Medical Services

STROKE

Version 1 Final

Document control

Version history

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Changes since last version

Introduction

Synonyms (Cerebrovascular Accident, Stroke, T.I.A.)

Definition

Stroke is defined as a clinical syndrome of rapid onset of focal cerebral deficit lasting more than 24 hours. TIAs differ from stroke as their duration is less than 24 hours, often making them more difficult to diagnose due to lack of signs on examination.

In Western countries, stroke is the third commonest cause of death after ischemic heart disease and all cancers. It is the second most common cause of neurological disability after Alzheimer's disease. Its incidence has decreased in recent decades, but the decrease appears now to be levelling off. Cerebrovascular disease remains the leading cause of institutional placement in adults who have lost functional ability to be independent. [1]

Most vascular injury to the brain is secondary to atherosclerosis or hypertension. There are three pathological types of stroke: ischemic stroke accounting for about 80%, primary intracerebral haemorrhage accounting for around 15%, and subarachnoid haemorrhage in 5%.

Aetiology

Normally, adequate cerebral blood supply is ensured by an efficient collateral system: from one vertebral artery to another, between the carotid and vertebral arteries via the anastomoses at the circle of Willis, and through collateral circulation at the level of the hemispheres. If the collateral circulation becomes impaired it can result in brain ischaemia and consequent neurological symptoms. If the blood supply is promptly restored, brain tissues recover and symptoms disappear, but if the blood supply is compromised for longer than one hour then permanent neurological damage can result. Around 50% of all ischemic strokes and TIAs are from atherothrombotic disease of the extracranial, or occasionally large intracranial, arteries. 20% are due to emboli from the heart and 25 % are due to lacunar infarcts. The remainder are due to much rarer causes. [2]

Risk Factor

Stroke Risk Factors

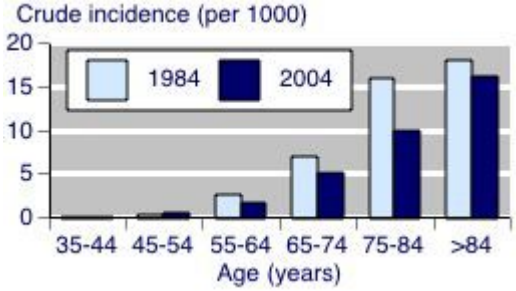
Untreatable	Treatable	
Age > 60 yr	Cardiac arrhythmia	Hypertension
Family history of stroke	Cardiomyopathy	Hyperviscosity state
Male sex	Diabetes mellitus	Illicit drug use
Prior transient ischemic attack or stroke	Excessive ethanol use	Oral contraceptive use
	History of migraine	Tobacco use
	Hypercoagulable state	Valvular heart disease
	Hyperlipidemia	Vasculitis

Prevalence / Incidence

Stroke is a world wide problem; about 4.5 million people die from it each year. Two thirds of stroke deaths occur in less developed countries. It can occur at any age but there is an increased incidence in the elderly with three quarters of all first strokes occurring in the over 65s.

By 2020, stroke mortality is set to double due to the increasing proportion of elderly people. However, one UK study based in Oxfordshire, demonstrated that the incidence of major debilitating stroke had fallen by 40% between 1981/84 and 2004. The improvement in this cohort is thought to be due to improved treatment of premorbid conditions and reduction in risk factors. [3]

Changes in crude stroke incidence in Oxfordshire between 1984 and 2004



Diagnosis

The diagnosis of stroke can be made reasonably accurately by history taking and clinical examination. Some clinical signs of a stroke include a hemiparesis affecting face +/- arm +/- leg, dysarthria, dysphasia, dysphagia, homonomous hemianopia and impairment of higher cortical function. The neurological signs may suggest the cerebral artery territory affected. The clinical findings can vary greatly in severity from minor weakness to complete disability. Stroke risk factors should be enquired about in the history. Some clinical signs, such as carotid bruits or thrills may indicate a carotid stenosis or plaque formation, but these clinical findings do not really correlate well with underlying carotid pathology. A doppler ultrasound is necessary to visualise the carotid arteries accurately.

Determining the immediate cause of a stroke may be difficult. Infarction can only be reliably differentiated from haemorrhage by brain imaging. Onset during sleep or on rising may suggest infarction while onset during exertion may suggest haemorrhage but this is not reliable for diagnosis. Headache, coma or stupor, marked hypertension and convulsive seizures are more likely with haemorrhage.

Concomitant signs of myocardial infarction, atrial fibrillation, or rheumatic heart disease suggest cardiac emboli may be the cause of stroke, therefore a cardiac echo should be done. Neck pain with a neurological deficit may suggest a dissection. Dissections can occur without pain.

A CT scan is the best initial investigation for acute stroke as it can be done quickly and will immediately differentiate between a haemorrhage and an infarct. MRI has a place in diagnosis too but is not used first line. It can be quite common for a CT scan not to show any abnormality (50% in a recent study in Edinburgh) but this does not mean the patient has not had a stroke. In some cases infarcted tissue has to become fluid before it can be visualised and this can take some days.

Stroke Management

Stroke management after the immediate stabilisation involves acute care and rehabilitation, and combines the use of medical and physical interventions to improve stroke outcome.

Medical Management

The table below demonstrates the current interventions, which have been shown to be of benefit in stroke prevention. [4, 5, 6, 7, 8]

Condition(s)	Treatment
Previous stroke or T.I.A.	Antiplatelet therapy Blood pressure reduction Cholesterol reduction Carotid endarterectomy in people with (moderately severe (50 – 69%) or severe (> 70%) carotid artery stenosis
Atrial fibrillation with previous stroke or T.I.A.	Oral anticoagulants
Atrial fibrillation without previous stroke or T.I.A.	Oral anticoagulants Aspirin (if anticoagulants are contraindicated)

Stroke Unit Care and Rehabilitation

Patients who receive organised stroke unit rehabilitation are more likely to survive their stroke, return home, and make a good recovery. [8]

Organised stroke unit care is a form of care provided in hospital by nurses, doctors and therapists who specialise in looking after stroke patients and work as a multidisciplinary team. The aim is to provide rapid diagnosis, full assessment by the multidisciplinary team, including occupational, speech and physiotherapists, and a period of rehabilitation. A variety of different types of stroke unit has been developed. The best results seem to come from those which are based in a dedicated ward. [9]

Restoration of motor function is best achieved by intensive physiotherapy which should be commenced as soon as is thought appropriate by the rehabilitation team. Improvement in motor function can continue for up to six months.

Language impairment (aphasia and dysphasia) is apparent in about one quarter of survivors of a stroke. About half of all recovery from this disability occurs over the first month and can continue for six months. About 12% remain aphasic at six months.

Expressive and receptive language, written language and overall functional communication can be affected Therapy is aimed at improving communication and the functional and psychological aspects of having language impairment.. Speech and language therapy can be delivered in a variety of settings (hospital, rehabilitation centre, home), individually or in groups, with formally trained speech and language therapists or informal support from family and volunteers. Studies have found that no difference could be found between formal therapy and informal support. [10]

Depression post stroke is common although the role of interventions for preventing depression after stroke is unclear. It is an important complication of stroke that is often missed or poorly managed. Little is known as to whether treatment started early after stroke will reduce the risk of depression and improve recovery. No evidence has been found that antidepressant drugs prevent depression or improve physical recovery after stroke. One large trial has shown that psychological therapy could improve patient's mood, but did not improve physical outcomes. More, well designed, clinical trials are thought to be required which should test practical treatments for preventing depression. [11]

Prognosis

During the first days of an ischaemic stroke neither the progression nor outcome can be predicted although there will be some cases of early death caused by mass effect from large strokes. About 20% of patients die in hospital and about 30% of patients die within a year of the stroke. The mortality rate increases with age.

The extent of neurological recovery depends on the patient's age and general state of health, although the size and position of the infarct has the main impact on prognosis. Impaired consciousness, mental deterioration, aphasia, or severe brain stem signs all suggest a poor prognosis. Complete recovery is uncommon but the sooner improvement begins the better the prognosis. Of all stroke survivors nearly half are left dependant. Those patients with milder defects may recover functionally by the time of discharge and may eventually take care of their basic needs, although are likely to require some additional assistance. Any deficit remaining after 6 months is likely to be permanent.

One study carried out in patients with acute stroke involved weekly examinations of neurological deficits using the Scandinavian Neurological Stroke Scale(SSS) [Appendix 1] and functional disabilities (Activity of Daily Living ADL) measured by the Barthel Index [Appendix 2] performed from the time of admission until the end of rehabilitation. These evaluations were repeated 6 months post stroke. Time course of recovery was stratified according to the initial stroke severity and disability. Best ADL function was reached within 8.5 weeks in patients with initially mild strokes, within 13 weeks in patients with moderate strokes and within 17 weeks in patients with severe strokes and 20 weeks in patients with very severe strokes. After these time points no significant changes occurred. The time course of neurological recovery followed a pattern similar to that of functional recovery but preceded functional recovery by 2 weeks.

Main Disabling Effects

50% of people who survive a stroke will exhibit some residual disability after 6 months. The type of disability can be wide ranging dependent on the area of the brain affected.

The most common site of brain damage results in hemiplegia (weakness or paralysis of one side of the body), which can affect face, arm and leg and can range from a mild weakness to complete paralysis. They may display receptive or expressive dysphasia if the stroke affects the dominant cerebral hemisphere. There may be visual or sensory inattention if the stroke has affected the non-dominant hemisphere. There may be a loss of vision due to a homonymous hemianopia

Strokes affecting the brain stem may produce vertigo, difficulty with speech, chewing, and swallowing. Weakness of the face, difficulty in controlling eye movements, ataxia and nystagmus may also occur.

Stroke affecting the cerebellum causes ipsilateral in coordination and decreased muscle tone. Dysarthria, nystagmus, ataxia and disorders of gait are possible long-term effects.

Cognitive impairment following a stroke is related to the extent of the brain damage resulting from the stroke.

Site of stroke	**Impairment/deficit**
Frontal lobe	Behavioural abnormalities, planning/anticipatory difficulties, inertia and decreased initiative
Parietal lobe	Spatial disorientation, apraxia, agnosia, sensory inattention, receptive aphasia
Pre-central gyrus (within parietal lobe)	Expressive aphasia
Temporal lobe	Memory loss, hallucinations (auditory and visual), decreased concentration and attention, mood problems, receptive aphasia
Occipital lobe	Cortical blindness
Brain stem	Decreased information processing, decreased IQ, cognitive problems

Personality changes may occur. These may include irritability, apathy, lability of mood, and occasionally aggressive behaviour. Inflexibility in coping with problems is common and, if severe, may result in a catastrophic reaction. Such changes are more likely to be associated with widespread cerebrovascular disease than a single stroke but may continue to worsen despite improvement in the physical aspects of the stroke.

Mood disorders are common after a stroke and include depression, anxiety and less commonly mania.

Transient Ischaemic Attacks (T.I.A.s)

Definition

Focal neurological abnormalities of sudden onset and brief duration that reflect dysfunction in the distribution of the internal carotid, middle cerebral or the vertebrobasilar arterial system. TIAs differ from stroke as their duration is less than 24 hours (frequently less than 1 hour), often making them more difficult to diagnose due to lack of signs on examination.

Aetiology

TIAs should be considered as a 'brain attack' as a significant proportion of TIA sufferers will go on to have a disabling stroke or myocardial infarction unless they are investigated and treated. Most T.I.A.s are due to cerebral emboli from ulcerated atheromatous plaques in the coronary arteries or vertebral arteries in the neck or, less often, from mural thrombi in a diseased heart.

Hypertension, arteriosclerosis, atrial fibrillation, diabetes mellitus and polycythaemia predispose to T.I.A.s. T.I.A.s are most common in the middle aged or elderly but occasionally occur in children with severe cardiovascular disease that produces emboli.

Symptoms and Signs.

Symptoms are identical to those of stroke but are transient.

T.I.A.s begin suddenly, last 2 to 30 minutes or less frequently 1-2 hours then abate without persistent neurological abnormalities. Consciousness remains intact throughout the episode. Patients may have several T.I.A.s daily or only two or three over several years. Patients with T.I.A.s should be investigated for possible causes on an urgent basis.

Diagnosis and Treatment

Differentiation from convulsive seizures, neoplasms, migraine, Meniere's disease, other forms of vertigo and hypoglycemia in diabetics is sometimes necessary and appropriate investigations should be carried out.

Underlying risk factors (the same as for stroke) should be identified and treated if possible. TIAs are rarely seen on a CT scan. Diffusion weighted MRI is the investigation of choice, although this is not readily available in all hospitals. All patients should have carotid Doppler investigation.

Main Disabling Effects

T.I.A.s do not result in residual disability. [However there may be a relationship between drop attacks and falls in the elderly.] Approximately 30% of people over 65 years and living in the community fall each year.
The number is higher in institutions. [12] Although less than one fall in 10 results in a fracture, a fifth of all falls require medical attention. Treatment of any other predisposing factors may be helpful as may be discontinuation of psychotropic drugs.

Home hazard assessment and modification by a health care professional can reduce falls. [12]

Drop attacks in which a conscious patient's legs buckle are often attributed to vertebrobasilar insufficiency, but the actual cause of this common condition often remains obscure. [2] In deed the American Hearing Research Foundation reports that about 12% are due to the heart (a variant of syncope), 8% are due to poor circulation to the brain, 8% are due to problems with both the heart and brain, 7% are due to seizures, 5% are due to the inner ear (Meniere's disease), and 1%, are due to psychological problems. [13]

Appendix A - The Scandinavian Neurological Scale (SSS)

Overview:

The Scandinavian Neurological Stroke Scale (SSS) can be used to evaluate a patient who has had an acute ischemic stroke. The scale can predict both prognosis and long-term outcome. The score was developed by the Scandinavian Stroke Study Group.

Parameters:

(1) consciousness

(2) eye movements

(3) motor power in arm on the affected side

(4) motor power in hand on the affected side

(5) motor power in leg on the affected side

(6) orientation

(7) speech

(8) facial palsy

(9) gait

Parameter	Finding	Points
consciousness	fully conscious	6
	somnolent, can be awakened to full consciousness	4
	reacts to verbal command but not fully conscious	2
	unconscious	0
eye movements	no gaze palsy	4
	gaze palsy present	2
	conjugate eye deviation	0
motor power in arm	raises arm with normal strength	6
	raises arm with reduced strength	5
	raises arm with flexion in elbow	4
	can move, but not against gravity	2
	paralysis	0

motor power in hand	normal strength	6
	reduced strength in full range	4
	some movement; fingertips do not reach palm	2
	paralysis	0
motor power in leg	normal strength	6
	raises straight leg with reduced strength	5
	raises leg with flexion of knee	4
	can move, but not against gravity	2
	paralysis	0
orientation	correct for time, place and person	6
	2 out of time, place and person	4
	1 out of time, place and person	2
	completely disoriented	0
speech	no aphasia	10
	limited vocabulary	6
	incoherent speech	6
	more than yes/no but no longer sentences	3
	only yes/no	0
	less than yes/no	0
facial palsy	none	2
	dubious	2
	present	0
gait	walks 5 meters without aids	12
	walks with aids	9
	walks with help of another person	6
	sits without support	3
	bedridden or wheelchair bound	0

where:

- The table in Lindestrom et al did not have an entry for unconsciousness. I added it because it seemed to make sense.

prognostic score =

= (points for consciousness) + (points for eye movement) + (points for motor power in arm) + (points for motor power in leg)

long term score =

= (points for motor power in arm) + (points for motor power in hand) + (points for motor power in leg) + (points for orientation) + (points for speech) + (points for facial palsy) + (points for gait)

Interpretation:

- minimum prognostic or long term score: 0
- maximum prognostic score: 22
- maximum long term score: 48
- The higher the scores the better the prognosis.

Performance:

- Interobserver agreement good to excellent (weighted kappa value 0.69 to 0.91).
- The score was found to be reliable for stratification of stroke patients and for evaluation of long-term outcome.

References:

Lindenstrom E, Boysen G, et al. Reliability of Scandinavian Neurological Stroke Scale. Cerebrovascular Dis. 1991; 1: 103-107. (Table 1, page 104).

Scandinavian Stroke Study Group. Multicenter trial of hemodilution in ischemic stroke. Background and study protocol. Stroke. 1985; 16: 885-890. (Table 1, page 888).

Appendix B - Barthel Index

Overview :

The Barthel Index is intended to measure the independence of a patient for mobility and personal care. It can be used to assess the effect of therapy or to determine the amount of nursing care needed by a patient.

Parameter	Finding	Points
controlling bowels	independent. Patient is able to control bowels and have no accidents.	10
	Patient may occasionally have an accident, or may require a suppository or enema.	5
	cannot meet defined criteria	0
controlling bladder	independent. Patient is able to control bladder day and night.	10
	Patient may occasionally have an accident, or cannot wait for a bedpan, or is unable to get to the toilet in time.	5
	cannot meet defined criteria	0
getting on and off toilet	independent. Patient can get on and off toilet, adjust clothing, use toilet paper, and keep clothes from becoming soiled. The patient can use an object for support if needed.	10
	with help	5
	cannot meet defined criteria	0
feeding	Independent. Patient can feed self if food is placed within reach. The patient may use an assistive device if needed. Eating needs to be accomplished within a reasonable time.	10
	Some help is needed, such as cutting up food.	5
	cannot meet defined criteria	0
moving from wheelchair to bed and return	independent in all phases of the activity	15
	with some minimal help, or some supervision	10
	requires assistance	5
	cannot meet defined criteria	0
walking on level surface	independent. Patient can walk at least 50 yards without help or supervision.	15
	with help	10
	unable to walk but can propel a wheelchair	5

	independently	
	unable to walk and unable to propel a wheelchair	0
dressing	independent	10
	with help	5
	cannot meet defined criteria	0
ascend and descend stairs	independent. Patient is able to go up and down a flight of stairs safely without supervision or help.	10
	with help	5
	cannot meet defined criteria	0
grooming	Patient can wash, comb hair, and brush teeth. Men can shave self, and women can apply makeup.	5
	cannot meet defined criteria	0
bathing self	Patient may use a bathtub, shower or take a complete sponge bath unassisted.	5
	cannot meet defined criteria	0

Barthel Index =

= SUM(points for all 10 items)

Interpretation:

- minimum score: 0
- maximum score: 100

References:

McDowell I, Newell C. Measuring Health - A Guide to Rating Scales and Questionnaires, Second Edition. Oxford University Press. 1996. pages 56-63

References

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[3] PM Rothwell et al. Change in Stroke Incidence, case fatality, severity and risk factors in Oxfordshire from 1981-2004 (Oxford Vascular Study). Lancet 2004 363:1925 – 1933.

[4] Gregory YH Lip, Peter Rothwell, Cathie Sudlow (Reviewers). Clinical Evidence. Cardiovascular Disorders: Stroke Prevention Search date September 2005.

[5] Elizabeth Warburton (Reviewer) Clinical Evidence: Stroke Management: Blood Pressure Reduction Search date January 2005.

[6] Elizabeth Warburton (Reviewer) Clinical Evidence: Stroke Management: Anticoagulation Search date January 2005.

[7] Elizabeth Warburton (Reviewer) Clinical Evidence: Stroke Management: Specialised Care Search date January 2005.

[8] Elizabeth Warburton (Reviewer) Clinical Evidence: Stroke Management: Interventions Search date January 2005.

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