

Managing stroke:

Key principles and updates

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Stroke is the second commonest cause of death worldwide and the most frequent cause of disability in adults in many countries, and patients with stroke account for more hospital and rest-home bed days than any other condition,¹ with total quantifiable direct costs to the country estimated at around \$156 million per year.² Stroke mortality in Western populations has declined steadily over the last few decades and, while stroke incidence trends differ between countries, the overall number of stroke survivors is increasing. In New Zealand, there are approximately 32 000 stroke survivors² of whom approximately 20% live in rest homes or private hospitals, 50% live outside institutional care, and only 30% remain independent in their activities of daily living.^{3,4} There are also noticeable ethnic disparities in stroke incidence and outcomes,⁴⁻⁶ with substantially higher incidence and worse stroke outcomes in Maori and Pacific Island peoples compared with New Zealand Europeans. Evidence-based stroke management is essential for improving stroke outcomes and reducing the burden of stroke. This review outlines current principles of stroke management with the emphasis on acute care and rehabilitation strategies.

Acute care

Hospitalisation

Any acute stroke patient should be admitted to a hospital stroke unit as soon as possible (Table 1). There is robust evidence that stroke patients who receive organised inpatient care

in a geographically defined acute stroke unit (ASU) are more likely to be alive, independent, and living at home one year after the stroke.⁷ All patients with acute stroke or transient ischaemic attack (TIA), irrespective of age or stroke severity or any other considerations, should be admitted to the ASU for initial evaluation and management. There are three major types of stroke units:

1. ASU unit for acute care only (the average length of staying in such units is usually a few days);
2. Comprehensive stroke unit that provides both acute care and rehabilitation (the average length of staying in such units is usually from several days to a few weeks); and
3. Mobile stroke team. Current evidence shows superiority of the first two types of acute stroke units over mobile stroke team. The key elements of acute stroke units are the co-ordinated expert interdisciplinary team working in a geographically-based setting with regular team meetings (at least weekly). The tasks of the team are to establish an accurate diagnosis, observe vital signs, maintain homeostasis, provide acute treatment, prevent complications, implement early rehabilitation, initiate secondary prevention strategies, and develop the most appropriate discharge and rehabilitation plan.

Anticoagulants

Current recommendations for prevention and management of complications of acute stroke are summarised in Table

2. Recent data from the International Stroke Trial⁸ do not support the routine use of subcutaneous unfractionated heparin in acute cardioembolic stroke irrespective of the brain territory involved. In this situation, aspirin is the drug of choice. An alternative approach may be the use of warfarin as the first line therapy. However, until more evidence from clinical trials are available, the use of heparin (including low molecular weight heparin) may be considered in patients with carotid artery dissection, crescendo TIAs, recurrent cardiac embolism, and acute cardioembolic stroke due to rheumatic atrial fibrillation.

Surgery for carotid artery stenosis

Carotid endarterectomy for patients with high grade (70–99% by NASCET method and 80–99% by ECST method) recently symptomatic stenosis is highly beneficial: the number-needed-to-treat is about eight for any stroke or surgical death prevented.⁹ On average, surgery for patients with 50–69% stenosis is only modestly effective: the number-needed-to-treat is about 14 and the effect is not felt until several years after surgery. Surgery confers no benefit at all if stenosis <50%. However, the severity of stenosis alone cannot be enough to decide surgery.

Subarachnoid haemorrhage

Early endovascular treatment with coil placement into the ruptured an-

eurysm is the preferred method of treatment of patients with mild to moderate severity of aneurysmal subarachnoid haemorrhage (SAH).¹⁰ Calcium channel blocking agents should be administered orally every four hours for 21 days or until the aneurysm surgery (whatever occurs first) in all patients with aneurysmal SAH.¹¹ Intravenous administration of calcium antagonists, which is more expensive, may be reserved for those patients with aneurysmal SAH who cannot take nimodipine orally.

Rehabilitation

The primary goal of rehabilitation is to optimise function, and promote well-being and quality of life, in the domains of disability and handicap. Secondary goals are the relief of caregiver stress, and the prevention of recurrence of stroke (secondary prevention). Current New Zealand guidelines for stroke management¹² recommend local stroke services to decide appropriate types, intensity and duration of ongoing rehabilitation in the community. The usefulness of a coordinated rehabilitation programme for treating functional impairment resulting from a stroke is well established. The rehabilitation programme should provide an environment of high motivation to help achieve maximal physical and psychological functional capacity and should be tailored to meet the needs of each patient and family. To plan and implement this programme most effectively, a coordinated, interdisciplinary team approach commenced in the hospital and continued at the community level is required. Besides a physician knowledgeable in stroke rehabilitation and rehabilitation nurses, the composition of this team often includes a physiotherapist, occupational therapist, speech and language therapist, dietitian, and social workers. The family/whanau (including caregivers and/or close friends) role in post-stroke rehabilitation is significant. Psychosocial support should be started with the family at the time of hospitalisation and begins with the patient as soon as

Table 1

Acute stroke treatment	Level of evidence*
All patients with suspected stroke/TIA should be referred to, and assessed by, the ASU team as soon as possible after the patient is considered for admission to hospital.	A
All patients should have a CT head scan ASAP to confirm the diagnosis of stroke and stroke subtype.	B
Unless there is absolute contraindication, or the patient has agreed to thrombolysis with Alteplace or an experimental hyper-acute treatment, all patients with ischaemic stroke should be given aspirin (150–300 mg) as soon as possible after onset.	A
All patients with subarachnoid haemorrhage (SAH), potentially due to intracranial aneurysm rupture, should be urgently evaluated by neurosurgeon for possible neurosurgical intervention.	A
All patients should be closely monitored for hyperglycaemia and hyperthermia ($\geq 37.5^{\circ}\text{C}$); those with diabetes or raised blood-glucose concentration should receive insulin; in patients with hyperthermia, an antipyretic such as paracetamol or cooling devices such as cooling blankets or compresses may be considered to maintain body temperature in the normal range.	B
All patients with deteriorating clinical state due to cerebellar haemorrhage should be considered for neurosurgical referral for possible intervention.	B

Table 2

Prevention and management of complications of acute stroke	Level of evidence*
Each stroke patient should undergo swallowing assessment.	B
Urinary catheters should be used with caution and alternative methods for the management of continence explored.	C
All those involved in moving stroke patients should receive training in lifting, transferring, and moving and handling of the upper limb.	C
In patients at high risk of deep vein thrombosis (DVT) and/or pulmonary embolism (PE), external compression stockings or intermittent pneumatic compression devices should be used where heparin/Clexane is contraindicated.	B
Awareness of the possibility of depression and other related mood disorders should lead to prompt evaluation and treatment.	B

- * **A:** at least one randomised controlled trial as part of the body of literature of overall good quality and consistency addressing specific recommendation;
B: availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation;
C: evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

feasible. Family members should be given realistic and straightforward information and instructions to provide support for the patient and to develop a partnership for the solutions to problems as early as possible. There is evidence that family (whanau) support services improve quality of life for carers¹³ and reduce their possible stress. The majority of patients should be informed of and referred to the Stroke Foundation, if the patient/family agrees.

Rehabilitation should be started with early, systematic, and realistic increases in activities and advanced in stages in a local hospital, in an outpatient clinic, at home, or in a specialised rehabilitation unit. The programme must include rehabilitation that is specific to the deficit (Table 3). For productive rehabilitation, the patient must willingly participate and have the cognitive ability to follow at least one-step commands and the memory to remember the lessons learned in therapy. In patients with cerebrovascular disease who have significant cardiac dysfunction (such as angina, arrhythmia, or myocardial infarction), the rehabilitation programme should be combined with a cardiac rehabilitation programme. The frequency of rehabilitation treatment sessions varies according to the availability of resources, the setting and timing after stroke, and with the patient's response to therapy.

The issue of post-stroke driving needs to be discussed with the patient by the medical team. In general, patients (especially those with moderate to severe hemiparesis and/or hemi-spatial deficit) are advised not to drive until clinical recovery is complete with no significant residual disability.

Prevention of complications

Complications of stroke include increased intracranial pressure, chest infections, urinary tract infection, deep vein thrombosis, pulmonary embolism, depression, painful shoulders, seizures, cardiopulmonary failure, hyponatraemia, hyperthermia,

Table 3

Rehabilitation following acute stroke	Level of evidence*
Rehabilitation should be started as soon as the patient's condition permits.	B
Rehabilitation aims, with short and long-term rehabilitation objectives, should be established and agreed by all parties including the patient and carers.	C
Physiotherapy should aim to promote recovery of motor control, independence in functional tasks, optimise sensory stimulation, and prevent secondary complications such as soft tissue shortening and chest infections.	C
The broad role of occupational therapy in the rehabilitation of stroke patients should be recognised. Early referral for assessment is appropriate.	C
All patients with a communication problem resulting from stroke should be referred for speech and language therapy assessment and treatment.	A
Intensive speech and language therapy should be initiated as soon as the patient's condition is stable and may be required to continue over the long term.	B
Where intelligible speech is not a reasonable goal, the speech and language therapist should augment speech attempts and enable communication through means other than spoken language.	B
Speech and language therapist should play a key role in swallowing assessment.	C
Patients with diabetes, high blood cholesterol levels, poor oral intake or who are significantly underweight should be referred to dietician.	C
Active bowel and bladder management should be implemented. Catheters should be used only after full assessment. It is important to have regular bowel movements with at least one bowel emptying every 2-3 days. Continence services can be approached when required.	C
Screening for depression and anxiety should be provided. Persistently (>6 weeks) depressed patients should be given antidepressant treatment.	B

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hyperglycaemia, pressure areas, gastrointestinal alterations, and falls. Patients should all be carefully monitored for such complications.

Swallowing problems

In dysphagic patients, nasogastric feeding within the first two to three weeks should be the chosen route of

feeding unless there is a strong practical reason to choose PEG feeding (e.g. the patient cannot tolerate a nasogastric tube).¹⁴ In patients with dysphagia, monitoring for chest infection is important. Vigorous tracheobronchial toilet, deep-breathing exercises, and early mobilisation are helpful preventive measures. To pre-

vent aspiration pneumonia, swallowing should be tested before oral feeding is permitted. If there is any question about the safety of the patient's swallowing, a formal study with fluoroscopy may clarify the potential for aspiration and consistency of food necessary to prevent aspiration. Antibiotic therapy is used only for clinical chest infection and not prophylactically.

Bladder and bowel problems

Urinary catheters should be used with caution and alternative methods are desirable. Indwelling catheters should be avoided; the alternative approach is frequent intermittent catheterisation to minimise bladder distention. In patients with incontinence or urinary retention, anticholinergic drugs may help in the recovery of bladder function. Stool softeners, laxatives, and suppositories lessen the risk of fecal impaction.

Thromboembolism and heart problems

In patients who have a high risk of pulmonary embolus and deep vein thrombosis (DVT) due to immobility, consideration should be given to low molecular weight heparin (Clexane) in a preventative dose. Elastic stockings can be used if anticoagulation is contra-indicated. Cardiovascular complications after stroke such as cardiac arrhythmias, myocardial infarction, and electrocardiographic abnormalities should be treated whenever possible, with attention given to the underlying disease according to a cardiologist's advice.

Mood disorders

The emotional impact of stroke is evident in approximately 25% of patients and may include anger, denial, anxiety, depression, emotionalism and post-traumatic stress disorder. Some patients with mood disorder may require treatment by staff skilled in psychological approaches. Depression is a common problem following stroke. Frequently this will resolve spontaneously. However, doctors need to be aware of the

possibility of ongoing depression and should monitor this closely.

Seizures

Seizures resulting from acute stroke are usually treated with IV diazepam followed by a loading dose of phenytoin. Anticonvulsants are usually not given prophylactically.

Bed sores

Decubitus ulcers are common but can be prevented with an air mattress on the bed, position adjustment every one

to two hours, tight bed sheets, dry skin surfaces, and prevention of urinary and fecal incontinence. For bedridden and severely immobilised patients, appropriate positioning and re-positioning in bed, supporting the weak (paralysed) limb with pillows or armrests, and breathing exercises are important to prevent complications, such as joint contractures and shoulder pain.

Physiotherapy

Physiotherapy in the form of passive exercises is begun as soon as the defi-

Table 4.

Secondary prevention of vascular events	Level of evidence*
All patients with ischaemic stroke or TIA should be given long-term aspirin (100–150 mg) for prevention of future vascular disease, unless contraindication to aspirin or warfarin is considered more appropriate. Other antiplatelet therapies (dipyridamol) should be used as an adjunct therapy in situations of 'aspirin failure'.	A
All post-acute patients with either ischaemic stroke or primary intracerebral haemorrhage (when the patient is medically stable, which usually within the first 5–10 days after stroke onset) should receive blood pressure lowering therapy (preferably ACE inhibitor–diuretic combination) irrespective of initial blood pressure (hypertensive or non-hypertensive), age and gender.	A
Warfarin anticoagulation (INR 2–3) should be used where the stroke resulted from a cardiac source (e.g. atrial fibrillation) and the patient has a good understanding of the treatment and they are at low risk of haemorrhagic complications (e.g. low risk of falls, no alcohol abuse).	A
Carotid ultrasound should be organised in patients with severe ipsilateral disease who have no major comorbidities that reduce life expectancy and are prepared to accept the real early risk of surgery.	A
Carotid endarterectomy for patients with high grade carotid artery stenosis should be considered.	A
Post-stroke or TIA patients who have a persistent elevation of cholesterol despite dietary modification and two fasting levels above 5 mmol/L should be considered for statin therapy to reduce the risk of further stroke.	A
Secondary prevention of stroke should include adequate control of stroke risk factors, including lifestyle modifications (e.g. diet low in saturated fat, salt, and cholesterol; smoking abstinence; reasonable physical activity etc).	B

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cit is stable. These measures are important not only for maintaining and increasing limb function and mobility but also for preventing DVT, especially in patients who are not receiving an anticoagulant (or antiplatelet) agent.

Patients who are alert and have a stable cardiovascular system should sit up in bed as soon as the neurologic deficit is stable (usually within the first or second day after onset of symptoms). Patients who tolerate sitting up in bed may sit in a chair and then should be aided or instructed in a stepwise fashion about how to stand, transfer to and from a wheelchair, walk (or push a wheelchair), and perform other regular activities of daily living, including eating, brushing teeth, washing, shaving, dressing, and undressing as their neurologic status permits (sudden or intense activity should be avoided). During the early part of the exercise programme, patients should be monitored closely, and special attention should be given to changes in blood pressure and heart function. For hemiplegic patients, the occupational therapist should cooperate closely with the physiotherapist, nursing staff, speech therapist, and the patient's spouse or family to provide retraining in basic self-care activities (such as feeding, dressing, and washing). The occupational therapist can individualise various types of upper extremity splints that can assist the patient in increasing function.

For prevention of ulnar nerve compression palsy and shoulder-hand syndrome, the weak arm should not be left to hang without support. In patients with equinovarus deformity of the foot or flexion contracture of the paretic wrist and fingers, a foot-ankle plastic orthosis (a short or long leg brace) or a wrist-finger extension splint is commonly used.

Coordination exercises and frequent practice of standing and walking between parallel bars are required for patients with poor coordination (ataxia without paralysis) and dysequilibrium. If cognitive function

is preserved in a patient with hemiparesis, instructions in the use of various special devices (such as handrails along walls, quad canes, bedside table, specially designed card holders, typewriters, telephones, and other specific activity aids) can assist the patient in becoming more independent in the activities of daily living.

Selective gymnasium therapy in conjunction with point massage and autogenous training, heat therapy, cryotherapy, and acupuncture also may be instituted to reduce spasticity.

Secondary stroke prevention

In patients with embolic ischaemic stroke and an established cardiac source of emboli, including atrial fibrillation, mechanical valve, dilated cardiomyopathy, known intracardiac thrombus, or recent myocardial infarction, where no contraindication to warfarinisation exists, consideration should be given to anticoagulation with warfarin, particularly if a good functional recovery from the index stroke has been achieved (Table 4).

In patients with ischaemic stroke who do not require warfarinisation, aspirin should be prescribed (100–150mg a day) unless contraindicated. In patients in sinus rhythm, who had the stroke while on aspirin, increasing the dosage of aspirin with the addition of dipyridamole (persantin retard) may be beneficial.

In patients with significant symptomatic carotid artery stenosis (70–99%) who are fit for surgery and have a life expectancy of at least five years, consideration should be given (provided a reasonable recovery from the initial event is made) to endarterectomy.

Attention should be given to lowering blood pressure, control of diabetes and modification of risk factors such as hypercholesterolaemia. All post-acute (>5 days) patients with either ischaemic stroke or primary intracerebral haemorrhage should receive blood pressure lowering therapy (presumably ACE inhibitor-diuretic combination) irrespective of initial blood pressure, age and gender. Pa-

tients with a high cholesterol (>5 mmol/L) who have a reasonable life expectancy should be considered for statin or other lipid-lowering therapy.

Patients with an intracerebral haemorrhage should have blood pressure optimised in the rehabilitation phase, and anticoagulation or antiplatelet therapy should be avoided.

In patients with unruptured intracranial aneurysm, considerations for neuroimaging evaluation and surgical treatment of the aneurysm should be given, especially if the aneurysm is 10 or more millimetre in size or becomes symptomatic.

Follow-up and duration of rehabilitation

All patients should have a follow-up plan at discharge from hospital. Follow up may involve different community services. The patients should be reviewed at stroke (neurovascular) clinic, or have a domiciliary visit. At follow-up the caregiver should be interviewed, and attempt made to minimise caregiver stress.

Although the duration of rehabilitation therapy is generally determined by the rate of functional recovery, the probability of improvement of movement in paralysed limbs is maximal during the first month after stroke and decreases significantly after six months, whereas improvement of speech, domestic and working skills, and unsteadiness can continue for up to two years. Recovery of arm movement is usually less complete than that of leg movement, and complete lack of any movement at onset of stroke, or no measurable grip strength by four weeks, is associated with a poor prognosis for return of useful arm function. About half of the patients who survive for six months after stroke are partially or totally dependent in their activities of daily living such as bathing, dressing, feeding, and mobility (10% need long-term nursing care). About one-third of patients surviving

stroke for one year are unable to remain independent, and this proportion remains relatively unchanged in survivors followed for up to five years. However, functional recovery (lessening of disability or handicap) often continues long after specific neurologic deficits have ceased to change. Therefore patients and their families should never give up their fight for recovery and greater independence.

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