Management of stroke: acute, rehabilitation and long-term care

David G Smithard

Stroke is the major cause of disability in adults, resulting in much morbidity and mortality in the west. Each year 120 000 people will suffer their first stroke with a further 40 000 suffering a recurrent stroke and 40 000 a transient ischaemic attack. The prevalence rises from 2/1000 population to 2/100 in those over 85 years of age. Consequently stroke is seen as a problem of the elderly.

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During the acute phase and post acute phases of stroke clinical management is often, at best, haphazard. This has been borne out by the National Sentinel Audit of Stroke (Rudd et al, 1999), which has revealed that although 75% of trusts have a stroke unit only about 25% of patients actually spend a significant amount of time in them.

Following the first two National Sentinel Audits of Stroke (Rudd et al, 1999; Intercollegiate Working Party for Stroke, 2001) detailing the deficits in provision of stroke care in the UK, the Government included the care of stroke patients (standard 5) in the National Service Framework (NSF) for Older People (Department of Health, 2001). Despite this, the standards pertain to all stroke patients irrespective of age (*Table 1*). The NSF contains a timeframe against which stroke services need to be in place, which is particularly important since a quarter of acute trusts do not yet have a designated stroke unit.

Often there is resistance to setting up stroke services in an acute trust, despite the fact that any one acute hospital site can have as many as 35–40 patients in their beds and stroke patients occupy 20% of hospital beds (Wade, 1994). Setting up a stroke unit can be cost neutral, and result in increased efficiency, shorter lengths of stay (more people returning to their own residence), reduced mortality and reduced morbidity (Langhorne and Duncan, 2001). The number of stroke patients discharged to their own home within 56 days is a benchmark against which trusts are assessed.

Studies from Norway (Indredavik et al, 1999) suggest significant savings can be made with improved patient care. The number of patients treated to save one life or disability in the case of stroke units is 9, where as for some drugs it is a lot higher. For instance the number needed to treat (NNT) for clopidogrel is between 75 and 200 (CAPRIE Steering Committee, 1996; Caro and Migliaccio-Walle, 1999) and for warfarin in atrial fibrillation is between 16 and 30 (Koudstaal, 2000). Antihypertensives are greater depending on age. Thrombolysis has a NNT of 7 but is only applicable to about 1% of admissions whereas a stroke unit is applicable to almost all patients with stroke (Lindley, 2002). Interestingly there is more evidence supporting the use of stroke units than there is for coronary care units.

The NSF is mandatory and gives those people championing stroke a stick with which to beat the drum, along with those provided by the Sentinel Audit and the survey by the British Association of Stroke Physicians (Rodgers et al, 2003), both showing that provision of stroke services is woefully inadequate, and in some cases absent. The purpose of all these tools is to deliver high quality care to all people suffering a stroke.

TABLE 1.
Aim and standards set out in standard 5 of the National Service Framework

Aim	To reduce the incidence of stroke in the population and ensure that those who have had a stroke have prompt access to integrated stroke care services
Standards	The NHS will take action to prevent strokes, working in partnership with other agencies where appropriate
	People who are thought to have had a stroke have access to diagnostic services, are treated appropriately by a specialist stroke service, and subsequently, with their carers, participate in a multidisciplinary programme of secondary prevention and rehabilitation

NATIONAL SERVICE FRAMEWORK

The NSF has an aim to reduce stroke incidence and to improve stroke care (*Table 1*). There are also milestones to be met both for hospital care

and general practice (*Tables 2* and *3*). The NSF details four aspects of stroke care:

1. Prevention
2. Immediate care
3. Early and continuing rehabilitation
4. Long-term care and support.

The aim must be to deliver the same standard of care to all patients irrespective of age and location (postcode). The difference between the standard of care we deliver and that which we would wish to deliver is great – we need to cross that divide.

This article focuses on the management of stroke care around acute phase and rehabilitation. Stroke management is an interagency interdisciplinary problem, not just medical nor just hospital-based.

IMMEDIATE CARE

Acute stroke and transient ischaemic attack (TIA) are medical emergencies. The first challenge is to make the diagnosis and then actively manage to prevent recurrence or deterioration (*Figure 1*). Acute ischaemic stroke should be treated along the same lines as acute ischaemic myocardial damage. The term stroke is slowly being changed to the phrase brain attack suggested by the European Stroke Initiative (Kaste et al, 2000).

Changes with neuronal cell permeability can be seen in minutes to hours of stroke onset. A diffusion weighted magnetic resonance imaging scan can show subtle changes very acutely (minutes), and often there are very subtle changes on the computed tomography scan (loss of definition of the basal ganglia, sulci effacement). Management in the acute phase is about protecting the brain and preventing further neurological damage, and in the case of TIA progression to a completed stroke.

In the acute phase of stroke the area surrounding the infarct (penumbra) and any haemorrhage (and possibly also in the case of haemorrhage) is potentially salvageable. The penumbra needs protecting from further damage. Blood flow below 20 ml/min is unable to maintain neurological function, and at this level the brain autoregulatory system will not work. Protection of the penumbra can be achieved either by restoring blood flow, reducing oedema or reducing toxic free radicals. Neuronal cells die following an infarct. On dying toxic chemicals are released including glutamate and aspartamine. Neuroprotective agents bind to the respective receptors to reduce the effect.

Neuronal protection has long been an aim. There are several approaches, one of which is to stabilize membranes. Many agents have been tried, including antibiotics, steroids, antihypertesives, vitamin E, cannabis derivatives, antiepileptic agents, magnesium, chlormethiazole, naloxone, monoclonal antibodies and hyperbaric oxygen. The IMAGES (Intravenous MAGnesium Efficiency in Stroke) study, investigating magnesium, has just finished recruiting and results should be published next year. Many of the neuroprotective agents have failed to show any benefit in man. Whether this is a result of stroke heterogeneity or bad trial design is debated. The other approach is to recanalize the artery that is occluded. Many studies have investigated the role of thrombolytics, aspirin or heparins/heparinoids.

Aspirin

Aspirin (Chinese Acute Stroke Trial, 1997; International Stroke Trial, 1997) has a marginal but positive effect on the acute management of stroke, such that most guidelines suggest giving aspirin at a dose of 300 mg for 2 weeks, starting within the first 48 hours. After this time the dose can be reduced to between 50 and 300 mg (Intercollegiate Working Party for Stroke, 2000).

TABLE 2.
Actions set out for the implementation of standard 5

Every health system should, in partnership with other agencies where appropriate:	Review current arrangements, in primary care and elsewhere to identify those at greatest risk of stroke, and to intervene actively to reduce these risks; and agree local priorities to improve rates of identification and effective intervention in stroke
	Review current arrangements, in primary care and elsewhere, for TIA and to agree and implement a local protocol for the rapid referral of patients with TIA who may be at risk of stroke
	Review current hospital services for stroke using the clinical audit methodology developed by the Royal College of Physicians
	On the basis of this, agree local priorities for action to establish an integrated stroke service, which is regularly audited with a continuing cycle of improvement

TIA = transient ischaemic attack

TABLE 3.
Milestones for the implementation of stroke care

April 2002	Every general hospital which cares for people with stroke will have plans to introduce a specialist stroke service from 2004	
April 2003	Every hospital which cares for older people with stroke will have established clinical audit systems to ensure delivery of Royal College of Physicians clinical guidelines for stroke care	
April 2004	PCTs will have ensured that:	Every general practice, using protocols agreed with local specialist services, can identify and treat patients identified as being at risk of a stroke because of high blood pressure, atrial fibrillation or other risk factors
		Every general practice is using a protocol agreed with local specialist services for the rapid referral and management of those with TIA
		Every general practice can identify people who have had a stroke and is treating them according to protocols agreed with local specialist services
	100% of all general hospitals to have a specialized stroke service in operation	

PCT = primary care trust; TIA = transient ischaemic attack

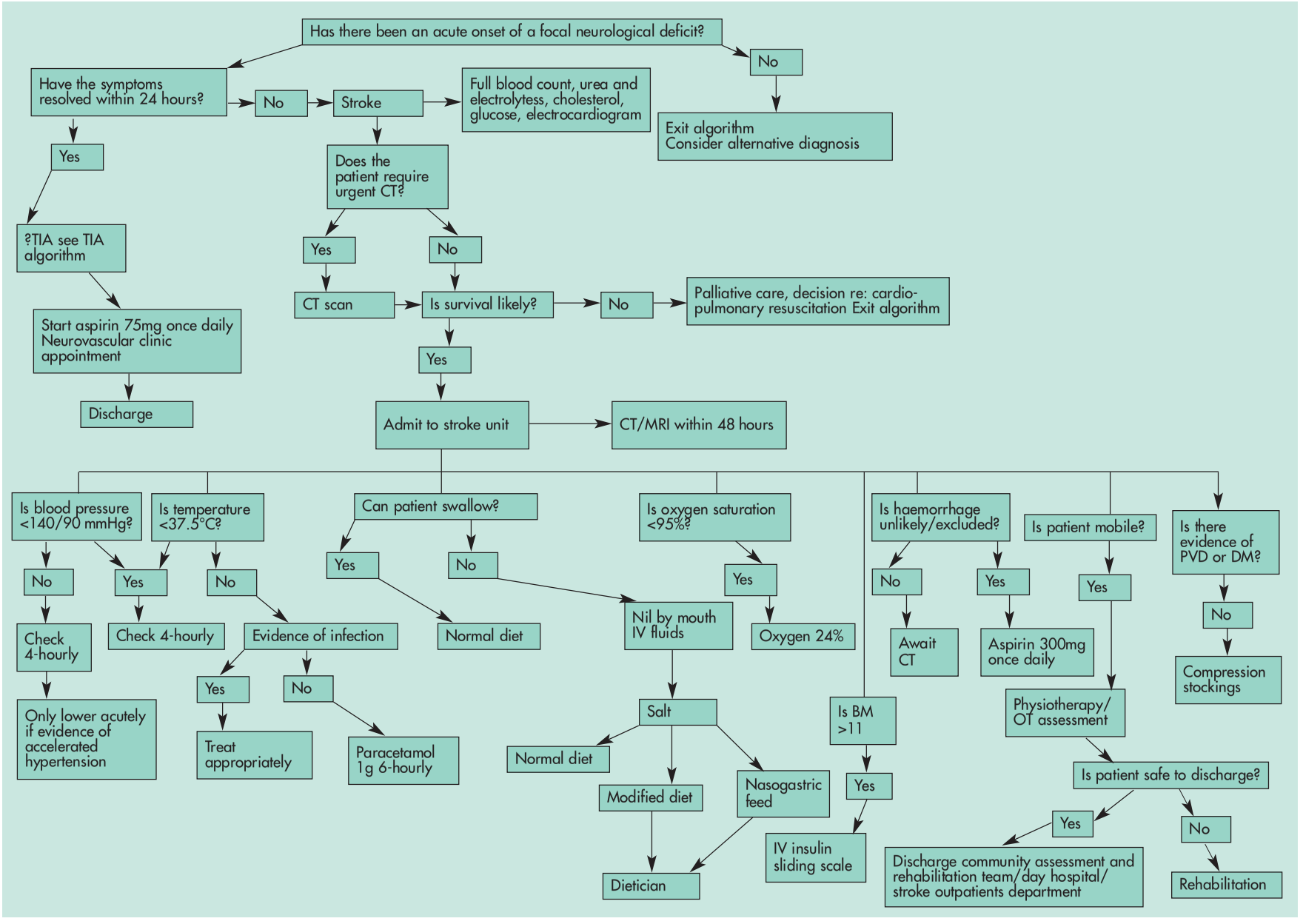

Figure 1. Acute care flow chart: East Kent Hospitals algorithm of acute stroke care. BM = finger prick glucose assessment; CT = computed tomography; DM = diabetes mellitus; IV= intravenous; MRI = magnetic resonance imaging; OT = occupational therapy; PVD = peripheral vascular disease; TIA = transient ischaemic attack.

Heparin/heparinoids

Many studies have been undertaken using low molecular weight heparins and sodium heparin. Most studies show a reduction in deep vein thrombosis and pulmonary embolus, but this is offset by the increase in symptomatic intracranial haemorrhage. Presently guidelines suggest avoiding heparin in the acute phase of stroke, although there are unanswered questions regarding the use of low dose subcutaneous sodium heparin.

Thrombolysis

Several agents have undergone clinical trials (recombinant tissue plasminogen activator (rtPA), streptokinase, ancrod, urokinase). Positive results from small studies have been shown with ancrod and vampire bat saliva, strongly positive results with rtPA, and negative results with streptokinase. Meta-analyses are positive for the use of rtPA, but these rely heavily on one study from the USA. Two large European studies have left the water muddied. Two studies (3rd European Cooperative Acute Stroke Study and International Stroke Trial 3; www.dcn.ed.ac.uk/ist3) are investigating the time window for thrombolysis – this is currently less than 3 hours, and the criteria are strict.

Within the UK the consensus is that unless a centre is set up to administer tPa then it should only be used in the context of a trial (Wardlaw, 1998). At this time the British Association of Stroke Physicians are planning to run training programmes for those involved in stroke management who are considering the use of thrombolysis.

Physiological management of acute stroke

Recently much attention has been paid to 'high tech' management of stroke. An exciting treatment that offers fantastic immediate results often does not come to fruition or only benefits a small number of patients. It is often blindly accepted that the neurological condition will deteriorate in the first 48 hours and may improve or may not, but this need not be so. Up to 40% of those with an acute stroke undergo 'stroke in progression' and this can often be predicted (Indredavik et al, 1999).

Factors that predict or result in progressive neurological damage include increasing age, dehydration, pyrexia, hyperglycaemia, arrhythmia, hypoxia and aspiration. Good acute care now accepts that acute management of stroke is proactive, not reactive. Intravenous fluids should be prescribed for the first 48 hours, saline not dextrose. Oxygen should be provided if saturations fall below 95%, paracetamol if temperature rises above 37°C and antibiotics if it rises above 37.5°C. Intravenous insulin should be given if the blood sugar level is >11 mmol/litre (Scott et al, 1999).

A raised temperature and a raised blood sugar level are thought to contribute to the ongoing intracranial damage. The evidence for lowering the blood glucose level below 5 mmol/litre is not yet present, although the GIST (Glucose Insulin Stroke Trial) study is being undertaken and coordinated in Sunderland (Scott et al, 1999) to investigate this. Certainly there is evidence of the use of intravenouse insulin to lower glucose from cardiac studies (Malmberg et al, 1995).

More radical approaches for the management of acute stroke have examined high-risk patients especially those with malignant stroke. In these cases craniotomy may benefit. There is a randomized control study ongoing. There has also been renewed interest in cooling the brain, first reports appearing in the early part of the 20th century.

Hypertension in the acute phase is more difficult to manage. Current consensus is to observe, and if it remains elevated after the first 10–14 days then to treat. There are no guidelines in this area but the PROGRESS (Perindopril Protection against Recurrent Stroke) Collaboration Group (2001) and HOPE (Heart Outcomes Prevention Evaluation) (Bosch et al, 2002) studies would suggest that an angiotensin-converting enzyme inhibitor would be the agent of first choice or the second agent to a thiazide. More information is becoming available that supports blockade of the renin–angiotensin system in the wake of recent trials with losartan and canadesartan.

PLACE OF MANAGEMENT

Acute phase

Should stroke patients be admitted in the acute phase? Certainly all patients need to be assessed, probably by an expert and within a short space of time. The Helsingborg declaration (Aboderin and Venables, 1996) suggests that all patients should be assessed by hospital specialists within 6 hours.

Where should the patient be managed in the acute phase? All the evidence suggests that the best place to be during the acute phase of stroke is an acute stroke unit. An acute stroke unit will deliver high quality care and reduce death and disability. Ideally these beds should either be co-located with the rehabilitation unit or be part of the rehabilitation phase. Indredavick's unit is a combined/comprehensive unit with about 20 beds. The maximum length of stay is 3 weeks with a median of around 11 days. Most stroke patients are discharged home with a supported discharge, others go to a slower rehabilitation facility or stroke unit. The comprehensive stroke unit has a NNT of 9 for death and disability and the positive effect will last for many years (Indredavik et al, 1999; Jorgensen et al, 2000; Langhorne and

Duncan, 2001). Given the lack of acute stroke units in the UK, hospitals need a simple model of care for the acute phase of stroke (*Figure 1*) that can be delivered effectively to all stroke patients.

Can the community deliver acute care? People would like to think so, but the evidence says not. Kalra et al (2000) conducted a study in the London borough of Bromley comparing acute in patient management with community management. The stroke unit reduced death and disability compared to the other settings (*Figure 2*).

Rehabilitation

Post acute rehabilitation, i.e. the first few weeks, is probably best managed in the acute setting (*Table 4*). However, after the first 10–21 days it is appropriate for the right patients to be discharged home with rehabilitation support. Once a patient has been assessed and fully investigated their rehabilitation can occur at home. The evidence for this is very convincing. People would appear to do at least as well as those that stay in and maybe better. Many parts of the world are attempting to provide early supported discharge. There are models in Devon and Northumberland (www.doh.gov.uk/nsf/olderpeople/index.htm) along these lines, not only using supported discharge but hospitals closer to home for prolonged and slower rehabilitation.

Despite the evidence there is a lot of resistance from the public and in some cases doctors. Evidence from several trials supports admission for the acute phase then supported discharge, resulting in a short length of stay (Rudd et al, 1997; Early Supported Discharge Trialists, 2000).

For those who need rehabilitation after discharge there has been a focus on rehabilitation at home. This may not suit all. A study in Nottingham suggested that the frail preferred the day hospital, the young preferred outpatient therapy and those in between preferred to rehabilitate in their own settings (Gladman et al, 1993).

When does stroke recovery end? This is a difficult question – it would appear to be many months if not years after the initial stroke, but all people are different. Different amounts of improved function will occur at different rates in fairly similar patients. In a nutshell rehabilitation needs to begin early and to continue. For how long is unknown, but certainly it is longer than used to be thought.

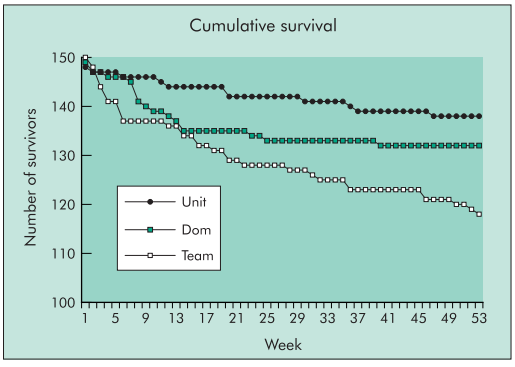

Figure 2. Survival following stroke management in different settings. Dom = domicillary.

TABLE 4.
Early and continuing rehabilitation

Interdisciplinary working with a multidisciplinary team	Speech therapy	
	Nutritional advice	
	Physiotherapy	
	Occupational therapy	
	Clinical psychology/psychiatry	
	Family support worker	
	Incontinence treatment	
	Equipment/disability aid issues	
Role	Discharge planning	Patient and carer involvement
		Individual care plan
	Objectives	
	Named responsibilities	
	Proposed outcomes	
	Role of stroke care coordinator	
Secondary prevention	Treatment should be initiated in hospital	
	Systems should be in place to ensure treatment is continued in primary care	
	Information given to patients, carers and GPs on treatments	

Secondary prevention

Management of risk factors is also part of acute or immediate stroke care. Recurrent strokes need to be prevented. Consequently advice needs to be given regarding a number of areas, including diet (fruit and vegetables, salt and fat intake), cholesterol, alcohol intake, exercise, smoking, diabetes, management of hypertension and anticoagulation.

LONG-TERM CARE

The NSF requires that there should be long-term and ongoing support (*Table 5*). The Stroke Association suggests that all patients should be reviewed by their GP within days of discharge. This often does not happen. Long-term follow up is needed to detect changes in patients' clinical, social and psychological condition and their compliance with secondary prevention measures.

Following discharge many psychological problems may hit (agoraphobia, anxiety, fear, depression) (Robinson, 1998). All patients should be followed up by someone. In many cases those discharged home are given a follow-up appointment in a clinic, but those in a nursing home often do not get that support. The NSF charges us to review all patients at 6 months and refer them back to any

part of the service that they may need. This is still quite short term; much needs to be done to ensure that patients are reviewed by someone who has good stroke knowledge and, depending on their needs, who can refer them back into the local stroke service. This requires a coordinated response from the health service, social services and often the voluntary sector (*Figure 3*). Professionals need to know where to refer for further advice, and patients and carers need to know where to seek advice. This is complex with a great deal of overlap between services.

These two points are not mutually exclusive. If patients are offered ongoing support then it is possible to identify those that need further review. There are many ways of doing this including stroke coordinators, liaison nurses, family support workers and informal networks. In Walsall, older patients are followed up by the stroke nurses while younger patients have 'maintenance centres'. Central to all this is the need to maintain a stroke register, which ideally would be nationally based. At present people moving into an area are missed unless the GP has a practice-based register as that suggested by projects such as that in East Kent (Primary Care Clinical Effectiveness; www.kentandmedway.nhs.uk/professional_pages/clinical_governance/welcome_to_pricce.asp).

CONCLUSIONS

With all the developments in the management of stroke, the future is exciting, and stroke care should be shared between professionals. Simple things will save patients' lives. Good organized care is the way forward: this will save time and lives. Stroke units have a better evidence base than coronary care units.

The model of stroke care will often depend on local situations. Whichever model is chosen, delivery of acute care with co-located rehabilitation is vital. These units may be next door to each other, in the same department or in the same clinical area. Both components of hospital care are required if high quality care is to be delivered. Highly intensive pharmacological therapies could not be administered without acute units.

So often the care of a patient on the ward is variable, depending on the team they are admitted on, which is a disservice. Patients deserve a service where political and historical differences between service providers are laid to rest and where there is joined up interdisciplinary working that is the best we can deliver, with a determination to make and keep the following promises:

- We will reduce deaths from stroke
- We will provide a service that will help you reduce your risk of stroke
- You and your family will be included and supported to make informed decisions about your care and how to prevent stroke
- You will be offered diagnosis, assessment and treatment by staff who have specialist, up to date knowledge of stroke
- We will prevent and treat stroke and TIA using the best and most suitable methods. HM

Conflict of interest: Dr Smithard has given lectures for Sanofi, BMS and Servier.

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TABLE 5.
Areas for consideration in long-term follow up

Review following discharge	Short term – 2 months
	Long term – 6 months and annual review
Indications	Action to prevent stroke – secondary prevention
	Reduce death and disability Improved care
	Early, continuing, coordinated rehabilitation
	Long-term support for patients and carers
	Review management plan
Areas to review	Mobility
	Activities of daily living (personal and extended)
	Handicap
	Work
	Driving
	Communication
	Cognitive problems
	Anxiety/depression/memory
	Continence
Further referral	Access to services
	Social services support
	Primary care/secondary care
	Access to specialists
	Stroke coordinators
	Discharge coordinator/clinical nurse specialist
	Family support worker
	Discharge liaison/clinical nurse specialist
	Family support workers
	Maintenance centres
	Stroke clubs

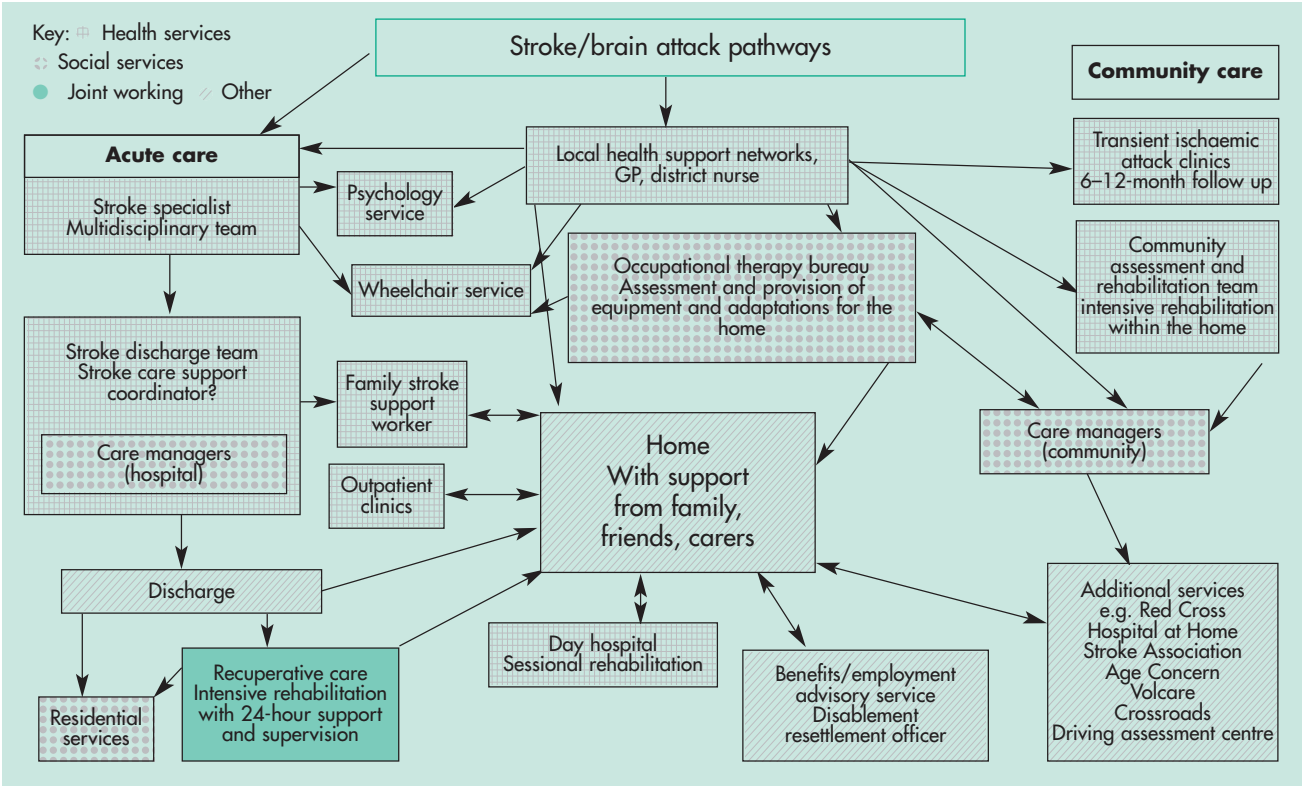

Figure 3. Pathway of long-term care.

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KEY POINTS

- Stroke is common, and acute care is proactive.
- Comprehensive stroke care is more effective at reducing death and disability up to 10 years after stroke than many pharmacological agents.
- Secondary prevention begins in hospital.
- Long-term care is important, but novel ways may be required to provide proactive follow up.