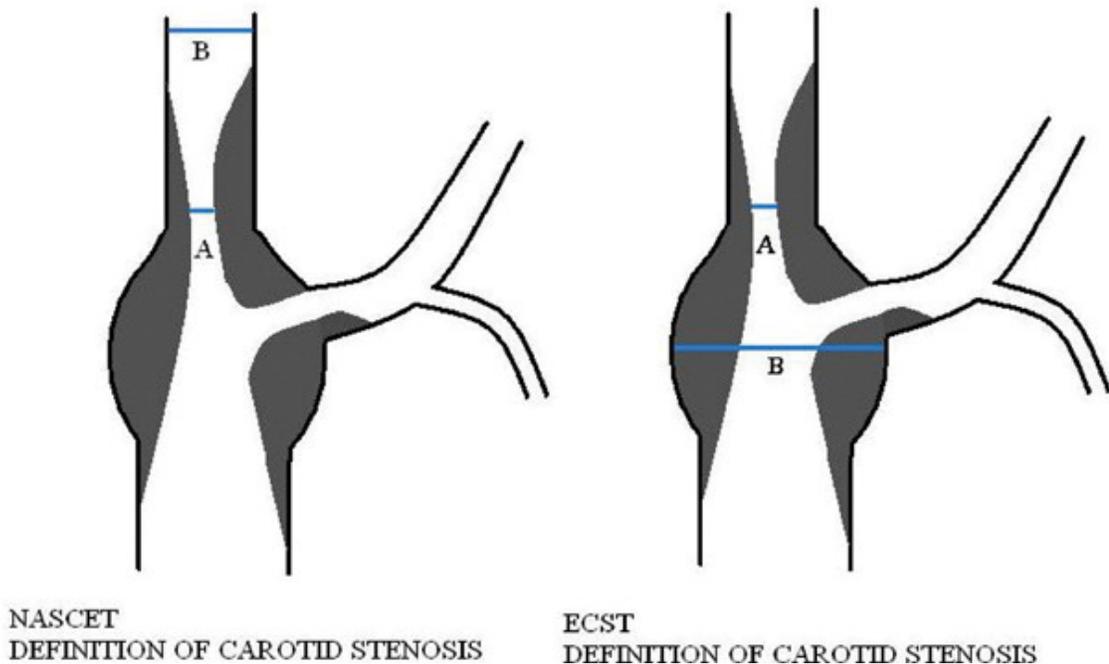
significantly reduces the chance of further strokes, particularly in the higher degrees of stenosis (>70% by NASCET criteria)<sup>12</sup>. Carotid stenosis is routinely assessed by doppler ultrasound. Two systems exist (fig 3)<sup>13</sup>, the North American Symptomatic Carotid Endarterectomy Trial (NASCET) and the European Carotid Surgery Trialists' Collaboration group (ECST). These take different measurements for comparison to the stenosed area. NASCET compares the normal distal lumen, ECST uses the diameter of the carotid bulb. A NASCET measurement of 50-99% stenosis or ECST measurement of 70-99% stenosis is an indication for surgery to be considered. Carotid imaging and referral to the appropriate vascular surgical team should take place within one week of symptom onset and surgery should take place within two weeks of symptom onset if it is to go ahead. In cases where the internal carotid artery is completely occluded there is no role for CEA.

Carotid surgery is a major undertaking and many people who experience a stroke or TIA have significant other co-morbidities that make them unfit for surgery. The aim of CEA is to prevent future disabling strokes. For this reason, people who are already significantly disabled, by their stroke or other conditions, do not stand to gain the same benefit as those with good functional status. This must be judged carefully on an individual basis. The difference between surgery on the carotid artery of the dominant or non-dominant cerebral hemisphere may be significant. Incidental stenosis of the asymptomatic carotid is not an uncommon finding on doppler ultrasound but currently there is no role for routine surgery on these lesions.

For those patients in whom CEA is not appropriate due to surgical risk, carotid stenting may be indicated. This is now supported by NICE as an alternative to CEA<sup>14</sup>. It is a less invasive procedure, the stent is placed via angiography, and some trial data suggest equivalent efficacy.

In patients receiving carotid intervention of any kind, medical treatment and control of vascular risk factors should still be optimised.

**Figure 3 – Classification of Carotoid Stenosis**



## **Lifestyle Changes**

All patients who suffer a stroke or TIA should be advised to stop smoking and should be offered contact with smoking cessation services. This has shown to reduce the chance of all future vascular events including stroke and myocardial infarction.

Other lifestyle measures that have been proven to be effective include taking regular cardiovascular exercise and eating a diet high in fruit and vegetables. Alcohol intake should be moderated.

## **Rehabilitation and the Multi-Disciplinary Team**

All patients admitted with a stroke should be reviewed within 24 hours by the multidisciplinary team (MDT). Input can then be tailored to their needs and rehabilitation started promptly. Not all patients will require input from all members of the multidisciplinary team.

MDT input can happen on the acute stroke unit, in a rehabilitation centre or at the patient's own home. It should continue as long the patient is receiving benefit and making progress but should not persist when there is no hope of further improvement as this can be psychologically distressing.

### ***Physiotherapy***

The role of physiotherapy following a stroke does not just centre around increasing strength and assisting mobility. Following a stroke, patients may suffer from a range of problems which have a motor component. They may have weakness, in co-ordination and imbalance, spasticity, pain and marked functional impairment. They may also require physiotherapy involvement for respiratory secretions following pneumonia.

The speed at which neurological motor deficits resolve depends on numerous factors such as age, pre-morbid health and cognition. Lower limbs tend to improve more quickly than upper limbs as the area of motor cortex which supplies the legs has some dual blood supply from both the anterior and middle cerebral arteries. Patients with expressive or receptive dysphasia may struggle to communicate with physiotherapists. Higher cortical function such as inattention can make it difficult for a patient to identify one side of their body and therefore use those muscles in exercise. Fatigue and depression may limit a patient's interaction with therapy. This can be an extremely prominent component in some patients.

Spasticity can develop over time following a stroke. This can restrict function and be painful and disabling. If spasticity is left untreated it can lead to permanent muscle shortening and contractures. These can interfere with activities of daily living; a hand with fixed finger flexion may be difficult to clean and long nails may cause trauma to the skin. Physiotherapy will identify spasticity early and work at preventing progression. This can be with active or passive stretching exercises. In more severe cases, splinting or applying plaster casts can help the affected limb to assume an appropriate position. Patients with spasticity may respond to medical therapies such as baclofen and tizanidine, though these are not without side effects. In selected cases botulinum toxin can be injected into the muscle. Increased tone can occasionally be used to a patient's advantage. A leg with increased tone may make transferring from a chair to bed easier than it would be with a flaccid leg.

Often the goal most important to patients following a stroke is regaining the ability to walk. This is a complex task requiring rehabilitation of strength, balance and cognition. It is a gradual process, progressing from using aids to help reach a standing position to walking a few steps with assistance and then walking with increasing independence and the use of mobility aids such as a wheeled walking frame or sticks. Orthoses may be required to treat specific problems such as foot drop. Regaining balance requires first the ability to sit and then stand and correct posture to compensate from external forces. Once mobility is regained, the chance of returning to independent living is greatly increased.

Goal setting and standardised measurements are useful in rehabilitation. Reducing a large goal into smaller goals can make the journey appear more manageable for patients and maintain their motivation. Objective scales to measure strength, balance and function allow progress to be recorded and reviewed, even when staff change between rehabilitation sessions. Power can be recorded using the Medical Research Council 0-5 scale, angles of flexion and extension can be objectively measured, balance can be assessed with the Tinetti scale. Overall function is measured on the modified Rankin scale but changes between grades may mask smaller degrees of improvement.

### ***Occupational Therapy***

The role of the occupational therapist is to rehabilitate patients to their activities of daily living. This includes any activity important to the individual at their stage of life and may go beyond the basic tasks of washing, dressing and eating.

Activities of daily living often require adequate motor function but also rely on higher cognitive function. Following a stroke, patients may have issues with praxis (planning and executing complex tasks) and communication, including expressive and receptive dysphasia. Concentration on the task in hand and the ability to recall which stages have already been completed is important, as is the ability to attend to both sides of the body and the immediate environment. Deficits in many of these areas may co-exist, making a previously simple task challenging.

Occupational therapy enables tasks to be broken down into composite parts that can later be pieced back together to formulate the complete process. The various stages may benefit from the use of aids to support patients to pursue the task independently; for example, a plate guard can allow a patient with a single functioning upper limb to feed themselves from a plate. Technology is playing an increasing role in occupational therapy rehabilitation and many “apps” are available for use on tablet platforms to increase concentration, planning and attention.

Cognitive assessment after a stroke often falls within the remit of occupational therapy. All stroke patients should have a cognitive assessment post-stroke even if no obvious deficit exists. Subtle problems may be present and may have a significant impact on a person’s ability to live independently and safely. This cognitive assessment can be challenging, particularly in patients with speech problems. The Montreal Cognitive Assessment tool (MoCA) is well validated but requires adjustment for those with expressive dysphasia. Following a stroke, many patients will have a persistent cognitive deficit, labelled as Vascular Cognitive Impairment (VCI). This is distinct to vascular dementia which is a progressive process and may occur without evidence of clinical stroke disease but it is possible for someone with VCI to develop vascular dementia as many of the risk factors are the same.

The most recognised role of occupational therapy is to assist the discharge of a patient by reviewing their home environment and providing aids and assistance to make that environment appropriate for their new needs. Despite the best rehabilitation, many patients are left with some residual difficulties following a stroke and many of these patients are pre-morbidly older and frail with multiple co-morbidities impacting on their ability to self-care. An assessment of the home environment will often be carried out before discharge, sometimes with the patient themselves. Areas of attention are access in and out of the building, enabling mobility around the house, including stairs, and transfer in and out of bed or bath. Toileting needs may require the provision of a commode. The height of light switches, electrical points or work surfaces may need to be adjusted if patients are now required to use a wheelchair. Speaking aids may assist patients with dysphasia. Alarms fitted to beds and doors may alert carers to the movements of a patient who is confused or at risk of falls.

### ***Speech and Language Therapy***

There are two main roles to speech and language therapy following stroke. Patients require assessment and review of their ability to swallow safely. They may also need assessment of their ability to speak and understand as even a subtle deficit could have a significant impact on their approach to rehabilitation.

Swallowing ability is usually assessed immediately post-stroke by ward nursing staff. Even people presenting with presumed mild deficits may have difficulty swallowing safely and may be at risk at aspiration. Swallowing is a complex task and each stage needs to happen safely to prevent aspiration.

Initial deficits in swallow function can be approached in two ways. Either diet can be adapted by thickening fluids and providing soft or pureed diet or, in the case of entirely unsafe swallowing, artificial enteral feeding via naso-gastric tube may be attempted. In some cases unsafe swallowing mechanisms may persist and discussions may be had regarding long term feeding via a percutaneous endoscopic gastrostomy (PEG) tube.

Speech is a function of the dominant cerebral hemisphere. In most right handed people this is the left hemisphere and in a slightly smaller majority of left handed people it is the right hemisphere. Strokes affecting the dominant hemisphere can cause issues with both the understanding of speech (receptive dysphasia), the formation of speech (expressive dysphasia) or both. Speech changes are also possible in non-dominant hemisphere strokes but may present with increased verbosity or conversely the inability to speak due to apraxia rather than dysphasia.

The loss of speech and understanding can be a very emotional and frustrating issue for patients following a stroke. Communication can be facilitated in numerous ways using picture and letter cards, digital speech tools and gestures. The participation in conversation, though frustrating, is therapeutic to improving speech overall. It requires time and patience but can be provided by untrained family, friends and carers under the guidance and review of speech and language therapists. Dysphasia may impact on mental capacity if a patient is unable to communicate their wishes.

### ***Psychological Support***

A stroke, whatever the magnitude of the neurological deficit, can have an enormous impact on the psychological wellbeing of the person. There are numerous issues to contend with including the acceptance of fallibility and mortality, coming to terms with possible on-going

physical problems and the need to depend on others. There may be a loss of role within society, such as that of carer or wage earner and concerns for the future, particularly whether a further stroke will occur. In addition to these issues of adjustment, post-stroke depression is a well-recognised phenomenon that has a neurochemical basis. Ischaemic damage to neurones disrupts serotonergic and dopaminergic pathways that can lead to a biological cause of depression. Depression can impact on a patient's ability to rehabilitate. It may lead to poor sleep, impaired appetite and subsequent low energy levels and low motivation.

Formal psychological support is of limited availability within hospital medicine as a whole. Ideally, patients with psychological issues following a stroke would have access to assessment and therapy with clinical psychologists. In the absence of these services there are other routes that can be pursued. Listening, explaining and reassuring are tools that any healthcare professional can provide and the importance of these processes should not be under-estimated. An awareness of what this event means to the individual and not attempting to minimise these feelings is essential. Education as to the cause of strokes and future risks following secondary prevention may provide some reassurance and the process of rehabilitation can restore hope and the idea of a future. The Stroke Association is a charitable organisation that can provide other forms of support including group sessions or the provision of a "buddy" who has previously been through similar events or comes from a similar background. In some cases, post-stroke depression requires pharmacological intervention. This is usually in the form of selective serotonin re-uptake inhibitors. This may be short-term in nature and can be reviewed at a later date.

## Conclusion

A stroke can be a devastating event and the subsequent recovery can be a long process. Life after a stroke may involve coping with a new disability, physical or cognitive, and with new medications. Prompt treatment in the acute phase followed by holistic rehabilitation give patients the best chance of returning to independent living. Secondary prevention gives the best chance of not having to experience the same challenge again in the future.

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