NATIONAL CLINICAL GUIDELINE FOR STROKE

for the United Kingdom and Ireland

2023 edition

Chapter 3

Acute care

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Contents

3 Acute care

3.0 Introduction

This chapter covers the acute presentation and treatment of people with stroke and TIA. The recommendations relate to the diagnosis and management of the underlying condition (at the WHO-ICF framework level of pathology) over the course of the first few days while clinical stability is being achieved, complications prevented, and rehabilitation can begin in earnest. A detailed examination of the evidence for rehabilitation is contained in Chapter 4. **[2023]**

3.1 Pre-hospital care

Most people with acute stroke (95%) have their first symptoms outside hospital. It is vital that members of the public and healthcare professionals (e.g. primary care team members, telephone advice line staff, paramedics, accident and emergency (A&E) personnel) can recognise stroke as early and accurately as possible to facilitate an appropriate emergency response. Measures taken by clinicians outside hospital (such as reduced time at the scene) can reduce the overall time to treatment, and thereby improve the prospects for the patient to respond to time-critical treatments. **[2016]**

3.1 Recommendations

A People seen by ambulance clinicians outside hospital with sudden onset of focal neurological symptoms should be screened for hypoglycaemia with a capillary blood glucose, and for stroke or TIA using a validated tool. Those people with persisting neurological symptoms who screen positive using a validated tool should be transferred to a hyperacute stroke service as soon as possible. **[2016]**

B People who are negative when screened with a validated tool but in whom stroke is still suspected should be treated as if they have stroke until the diagnosis has been excluded by a specialist stroke clinician. **[2016]**

C The pre-hospital care of people with suspected stroke should minimise time from call to arrival at hospital and should include a hospital pre-alert to expedite specialist assessment and treatment. **[2016]**

D Patients with suspected stroke whose airway is considered at risk should be managed appropriately with suction, positioning and airway adjuncts. **[2016]**

E Patients with residual neurological symptoms or signs should remain nil by mouth until screened for dysphagia by a specifically trained healthcare professional. **[2016]**

F Patients with suspected TIA should be given 300 mg of aspirin immediately and assessed urgently within 24 hours by a specialist physician in a neurovascular clinic or an acute stroke unit. **[2016]**

G Patients with suspected stroke or TIA should be monitored for atrial fibrillation and other arrhythmias. **[2016]**

3.1 Sources

A Harbison et al, 2003; Working Party consensus

B-E Working Party consensus

F Rothwell, 2007; Lavallee et al, 2007; Giles and Rothwell, 2007; Rothwell et al, 2016

G Working Party consensus

3.1 Evidence to recommendations

A number of pre-hospital screening tools have been developed that are sensitive in detecting the majority of people with acute stroke that present with facial weakness, speech disturbance or unilateral limb weakness. The FAST test is accepted as the screening tool of choice for clinicians and the general public (Harbison et al, 2003). However, some people with symptoms of stroke will not be identified by the FAST test (e.g. sudden onset visual disturbance, lateralising cerebellar dysfunction) and thus stroke may not be suspected. The Working Party considers that community-based clinicians should continue to treat a person as having a suspected stroke if they are suspicious of the diagnosis despite a negative FAST test. Further evidence is required before the Working Party could recommend the use of other screening tools (e.g. forms of the National Institutes of Health Stroke Scale [NIHSS], Recognition of Stroke in the Emergency Room [ROSIER) that screen for non-FAST symptoms in the pre-hospital phase. **[2016]**

Community-based clinicians are likely to assess people whose neurological symptoms have already resolved before reaching hospital, suggesting a diagnosis of TIA rather than stroke. These people should be given antiplatelet treatment with aspirin immediately (Rothwell et al, 2016) and referred for urgent investigation in a specialist neurovascular clinic since the risk of subsequent stroke is substantial in the first few days. There was insufficient precision in the current evidence for the Working Party to make recommendations concerning risk stratification by community-based clinicians. When considering the diagnosis of TIA and making a direct referral, clinicians need to be aware that a person may have ongoing focal neurological deficits despite a negative FAST test – such people should be managed along the acute stroke pathway rather than a TIA pathway. **[2016]**

There is a general paucity of research evidence on the management of the person with suspected stroke before arrival at the hospital. The majority of recommendations are based on consensus and widely accepted practice in the pre-hospital management of people with suspected stroke or TIA. Pre-hospital brain imaging in other healthcare settings may reduce onset-to-treatment time (Ebinger et al, 2014), but cost-effectiveness and clinical outcomes have not been tested in UK/Ireland settings. **[2016]**

3.1 Implications

The training of primary care teams, other healthcare personnel and the general public in the recognition of the signs of possible stroke using the FAST involves an ongoing public health commitment requiring multiple approaches (Section 2.1 *Public awareness of stroke*). Patients in groups at high risk of stroke (e.g. older people with diabetes, hypertension or atrial fibrillation) and their family and/or carers should have training in the FAST test as part of their disease education. **[2016]**

3.2 Management of TIA and minor stroke – assessment and diagnosis

Any person with a fully resolved acute onset neurological syndrome that might be due to cerebrovascular disease needs urgent specialist assessment to establish the diagnosis and to determine whether the cause is vascular, given that about half have an alternative diagnosis. **[2023]**

3.2 Recommendations

A Patients with acute focal neurological symptoms that resolve completely within 24 hours of onset (i.e. suspected TIA) should be given aspirin 300 mg immediately unless contraindicated and assessed urgently within 24 hours by a stroke specialist clinician in a neurovascular clinic or an acute stroke unit. **[2023]**

B Healthcare professionals should not use assessment tools such as the ABCD2 score to stratify risk of TIA, inform urgency of referral or subsequent treatment options. **[2023]**

C Patients with suspected TIA that occurred more than a week previously should be assessed by a stroke specialist clinician as soon as possible within 7 days. **[2016]**

D Patients with suspected TIA and their family/carers should receive information about the recognition of stroke symptoms and the action to be taken if they occur. **[2016]**

E Patients with suspected TIA should be assessed by a stroke specialist clinician before a decision on brain imaging is made, except when haemorrhage requires exclusion in patients taking an anticoagulant or with a bleeding disorder when unenhanced CT should be performed urgently. **[2023]**

F For patients with suspected TIA, MRI should be the principal brain imaging modality for detecting the presence and/or distribution of brain ischaemia. **[2023]**

G For patients with suspected TIA in whom brain imaging cannot be undertaken within 7 days of symptoms, MRI (using a blood-sensitive sequence, e.g. SWI or T2*-weighted imaging) should be the preferred means of excluding haemorrhage. **[2023]**

3.2 Sources

A Lavallee et al, 2007; Rothwell et al, 2016; Guideline Development Group consensus

B Amarenco et al, 2012; Ildstad et al, 2021

C Giles and Rothwell, 2007

D Working Party consensus

E-G Wardlaw et al, 2014; NICE, 2022e

3.2 Evidence to recommendations

A systematic review of observational studies of the risk of stroke within 7 days of confirmed TIA (Giles & Rothwell, 2007) showed a risk of stroke at 2 days of between 2.0 and 4.1%, and at 7 days of between 3.9 and 6.5%. The risk of completed stroke was much lower in studies of emergency treatment in specialist stroke services compared to non-urgent settings (0.9% v. 11.0%). Patients with suspected TIA should therefore have a full diagnostic assessment urgently without further risk stratification (Lavallee et al, 2007; Wardlaw et al, 2014). Risk predictive clinical tools such as ABCD2, ABCD2-I and ABCD3-I scores did not discriminate sufficiently between low- and high-risk patients in both the short-term and long-term follow-up (Ildstad et al, 2021) either for determining the urgency of assessment or subsequent treatment options (Amarenco et al, 2012) and their use is no longer recommended. Secondary prevention measures which can reduce the risk of recurrence should be promptly initiated (Rothwell, 2007). Additional risk may be conferred by the presence of atrial fibrillation or anticoagulant therapy, or with recurrent attacks, while patients presenting with symptoms more than a week ago can be considered at lower risk. **[2023]**

There is little evidence to guide the use of brain imaging in suspected TIA. The consensus of the Guideline Development Group is that imaging all people referred to a neurovascular clinic is not always appropriate or cost-effective given the high rate of stroke mimics in most clinics. Patients with suspected TIA should normally be assessed by a specialist clinician before a decision on brain imaging is made, and imaging should be used in those patients where the results are likely to influence management such as reducing diagnostic uncertainty, confirming the territory of ischaemia prior to making a decision about carotid artery surgery and prior to commencing dual antiplatelet therapy. When the exclusion of haemorrhage is the objective of imaging, early unenhanced computed tomography (CT) remains the most sensitive investigation (Wardlaw et al, 2014). The greater sensitivity of magnetic resonance imaging (MRI) to detect ischaemic lesions using diffusion-weighted imaging (DWI) makes it the modality of choice if positive confirmation of the presence or location of a lesion is the objective (Whiteley et al, 2022), but the significant false-negative rate with DWI precludes

its use as a diagnostic tool in isolation from clinical assessment, particularly in unselected patients (Wardlaw et al, 2014). **[2023]**

3.2 Implications

Additional training of healthcare professionals and other primary care staff may be required so that they are able to appreciate the immediate risk in people presenting with a suspected TIA or minor stroke, advise immediate aspirin use where appropriate and expedite the process of referral for diagnostic assessment. Referrers and neurovascular clinics should discontinue the practice of triaging patients with suspected TIA according to risk stratification tools, and ensure that all patients with suspected TIA are assessed and diagnosed urgently 7 days a week. **[2023]**

3.3 Management of TIA and minor stroke – treatment and vascular prevention

Patients who have short-lived symptoms due to cerebrovascular disease remain at high risk of further vascular events, and this risk is highest in the first few days. Consequently, their management is urgent. This section covers medical and surgical management following confirmation of the diagnosis. **[2023]**

3.3 Recommendations

A Patients with minor ischaemic stroke or TIA should receive treatment for secondary prevention as soon as the diagnosis is confirmed, including:
- support to modify lifestyle factors (smoking, alcohol consumption, diet, exercise);
- antiplatelet or anticoagulant therapy;
- high intensity statin therapy;
- blood pressure-lowering therapy with a thiazide-like diuretic, long-acting calcium channel blocker or angiotensin-converting enzyme inhibitor. **[2023]**

B Patients with TIA or minor ischaemic stroke should be given antiplatelet therapy provided there is neither a contraindication nor a high risk of bleeding. The following regimens should be considered as soon as possible:
- For patients within 24 hours of onset of TIA or minor ischaemic stroke and with a low risk of bleeding, the following dual antiplatelet therapy should be given:
  Clopidogrel (initial dose 300 mg followed by 75 mg per day) plus aspirin (initial dose 300 mg followed by 75 mg per day for 21 days) followed by monotherapy with clopidogrel 75 mg once daily
  OR
  Ticagrelor (initial dose 180 mg followed by 90 mg twice daily) plus aspirin (300 mg followed by 75 mg daily for 30 days) followed by antiplatelet monotherapy with ticagrelor 90 mg twice daily or clopidogrel 75 mg once daily at the discretion of the prescriber;
- For patients with TIA or minor ischaemic stroke who are not appropriate for dual antiplatelet therapy, clopidogrel 300 mg loading dose followed by 75 mg daily should be given;
- A proton pump inhibitor should be considered for concurrent use with dual antiplatelet therapy to reduce the risk of gastrointestinal haemorrhage;
- For patients with recurrent TIA or stroke whilst taking clopidogrel, consideration should be given to clopidogrel resistance. **[2023]**.

C Patients with TIA or ischaemic stroke should receive high-intensity statin therapy (e.g. atorvastatin 20-80 mg daily) started immediately. **[2023]**

D Patients with non-disabling ischaemic stroke or TIA in atrial fibrillation should be anticoagulated, as soon as intracranial bleeding has been excluded, with an anticoagulant that has rapid onset, provided there are no other contraindications. **[2016]**

E Patients with ischaemic stroke or TIA who after specialist assessment are considered candidates for carotid intervention should have carotid imaging performed within 24 hours of assessment. This includes carotid duplex ultrasound or either CT angiography or MR angiography. **[2023]**

F The degree of carotid artery stenosis should be reported using the North American Symptomatic Carotid Endarterectomy Trial (NASCET) method. **[2016]**

G Patients with TIA or acute non-disabling ischaemic stroke with stable neurological symptoms who have symptomatic severe carotid stenosis of 50–99% (NASCET method) should:

- be assessed and referred for carotid endarterectomy to be performed as soon as possible within 7 days of the onset of symptoms in a vascular surgical centre routinely participating in national audit;
- receive optimal medical treatment: control of blood pressure, antiplatelet treatment, cholesterol reduction through diet and medication, and lifestyle advice including smoking cessation. **[2016]**

H Patients with TIA or acute non-disabling ischaemic stroke who have mild or moderate carotid stenosis of less than 50% (NASCET method) should:

- not undergo carotid intervention;
- receive optimal medical treatment: control of blood pressure, antiplatelet treatment, cholesterol reduction through diet and medication, and lifestyle advice including smoking cessation. **[2016]**

I Patients with recurrent attacks of transient focal neurological symptoms despite optimal medical treatment, in whom an embolic source has been excluded, should be reassessed for an alternative neurological diagnosis. **[2016]**

J Patients who meet the criteria for carotid intervention but who are unsuitable for open surgery (e.g. inaccessible carotid bifurcation, re-stenosis following endarterectomy, radiotherapy-associated carotid stenosis) should be considered for carotid angioplasty and stenting. **[2016]**

K Patients who have undergone carotid revascularisation should be reviewed post-operatively by a stroke clinician to optimise medical aspects of vascular secondary prevention. **[2016]**

3.3 Sources

A PROGRESS Collaborative Group, 2001; Rothwell et al, 2007; NICE, 200b, 2022e, 2023a; Follows from the evidence concerning antiplatelet treatment and lipid modification (Section 5.5 *Lipid modification*, Section 5.6 *Antiplatelet treatment*)

B Wang et al, 2013, 2021c; Johnston et al, 2018, 2020

C Rothwell et al, 2007; NICE, 2010b, 2022e, 2023a

D Working party consensus

E Guideline Development Group consensus

F Working Party consensus

G, H Barnett et al, 1998; Rothwell et al, 2003b; NICE, 2022d, 2023a; Working Party consensus

I Working Party consensus

J Economopoulos et al, 2011; International Carotid Stenting Study investigators, 2010; Bonati et al, 2012

K Working Party consensus

3.3 Evidence to recommendations

Ischaemic stroke and TIA are similar manifestations of vascular disease and their treatment for the prevention of recurrent vascular events reflects this. Long-term risk factor management is reviewed in Chapter 5 on secondary prevention. In the acute setting, there is no evidence to support the use of anticoagulation for recurrent TIA for those in sinus rhythm. There are also no studies specifically addressing the clinical benefit of early anticoagulation for patients with cardioembolic TIA, but the consensus of the Working Party is that the balance of risk and benefit from the early secondary prevention of cardioembolism with a rapidly-acting anticoagulant is favourable in the majority of patients. **[2016]**

Recent evidence supports the early use of dual antiplatelet therapy in patients with TIA or minor ischaemic stroke. The CHANCE trial (Wang et al, 2013) showed in a Chinese population of patients with TIA or minor ischaemic stroke (NIHSS 0-3) that dual antiplatelet therapy started within 24 hours of onset for 21 days resulted in a significant reduction in ischaemic stroke from 11.7% (aspirin group) to 8.2 % (aspirin-clopidogrel group) with no significant difference in haemorrhagic stroke. A 300 mg loading dose of clopidogrel was used in this trial. The POINT trial (Johnston et al, 2018) showed in patients with TIA or minor ischaemic stroke (NIHSS 0-3) that dual antiplatelet therapy started within 12 hours of onset and continued for 90 days resulted in a significant reduction of ischaemic stroke from 6.5% (aspirin group) to 5.0% (aspirin-clopidogrel group). The trial was stopped early because of effectiveness and a significant increase in major haemorrhage in the dual antiplatelet group with an absolute risk increase of 0.5%. A 600 mg loading dose of clopidogrel was used in this trial. Pooled analysis of these trials demonstrated the benefit of dual antiplatelet therapy up to at least 21 days. The THALES trial (Johnston et al, 2020), showed in patients with a high-risk TIA or minor ischaemic stroke (NIHSS 0-5) that dual antiplatelet therapy with aspirin and ticagrelor started within 24 hours of onset resulted in a significant reduction in composite outcome of stroke or death from 6.6% (aspirin group) to 5.5% (aspirin-ticagrelor group) within 30 days. A 180 mg loading dose of ticagrelor was used. Severe bleeding was more frequent with ticagrelor with an absolute risk increase of 0.4%. In these three trials, high risk TIA was defined using an ABCD2 score of 4 or 6, despite evidence that the score performs poorly in successfully identifying TIAs previously identified as low risk which should be considered high risk (Amarenco et al, 2012). In these trials of TIA and minor stroke, patients underwent either CT or MRI to exclude the presence of cerebral haemorrhage or alternative explanations for their symptoms. **[2023]**

A substantial proportion of patients with TIA and stroke in some populations may be resistant to clopidogrel (Pan et al, 2017). Clopidogrel resistance and non-responsiveness is linked to a genetic polymorphism in the cytochrome *CYP2C19* loss-of-function allele. Ticagrelor is not affected. In a selected Chinese population with a genetic polymorphism in the *CYP2C19* loss-of-function allele, the CHANCE 2 trial (Wang et al, 2021c) showed that the risk of ischaemic stroke was significantly reduced from 7.6% in patients treated with clopidogrel (90 days) plus aspirin (21 days) to 6.0% in those randomised to ticagrelor (90 days) plus aspirin (21 days). These results are promising but not yet generalisable owing to the selected nature of the population. **[2023]**

Carotid imaging is essential for any patient, presenting with symptoms suggesting anterior circulation cerebral ischaemia, who might be suitable for intervention for carotid stenosis. There are two methods for reporting the degree of carotid stenosis that give differing results, derived from the North American Symptomatic Carotid Endarterectomy Trial (NASCET) and the European Carotid Surgery Trial (ECST). Both are valid but the Working Party considers that the NASCET method is preferred (Rothwell et al, 2003). After carotid territory TIA or non-disabling stroke, the Working Party consensus was that carotid intervention should be performed as soon as possible. **[2016]**

A Cochrane review of carotid stenting for symptomatic carotid stenosis identified a higher risk of both short- and long-term stroke complications, especially in patients 70 years and older, but a lower risk of peri-procedural myocardial infarction and cranial nerve injury (Bonati et al, 2012). This section should be read in conjunction with Section 5.3 *Carotid artery stenosis*. **[2016]**

3.3 Implications

Local health economies and networks should establish clinical pathways designed to expedite referral of appropriate patients to vascular surgical centres, especially where reconfiguration has resulted in vascular services being at another site. **[2016]**

A protocol should be in place for the use of parenteral or direct oral anticoagulants (DOACs) in the setting of a neurovascular clinic, with a process to supervise the transition from acute to long-term anticoagulation. **[2016]**

3.4 Diagnosis and treatment of acute stroke – imaging

Stroke is a medical emergency and if outcomes are to be optimised there should be no time delays in diagnosis and treatment. Any person with the acute onset of a focal neurological syndrome with persisting symptoms and signs (i.e. suspected stroke) needs urgent diagnostic assessment to differentiate between acute stroke and other causes needing their own specific treatments. To maximise the potential benefit from revascularisation treatments and the acute management of intracerebral haemorrhage, a corresponding increase in the availability of advanced imaging techniques is required, and all hyperacute stroke services should have timely access to brain imaging including CT or MR angiography and perfusion (See Section 2.3 *Transfer to acute stroke services*). **[2023]**

Underlying causes of stroke such as heart disease, diabetes and hypertension need diagnosis and management in their own right, but these are outside the scope of this guideline. **[2016]**

3.4 Recommendations

A Patients with suspected acute stroke should be admitted directly to a hyperacute stroke service and be assessed for emergency stroke treatments by a specialist clinician without delay. **[2016]**

B Patients with suspected acute stroke should receive brain imaging as soon as possible (at most within 1 hour of arrival at hospital). **[2023]**

C Interpretation of acute stroke imaging for decisions regarding reperfusion treatment should only be made by healthcare professionals who have received appropriate training. **[2023]**

D Patients with ischaemic stroke who are potentially eligible for mechanical thrombectomy should have a CT angiogram from aortic arch to skull vertex immediately. This should not delay the administration of intravenous thrombolysis. **[2023]**

E Patients with stroke with a delayed presentation for whom reperfusion is potentially indicated should have CT or MR perfusion as soon as possible (at most within 1 hour of arrival at hospital). An alternative for patients who wake up with stroke is MRI measuring DWI-FLAIR mismatch. **[2023]**

F MRI brain with stroke-specific sequences (DWI with SWI or T2*-weighted imaging) should be considered in patients with suspected acute stroke when there is diagnostic uncertainty. **[2023]**

3.4 Sources

A, B Follows from the evidence for emergency stroke treatments in Section 3.5 *Management of ischaemic stroke*, 3.6 *Management of intracerebral haemorrhage*

C Spokoyny et al, 2014; Guideline Development Group consensus

D, E Follows from the evidence for emergency stroke treatments in Section 3.5 *Management of ischaemic stroke*

F Wardlaw et al, 2014

3.4 Evidence to recommendations

The evidence supporting stroke unit care from the Stroke Unit Trialists in the 1990s has been updated in a 2013 Cochrane review, which found that patients with stroke who receive organised inpatient care in a stroke unit are more likely to be alive, independent, and living at home one year after a stroke (Stroke Unit Trialists' Collaboration, 2013). **[2016]**

Imaging patients with suspected stroke immediately is cost-effective compared to other approaches because it enables emergency treatments directed at the pathology of stroke (Wardlaw et al, 2004), although MRI with DWI may be required when diagnostic uncertainty persists (Wardlaw et al, 2014). Interpretation of acute stroke imaging by trained non-radiologists is safe and effective (Spokoyny et al, 2014). Multi-modal imaging is becoming more widely available and quicker to undertake and interpret. It is recommended that if multi-modal imaging is required, all relevant imaging should be performed in the same session to avoid delays in decision making for acute treatments (National Optimal Stroke Imaging Pathway [NOSIP], NHS England, 2021). The recommendations regarding reperfusion treatments contained in Section 3.5 *Management of ischaemic stroke* require CT angiography (with or without CT perfusion) to be performed immediately in potentially eligible patients, but image processing and interpretation should not delay intravenous thrombolysis if this is indicated. **[2023]**

3.4 Implications

These recommendations align with the recommendations in Chapter 2 concerning the organisation of acute stroke care and Sections 3.5 *Management of ischaemic stroke* and 3.6 *Management of intracerebral haemorrhage* regarding the management of acute stroke. Hyperacute stroke services will need to review their provision of specialist assessment and imaging policies for people with suspected acute stroke, which in many centres will involve a step-change in provision. **[2023]**

3.5 Management of ischaemic stroke

Thrombolysis with alteplase is now administered to between 10 and 11% of patients with acute stroke in the UK and Ireland (Scottish Stroke Care Audit, 2022; Sentinel Stroke National Audit Programme, 2022; National Office of Clinical Audit (Ireland), 2023) although higher rates should be readily achievable (Allen et al, 2022). Treatment with thrombolysis should only be given in units where staff are trained and experienced in the provision of stroke thrombolysis, and have a thorough knowledge of the contraindications to treatment and the management of complications such as neurological deterioration. **[2023]**

Reperfusion treatment for people with acute ischaemic stroke has evolved significantly since the 2016 edition and new guidance is provided in this section, including updates to the management of thrombolysis and thrombectomy. **[2023]**

3.5 Recommendations

A Patients with acute ischaemic stroke, regardless of age or stroke severity, in whom treatment can be started within 4.5 hours of known onset, should be considered for

thrombolysis with alteplase or tenecteplase. **[2023]**

B Patients with acute ischaemic stroke, regardless of age or stroke severity, who were last known to be well more than 4.5 hours earlier, should be considered for thrombolysis with alteplase if:

– treatment can be started between 4.5 and 9 hours of known onset, or within 9 hours of the midpoint of sleep when they have woken with symptoms

AND

– they have evidence from CT/MR perfusion (core-perfusion mismatch) or MRI (DWI-FLAIR mismatch) of the potential to salvage brain tissue *(see Table 3.5.1)*.

This should be irrespective of whether they have a large artery occlusion and require mechanical thrombectomy. **[2023]**

Table 3.5.1 Eligibility criteria for extending thrombolysis to 4.5-9 hours and wake-up stroke

	Time window	Imaging	Imaging criteria
Wake-up stroke	>4.5 hours from last seen well, no upper limit	MRI DWI-FLAIR mismatch	DWI lesion and no FLAIR lesion
Wake-up stroke or unknown onset time	>4.5 hours from last seen well, and within 9 hours of the midpoint of sleep. The midpoint of sleep is the time halfway between going to bed and waking up	CT or MRI core-perfusion mismatch	Suggested: mismatch ratio greater than 1.2, a mismatch volume greater than 10 mL, and an ischaemic core volume <70 mL
Known onset time	4.5-9 hours	CT or MRI core-perfusion mismatch	Suggested: mismatch ratio greater than 1.2, a mismatch volume greater than 10 mL, and an ischaemic core volume <70 mL

C Patients with acute ischaemic stroke otherwise eligible for treatment with thrombolysis should have their blood pressure reduced to below 185/110 mmHg before treatment. **[2016]**

D Thrombolysis should only be administered within a well-organised stroke service with:
- processes throughout the emergency pathway to minimise delays to treatment to ensure that thrombolysis is administered as soon as possible after stroke onset;
- staff trained in the delivery of thrombolysis and monitoring for post-thrombolysis complications;
- nurse staffing levels equivalent to those required in level 1 or level 2 nursing care with training in acute stroke and thrombolysis;
- timely access to appropriate imaging and trained staff;
- protocols in place for the management of post-thrombolysis complications. **[2016]**

E Emergency medical staff, if appropriately trained and supported, should only administer thrombolysis for the treatment of acute ischaemic stroke provided that patients can be subsequently managed within a hyperacute stroke service with appropriate neuroradiological and stroke specialist support. **[2016]**

F Patients with acute ischaemic stroke eligible for mechanical thrombectomy should receive prior intravenous thrombolysis (unless contraindicated) irrespective of whether they have presented to an acute stroke centre or a thrombectomy centre. Every effort should be made to minimise process times throughout the treatment pathway and thrombolysis should not delay urgent transfer to a thrombectomy centre. **[2023]**

G Patients with acute anterior circulation ischaemic stroke, who were previously independent (mRS 0-2), should be considered for combination intravenous thrombolysis and intra-arterial clot extraction (using a stent retriever and/or aspiration techniques) if they have a proximal intracranial large artery occlusion causing a disabling neurological deficit (NIHSS score of 6 or more) and the procedure can begin within 6 hours of known onset. **[2023]**

H Patients with acute anterior circulation ischaemic stroke and a contraindication to intravenous thrombolysis but not to thrombectomy, who were previously independent (mRS 0-2), should be considered for intra-arterial clot extraction (using a stent retriever and/or aspiration techniques) if they have a proximal intracranial large artery occlusion causing a disabling neurological deficit (NIHSS score of 6 or more) and the procedure can begin within 6 hours of known onset. **[2023]**

I Patients with acute anterior circulation ischaemic stroke and a proximal intracranial large artery occlusion (ICA and/or M1) causing a disabling neurological deficit (NIHSS score of 6 or more) of onset between 6 and 24 hours ago, including wake-up stroke, and with no previous disability (mRS 0 or 1) should be considered for intra-arterial clot extraction (using a stent retriever and/or aspiration techniques, combined with thrombolysis if eligible) providing the following imaging criteria are met:

- between 6 and 12 hours: an ASPECTS score of 3 or more, irrespective of the core infarct size;
- between 12 and 24 hours: an ASPECTS score of 3 or more and CT or MRI perfusion mismatch of greater than 15 mL, irrespective of the core infarct size. **[2023]**

J Clinicians interpreting brain imaging for eligibility for mechanical thrombectomy should have the appropriate knowledge and skills and should consider all the available information (e.g. plain and angiographic images, colour maps, AI-derived figures for core/penumbra and mismatch overlays). **[2023]**

K Patients with acute ischaemic stroke in the posterior circulation within 12 hours of onset should be considered for mechanical thrombectomy (combined with thrombolysis if eligible) if they have a confirmed intracranial vertebral or basilar artery occlusion and their NIHSS score is 10 or more, combined with a favourable PC-ASPECTS score and Pons-Midbrain Index. Caution should be exercised when considering mechanical thrombectomy for patients presenting between 12 and 24 hours of onset and/or over the age of 80 owing to the paucity of data in these groups. **[2023]**

L The selection of anaesthetic technique for thrombectomy should be guided by local protocols for general anaesthesia, local anaesthesia and conscious sedation which include choice of anaesthetic agents, timeliness of induction, blood pressure parameters and postoperative care. Selection of anaesthesia should be based on an individualised assessment of patient risk factors, technical requirements of the procedure and other clinical characteristics such as conscious level and degree of agitation. General anaesthesia should be considered in the following circumstances:

- patients with agitation or a reduced level of consciousness, or those judged to be at high risk of requiring conversion to general anaesthesia;
- patients with airway compromise or who are already intubated, or at risk of aspiration due to nausea or vomiting;
- patients in whom, due to technical or anatomical factors, thrombectomy is anticipated to be more complicated. **[2023]**

M Hyperacute stroke services providing endovascular therapy should participate in national stroke audit to enable comparison of the clinical and organisational quality of their

services with national data, and use the findings to plan and deliver service improvements. **[2016]**

N Patients with middle cerebral artery (MCA) infarction who meet the criteria below should be considered for decompressive hemicraniectomy. Patients should be referred to neurosurgery within 24 hours of stroke onset and treated within 48 hours of stroke onset:
- pre-stroke mRS score of 0 or 1;
- clinical deficits indicating infarction in the territory of the MCA;
- NIHSS score of more than 15;
- a decrease in the level of consciousness to a score of 1 or more on item 1a of the NIHSS;
- signs on CT of an infarct of at least 50% of the MCA territory with or without additional infarction in the territory of the anterior or posterior cerebral artery on the same side, or infarct volume greater than 145 mL on MRI DWI. **[2016]**

O Patients with acute ischaemic stroke treated with thrombolysis should be started on an antiplatelet agent after 24 hours unless contraindicated, once significant haemorrhage has been excluded. **[2016]**

P Patients with disabling acute ischaemic stroke should be given aspirin 300 mg as soon as possible within 24 hours (unless contraindicated):
- orally if they are not dysphagic;
- rectally or by enteral tube if they are dysphagic.
- Thereafter aspirin 300 mg daily should be continued until 2 weeks after the onset of stroke at which time long-term antithrombotic treatment should be initiated. Patients being transferred to care at home before 2 weeks should be started on long-term treatment earlier. **[2016]**

Q Patients with acute ischaemic stroke reporting previous dyspepsia with an antiplatelet agent should be given a proton pump inhibitor in addition to aspirin. **[2016]**

R Patients with acute ischaemic stroke who are allergic to or intolerant of aspirin should be given an alternative antiplatelet agent (e.g. clopidogrel). **[2016]**

3.5 Sources

A Wardlaw et al, 2012; Emberson et al, 2014; Menon et al, 2022

B Thomalla et al, 2018; Campbell et al, 2019

C, D Wardlaw et al, 2012; Working Party consensus

E Working Party consensus

F Yang et al, 2020; LeCouffe et al, 2021; Suzuki et al, 2021; Zi et al, 2021; Fischer et al, 2022; Mitchell et al, 2022; Turc et al, 2022

G, H Goyal et al, 2016

I Sarraj et al, 2023; Huo et al, 2023

J Jovin et al, 2022a, b

K Liu et al, 2020, Langezaal et al, 2021; Tao et al, 2022; Jovin et al, 2022a

L Mortimer et al, 2021; Maurice et al, 2022

M Obligations under the NHS Standard Contract; Working Party consensus

N Cruz-Flores et al, 2012; Jüttler et al, 2014

O, P Sandercock et al, 2015; Working Party consensus

Q, R NICE, 2010a ; Working Party consensus

3.5 Evidence to recommendations

An updated Cochrane systematic review and an individual patient meta-analysis by the Stroke Thrombolysis Trialists' Collaboration guide the use of intravenous thrombolysis without advanced imaging (International Stroke Trial Collaborative Group, 2012; Wardlaw et al, 2012; Emberson et al, 2014). These analyses emphasise the importance of rapid treatment. Patients who are over 80 years old with mild or severe stroke and those with early signs of infarction on initial brain imaging all benefit from treatment. **[2023]**

The Enhanced Control of Hypertension and Thrombolysis Stroke Study (ENCHANTED) of lower (0.6 mg/kg) versus standard dose alteplase showed a lower risk of intracerebral haemorrhage and early mortality with the lower dose, without conclusively demonstrating that the doses were of equivalent efficacy (Anderson et al, 2016). These findings suggest that there may be circumstances in which the treating physician and/or the patient wish to forgo some of the potential disability benefit from standard dose alteplase in order to reduce the early risk of intracerebral haemorrhage through the use of the lower dose. A meta-analysis of risk factors for intracerebral haemorrhage with alteplase (Whiteley et al, 2012) suggested a greater risk in people with atrial fibrillation, congestive cardiac failure, renal impairment, prior antiplatelet treatment, leukoaraiosis and visible cerebral infarction on pre-treatment brain imaging, but the extent to which any of these factors should influence dose selection for alteplase remains unknown. **[2016]**

Patients presenting with acute ischaemic stroke whilst taking a direct oral anticoagulant (DOAC) should be excluded from receiving thrombolysis unless, in the case of dabigatran, the prothrombin time and activated partial thromboplastin time are both normal. The use of reversal agents (idarucizumab or andexanet alfa) in order to then administer thrombolysis for an ischaemic stroke that has occurred during DOAC treatment is not recommended. **[2016]**

Patients more than 4.5 hours after stroke or with an unknown time of onset, and those with wake-up stroke, who have radiologically defined 'penumbra' benefit from alteplase. Participants in the WAKE-UP trial (Thomalla et al, 2018) were aged up to 80 years and had woken from sleep or could not report the time of stroke onset, were at least 4.5 hours from when last seen well, and had evidence of MRI DWI-FLAIR mismatch. Allocation to 0.9 mg/kg alteplase rather than placebo led to a higher proportion of patients (53.3% v. 41.8%) with an excellent functional outcome at 90 days. The THAWS trial (Koga et al, 2020) demonstrated no clear benefit from a lower dose of alteplase (0.6mg/kg). **[2023]**

In an individual participant data meta-analysis of EXTEND (Ma et al, 2019), ECASS-4 (Ringleb et al, 2019) and a subset of the EPITHET trial (Davis et al, 2008) patients with CT or MR perfusion imaging-defined penumbra between 4.5 and9 hours after onset or with wake-up stroke (Campbell et al, 2019) gained benefit from intravenous alteplase (7% absolute increase in excellent outcome). No patients received mechanical thrombectomy in these trials. In a prespecified subset who had mismatch defined by a mismatch ratio greater than 1·2, a mismatch volume greater than 10 mL, and an ischaemic core volume less than 70 mL (EXTEND criteria), benefit with alteplase was also seen. Participants with and without a large artery occlusion appeared to benefit similarly. The TWIST trial (Roaldsen et al, 2023) comparing intravenous thrombolysis with tenecteplase given within 4.5 hours of awakening versus control (no thrombolysis) in patients with wake-up stroke, did not demonstrate benefit in patients selected with non-contrast CT imaging alone. **[2023]**

Tenecteplase is a single bolus thrombolytic agent with higher fibrin specificity and longer half-life than alteplase. Nine RCTs have compared tenecteplase with alteplase in people with acute ischaemic stroke (Haley et al, 2010; Parsons et al, 2012; Huang et al, 2015; Logallo et al, 2017; Campbell et al, 2018b; Bivard et al, 2022; Kvistad et al, 2022; Menon et al, 2022; Wang et al, 2023). No single trial in

unselected patients has demonstrated that tenecteplase leads to greater recovery than alteplase. A 2019 meta-analysis (Burgos & Saver, 2019) concluded that tenecteplase was non-inferior to alteplase but this was confounded by the significant contribution of the large NOR-TEST study which used a higher dose of 0.4 mg/kg and included a substantial proportion of people with stroke mimics (Logallo et al, 2017). A subsequent trial of 0.4 mg/kg tenecteplase in patients with moderate-severe ischaemic stroke showed this higher dose led to higher rates of intracerebral haemorrhage than alteplase (NOR-TEST 2, part A; (Kvistad et al, 2022), and this dose is no longer recommended. Tenecteplase (0.25 mg/kg) delivered in an MSU setting (TASTE-A; (Bivard et al, 2022) led to better measures of imaging reperfusion than alteplase but the study was inadequately powered to test any difference in outcomes. Two large randomised trials have demonstrated that tenecteplase 0.25 mg/kg is non-inferior to alteplase for excellent clinical outcome when delivered within 4.5 hours of stroke onset (Menon et al, 2022; Wang et al, 2023). In patients with proven large artery occlusion prior to planned thrombectomy tenecteplase (0.25 mg/kg) may be superior to alteplase when given within 4.5 hours of onset (Campbell et al, 2018b). **[2023]**

Since the 2012 edition of the guideline, five RCTs have been published evaluating the effects of endovascular treatment in addition to thrombolysis, compared with standard treatment (intravenous thrombolysis alone administered within 4.5 hours) in 'early-presenting' patients (typically within 6 hours) with proven large artery occlusion stroke (Berkhemer et al, 2015; Campbell et al, 2015; Goyal et al, 2015; Jovin et al, 2015; Saver et al, 2015). In an individual patient meta-analysis of these five trials involving 1,287 patients (Goyal et al, 2016) endovascular therapy showed significant improvements in functional outcomes at 90 days. The number needed to treat for one additional patient to have reduced disability of at least one point on the mRS was 3. The trials were heterogenous in their patient selection (age, NIHSS score) and only included patients with pre-stroke mRS of 2 or less. There was also variation in imaging criteria, in particular whether the identification of salvageable brain tissue on neuroimaging was a trial inclusion criterion (EXTEND-IA, ESCAPE, SWIFT-PRIME, and REVASCAT beyond 4.5 hours) or not (MR CLEAN). Three trials included some patients for whom intravenous thrombolysis was contraindicated. The trials varied in onset to endovascular treatment from a maximum of 6 up to 12 hours, and it is pertinent that all the trials with an extended time window required imaging identification of the potential to salvage brain tissue prior to randomisation (see below). The SWIFT-PRIME trial had the fastest process times with a median time from hospital arrival to groin puncture of 90 minutes, and the median procedure time in the five trials was just under 60 minutes. An NIHSS score of 6 or more was an inclusion criterion for several trials with clear positive subgroup effects for NIHSS 6-19 (ESCAPE) and 6-17 (SWIFT-PRIME). Not all trials reported a positive effect on mortality. The Working Party concludes that mechanical thrombectomy is an effective acute stroke treatment for selected patients with proximal large artery occlusions as an adjunct to intravenous thrombolysis, and for those patients with contraindications to intravenous thrombolysis but not to mechanical thrombectomy (e.g. recent surgery, anticoagulant use). Centres that provide endovascular treatment should meet the professional standards set out by the joint societies' working group (White et al, 2015; NICE, 2016a). There remain significant challenges to the full implementation of this treatment in the UK and Ireland. **[2023]**

Two RCTs have reported on patients with a large ischaemic core who have previously been ineligible for trials of thrombectomy beyond 6 hours. SELECT2 (N=352; Sarraj et al, 2023) demonstrated that patients aged 18-85 years with a pre-stroke mRS score of 0 or 1 presenting with a proximal large artery occlusion (ICA/M1) and an ASPECTS score of 3-5 or an infarct core of >50 mL benefitted from mechanical thrombectomy up to 24 hours after onset. Thrombectomy resulted in functional independence (mRS 0-2) in 20.3% of treated patients compared with 7% in the medical arm (NNT=8). ANGEL-ASPECT (N=456; Huo et al, 2023) also demonstrated significant benefit from mechanical thrombectomy in patients aged 18-80 years with a pre-stroke mRS score of 0 or 1 and an ICA/M1 occlusion and either ASPECTS 3-5 or an infarct core of 70-100 mL presenting within 24 hours of onset. Thrombectomy increased the proportion of patients with functional independence (mRS 0-2) to 30% compared with 11.6% in the medical arm (NNT=6). In both trials, perfusion imaging (almost all CT

perfusion) was undertaken to confirm a large infarct core volume (median 80 mLs in SELECT2, 62 mLs in ANGEL-ASPECT) and benefits were observed despite a higher rate of intracranial haemorrhage with thrombectomy. It is noteworthy in these late-presenting groups that around two thirds of patients were still ineligible for treatment, and after thrombectomy the median mRS at 90 days was 4 and mortality ranged from 22-38%. Considering this evidence in conjunction with the results of DEFUSE-3 (Albers et al, 2018), in patients presenting between 12 and 24 hours after onset, there is robust evidence to select individuals for mechanical thrombectomy based on perfusion imaging (particularly perfusion mismatch > 15 mL). In patients presenting between 6 and 24 hours after onset with a pre-stroke modified Rankin score of 2 or more, or who are older than 85 years, there is still insufficient evidence, and the more selective DAWN/DEFUSE-3 radiological criteria should be considered as the primary means of selection for these groups. As yet there are no RCT data from patients with anterior circulation stroke presenting between 12 and24 hours with non-proximal M1/intracranial ICA occlusion. It should also be noted that the perfusion criteria applied in these trials of late-presenting patients (core defined by rCBF below 30% and penumbra by T_{max} greater than 6 secs) were mostly based on the use of RAPID™ AI decision-support software from IschemaView (Stanford, USA) and direct extrapolation of these results to other AI systems should not be assumed as appropriate or equivalent to the referenced trials. **[2023]**

A recent meta-analysis (Turc et al, 2022) of six RCTs (Yang et al, 2020; LeCouffe et al, 2021; Suzuki et al, 2021; Zi et al, 2021; Fischer et al, 2022; Mitchell et al, 2022) supports the administration of thrombolysis within 4.5 hours of onset in eligible patients prior to thrombectomy (bridging thrombolysis) given that no trial showed superiority and only two of the six trials, both judged at high or moderate risk of bias, showed non-inferiority for proceeding direct to thrombectomy (Yang et al, 2020; Zi et al, 2021). Furthermore, the meta-analysis indicated superior reperfusion rates, trends to improved clinical outcome and no statistical increase in adverse safety outcomes (mortality and symptomatic intracranial haemorrhage) with bridging thrombolysis. All the randomised trials recruited patients presenting directly to thrombectomy centres. No randomised trial has yet addressed the question of whether patients presenting initially to an acute stroke centre should proceed directly to mechanical thrombectomy without bridging thrombolysis. However, a meta-analysis of observational studies found better clinical outcomes for the bridging thrombolysis group, although direct mechanical thrombectomy was deemed safe (Turc et al, 2022). There is now sufficient evidence to guide the selection of patients for both thrombolysis and thrombectomy presenting later than 4.5 hours after symptom onset or where the onset time is not known (Albers et al, 2018; Nogueira et al, 2018; Thomalla et al, 2018; Campbell et al, 2019; Albers et al, 2021; Jovin et al, 2022b; Tao et al, 2022). **[2023]**

Two RCTs (BASICS and BEST) were published in 2020 and 2021 addressing whether thrombectomy and best medical therapy was superior to best medical therapy alone in imaging-confirmed basilar artery occlusion (BAO)/vertebral artery (VA) occlusion (Liu et al, 2020; Langezaal et al, 2021). Neither trial had an NIHSS restriction on eligibility or systematic imaging exclusion criteria other than extensive bilateral brainstem ischaemia. Both trials were neutral on an intention-to-treat analysis for their primary endpoint of mRS of 0-3 at 90 days. Two further Chinese RCTs of the effectiveness of thrombectomy in BAO have been published (Jovin et al, 2022a; Tao et al, 2022). The ATTENTION trial randomised 340 patients in a 2:1 ratio to either thrombectomy and best medical therapy or best medical therapy alone, with additional eligibility criteria of an NIHSS of 10 or more, PC-ASPECTS of 6 or more and in a time window of up to 12 hours after stroke onset (Tao et al, 2022). Patients over 80 years of age additionally had to have PC-ASPECTS of 8 or more and a pre-stroke mRS of 0-1. The trial demonstrated superiority of thrombectomy with an absolute difference in mRS 0-3 of 23.2%. The BAOCHE trial randomised 218 patients aged 80 or younger between 6 and 24 hours after stroke onset in a 1:1 ratio if the NIHSS was 6 or more, PC-ASPECTS 6 or more and the Pons-Midbrain Index was 2 or more (Jovin et al, 2022a).). It enrolled 82 patients (38%) in the 12-24 hour window and also showed superiority for thrombectomy with an absolute difference in mRS 0-3 of 22.1%. All three Chinese trials had much lower intravenous thrombolysis rates than was seen in BASICS. Despite the results from 4 RCTs, there are very limited data for patients over the age of 80 years, those with a baseline NIHSS of 6-9 and those presenting beyond 12 hours. **[2023]**

A systematic review and meta-analysis of five small trials randomising 498 patients either to general anaesthesia or heavy conscious sedation concluded that general anaesthesia resulted in superior functional independent outcomes, with only one of the five small RCTs showing statistical superiority for general anaesthesia over conscious sedation (Bai et al, 2021). A subsequent meta-analysis including non-randomised data from eight studies including 7,797 patients demonstrated that local anaesthesia without sedation was not significantly superior to either conscious sedation or general anaesthesia in improving outcomes (Butt et al, 2021). A subsequent larger multi-centre trial (GASS; Maurice et al, 2022) which included standardised approaches to blood pressure management did not demonstrate differences in functional outcome with anaesthetic method, despite a higher recanalisation rate with general anaesthesia. These data contrast with larger volume real-world registries or individual patient data level RCT post-hoc analyses, which tend to favour non-general anaesthesia over general anaesthesia in terms of functional outcomes (Campbell et al, 2018a; Powers et al, 2019). There is a paucity of randomised evidence comparing general anaesthesia with local anaesthesia or minimal conscious sedation approaches, but trials are ongoing. **[2023]**

The DESTINY II trial of decompressive hemicraniectomy for older patients with severe space-occupying MCA territory infarction has shown a substantial survival benefit for patients over the age of 60 years (Jüttler et al, 2014) akin to that seen in young patients (Cruz-Flores et al, 2012). Decisions to undertake major life-saving surgery need to be carefully considered on an individual basis, but patients should not be excluded from treatment by age alone. **[2016]**

3.5 Implications

These recommendations underpin the earlier recommendations concerning the organisation of acute stroke care (Section 2.2 *Definitions of specialist stroke services*, Section 2.3 *Transfer to acute stroke services,* Section 2.4 *Organisation of inpatient services*), with significant implications for the organisation of acute stroke services and referrals to tertiary neurosurgical and interventional neuroradiology services. Provision of hyperacute stroke care should be organised to minimise time to treatment for the maximum number of people with stroke, and in some areas this will require reconfiguration of hyperacute stroke services with some hospitals stopping providing acute stroke services altogether. **[2023]**

A global shortage of tenecteplase will limit the initial extent to which Recommendation 3.5A can be implemented, at least until the end of 2024. Individual nations and clinicians will need to consider these supply implications when planning a managed transition from alteplase to tenecteplase – for example, in England, the NHS expects a planned transition (licence permitting) from April 2025. **[2023]**

3.6 Management of intracerebral haemorrhage

About 11% of all patients presenting to hospital in the UK and Ireland with acute stroke have intracerebral haemorrhage (ICH) as the cause (Kelly et al, 2012; Intercollegiate Stroke Working Party, 2016). Patients with ICH can deteriorate quickly and should be admitted directly to a hyperacute stroke unit for urgent specialist assessment and monitoring. **[2023]**

3.6 Recommendations

A Patients with intracerebral haemorrhage in association with vitamin K antagonist treatment should have the anticoagulant urgently reversed with a combination of prothrombin complex concentrate and intravenous vitamin K. **[2016]**

B Patients with intracerebral haemorrhage in association with direct oral anticoagulant (DOAC) treatment should have the anticoagulant urgently reversed. For patients taking dabigatran, idarucizumab should be used. If idarucizumab is unavailable, 4-factor

prothrombin complex concentrate may be considered. For those taking factor Xa inhibitors, 4-factor prothrombin complex concentrate should be considered and andexanet alfa may be considered in the context of a randomised controlled trial. **[2023]**

C Patients with acute spontaneous intracerebral haemorrhage with a systolic BP of 150-220 mmHg should be considered for urgent treatment within 6 hours of symptom onset using a locally agreed protocol for BP lowering, aiming to achieve a systolic BP between 130-139 mmHg within one hour and sustained for at least 7 days, unless:
- the Glasgow Coma Scale score is 5 or less;
- the haematoma is very large and death is expected;
- a macrovascular or structural cause for the haematoma is identified;
- immediate surgery to evacuate the haematoma is planned, in which case BP should be managed according to a locally agreed protocol. **[2023]**

D Patients with intracerebral haemorrhage should be admitted directly to a hyperacute stroke unit for monitoring of conscious level and referred immediately for repeat brain imaging if deterioration occurs. **[2023]**

E Patients with intracranial haemorrhage who develop hydrocephalus should be considered for surgical intervention such as insertion of an external ventricular drain. **[2016]**

F Patients with intracerebral haemorrhage in whom the haemorrhage location or other imaging features suggest cerebral venous thrombosis should be investigated urgently with a CT or MR venogram. **[2023]**

G The DIAGRAM score (or its components: age; intracerebral haemorrhage location; CTA result where available; and the presence of white matter low attenuation [leukoaraiosis] on the admission non-contrast CT) should be considered to determine the likelihood of an underlying macrovascular cause and the potential benefit of intra-arterial cerebral angiography. **[2023]**

H Early non-invasive cerebral angiography (CTA/MRA within 48 hours of onset) should be considered for all patients with acute spontaneous intracerebral haemorrhage aged 18-70 years who were independent, without a history of cancer, and not taking an anticoagulant, except if they are aged more than 45 years with hypertension and the haemorrhage is in the basal ganglia, thalamus, or posterior fossa. If this early CTA/MRA is normal or inconclusive, MRI/MRA with susceptibility-weighted imaging (SWI) should be considered at 3 months. Early CTA/MRA and MRI/MRA at 3 months may also be considered in patients not meeting these criteria where the probability of a macrovascular cause is felt to justify further investigation. **[2023]**

3.6 Sources

A Working Party consensus

B Pollack et al, 2017

C Anderson et al, 2013; Qureshi et al, 2016; NICE, 2022e; Guideline Development Group consensus

D Guideline Development Group consensus

E Working Party consensus

F van Asch et al, 2015

G van Asch et al, 2015; Hilkens et al, 2018

H Guideline Development Group consensus

3.6 Evidence to recommendations

The effect of reducing blood pressure in the first few hours after the onset of ICH has been tested in two international RCTs. In INTERACT-2, the rapid lowering of systolic blood pressure (SBP) to a target below 140 mmHg within 1 hour in 2839 patients presenting within 6 hours of onset with mainly small, deep (thalamic or basal ganglia) ICH did not reduce haematoma expansion or improve the primary outcome of death or major disability (mRS 3-6), but secondary outcomes (ordinal shift analysis of the mRS and health-related quality of life measures) were improved. Death (12% at 3 months) and institutionalisation (9%) were not affected by intensive treatment (Anderson et al, 2013). In ATACH-2, pursuing a lower SBP target of 110-139 mmHg within 2 hours in 1,000 patients presenting within 4.5 hours of onset with small, deep ICH tended to reduce haematoma expansion but conferred no reduction in severe disability or death (mRS 4-6) compared to a target of 140-179 mmHg (Qureshi et al, 2016). Mortality (6.7%) was also not affected. More intensive SBP lowering was associated with more renal adverse events in the first 7 days. In comparing these two trials, it is noteworthy that a lower SBP was achieved in the acute phase in the standard treatment arm of ATACH-2 (all of whom received intravenous nicardipine) than in the intensive treatment arm of INTERACT2 (141 mmHg vs. 150 mmHg respectively). As the intensive arm of ATACH-2 led to a still greater SBP reduction, ATACH-2 can be interpreted as showing no additional benefit from a more aggressive blood pressure target than that tested in INTERACT2. More research is still needed to clarify the effect on clinical outcomes from hyperacute SBP reductions in people with acute ICH, including in large and/or lobar haemorrhages. **[2016]**

A systematic review and individual participant meta-analysis summarised the evidence regarding a much broader range of blood pressure-lowering strategies during the first 7 days after ICH (Moullaali et al, 2022). Active/intensive blood pressure-lowering interventions had no overall effect on mRS at the end of follow-up compared with placebo/standard (guideline-based) treatment but significantly reduced haematoma expansion. Subgroup analyses suggested that an intensive target should be preferred to a fixed dose of a specific agent and that other antihypertensive agents should be preferred over renin-angiotensin system blockers, though all data on renin-angiotensin system blockers in the meta-analysis came from a single trial of candesartan (Sandset et al, 2011). Post-hoc secondary analyses of INTERACT2 and ATACH-2 used as observational cohorts (i.e. no longer providing randomised data on the effects of the intervention) found that achieving early and stable target blood pressure over the first 24 hours was associated with better outcomes (Moullaali et al, 2019). Although there is sufficient evidence to support the safety of intensive blood pressure lowering as delivered in the INTERACT2 trial, further evidence is required to establish the optimal strategy for intensive blood pressure lowering. There is limited RCT evidence regarding intensive blood pressure lowering in patients after ICH with baseline systolic blood pressure greater than 220 mmHg or beyond 6 hours from onset, so no specific recommendations can be made regarding these patient groups although more careful acute blood pressure lowering may need to be considered. **[2023]**

Abnormalities of clotting, especially in patients taking anticoagulants, should be urgently reversed, using 4-factor prothrombin complex concentrate (PCC) to reverse vitamin K antagonists. A trial of idarucizumab in patients taking the direct thrombin inhibitor dabigatran has shown the agent to be safe, rapid in action and effective in reversing the anticoagulant effect (Pollack et al, 2017). Multiple low to medium quality, non-randomised, observational studies suggest that 4-factor PCC demonstrates haemostatic efficacy in ICH in patients taking factor Xa inhibitors (Jaspers et al, 2021), but there is insufficient evidence to support a significant benefit in terms of haematoma expansion, mortality, or functional outcome. Andexanet alfa has been shown in normal volunteers to reverse the anticoagulant effect of the factor Xa inhibitors apixaban and rivaroxaban (Siegal et al, 2015) and this has been replicated in patients with ICH (Demchuk et al, 2021). However, the lack of comparative trials examining the effects of andexanet alfa in improving clinical outcome needs to be addressed to inform treatment of this patient group (NICE, 2021). **[2023]**

In contrast to the long-standing and clear role for neurosurgical intervention in posterior fossa haemorrhage, and following a neutral neurosurgical trial in lobar haemorrhage without intraventricular haemorrhage (Mendelow et al, 2013), the role of neurosurgery for supratentorial ICH remains unclear. Most patients with ICH do not require surgical intervention and should receive monitoring and initial medical treatment on an acute stroke unit. Such patients are those with small, deep haemorrhage; lobar haemorrhage without hydrocephalus, intraventricular haemorrhage or neurological deterioration; large haemorrhage and significant co-morbidities before the stroke; and those with supratentorial haemorrhage with a Glasgow Coma Scale score below 8 unless this is because of hydrocephalus. **[2016]**

The majority of spontaneous ICH is caused by cerebral small vessel disease, including arteriolosclerosis (also termed deep perforator arteriopathy or hypertensive arteriopathy) and cerebral amyloid angiopathy (CAA). In a minority of patients, bleeding is caused by a macrovascular abnormality such as an arteriovenous malformation, dural arteriovenous fistula, intracranial aneurysm or cavernous malformation or by cerebral venous thrombosis (CVT). Detection of these causes may be worthwhile because of the risk of ICH recurrence and progression, if preventative interventions are in the patient's best interests. Intra-arterial digital subtraction angiography is the reference standard investigation for detection of all macrovascular abnormalities other than cavernous malformations, which require MRI for diagnosis; the angiography procedure is associated with a very small (0.5-1%) but important risk of serious vascular and neurological complications. A 2015 Cochrane review found that studies of non-invasive angiography (CTA or MRA) of the entire cerebral vasculature (i.e. not limited to the Circle of Willis) had good diagnostic accuracy in comparison to acute intra-arterial angiography. However, studies were of varying quality, with partial verification bias and retrospective designs being common (Josephson et al, 2015). Subsequently, the use of CTA or MRI/MRA has been investigated in the high quality, prospective DIAGRAM study (van Asch et al, 2015). In a selected cohort (aged 18-70 years but excluding patients over 45 years of age with hypertension and ICH in the basal ganglia, thalamus or posterior fossa because of the low probability of finding an underlying macrovascular cause), DIAGRAM demonstrated early CTA (within 48 hours of onset) to have a positive predictive value of 72% (60 to 82%), detecting 51 of 69 (86%) macrovascular causes identified after a systematic investigation pathway in a total study sample of 298 patients. Subsequent MRI/MRA at 4-8 weeks in 214 patients with a negative CTA identified another two of 69 (3%) macrovascular causes. Delayed intra-arterial angiography then identified the remaining 15 of 69 (22%) macrovascular causes in 97 patients where the CTA and MRI/MRA were normal or inconclusive. **[2023]**

For patients not meeting the DIAGRAM study criteria, clinicians will need to estimate the probability of an underlying macrovascular cause to decide on whether to proceed to CTA, MRI/MRA, and/or intra-arterial angiography. The DIAGRAM score (which includes as predictors younger age, lobar or posterior fossa ICH location and absence of cerebral small vessel disease markers) has been derived from the original study cohort and externally validated, with moderate performance for detection of a macrovascular cause in the validation cohort (Hilkens et al, 2018). Including the CTA result in the DIAGRAM score resulted in good performance in the external cohort. The secondary ICH score uses age, sex, hypertension and imaging features and has good performance in validation cohorts. High probability imaging features included enlarged vessels or calcifications along margins of ICH suggesting an AVM or hyperattenuation within dural venous sinus or cortical vein along the path of drainage of the ICH suggesting cortical vein or venous sinus thrombosis. Low probability features were basal ganglia, thalamus or brainstem ICH location (van Asch et al, 2013). Where CTA/MRI/MRA is normal or inconclusive, it is important to consider a subsequent intra-arterial angiogram so as not to miss a macrovascular cause amenable to treatment. **[2023]**

3.6 Implications

Poor therapeutic outcomes affecting the management of patients with acute intracerebral haemorrhage have been partially reversed by the findings of INTERACT2. The resulting potential benefit of care associated with blood pressure reduction, in addition to the safety of blood pressure lowering,

was the rationale for the strength of the Guideline Development Group's recommendation being 'should be considered' despite the recent individual patient data meta-analysis showing no effect of blood pressure lowering on functional outcome. All hyperacute stroke units should consider developing processes to quickly identify patients presenting with intracerebral haemorrhage within 6 hours of onset and consider rapidly and safely lowering SBP for the majority of these patients. As in Section 2.3 *Transfer to acute stroke services*, referral protocols will need to be developed or refined to specify the role of neurosurgery in ICH. A systematic, multidisciplinary, evidence-based approach to investigation for a macrovascular cause of ICH will aid timely and equitable detection of underlying causes amenable to treatment aimed at reducing the risk of recurrence. In implementing these recommendations, efficient resource use should be considered, such as undertaking CTA immediately after diagnostic non-contrast CT. **[2023]**

3.7 Management of subarachnoid haemorrhage

The incidence of subarachnoid haemorrhage (SAH) has been declining in the UK and Ireland (Kelly et al, 2012) and mortality has improved significantly in recent years with improvements in diagnosis and management (Mukhtar et al, 2016). SAH still accounts for approximately 5% of all acute strokes. 10–15% of those affected die before reaching hospital and overall survival is about 70%, but amongst patients admitted to a neurosurgical unit with a confirmed aneurysm, 85% will survive (Society of British Neurosurgeons, 2006). Case fatality and unfavourable outcomes rise with age and are highest in the over 65 age group (Society of British Neurosurgeons, 2006), and in those patients of a 'poor clinical grade' (Hunt and Hess or World Federation of Neurological Surgeons grades 4 & 5). Recurrent haemorrhage from the culprit aneurysm is the most frequent cause of death after the initial presentation. Diagnosis, referral to a tertiary centre and treatment to prevent rebleeding are therefore urgent. CT scanning is the most sensitive method to detect subarachnoid blood but when CT is negative lumbar puncture for xanthochromia after 12 hours may still be required, particularly if there has been a delay in presentation, as the sensitivity of CT for SAH declines with time from ictus. Usually non-invasive angiography (CT or MR) is required prior to intra-arterial angiography undertaken in the referring or neurosciences centre. After SAH many patients will have residual disability requiring neurorehabilitation and most will experience long-term symptoms, especially fatigue and cognitive disability. **[2016]**

3.7 Recommendations

A Any person presenting with sudden severe headache and an altered neurological state should have the diagnosis of subarachnoid haemorrhage investigated by:
- immediate CT brain scan (also including CT angiography if a protocol is agreed with the neurosciences centre);
- lumbar puncture 12 hours after ictus (or within 14 days if presentation is delayed) if the CT brain scan is negative and does not show any contraindication;
- spectrophotometry of the cerebrospinal fluid for xanthochromia. **[2016]**

B Patients with spontaneous subarachnoid haemorrhage should be referred immediately to a neurosciences centre and receive:
- nimodipine 60 mg 4 hourly unless contraindicated;
- frequent neurological observation for signs of deterioration. **[2016]**

C Following transfer to the neurosciences centre, patients with spontaneous subarachnoid haemorrhage should receive:
- CT or MR angiography (if this has not already been done by agreed protocol in the referring hospital) with or without intra-arterial angiography to identify the site of bleeding;
- specific treatment of any aneurysm related to the haemorrhage by endovascular

embolisation or surgical clipping if appropriate. Treatment to secure the aneurysm should be undertaken within 48 hours of ictus for patients of appropriate status (Hunt and Hess or World Federation of Neurological Sciences grades 1-3), or within a maximum of 48 hours of diagnosis if presentation was delayed. **[2016]**

D After any immediate treatment, patients with subarachnoid haemorrhage should be monitored for the development of treatable complications, such as hydrocephalus and cerebral ischaemia. **[2016]**

E After any immediate treatment, patients with subarachnoid haemorrhage should be assessed for hypertension treatment and smoking cessation. **[2016]**

F Patients with residual symptoms or disability after definitive treatment of subarachnoid haemorrhage should receive specialist neurological rehabilitation including appropriate clinical/neuropsychological support. **[2016]**

G People with two or more first-degree relatives affected by aneurysmal subarachnoid haemorrhage and/or polycystic kidney disease should be referred to a neurovascular and/or neurogenetics specialist for information and advice regarding the risks and benefits of screening for cerebral aneurysms. **[2016]**

3.7 Sources

A Working Party consensus

B Allen et al, 1983; Barker and Ogilvy, 1996; Pickard et al, 1989

C Molyneux et al, 2005; Society of British Neurosurgeons, 2006

D-F Working Party consensus

G Bor et al, 2008

3.7 Evidence to recommendations

There have been a number of negative trials in SAH management. Statins (Liu & Chen, 2015), magnesium (Mees et al, 2012) and endothelin receptor antagonists (Guo et al, 2012) have all been shown not to improve clinical outcome after SAH. **[2016]**

3.8 Cervical artery dissection

A small proportion of patients with acute ischaemic stroke will have a dissection of a carotid or vertebral artery as the underlying cause of their stroke. As non-invasive carotid and vertebral imaging has become more accessible and of higher quality, the proportion of patients diagnosed with dissection has increased. This group of patients tends to be younger, and may have experienced preceding neck trauma. **[2023]**

3.8 Recommendations

A Any patient suspected of cervical artery dissection should be investigated with CT or MR including angiography. **[2016]**

B Patients with acute ischaemic stroke suspected to be due to cervical arterial dissection should receive thrombolysis if they are otherwise eligible. **[2016]**

C Patients with acute ischaemic stroke suspected to be due to cervical arterial dissection should be treated with either an anticoagulant or an antiplatelet agent for at least 3 months. **[2016]**

D For patients with cervical arterial dissection treated with an anticoagulant, either a DOAC or a Vitamin K antagonist may be used for three months. **[2023]**

E For patients with acute ischaemic stroke or TIA secondary to cervical artery dissection,

dual antiplatelet therapy with aspirin and clopidogrel may be considered for the first 21 days, to be followed by antiplatelet monotherapy until at least three months after onset. **[2023]**

3.8 Sources

A Working Party consensus

B Zinkstok et al, 2011; Engelter et al, 2012

C CADISS Trial Investigators, 2015

D CADISS Trial Investigators, 2015; TREAT-CAD Trial Investigators, 2021; Debette et al, 2021; Guideline Development Group consensus

E Guideline Development Group consensus

3.8 Evidence to recommendations

The CADISS RCT in people with symptomatic carotid and vertebral artery dissection showed no significant difference between anticoagulant and antiplatelet treatment in the prevention of recurrent stroke or death (CADISS Trial Investigators, 2015). The incidence of either outcome was low, with a 2% stroke rate within 3 months and no deaths. This low rate may reflect greater diagnostic yield in patients previously classified as 'cryptogenic'. The TREAT-CAD RCT did not show that aspirin was non-inferior to anticoagulation (Vitamin K antagonist) in the prevention of either new MRI lesions during follow-up, or clinical endpoints (acute ischaemic stroke, major intra- or extracranial haemorrhage, death) in a primary composite endpoint. The endpoint occurred in 21 (23%) patients in the aspirin group and in 12 (15%) in the VKA group (absolute difference 8% [95% CI, –4 to 21], non-inferiority p=0.55). There were no deaths in either group (TREAT-CAD Trial Investigators, 2021). **[2023]**

A meta-analysis combining the per-protocol results of CADISS and TREAT-CAD showed that at 3 months there was no significant difference between anticoagulant and antiplatelet treatment for the composite endpoint of ischaemic stroke or major haemorrhage (Debette et al, 2021). In patients randomised to anticoagulation, the odds of the composite endpoint was 0.35 (95% CI, 0.08-1.63), ischaemic stroke was 0.18 (95% CI, 0.03 to 1.10) and major bleeding was 3.28 (95% CI, 0.34 to 31.80. Overall, the two RCTs did not show a significant difference between the two treatment groups in the acute phase of symptomatic extracranial cervical artery dissection. **[2023]**

There is no evidence on which to base a recommendation regarding long-term antithrombotic treatment after cervical artery dissection as the intervention (anticoagulant or antiplatelet) in the two trials (CADISS and TREAT-CAD) was stopped at 3 months. **[2023]**

There is no evidence to suggest that thrombolysis carries any greater risk in patients with cervical artery dissection compared to stroke from other causes (Engelter et al, 2012). **[2016]**

3.9 Cerebral venous thrombosis

Cerebral venous thrombosis (CVT) is a rare cause of an acute stroke syndrome. Headache, seizures and focal (sometimes bilateral) neurological deficits are typical presenting features. CVT is more likely in patients with a prothrombotic tendency (e.g. around the time of pregnancy), or who have local infection, dehydration or malignancy, and it is important to investigate for a possible underlying cause. In the largest published registry series of 11,400 patients with CVT, 232 (2%) died in hospital due to the CVT (Nasr et al, 2013). Older patients and those with sepsis had the greatest risk of in-hospital mortality. Hydrocephalus, intracranial haemorrhage, and motor deficits were also associated with a worse outcome. **[2016]**

3.9 Recommendations

A Any patient suspected of cerebral venous thrombosis should be investigated with CT or MRI including venography. **[2016]**

B Patients with cerebral venous thrombosis (including those with secondary cerebral haemorrhage) should receive full-dose anticoagulation (initially full-dose heparin and then warfarin with a target INR of 2–3) for at least three months unless there are comorbidities that preclude their use. **[2016]**

3.9 Sources

A Working Party consensus

B Coutinho et al, 2011; Working Party consensus

3.9 Evidence to recommendations

Case series suggest that anticoagulation is the treatment of choice for CVT, even when haemorrhage is seen on brain imaging, with a reduction in death and dependency (Stam et al, 2002). A Cochrane review (Coutinho et al, 2011) identified two small trials of anticoagulation after CVT. Although not reaching statistical significance, there was a trend toward a positive benefit from anticoagulation for at least three months. DOACs are licensed for venous thromboembolism but not for CVT. There is no evidence to support the use of corticosteroids in the management of CVT; what information is available is likely to be affected by selection bias and does not support their use, and may even suggest some circumstances where their use may be harmful (Canhao et al, 2008). **[2016]**

3.10 Acute stroke care

Many patients presenting with acute neurological deficits secondary to vascular disease will have other problems requiring attention during and after their initial diagnosis (Section 3.4 *Diagnosis and treatment of acute stroke - imaging*) and the pathology-specific treatments described in Sections 3.5 *Management of ischaemic stroke* and 3.6 *Management of intracerebral haemorrhage*. Three-quarters of patients with acute stroke admitted to hospital in the UK have at least one co-morbidity, and one in ten have at least three (Intercollegiate Stroke Working Party, 2016). Patients need specialist care on a stroke unit focused initially on preserving life, limiting brain damage and preventing complications before rehabilitation can begin in earnest. Patients with stroke often have significant disturbances of physiological homeostasis with raised temperature, raised blood glucose, hypoxia, etc. During the first week, 5% of patients with acute stroke develop urinary sepsis, and 9% require antibiotic treatment for pneumonia (Intercollegiate Stroke Working Party, 2016). **[2016]**

3.10 Recommendations

A Patients with acute stroke should be admitted directly to a hyperacute stroke unit with protocols to maintain normal physiological status and staff trained in their use. **[2016]**

B Patients with acute stroke should have their clinical status monitored closely, including:
- level of consciousness;
- blood glucose;
- blood pressure;
- oxygen saturation;
- hydration and nutrition;
- temperature;
- cardiac rhythm and rate. **[2016]**

C Patients with acute stroke should only receive supplemental oxygen if their oxygen saturation is below 95% and there is no contraindication. **[2016]**

D Patients with acute stroke should have their hydration assessed using a standardised approach within four hours of arrival at hospital, and should be reviewed regularly and managed so that normal hydration is maintained. **[2016]**

E Patients with acute stroke should have their swallowing screened, using a validated screening tool, by a trained healthcare professional within four hours of arrival at hospital and before being given any oral food, fluid or medication. **[2016]**

F Until a safe swallowing method is established, patients with dysphagia after acute stroke should:
- be immediately considered for alternative fluids;
- have a comprehensive specialist assessment of their swallowing;
- be considered for nasogastric tube feeding within 24 hours;
- be referred to a dietitian for specialist nutritional assessment, advice and monitoring;
- receive adequate hydration, nutrition and medication by alternative means;
- be referred to a pharmacist to review the formulation and administration of medication. **[2023]**

G Patients with swallowing difficulties after acute stroke should only be given food, fluids and medications in a form that can be swallowed without aspiration. **[2016]**

H Patients with acute stroke should be treated to maintain a blood glucose concentration between 5 and 15 mmol/L with close monitoring to avoid hypoglycaemia. **[2016]**

I Patients with acute ischaemic stroke should only receive blood pressure-lowering treatment if there is an indication for emergency treatment, such as:
- systolic blood pressure above 185 mmHg or diastolic blood pressure above 110 mmHg when the patient is otherwise eligible for treatment with thrombolysis;
- hypertensive encephalopathy;
- hypertensive nephropathy;
- hypertensive cardiac failure or myocardial infarction;
- aortic dissection;
- pre-eclampsia or eclampsia. **[2016]**

J Patients with acute stroke admitted on antihypertensive medication should resume oral treatment once they are medically stable and as soon as they can swallow medication safely. **[2016]**

K Patients with acute ischaemic stroke should receive high-intensity statin treatment with atorvastatin 20-80 mg daily as soon as they can swallow medication safely. **[2016]**

L Patients with primary intracerebral haemorrhage should only be started on statin treatment based on their cardiovascular disease risk and not for secondary prevention of intracerebral haemorrhage. **[2016]**

3.10 Sources

A, B Middleton et al, 2011

C Working Party consensus; Roffe et al, 2011

D Working Party consensus

E NICE, 2016d; Kertscher et al, 2014; Martino et al, 2014; Bray et al, 2017

F Geeganage et al, 2012; NICE, 2017b, 20023b

G, H Working Party consensus

I, J Bath and Krishnan, 2014; Working Party consensus

K, L Amarenco and Labreuche, 2009; NICE, 2023a

3.10 Evidence to recommendations

Patients with acute stroke are at high risk of dehydration, malnutrition, infection, hypoxia and hyperglycaemia. Middleton et al (2011) showed that training stroke unit staff in the use of standardised protocols to manage physiological status can significantly improve outcomes. The management of blood pressure after acute ischaemic stroke remains an area with little evidence to guide practice (see Section 3.6 *Management of intracerebral haemorrhage* for the recommendation regarding blood pressure management in acute intracerebral haemorrhage). There is no evidence for the use of hyperbaric oxygen therapy in stroke (Bennett et al, 2014) nor for the use of supplemental oxygen in normoxic patients (Roffe et al, 2011) and from the evidence available, the Working Party recommends that mannitol for the treatment of cerebral oedema should not be used outside of a clinical trial. **[2016]**

There is very little trial evidence on which to base the management of hydration in acute stroke. A Cochrane review of the signs and symptoms of impending and current water-loss dehydration in older people (Hooper et al, 2015) concluded that there is little evidence that any one symptom, sign or test, including many that clinicians customarily rely on, have any diagnostic utility for dehydration. **[2016]**

There is good evidence that a multi-item dysphagia screening protocol that includes at least a water intake test of 10 teaspoons and a lingual motor test was more accurate than screening protocols with only a single item (Martino et al, 2014). There is good evidence from a systematic review (Kertscher et al, 2014) that the investigation of dysphagia with instrumental assessments providing direct imaging for evaluation of swallowing physiology help to predict outcomes and improve treatment planning. **[2016]**

In contrast to acute myocardial infarction, tight glycaemic control has not been shown to improve outcome in stroke (Gray et al, 2007) and studies have warned against aggressive lowering with insulin infusions due to the risk of hypoglycaemia. This has led the Working Party to recommend a broadening of the target range for blood glucose in acute stroke from 4-11 mmol/L to 5-15 mmol/L. **[2016]**

Two recent studies showed no clinical benefit from the prophylactic use of antibiotics in dysphagic stroke patients and thus routine antibiotic prophylaxis is not recommended (Kalra et al, 2015; Westendorp et al, 2015). **[2016]**

3.11 Positioning

Following a stroke many patients are left with varying degrees of physical impairment which can reduce their ability to change position and posture. Therapeutic positioning, whether in bed, chair or wheelchair, aims to reduce skin damage, limb swelling, shoulder pain or subluxation, and discomfort, and maximise function and maintain soft tissue length. Good positioning may also help to reduce respiratory complications and avoid compromising hydration and nutrition. **[2016]**

3.11 Recommendations

A Patients with acute stroke should have an initial specialist assessment for positioning as soon as possible and within 4 hours of arrival at hospital. **[2016]**

B Patients admitted to hospital with acute stroke should be allowed to adopt either a sitting-up or lying-flat head position in the first 24 hours, according to comfort. Stroke units should not have a policy or practice that favours either head position. **[2023]**

C Healthcare professionals responsible for the initial assessment of patients with acute stroke should be trained in how to position patients appropriately, taking into account the degree of their physical impairment after stroke. **[2016]**

D When lying or sitting, patients with acute stroke should be positioned to minimise the risk of aspiration and other respiratory complications, shoulder pain and subluxation, contractures and skin pressure ulceration. **[2016]**

3.11 Sources

A Working Party consensus

B Anderson et al, 2017

C, D Working Party consensus

3.11 Evidence to recommendations

One systematic review (Olavarria et al, 2014) examined four small non-randomised trials of head position in acute patients with ischaemic stroke. The trials studied cerebral blood flow using transcranial Doppler but did not report on functional outcome. In the international multicentre cluster-randomised trial HeadPoST (Anderson et al, 2017) of 11,093 patients hospitalised with acute stroke, there was no significant difference between the lying-flat head position and the sitting-up position for the first 24 hours with respect to the primary outcome of disability at 90 days. There were also no significant differences in mortality or in the rates of serious adverse events, including pneumonia. **[2023]**

3.12 Early mobilisation

Immobility and/or bed rest are well-documented to have detrimental effects on hospital patients in general. Early mobilisation (e.g. activities such as sitting out of bed, transfers, standing and walking) aims to minimise the risk of the complications of immobility and improve functional recovery. **[2016]**

3.12 Recommendations

A Patients with difficulty moving after stroke should be assessed as soon as possible within the first 24 hours of onset by an appropriately trained healthcare professional to determine the most appropriate and safe methods of transfer and mobilisation. **[2016]**

B Patients with difficulty moving early after stroke who are medically stable should be offered frequent, short daily mobilisations (sitting out of bed, standing or walking) by appropriately trained staff with access to appropriate equipment, typically beginning between 24 and 48 hours of stroke onset. Mobilisation within 24 hours of onset should only be for patients who require little or no assistance to mobilise. **[2016]**

3.12 Sources

A Working Party consensus

B AVERT Trial Collaboration group, 2015; Bernhardt et al, 2016

3.12 Evidence to recommendations

Recommendations have been changed as a result of an international RCT of over 2000 people with acute stroke (AVERT Trial Collaboration group, 2015). Although two small RCTs previously showed that very early mobilisation (beginning within 24 hours) was feasible in an acute setting, the AVERT trial showed that very early, more frequent, higher dose mobilisation focused on out-of-bed activities in addition to usual care was worse than usual care alone. Very early mobilisation led to greater disability at three months with no effect on immobility-related complications or walking recovery. The trial included people with previous stroke, severe stroke, intracerebral haemorrhage and those who were thrombolysed, if they required help to mobilise and were expected to remain in hospital for at least three days. It excluded those who were medically unstable or with significant previous disability. **[2016]**

To implement this evidence into practice it is important to understand the nature of the usual care and the other factors within this complex intervention. In AVERT's very early intervention, 92% were mobilised within 24 hours of stroke onset (as opposed to admission) and 23% were mobilised within 12

hours. This was carried out by nurses or therapists an average of six times per day, and included an average daily amount of 31 minutes of mobilisation by a physiotherapist measured over 14 days or until transfer of care if earlier. Given the trial outcomes, such very early mobilisation cannot be recommended. **[2016]**

The more beneficial usual care was still early but slightly later, less frequent and at a lower dose. Almost everyone (93%) was mobilised within 48 hours of onset, 59% within 24 hours and 14% within 12 hours, by nurses or therapists an average of three times per day, and including an average daily amount of 10 minutes of mobilisation by a physiotherapist. A subsequent exploration of dose hypothesised that early mobilisation might be best delivered in short, frequent amounts (Bernhardt et al, 2016) but this requires further research. **[2016]**

3.13 Deep vein thrombosis and pulmonary embolism

Deep vein thrombosis (DVT) and pulmonary embolism (PE) are common complications of hemiplegic stroke with up to 50% of patients having thrombus in either the calf or thigh of the paretic limb (Kelly et al, 2004). **[2016]**

3.13 Recommendations

A Patients with immobility after acute stroke should be offered intermittent pneumatic compression within 3 days of admission to hospital for the prevention of deep vein thrombosis. Treatment should be continuous for 30 days or until the patient is mobile or discharged, whichever is sooner. **[2016]**

B Patients with immobility after acute stroke should not be routinely given low molecular weight heparin or graduated compression stockings (either full-length or below-knee) for the prevention of deep vein thrombosis. **[2016]**

C Patients with ischaemic stroke and symptomatic deep vein thrombosis or pulmonary embolism should receive anticoagulant treatment provided there are no contraindications. **[2016]**

D Patients with intracerebral haemorrhage and symptomatic deep vein thrombosis or pulmonary embolism should receive treatment with a vena caval filter. **[2016]**

3.13 Sources

A CLOTS Trials Collaboration, 2014

B Geeganage et al, 2013; CLOTS Trials Collaboration, 2013

C, D Working Party consensus

3.13 Evidence to recommendations

The risk of symptomatic intracerebral haemorrhage outweighs the benefit from the prevention of venous thromboembolism (VTE) with routine anticoagulation with low-dose heparin (including low molecular weight heparin) following acute ischaemic stroke (Geeganage et al, 2013). It is also not possible to predict which patients with acute stroke may be at sufficiently high risk of VTE compared to haemorrhagic complications to inform the targeted use of heparin treatment in selected patients (Whiteley et al, 2013). The CLOTS 1 and 2 trials showed that graduated compression stockings were ineffective in preventing VTE or improving functional outcome in stroke (CLOTS Trials Collaboration, 2013). The CLOTS 3 trial showed that intermittent pneumatic compression (IPC) using sequential compression with venous refill technology in immobile patients in the first 30 days after stroke is an effective treatment for reducing proximal DVT and improves survival but not functional outcomes (CLOTS Trials Collaboration, 2014). In evaluating the cost-effectiveness of IPC in stroke, NICE

recommended that healthcare professionals explain to the patient or their family members or carers that IPC reduces the risk of DVT and may provide an increase in survival, but it will not help them recover from their stroke, and there may be an associated increased risk of surviving with severe disability (NICE, 2015). **[2016]**

If proximal DVT does occur in a patient with ischaemic stroke, the risk of PE is high and such patients should receive treatment-dose anticoagulation. If DVT occurs in a patient with ICH there are no randomised trial data to support any particular treatment, but single-centre case series have reported that in such cases a vena caval filter is probably safe and effective for the prevention of PE (Somarouthu et al, 2011). There is no evidence to guide the management of patients with ICH and PE, and the decision to use or to avoid the use of anticoagulant treatment can only be made on the physician's individualised assessment of the balance of risk and benefit. **[2016]**

Glossary

Activities of daily living	Refers to activities that people normally undertake (e.g. bathing, dressing, feeding themselves).
Acupuncture	A complementary medicine that involves inserting thin needles into the skin.
Acute stroke service	Consists of: a) a comprehensive stroke centre (CSC) providing hyperacute, acute and inpatient rehabilitation including thrombectomy (thrombectomy centre) and neurosurgery; or b) an acute stroke centre (ASC) providing hyperacute, acute and inpatient rehabilitation. All components of a specialist acute stroke service should be based in a hospital that can investigate and manage people with acute stroke and their medical and neurological complications.
Aerobic exercise	Low- to moderate-intensity exercise that can be sustained for long periods of time (e.g. cycling, swimming or walking).
Agnosia	The inability for a patient to recognise or make proper sense of sensory information.
Alteplase	A drug used for thrombolysis.
Aneurysm	A bulge in the wall of a blood vessel that is filled with blood. This can burst and cause a haemorrhage.
Angiography	A technique that uses X-ray technology to image blood vessels.
Anticoagulants	A group of drugs used to reduce the risk of clots by thinning the blood.
Antiphospholipid syndrome	Sometimes called 'sticky blood syndrome' because blood clots form too quickly; this is due to antibodies against the body's phospholipid part of every cell in the body.
Antiplatelets	A group of drugs used to prevent the formation of clots by stopping platelets in the blood sticking together.
Antithrombotics	The generic name for all drugs that prevent the formation of blood clots. This includes antiplatelets and anticoagulants.
Aphasia	Communication difficulties after a stroke which can affect a person's speech, processing, reading and writing.
Arterial dissection	This is caused as a result of a small tear forming in the lining of the arterial wall.
Atherosclerosis	Fatty deposits that harden on the inner wall of the arteries (atheroma) and roughen its surface; this makes the artery susceptible to blockage either by narrowing or by formation of a blood clot.
Atrial fibrillation	A heart condition that causes an irregular heartbeat, often faster than the normal heart rate.
Audit (clinical)	A method of evaluating the performance of a clinical service against a set of standards/criteria.
Bobath therapy	Treatment which aims to use facilitative handling which prioritises normal movement and muscle tone or inhibition of reflex activity rather than maximising practice and patient activity. Also known as neurophysiological or neurodevelopmental treatment.
Body mass index (BMI)	An index of body weight corrected for height.
Botulinum toxin	A toxin which when injected can relax muscles to reduce spasticity.

Cardiovascular disease	Disease of the heart and/or blood vessels.
Care pathway	A tool used by healthcare professionals to define the sequence and timings of a set of tasks or interventions that should be performed for a patient who enters a healthcare setting (e.g. a hospital) with a specific problem.
Carotid angioplasty	A surgical procedure that widens the internal diameter of the carotid artery, after it has been narrowed by atherosclerosis.
Carotid arteries	Main blood vessels in the neck, which supply oxygenated blood to the brain.
Carotid endarterectomy (CEA)	A surgical procedure used to clear the inside of the carotid artery of atheroma.
Carotid stenosis	The narrowing of the carotid arteries in the neck.
Carotid stenting	Insertion of a tube into the carotid artery in order to prop the artery open and reduce narrowing.
Caval filter	A device that is inserted into the veins to prevent a blood clot entering the lungs.
Cerebral venous thrombosis	A blood clot that forms within a vein inside the brain.
Clinician	A registered healthcare professional such as a doctor, nurse or therapist.
Cochrane review	A systematic review of research in health care and health policy that is published in the Cochrane Database of Systematic Reviews.
Commissioner (health services)	Person or organisation in some parts of the UK National Health Service (NHS) that decides how to allocate the health budget for a service.
Community stroke team, community stroke rehabilitation team	A stroke specialist multidisciplinary team that provides stroke rehabilitation for patients in their own home or other community setting (including care homes and nursing homes). This may be following hospital discharge, after a patient has been discharged from an early supported discharge team or at any point post stroke where rehabilitation needs are identified. The intensity and duration of this service should be determined by patient need.
Compensatory strategies	Learning an alternative way of completing a task.
Computed tomography (CT)	An X-ray technique used to examine the brain.
Confidence interval (CI)	When analysing a research study, this is the range (‘interval’) of possible results that statisticians are 95% confident the actual result lies between.
Constraint-induced movement therapy	Therapy that involves preventing the use of the unaffected side of the body thus forcing the use of the affected side.
Cost-effectiveness	The extent to which the benefits of a treatment outweigh the costs.
Decompressive hemicraniectomy	A surgical procedure for the treatment of raised pressure inside the brain from fluid, blood or swelling. A piece of skull is removed to allow the brain to swell.
Deep vein thrombosis (DVT)	A blood clot that develops in the large veins, usually in the legs.
Diabetes, diabetes mellitus	A metabolic disease in which a person has high blood sugar.
Diagnostic accuracy	The degree to which a diagnostic (or screening) tool or procedure is able to distinguish between cases and non-cases. See also ‘sensitivity’ or ‘specificity’.
Doppler ultrasound	An imaging technique that measures blood flow and velocity through blood vessels.

Dysarthria	Difficulty producing clear speech, caused by muscle weakness.
Dyspepsia	Indigestion.
Dysphagia	Difficulty in swallowing.
Early supported discharge	An intervention delivered by a co-ordinated, stroke specialist, multidisciplinary team that facilitates the earlier transfer of care from hospital into the community and provides responsive (within 24 hours) and intensive stroke rehabilitation in the patient's place of residence (usually over a time-limited period).
Endarterectomy	The surgical removal of plaque from a blocked artery to restore blood flow.
Face Arms Speech Time (FAST) test	A test used to screen for the possibility of a stroke or a TIA.
Fatigue	Physical or mental exhaustion that does not get better through normal periods of rest.
Foot-drop	A condition in which the foot hangs limply whilst walking.
Gastrointestinal bleeding	Bleeding anywhere between the throat and the rectum.
Gastrostomy	A surgical opening into the stomach to enable feeding.
Gastrostomy feeding (also tube feeding)	Provision of nutrition and fluids via a tube directly into the gastrointestinal tract.
Goal attainment	Rehabilitation goals for particular tasks are set by the patient and therapists together.
Haemorrhage	Bleeding caused by blood escaping into the tissues.
Haemorrhagic stroke	A stroke that happens when a blood vessel bursts, leading to bleeding in the brain (also called a 'brain haemorrhage').
Healthcare professional	A professional involved in stroke care, such as a doctor, nurse, therapist, or care staff.
HEART UK	A cholesterol charity.
Hemianopia	Blindness or some loss of vision in one part of the visual field.
Homeostasis	Regulation of internal environment (e.g. body temperature regulated at 37°C).
Hydrocephalus	A build up of fluid within the skull.
Hyperacute stroke unit/centre/service	A stroke unit, centre or service that treats patients in the first 72 hours of symptom onset.
Hyperlipidaemia	Raised levels of lipids (cholesterol, triglycerides or both) in the blood serum.
Hypertension	Raised blood pressure.
Hypertensive encephalopathy	Brain damage caused by raised blood pressure.
Hypoglycaemia	Blood sugar levels lower than the normal range.
Hypoxia	Blood oxygen levels outside the normal range, e.g. below 95% saturation.
Incontinence	Inability to control passing of urine and/or faeces.
Infarct	An area of cell death due to a deprived blood supply.
Integrated community stroke service	An integrated service that provides early supported discharge and community stroke rehabilitation.
International Classification of	A classification of health used as a framework by the World Health Organization (WHO) to measure health and disability.

Functioning, Disability and Health (ICF)	
Ischaemic stroke	A stroke that happens when a blood clot blocks an artery that is carrying blood to the brain.
Lumbar puncture	A diagnostic or therapeutic procedure that involves collection of fluid from the base of the spine.
Magnetic resonance imaging (MRI)	A non-invasive imaging technique that allows for detailed examination of the brain.
Malnutrition Universal Screening Tool (MUST)	A screening tool consisting of five steps to help identify which adults are malnourished or at risk of malnourishment.
Meta-analysis	A statistical technique for combining the results of a number of studies that address the same question and report on the same outcomes to produce a summary result.
Mouth care	Also referred to as oral health care. Refers to the promotion and maintenance of a clean oral cavity including the teeth, gums, cheeks, tongue and palate. A clean mouth requires the removal of traces of food and debris and dental plaque.
MRI with diffusion-weighted imaging	This type of scan shows areas of recent ischaemic brain damage.
Musculoskeletal pain	Pain of the muscles and/or joints.
National Institute for Health and Care Excellence (NICE)	A special health authority set up within the NHS to develop appropriate and consistent advice on healthcare technologies, and to commission evidence-based guidelines. Its remit extends in most cases to England, Wales and Northern Ireland.
National Institute of Health Stroke Scale (NIHSS)	A score to assess the severity of a stroke.
Neuropathic pain	Pain caused by damage to nerves.
Orthosis	An appliance used to support or align an area of the body to facilitate movement, or prevent or correct damage.
Palliative care	Care that relieves rather than treats symptoms.
Pneumonia	An inflammatory condition of the lungs usually caused by infection.
Pulmonary embolism	A blood clot in the lungs.
Quality of life	Refers to the level of comfort, enjoyment, and ability to pursue daily activities.
Quality standard	A standard set (e.g. by NICE) that is used to define whether the quality of care is of a high standard.
Randomised controlled trial (RCT) (often 'randomised trial')	A trial in which people are randomly assigned to two (or more) groups: one (the experimental group) receiving the treatment that is being tested, and the other (the comparison or control group) receiving an alternative treatment, a placebo (dummy treatment) or no treatment. The two groups are followed up to compare differences in outcomes to see how effective the experimental treatment was. Such trial designs help minimise experimental bias.
Recognition of stroke in the emergency room (ROSIER)	A tool used to establish the diagnosis of stroke or TIA.

Rehabilitation	A set of treatments and activities to promote recovery and reduce disability. Rehabilitation treatments are provided by therapists and therapy assistants.
Saturated fat	A type of fat that is commonly found in meat and dairy products as opposed to fats found in plants and fish, which may be unsaturated.
Self-efficacy	A person's belief in their own competency.
Self-management	Actions and confidence of individuals to manage the medical and emotional aspects of their condition in order to maintain or create new life roles.
Sensitivity	The ability of a test to detect a problem.
Service planners	Those responsible for planning and sanctioning health services in Ireland.
Side effect	An adverse event that occurs because of a therapeutic intervention.
SIGN	Scottish Intercollegiate Guidelines Network, an organisation set up to develop evidence-based guidelines. It is part of Healthcare Improvement Scotland and its remit covers Scotland.
Spasticity	Increased stiffness of the muscles that occurs in the paralysed limbs after stroke.
Specialist	A healthcare professional with the necessary knowledge and skills in managing people with stroke and conditions that mimic stroke, usually by having a relevant further qualification and keeping up to date through continuing professional development. This does not require the healthcare professional exclusively to manage people with stroke, but does require them to have specific knowledge and practical experience of stroke.
Specialist team	A group of specialists who work together regularly managing people with stroke and conditions that mimic stroke, and who between them have the knowledge and skills to assess and resolve the majority of problems. At a minimum, any specialist unit, team or service must be able to deliver all the relevant recommendations made in this guideline. This does not require the team exclusively to manage people with stroke, but the team should have specific knowledge and practical experience of stroke.
Specificity	The ability of a test to detect the right problem.
Splint	A custom or ready-made external device to support a joint or limb in a certain position.
Stenosis	Abnormal narrowing of a blood vessel.
Stenting	A metal mesh tube is placed in an artery or blood vessel to increase blood flow to an area blocked by stenosis.
Stroke	A clinical syndrome, of presumed vascular origin, typified by rapidly developing signs of focal or global disturbance of cerebral functions lasting more than 24 hours or leading to death.
Subarachnoid haemorrhage (SAH)	A haemorrhage from a cerebral blood vessel, aneurysm or vascular malformation into the subarachnoid space (the space surrounding the brain where blood vessels lie between the arachnoid and pia mater).
Subluxation	An incomplete or partial dislocation of a joint.
Systematic review	A way of combining the findings from a variety of different research studies to better analyse whether the studies have provided a convincing answer to a research question.
Telemedicine	The use of telecommunication and information technologies in order to provide clinical healthcare at a distance.
Tenecteplase	A drug used for thrombolysis.
Therapist	In the context of the guideline this includes the allied health professionals (UK) and health and social care professionals (Ireland) involved in stroke care.

	The main ones are dietitians, occupational therapists, orthoptists, orthotists, physiotherapists, and speech and language therapists.
Thrombectomy	The excision of a blood clot from a blood vessel.
Thrombectomy centre	A centre providing thrombectomies without providing acute stroke care.
Thrombolysis	The use of drugs to break up a blood clot. An example of a thrombolysis drug is alteplase, also sometimes called tPA.
Thrombosis	A formation of a blood clot.
Transient ischaemic attack (TIA)	An acute loss of focal cerebral or ocular function with symptoms lasting less than 24 hours and which is thought to be due to inadequate cerebral or ocular blood supply as a result of low blood flow, thrombosis or embolism associated with diseases of the blood vessels, heart, or blood.
Tube feeding (also gastrostomy feeding)	Provision of nutrition and fluids via a tube directly into the gastrointestinal tract.
Venography	An X-ray test that provides an image of the leg veins after a contrast dye is injected into a vein in the patient's foot.
Videofluoroscopy	A test for assessing the integrity of the oral and pharyngeal stages of the swallowing process. It involves videotaping X-ray images as the patient swallows a bolus of barium.
Vocational rehabilitation	A co-ordinated plan to optimise a person's ability to participate in paid or voluntary work.
Work	Different forms of occupation, including paid employment, vocational training, sheltered, therapeutic or voluntary work, and adult education.
Xanthochromia	The yellowish appearance of cerebrospinal fluid that occurs after bleeding into the fluid, usually after subarachnoid haemorrhage.

Abbreviations and acronyms

ABCD2	Age, blood pressure, clinical features, duration of TIA, and presence of diabetes
ADL	Activities of daily living
AF	Atrial fibrillation
APS	Antiphospholipid syndrome
ASC	Acute stroke centre
ASPECTS	Alberta Stroke Program Early Computed Tomography Score
ASA	Atrial septal aneurysm
BADS	Behavioural Assessment of the Dysexecutive Syndrome
BMI	Body mass index
BOA	Behavioural Outcomes of Anxiety
BP	Blood pressure
BPPV	Benign paroxysmal positional vertigo
CAA	Cerebral amyloid angiopathy
CADASIL	Cerebral autosomal dominant arteriopathy with subcortical infarcts and leucoencephalopathy
CI	Confidence interval
CIMT	Constraint-induced movement therapy
COC	Combined oral contraceptive
COVID-19	Coronavirus disease
CPAP	Continuous positive airways pressure
CPSP	Central post-stroke pain
CSC	Comprehensive stroke centre
CT	Computed tomography
CTA	Computed tomography angiography
CVT	Cerebral venous thrombosis
DISCs	Depression Intensity Scale Circles
DOAC	Direct oral anticoagulant
DVA	Driver and Vehicle Agency (Northern Ireland)
DVLA	Driver and Vehicle Licencing Agency (England, Scotland, Wales)
DVT	Deep vein thrombosis
DWI	Diffusion-weighted imaging
EADL	Extended activities of daily living
ECG	Electrocardiogram
ELISA	Enzyme-linked immunosorbent assay
EMA	European Medicines Agency
FAST test	Face Arm Speech Time test
FEES	Fibre-optic endoscopic evaluation of swallowing
FLAIR	Fluid attenuated inversion recovery
GDG	Guideline Development Group
GP	General practitioner
HAS-BLED	Hypertension, Abnormal score renal and liver function, Stroke, Bleeding, Labile INRs, Elderly, Drugs or alcohol score
HDL	High density lipoprotein
HIIT	High intensity interval training
HR	Hazard ratio
HRT	Hormone replacement therapy
HSE	Health Service Executive (Ireland)

IAPT	Improving Access to Psychological Therapies
ICF	International Classification of Functioning, Disability and Health
ICH	Intracerebral haemorrhage
ILR	Implantable loop recorder
INR	International normalised ratio (for blood clotting time)
IQR	Interquartile range
LDL	Low density lipoprotein
MCA	Middle cerebral artery
mCIMT	Modified constraint-induced movement therapy
MDT	Multidisciplinary team
MHRA	Medicines and Healthcare Products Regulatory Agency
MI	Myocardial infarction
MICON	Microbleeds International Collaborative Network
MR	Magnetic resonance
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
mRS	Modified Rankin Scale score
MSU	Mobile stroke unit
MUST	Malnutrition Universal Screening Tool
NASCET	North American Symptomatic Carotid Endarterectomy Trial
NDLS	National Driver Licence Service (Ireland)
NHS	National Health Service (UK)
NICE	National Institute for Health and Care Excellence
NIHSS	National Institutes of Health Stroke Scale
NIMAST	Northern Ireland Multidisciplinary Association of Stroke Teams
NMES	Neuromuscular electrical stimulation
NNT	Number needed to treat
NOAC	Non-vitamin K anticoagulant
NSAID	Non-steroidal anti-inflammatory drug
OR	Odds ratio
OSA	Obstructive sleep apnoea
PADL	Personal activities of daily living
PAF	Paroxysmal atrial fibrillation
PC-ASPECTS	Posterior circulation – Alberta Stroke Program Early Computed Tomography Score
PCC	Prothrombin complex concentrate
PE	Pulmonary embolism
PES	Pharyngeal electrical stimulation
PFO	Patent foramen ovale
POC	Progestin only contraceptive
RBMT	Rivermead Behavioural Memory Test
RCP	Royal College of Physicians of London
RCT	Randomised controlled trial
ROSIER	Recognition of Stroke in the Emergency Room
RR	Relative risk
SAH	Sub arachnoid haemorrhage
SARA	Scale for the Assessment and Rating of Ataxia
SBP	Systolic blood pressure
SIGN	Scottish Intercollegiate Guidelines Network
SLT	Speech and language therapy
SMC	Scottish Medicines Consortium
SRU	Stroke rehabilitation unit
SSNAP	Sentinel Stroke National Audit Programme

SSRI	Selective serotonin reuptake inhibitor
SWI	Susceptibility-weighted imaging
tDCS	Transcranial direct current stimulation
TENS	Transcutaneous electrical nerve stimulation
TIA	Transient ischaemic attack
TMS	Transcranial magnetic stimulation
TOE	Transoesophageal echocardiogram
TTE	Transthoracic echocardiogram
TULIA	Test of Upper Limb Apraxia
VA	Vertebral artery
VKA	Vitamin K antagonist
VNS	Vagus nerve stimulation
VOSP	Visual Object and Space Perception battery
VR	Vocational rehabilitation
VTE	Venous thromboembolism
WHO	World Health Organization
WTE	Whole time equivalent

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