The Statewide Stroke Clinical Network has developed this document to facilitate the delivery of best practice acute stroke care for all South Australians. The content is largely targeted at hospitals with stroke units and focuses on pre-hospital notification through to discharge. The document aims to provide standardized management that eliminates variability and promotes a platform for inter-hospital collaboration.

This document has been developed by stroke experts from the Statewide Stroke Clinical Network, representing all disciplines and stroke units in SA, and incorporates recommendations from the National Stroke Foundation Clinical Guidelines for Stroke Management 2010, SA Stroke Service Plan 2009-2016, international guidelines and landmark research publications.

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All Department for Health and Ageing Divisions
All Health Networks
CALHN, SALHN, NALHN, CHSALHN, WCHN, SAAS
Other

Staff impact
All Clinical, Medical, Nursing, Allied Health, Emergency, Pathology

PDS reference
CG002

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<td>Amendment to original section, and additional: care post 48hrs</td>
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Stroke Management
Procedures & Protocols:
A Guide for Stroke Units and Emergency Departments

Statewide Stroke Clinical Network

October 2014
Acknowledgements

We offer sincere thanks to the many contributors whose commitment and knowledge have informed the development of this document. Specific gratitude is directed to the Statewide Stroke Clinical Network Steering Committee, for their intellectual input and time in finalizing this document. They are,

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Disclaimer

This document has been developed by the Statewide Stroke Clinical Network to support service change according to best practice within allocated funding and industrial agreements. This paper is expected to challenge how any current funds for stroke services are spent, ensuring allocated funds are reviewed and used to deliver stroke care according to best practice. This paper is not a tool to seek funds over and above what is allocated now or into the future for these services.

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# Table of Contents

**Acknowledgements** ............................................................................................................................. 2  
**Disclaimer** ............................................................................................................................................ 3  
**Abbreviations** ...................................................................................................................................... 6  
**Introduction** ......................................................................................................................................... 7  
**Acute Stroke Management Pathway** ................................................................................................... 8  
**Stroke Triage Protocol** ......................................................................................................................... 9  
**Inter-hospital Transfer Protocol** ......................................................................................................... 11  
  - Transfer of a potential thrombolysis case ...................................................................................... 11  
  - Transfer of a potential intra-arterial mechanical embolectomy case ............................................. 11  
**Code Stroke Protocol** ......................................................................................................................... 12  
  - Introduction ................................................................................................................................... 12  
  - Code Stroke Activation ................................................................................................................... 12  
  - The Code Stroke Team ................................................................................................................... 12  
  - Task Designation ............................................................................................................................ 13  
  - Code Stroke Radiology ................................................................................................................... 14  
  - Code Stroke Outcome ..................................................................................................................... 15  
  - Timeliness ...................................................................................................................................... 15  
**Intravenous Alteplase Protocol** .......................................................................................................... 16  
  - Eligibility Criteria ............................................................................................................................ 16  
  - Alteplase Administration - General Considerations ....................................................................... 17  
  - Alteplase Weight – Dose Schedule ................................................................................................. 20  
  - Management of Hypertension with Alteplase Therapy .................................................................. 22  
  - Management of Haemorrhage with Alteplase Therapy ................................................................. 23  
  - Management of Alteplase Related Angioedema ............................................................................ 25  
  - Management of Alteplase Related Anaphylaxis ............................................................................ 25  
**Intracranial Haemorrhage Protocol** ................................................................................................... 26  
  - Emergency Assessment of Intracranial Haemorrhage .................................................................... 26  
  - Criteria for Neurosurgical Care .................................................................................................... 27  
  - Stroke Unit versus Intensive Care Unit .......................................................................................... 27  
  - General Principles of Intracranial Haemorrhage Management ...................................................... 28  
  - Additional Disease Specific Supportive Measures ........................................................................ 28  
  - Reversal of Coagulopathy ................................................................................................................ 29  
  - Management of Intracerebral Haemorrhage Related Complications 14 .......................................... 29  
**Intra-Arterial Mechanical Embolectomy Protocol** .............................................................................. 31
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASPECTS</td>
<td>Alberta Stroke Program Early Computerised Tomography Score</td>
</tr>
<tr>
<td>APTT</td>
<td>Activated Partial Thromboplastin Time</td>
</tr>
<tr>
<td>ART</td>
<td>Assessment for Rehabilitation Tool</td>
</tr>
<tr>
<td>BGL</td>
<td>Blood Glucose Level</td>
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<tr>
<td>BP</td>
<td>Blood Pressure</td>
</tr>
<tr>
<td>CT</td>
<td>Computed Tomography</td>
</tr>
<tr>
<td>CTA</td>
<td>Computed Tomography Angiography</td>
</tr>
<tr>
<td>CTP</td>
<td>Computed Tomography Perfusion</td>
</tr>
<tr>
<td>DN</td>
<td>Dietitian</td>
</tr>
<tr>
<td>DVT</td>
<td>Deep Vein Thrombosis</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiograph</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>eGFR</td>
<td>estimated Glomerular Filtration Rate</td>
</tr>
<tr>
<td>FFP</td>
<td>Fresh Frozen Plasma</td>
</tr>
<tr>
<td>GCS</td>
<td>Glasgow Coma Scale</td>
</tr>
<tr>
<td>GI</td>
<td>Gastrointestinal</td>
</tr>
<tr>
<td>GTN</td>
<td>Glyceryl Trinitrate</td>
</tr>
<tr>
<td>HDU</td>
<td>High Dependency Unit</td>
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<tr>
<td>IA</td>
<td>Intra-Arterial</td>
</tr>
<tr>
<td>ICA</td>
<td>Internal Carotid Artery</td>
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<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
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<tr>
<td>IMI</td>
<td>Intramuscular injection</td>
</tr>
<tr>
<td>INR</td>
<td>International Normalised Ratio</td>
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<tr>
<td>IV</td>
<td>Intravenous</td>
</tr>
<tr>
<td>LMWH</td>
<td>Low Molecular Weight Heparin</td>
</tr>
<tr>
<td>MAP</td>
<td>Mean Arterial Pressure</td>
</tr>
<tr>
<td>MCA</td>
<td>Middle Cerebral Artery</td>
</tr>
<tr>
<td>MET</td>
<td>Medical Emergency Team</td>
</tr>
<tr>
<td>mNIHSS</td>
<td>modified National Institute of Health Stroke Scale</td>
</tr>
<tr>
<td>MO</td>
<td>Medical Officer</td>
</tr>
<tr>
<td>MRC</td>
<td>Medical Retrieval Consultant</td>
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<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
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<tr>
<td>MTP</td>
<td>Massive Transfusion Protocol</td>
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<td>New Oral Anticoagulants</td>
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<td>NSF</td>
<td>National Stroke Foundation</td>
</tr>
<tr>
<td>OT</td>
<td>Occupational Therapy</td>
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<td>PE</td>
<td>Pulmonary Embolus</td>
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<tr>
<td>PT</td>
<td>Physiotherapy</td>
</tr>
<tr>
<td>PWS</td>
<td>Patient With Stroke (PWS)</td>
</tr>
<tr>
<td>rCBF</td>
<td>relative Cerebral Blood Flow</td>
</tr>
<tr>
<td>rtPA</td>
<td>Recombinant tissue plasminogen activator</td>
</tr>
<tr>
<td>ROSIER</td>
<td>Recognition of Stroke in the Emergency Room</td>
</tr>
<tr>
<td>SAAS</td>
<td>SA Ambulance Service</td>
</tr>
<tr>
<td>SCD</td>
<td>Sequential Compression Device</td>
</tr>
<tr>
<td>SP</td>
<td>Speech Pathology</td>
</tr>
<tr>
<td>SpO2</td>
<td>Oxygen Saturation</td>
</tr>
<tr>
<td>SW</td>
<td>Social Work</td>
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Introduction

The Statewide Stroke Clinical Network has developed this document to facilitate the delivery of best practice acute stroke care for all South Australians. The content is targeted at hospitals with stroke units and focuses on care that is required from the time of admission to discharge from an acute stroke unit bed. The document aims to provide standardized management that eliminates variability and promotes a platform for inter-hospital collaboration. This document has been developed by stroke experts from the Statewide Stroke Clinical Network and incorporates recommendations from the Clinical Guidelines for Stroke Management 2010, National Stroke Foundation (NSF) and SA Stroke Service Plan 2009-2016. It is recommended that each stroke unit use this document to generate a hospital specific management protocol that is ratified by their respective protocol committee.

The document assumes that all people presenting with stroke will be cared for by a stroke team comprised of medical, allied health and nursing professionals who have a special interest and expertise in the management of stroke, and staffed at NSF recommended staff to patient ratios. The successful implementation of this document relies on stroke teams working in a coordinated model, and taking a patient-centred approach to care delivery. Senior team members provide ongoing support and training to less experienced staff who may rotate through the stroke team. Ideally senior members of the acute stroke team have the opportunity to get experience in sub-acute/community stroke rehabilitation facilities to enhance understanding of the whole stroke pathway. Unless stated otherwise the stroke team in this document refers to the stroke medical consultant and medical officers, the stroke nurse coordinator, and senior stroke allied health staff from each discipline (physiotherapy (PT), occupational therapy (OT), dietetics (DN), speech pathology (SP), social work (SW)). Pharmacists, psychologists and allied health assistants are valuable stroke team members when available. Allied health team leader positions assist in service coordination and should be considered as part of the stroke team. Junior and trainee staff from all disciplines should rotate through the team in order to foster ongoing learning in a supportive environment.

An overview of the pathway for stroke management is provided on page 8. The pathway is designed to effectively recognise stroke in the community and transport patients to the nearest stroke unit hospital whereby appropriate acute therapy can be delivered. On arrival, a triage protocol assesses eligibility for hyper acute therapies with subsequent activation of a dedicated team that facilitates rapid transit to the stroke unit where treatment can be effectively delivered. The pathway also accommodates a standardized approach for inter-hospital transfer, management of transient ischaemic attack and an acute stroke care protocol applicable to all patients beyond the hyper acute phase.

This document includes the following protocols:

1. Stroke Triage Protocol
2. Inter-Hospital Transfer Protocol
3. Code Stroke Protocol
4. Intravenous Alteplase Protocol
5. Intracerebral Haemorrhage Protocol
6. Intra-Arterial Mechanical Embolectomy Protocol
7. Decompressive Craniectomy Protocol
8. Acute Stroke Care Protocol
Stroke Triage Protocol

The Stroke Triage Protocol is designed to rapidly confirm a diagnosis of stroke and identify patients who may benefit from acute reperfusion therapy. Implementation is recommended in the hospital emergency department (ED) and available on a 24/7 basis. The protocol should be performed by an ED health care worker (typically ED triage nurse) on all patients who present with suspected stroke.

It is recommended that patients initially undergo a finger prick blood glucose level (BGL) with readings < 3.5 mmol/l urgently corrected to normal prior to proceeding with ED Stroke Triage Protocol. The latter comprises of completing the Recognition Of Stroke In the Emergency Room (ROSIER) Scale (see below), establishing the stroke onset time and premorbid function.

Patients are deemed eligible for acute treatment if all three of following criteria are met:

1. ROSIER Scale of ≥ +1, and
2. Symptom onset of ≤ 4 hours (if stroke onset time is unknown, presume >4 hours), and
3. Independent and with no history of severe cognitive dysfunction or terminal illness (if uncertain assume normality).

In the event that the onset time is unknown the onset time is taken from the time that they were last known to be well. If the history of premorbid function cannot be obtained it is reasonable to assume normality and assess eligibility based on criteria 1 and 2 alone. Wake up strokes should not be excluded at this stage of triage (as time of onset can often be subsequently established).

**ROSIER Scale: Recognition of Stroke in the Emergency Room**

<table>
<thead>
<tr>
<th>Has there been loss of consciousness or syncope?</th>
<th>Y (-1)</th>
<th>N (0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has there been seizure activity?</td>
<td>Y (-1)</td>
<td>N (0)</td>
</tr>
</tbody>
</table>

Is there a NEW ACUTE onset (or on awakening from sleep) of:

- I. Asymmetric facial weakness
- II. Asymmetric arm weakness
- III. Asymmetric leg weakness
- IV. Speech disturbance
- V. Visual field defect

| Total Score | (-2 to +5) |

---

Page 9 of 94
The above may result in the following outcomes:

1. Patient presents to a non-stroke unit hospital and all Stroke Triage criteria are met:
   
   Action: Patient to be urgently reviewed by the most senior ED Medical Officer and considered for transfer to the nearest Stroke Unit Hospital (see Inter-Hospital Transfer Protocol, page 11).

2. Patient presents to a stroke unit hospital and all Stroke Triage criteria are met:
   

3. Patient is considered to have a stroke (i.e. ROSIER Scale of ≥ +1) but does not fulfil other Stroke Triage criteria (i.e. symptom onset time > 4 hours or severe dementia):
   
   Action: Admit to ED as per local hospital practice. For hospitals with stroke units notify the on call stroke team as soon as possible. For non-stroke unit hospitals consider transfer to nearest stroke unit hospital (see Inter-Hospital Transfer Protocol, page 11).

4. Patient is not considered to have a stroke (i.e. ROSIER Scale of ≤ 0) and Stroke Triage criteria are not met:
   
   Action: Admit to ED as per local hospital practice.
Inter-hospital Transfer Protocol

This pathway has been developed to streamline patient transfer between hospitals and to clarify responsibility of patient care. The pathway is applicable to any hospital requiring transfer of a patient to specialist stroke care. It is recommended that transfer of a stroke patient from hospital A (transferring hospital) to hospital B (stroke unit hospital) take the following path:

Transfer of a potential thrombolysis case

1. Medical Officer from hospital A contacts Stroke Consultant (or delegate) in hospital B - the case is discussed and decision to accept transfer considered.

2. If accepted:
   a. Medical Officer from hospital A arranges priority 2 SA Ambulance Service (SAAS) transfer to hospital B. It should be noted that despite acceptance of transfer by hospital B, that patient responsibility remains with hospital A during the transit process. A medical escort is required if an Alteplase infusion is being administered in transit.
   b. Stroke Consultant (or delegate) in hospital B notifies their emergency service of transfer and activates the local hospital Code Stroke Protocol and provides estimated time of arrival. This process should also pre-notify radiology and the bed coordinator of incoming activity. The stroke team in hospital B should greet the patient on arrival whereby patient responsibility is transferred.

Transfer of a potential intra-arterial mechanical embolectomy case

1. Medical Officer from hospital A contacts Stroke Consultant (or delegate) in hospital B - the case is discussed and decision to accept transfer considered.

2. If the patient is considered appropriate for mechanical embolectomy:
   a. Stroke Consultant (or delegate) in hospital B should initially determine the availability of Interventional Neuroradiologist and feasibility of the procedure prior to acceptance of transfer. This usually entails review of imaging and discussion with the Interventional Neuroradiologist.
   b. If the Consultant from hospital A also works in hospital B they may contact the Interventional Neuroradiologist directly.
   c. If agreed, Medical Officer A is notified of acceptance of transfer and may then arrange priority 2 SAAS transfer to hospital B. It should be noted that despite acceptance of transfer by hospital B, that patient responsibility remains with hospital A during the transit process. A medical escort (e.g. Stroke Registrar) is required if an Alteplase infusion is being administered in transit.
   d. Stroke Consultant (or delegate) in Hospital B notifies their emergency service of transfer and activates the local hospital Code Stroke Protocol and provides estimated time of arrival. This process should also pre-notify radiology, anaesthetic, intensive care and the bed coordinator of incoming activity. The stroke team in hospital B should greet the patient on arrival whereby patient responsibility is transferred.

If the patient is critically unwell (e.g. intubated) or likely to require aeromedical retrieval, then the Medical Retrieval Consultant (MRC) at MedSTAR should be involved early via 13STAR. The MRC can then also involve (via a multi-party conference call if required) the Stroke Consultant, Intensive Care Consultant and/or Interventional Neuroradiologist at the receiving unit. The MRC will be responsible for arranging the transfer of aeromedical and critically unwell stroke cases using the shared resources that may be available for all critical pre-hospital and retrieval cases across the State.
Code Stroke Protocol

Introduction

The Code Stroke Protocol is designed to expedite workup of stroke patients who may benefit from acute reperfusion therapy including intravenous Alteplase and intra-arterial (IA) mechanical embolectomy. The protocol functions via early engagement of stroke unit workforce and designation of tasks for ED and stroke unit personnel allowing for rapid transition to the stroke unit (via radiology) where treatment can be delivered. It is recommended that this protocol be adopted in all stroke unit hospitals and accessible on a 24/7 basis and be coordinated by workforce derived from the stroke unit or other health care workers who have completed an accredited code stroke training program. Robust communication infrastructure (i.e. code stroke pager number) and remote access to neuro-imaging is recommended.

Code Stroke Activation

It is recommended that activation of a Code Stroke Protocol be restricted to the following:

1. **SAAS Stroke Pre-hospital notification** – This scenario leads to direct pre-notification of a patient en-route to hospital via ambulance. Code Stroke activation and notification of patient estimated time of arrival to ED is actioned by the stroke team (or other recipient of the SAAS pre-notification call). The stroke team should ensure that the patient and SAAS workforce are met on immediate arrival to ED.

2. **Stroke Triage Protocol** – This applies to patients presenting to ED who fulfil Stroke Triage Protocol criteria (page 9). Code Stroke Protocol is activated by the ED triage nurse (or designated ED stroke triage personnel).

3. **Inpatient stroke and other** – for all other cases, including inpatient stroke, Code Stroke activation may be actioned by a member of the stroke team where appropriate.

The Code Stroke Team

The protocol recommends that a code stroke team is available 24/7 and that a roster of personnel is available to relevant hospital staff (i.e. ED, switchboard and Stroke Unit). The minimum workforce that should receive simultaneous notification of a Code Stroke request is listed below.

1. **Stroke Medical Consultant** – Consultant support is mandatory for all Code Stroke patients. A Neurologist or Physician with expertise in the management of complex stroke patients is considered appropriate. On site presence is preferable although not mandatory. In the event of being off site (i.e. after-hours remote on-call) it is recommended that robust infrastructure allowing for communication and remote access to neuroimaging is available.

2. **Stroke Nurse** – 24/7 on site presence is preferable. A Stroke Unit Nurse Coordinator or nurse who has completed an accredited code stroke training program is recommended.

3. **Stroke Medical Officer** – 24/7 on site presence is preferable. A registrar, stroke fellow or senior resident medical officer (i.e. 2nd or 3rd year physician trainee) is considered appropriate. If on remote call, arrival within 30 minutes of Code Stroke activation is considered acceptable.

Immediate notification may also be considered for the following hospital personnel:

1. CT Radiographer and Radiologist
2. Stroke Unit Clinical Nurse Consultant
3. Hospital porters
4. Hospital bed coordinator
5. Pathology laboratory staff
Task Designation

Recent evidence suggests that door to needle times are best reduced by an immediate door to Computed Tomography (CT) transfer process, bypassing the emergency department, and that the tasks below may all be performed by the code stroke team (with senior ED nurse support) prior to CT if local practice allows.

The following designation of tasks is recommended upon Code Stroke activation:

**ED Medical Officer and Nurse:**

1. Assess vital signs and resuscitate unless advance care directive to the contrary.
2. Oxygen supplementation (Target oxygen saturation > 95%).
3. Perform venesection and arrange URGENT bloods:
   a. Full blood examination
   b. Electrolytes
   c. Glucose
   d. Liver function tests
   e. International normalised ratio (INR), activated partial thromboplastin time (APTT) +/- Thrombin Time or Haemoclot (if patient potentially taking Dabigatran)
   f. Troponin, Creatine Kinase.
4. Insert a large bore jelco in each cubital vein (two jelcos required).
5. Perform 12 lead electrocardiogram (ECG) (should not delay CT scan).
7. Notify radiology and arrange urgent CT brain scan.

**Stroke Nurse and Medical Officer:**

1. Confirm history with patient and/or SAAS, family, witnesses or general practitioner with particular reference to:
   a. Stroke onset time
   b. Medical history
   c. Advance care directive / refusal of life sustaining treatment / outcomes to avoid
   d. Medication
   e. Premorbid cognitive and physical function
   f. Previous surgery or bleeding history.
2. Perform National Institute of Health Stroke Scale (NIHSS).
3. Identify any potential bleeding source.
4. Assess vital signs every 15 minutes.
5. Ensure ED Officer/Nurse responsibilities are completed.
6. Obtain and document all results (i.e. ECG, blood tests, vital signs ).
7. Complete checklist of inclusion/exclusion criteria for intravenous alteplase (see page 16).
9. Assist and supervise patient during transfer to radiology.

10. Contact hospital bed manager regarding bed destination post radiology.

11. Obtain consent for intravenous alteplase (if applicable).

12. Action treatment specific protocols as recommended by Stroke Consultant.

**Stroke Consultant:**

1. The Consultant’s primary role is to determine if the patient is eligible for acute therapy and to advise on acute management. This requires review of the patient’s history, clinical findings, laboratory investigations and neuro-imaging. On site assessment is optimal although not mandatory if the above can be adequately addressed via remote means. The latter requires experienced on-site medical staff and infrastructure to accommodate remote access to neuroimaging and laboratory results. On site consultant assessment is considered best practice for complex stroke and for all patients considered for IA mechanical embolectomy.

2. Liaise and provide information to patient (if possible) or substitute decision maker/s (if any), persons responsible/family members or friends (Medical Registrar or Stroke Nurse Coordinator may take on this role if the Consultant is not on site).

**Code Stroke Radiology**

The imaging protocol applicable to Code Stroke patients is based on Consensus Guidelines for Acute Stroke Multimodal Imaging endorsed by the Statewide Stroke Clinical Network (page 72).

1. An urgent non-contrast CT brain scan is mandatory for all Code Stroke patients.

2. CT angiography (CTA) (aortic arch to vertex) and CT perfusion (CTP) is also recommended (where available) provided the following criteria are met:
   a. There is no contraindication for additional imaging (i.e. known contrast allergy, significant renal impairment with estimated glomerular filtration rate (eGFR) < 30).
   b. Additional imaging does not unduly delay deployment of intravenous Alteplase (maximum of 10 minute delay acceptable).
   c. Availability of a radiologist experienced in reporting multimodal CT imaging.

Given the variation in CT equipment and software the optimal CT perfusion parameters defining infarct core and penumbra should be determined by each hospital provided they are evidence based. An example of an evidence based definition of core is: a cerebral blood volume of less than 2 ml/100g and that of penumbra would be a mean transit time delay of > 145% compared to the asymptomatic side. Another is relative cerebral blood flow (rCBF) <30% (core) + Tmax >6 seconds (penumbra).

In the presence of non-traumatic intracerebral haemorrhage, CT perfusion is not recommended. Intracranial CT angiography is recommended in all patients (unless contraindicated) in the following scenarios:

a. To help determine the risk of haematoma expansion (i.e. presence of the spot sign) if imaging can be performed within 6 hours of symptom onset.

b. To determine the presence of underlying vascular pathology (e.g. aneurysm or vascular malformation) in patients where the apparent aetiology is uncertain.
Code Stroke Outcome

Upon completion of imaging a treatment decision is made by the Stroke Consultant. The following outcomes may occur:

1. Patient confirmed to have a stroke and is eligible for acute therapy - the relevant hyper acute stroke protocol is actioned and the patient is admitted to the stroke unit.

2. Patient is confirmed to have a stroke but ineligible for acute therapy – the generic acute stroke protocol is actioned and the patient is admitted to the stroke unit. Patients with potentially disabling events who have returned close to normal (and have not received rtPA) should be kept under close observation given the risk of deterioration.

3. Patient deemed not to have experienced a cerebrovascular event – patient is transferred to ED or appropriate medical unit.

Timeliness

Overall the aim is for the following to occur:

> Initial medical assessment to be completed in the first 15 minutes

> CT scan within 30 minutes in hours, 45 minutes out of hours

> a door to needle time of <45 minutes in hours and <60 minutes after hours.
Intravenous Alteplase Protocol

Eligibility Criteria

Inclusion criteria

1. Onset of ischaemic stroke within the preceding 4.5 hours.
2. Potentially disabling neurological deficit.
3. Patient’s CT scan does not show haemorrhage or non-vascular cause of stroke.

Exclusion criteria:

Absolute (thrombolysis should not be administered)

1. Uncertainty about time of stroke onset if last seen well > 4.5 hours (e.g. patients awaking from sleep).
2. Hereditary or acquired coagulopathy (INR>1.7, platelet count ≤100,000 µL, heparinisation with raised APTT, or therapeutic dose of low molecular weight heparin (LMWH) or other oral anticoagulant within the last 12 hours.
4. Suspected septic embolus.
5. Hypoglycaemia (BGL≤3.5mmol/L) or hyperglycaemia (BGL≥22.2), where there is no perfusion defect or arterial occlusion on CT, or where more normal levels cannot be achieved within the 4 ½ hour window.
6. Hypertension: systolic blood pressure ≥185 mmHg or diastolic blood pressure > 110 mmHg on repeated measures despite treatment*.
7. Seizure at symptom onset without vessel occlusion or CT perfusion abnormality.

Relative (use thrombolysis with caution)

1. Age < 18 years (thrombolysis can be considered in physiologically adult adolescents, but should not be administered to children).
2. Pregnancy.
3. CT evidence of extensive middle cerebral artery (MCA) territory infarction (sulcal effacement or blurring of grey-white junction in greater than 1/3 of MCA territory, evidence of similarly-sized core infarction (>70-80mL) on CT perfusion, Alberta Stroke Program Early CT Score (ASPECTS) <8).
4. Stroke or serious head trauma within the past three months where the risks of bleeding are considered to outweigh the benefits of therapy.
5. Patient has known history of intracranial haemorrhage, subarachnoid haemorrhage, known intracranial arteriovenous malformation or previously known intracranial neoplasm such that, in the opinion of the clinician, the increased risk of intracranial bleeding would outweigh the potential benefits of treatment.
6. Suspected recent (within 30 days) myocardial infarction.
7. Recent (<30 days) parenchymal organ biopsy or surgery, trauma with internal injuries, partuition, gastrointestinal or urinary tract haemorrhage that in the opinion of the responsible clinician, would increase the risk of unmanageable (e.g. by local pressure) bleeding.
8. Cardiopulmonary resuscitation or arterial puncture at non-compressible site within the last 7 days.

9. Severe comorbidities limiting life expectancy or posing treatment risk.

10. Pre-existing dementia or dependency (modified Rankin score ≥3).

11. Minor or rapidly improving non-disabling neurological deficit (especially if CTA/CTP) is normal).\textsuperscript{9,10}

12. Dose of oral anticoagulant (apixaban, dabigatran or rivaroxaban) last administered >12 hours.

Patients on Dabigatran with last dose administered > 12 hours (or uncertain time of administration) should be considered for thrombolysis according to the attached decision pathway (page 87).\textsuperscript{11}

In cases where Alteplase is cautioned/contraindicated because of bleeding risk, intra-arterial mechanical embolectomy should be considered (see page 31).

*Management of pre-treatment hypertension:

In patients who are eligible for thrombolysis therapy but have systolic blood pressure (BP)>185 mmHg or diastolic BP>110 mmHg, 10-20mg of intravenous Labetalol (or other agents if Labetalol is contraindicated or not available) may be administered via slow injection over 1-2 minutes (can be repeated once after 10 minutes). Note cardiac monitoring is essential. Record blood pressure every 5 minutes. If BP remains >185/110 mmHg despite aggressive treatment, management with Alteplase is contraindicated.

Alteplase Administration - General Considerations

Treatment Order

A decision to proceed with intravenous Alteplase therapy may only occur following recommendation by a Stroke Consultant.

Counselling and Consent

Eligible patients (or relevant third-party where appropriate) should receive counselling and provide written consent to proceed (see Alteplase Patient Information Sheet – page 74). Consent must be sought from the patient (if they have decision-making capacity) and if not, the patient’s appointed substitute decision maker if they have an advance care directive in place.

Timing considerations

For patients who are obviously well-within treatment guidelines (e.g. major stroke presenting very early), bolus administration should be considered following non-contrast CT and prior to advanced neuroimaging (if performed).

Nursing and Location

A 1:1 nurse: patient ratio is recommended for the first 24 hours. Patients should be transferred to dedicated area within the hospital where the Alteplase infusion can be administered and monitored by nursing staff with expertise in neurological assessment and acute stroke care. A designated hyper acute area within a stroke unit is ideal. Emergency Departments, Intensive Care and High Dependency Units are suitable provided medical and nursing staff have received appropriate training. Completion of an accredited code stroke training program is recommended.
Safety Precautions

1. Use dedicated cannula. Alteplase is not to be given through the same line as other medication, fluids or blood products.

2. Avoid any invasive therapies for at least 12 hours (including non-urgent blood sampling, intramuscular injections, nasogastric tube, and urinary catheter).

3. No antiplatelets (i.e. Aspirin, Clopidogrel, Dipyridamole or Asasantin SR) or anticoagulants (i.e. Heparin, Clexane, Warfarin, New Oral Anticoagulants (NOAC’s)) including deep vein thrombosis (DVT) heparin prophylaxis for 24 hours.

4. A Sequential Compression Device (SCD) is recommended for DVT prophylaxis in the first 24 hours.

5. Safety precautions to prevent falls.

6. Do not use razor blade for shaving (electric razor only).
Alteplase Background Information

Drug: Recombinant tissue plasminogen activator (rtPA) or alteplase

Trade Name: Actilyse (Boehringer Ingelheim)

Action: Alteplase binds to fibrin in a thrombus and converts the entrapped plasminogen to plasmin. This initiates local fibrinolysis (clot breakdown). Alteplase can induce haemorrhage in ischaemic stroke patients, particularly if the protocol is not strictly followed.

Pharmacokinetics: Alteplase is metabolised primarily by the liver. More than 50% of alteplase in plasma is cleared within 5 mins after the infusion has been completed (i.e. half-life) and approximately 80% is cleared within 10 mins.

Presentation: The drug comes as 50mg vial and a 10mg vial (off-white lyophilized powder) of alteplase, and is reconstituted with 50mls or 10mls sterile water (supplied with drug), as per manufacturer’s instructions. When mixed, the resulting solution is colourless to pale yellow. The final concentration 1mg/ml alteplase.

Storage: Alteplase stock may be stored at room temperature up to 30°C or under refrigeration at 2–8°C and protected from light. Any unused drug following reconstitution may be kept in the refrigerator at 2–8°C for 24 hours.

Dosing: The dose of intravenous alteplase is 0.9 mg/kg (max total dose of 90 mg) See alteplase weight-dose schedule.

10% given as an initial bolus over 1 minute
The remaining 90% to be given as an infusion via syringe pump over 60 minutes immediately after bolus dose

Alteplase vial use: If the patient requires ≤ 80mg, the total dose may be reconstituted from: 1 x 50mg vial followed by the necessary 10mg vials. If the patient requires > 80mg, the total dose must be reconstituted 2 x 50mg vials (see weight-dose schedule).

Requirements: Alteplase: 50mg +/- 10mg vials (as per weight-dose schedule)
Each alteplase pack will contain:

1 vial of powder (50mg or 10mg)
1 vial sterile water for injection (50mls or 10mls)
1 transfer cannula is supplied with 50mg pack

Other items required:
60ml, 20ml, 10ml, 5ml 2ml syringes with luer lock
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Alteplase Administration Procedure:

1. With a 5 or 10ml syringe and blunt plastic cannula, draw up the bolus dose and administer, over 1 minute.
2. Draw up the rest of the required dose in 60ml syringe (note 2 x 60ml syringes will be required for amount > 60mls).
3. Attach completed “Medication added” label to syringe.
4. Insert the infusion tubing to the syringe and attach lever lock cannula to other end.
5. Set pump to infuse the total dose remaining amount over 1 hour.
6. If 2 syringes are used the syringe driver should still be set to infuse the total dose remaining over 1 hour (see example).
7. After infusion completed flush infusion line with 30mls sodium chloride to ensure all drug is infused.
8. Disconnect syringe infusion from patient. Leave intravenous (IV) cannula insitu.

Example:

1. Patient weighs 84kgs - total dose of Alteplase required = 75.6mls.
2. Mix 1x50mg vial with 50mls water.
3. Mix 3x10mg vial each with 10mls water for injection.
4. Using a 10ml syringe draw up 7.6mls of Alteplase to give 10% bolus leaving 68mls still to infuse.
5. Using a 60ml syringe number 1 draw up 34mls of Alteplase.
6. Using a 60ml syringe number 2 draw up 34mls of Alteplase.
7. Set syringe pump to infuse at 68mls an hour.
8. Each syringe will take 30 minutes to infuse.

Nursing Observation:

The following nurse observation and task schedule is recommended:

<table>
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<tr>
<th>Time</th>
<th>Activity</th>
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| 0 hrs  | Apply telemetry monitoring equipment  
Administer Alteplase bolus and commence infusion as per protocol |
| 0-1 hrs| Write timetable for observations on chart  
15 minutely observation: modified NIHSS (mNIHSS), blood pressure (BP), Pulse, oxygen saturation (SpO2), Temperature  
Assess size and shape of tongue. Observe for signs of allergy: unilateral or bilateral tongue enlargement, rash or redness, coughing, lip, face swelling.  
(See guideline for management of angioedema / anaphylaxis, page 25)  
Nil by mouth – commence 0.9 % sodium chloride intravenous fluids  
Hourly Fluid Balance Chart  
Strict Bed Rest; Safety Precautions: falls prevention (ongoing)  
Avoid invasive therapies (including thrombo embolic deterrent (TED) stockings)  
Internal and external bleeding assessment |
Management of Hypertension with Alteplase Therapy

Uncontrolled hypertension during Alteplase infusion and subsequent 24 hours may result in intracranial haemorrhage. Early recognition and management is therefore critical.

In the advent of a blood pressure reading > 180/110 mmHg the following measures should be taken:

1. Confirm reading manually using a sphygmomanometer.
2. Check the patient is not in pain or urinary retention (may need bladder scan) and manage accordingly.
3. If hypertension is associated with deterioration of neurological status consider possibility of symptomatic intracerebral haemorrhage. Contact Stroke Medical Officer in view to urgent non-contrast CT Brain. Continue with BP management protocol as specified below.
4. Recheck blood pressure 5 minutes after first reading - if second reading is >180/110 mmHg proceed with antihypertensive therapy:
   a. Intravenous labetalol 10-20mgs via slow injection over 1-2 minutes. This may be repeated every 10-20 minutes to a maximum total dose of 300mgs in any six hour period OR
   b. Intravenous labetalol 10 mgs over 1-2 minutes follow with continuous labetalol infusion at a rate of 2-8 mg / minute to a maximum total dose of 300mgs in any six hour period OR
   c. Intravenous glyceryl trinitrate (GTN) - 30mg in 100ml. Commence 3ml/hr and titrate by 1ml/hr at 5-10 minute intervals to desired BP. Note GTN must be administered via separate intravenous line using non-PVC giving set via a controlled dose infusion device.
In the event of persistent hypertension (i.e. > 180/110 mmHg), despite the above measures, consider transfer to high dependency unit (HDU) or intensive care unit (ICU) for treatment, within their protocols, with agents such as:

a. Nitroprusside 0.5 micrograms/kg/min IV infusion (as initial dose and titrate to desired blood pressure) OR
b. Hydralazine as a slow bolus 5mg intravenously, repeated as required every 20 minutes (maximum 5 boluses in any six hour period).

NB If intravenous medications are unsuitable, and ICU is not available, consider administering oral nifedipine (10-20mg) with caution (note peak antihypertensive effect in 1-2 hours and risk of end-organ hypoperfusion).

If hypertension (i.e. systolic BP > 185 mmHg or diastolic BP > 110 mmHg) occurs during Alteplase infusion and remains above these levels for >15 minutes despite treatment as specified above, Alteplase infusion should be ceased. It can be recommenced if BP returns to acceptable levels, on the provision that the entire dose can be administered within 5 ½ hours of symptom onset.

Management of Haemorrhage with Alteplase Therapy

Haemorrhage is the most frequent adverse reaction associated with Alteplase. The types of haemorrhage can be divided into 3 broad categories:

1. Intracranial – clinical features include headache, nausea with refractory vomiting, and declining neurological status.

2. Internal – gastrointestinal (GI) tract (5%), genito-urinary tract (4%), retroperitoneal sites (<1%), parenchymal organs. Clinical features include tachycardia, hypotension, pallor, restlessness, lower back pain, lower limb pain and weakness.

3. External or surface bleeding - observed mainly at disturbed sites such as venous & arterial punctures sites of recent surgical intervention. Extensive skin bruising, epistaxis & gingival bleeding ≤ 1%. Assessment includes examination of IV sites, gums (2-hourly mouth care), urine and faeces.

Management of Suspected Intracranial Haemorrhage:

Intracranial haemorrhage should be suspected if the following occurs:

1. Neurological deterioration
2. New onset headache, or drowsiness
3. Acute hypertension
4. Convulsions
5. Nausea and vomiting

The following should be considered in the event of suspected intracranial haemorrhage (depending on index of suspicion):

1. Suspend Alteplase infusion. It should be noted that Alteplase has a very short half-life and has no reversal agent.
2. Arrange urgent non-contrast CT brain.
3. Take venous blood for full blood count, APTT, INR, fibrinogen, electrolytes, urea, creatinine, blood group and save.
If intracranial haemorrhage is confirmed on CT brain:

1. Discuss with on call haematologist and notify the hospital transfusion service immediately of blood product requirements.
   - Administer cryoprecipitate (1 adult dose as directed by haematologist / transfusion service, number of packs depends on size of the pack). Note cryoprecipitate takes 15 - 30 minutes to thaw.
   - Platelet transfusion (1 or 2 adult therapeutic doses – note 1 adult therapeutic dose is now contained in 1 single bag not as multiple ‘units’) in patients with thrombocytopenia or on antiplatelet therapy.

2. If haemorrhage is life threatening consider antifibrinolytic therapy with tranexamic acid\(^\text{12}\) (1-2 gm over 10-20 minutes). Tranexamic acid should not be given in the same IV line as blood products. Note antifibrinolytic therapy may cause thrombosis.

3. Discuss with duty neurosurgeon – haematoma evacuation may be beneficial in selected cases.

**Management of Suspected Extracranial Haemorrhage:**

1. Superficial bleeding - i.e. venepuncture sites, nose bleeds, other superficial wounds
   a. Apply direct pressure, dressings
   b. Intravenous fluids as required
   c. If bleeding occurs during Alteplase infusion, continue unless bleeding becomes problematic.

2. Serious bleeding from non-compressible site - i.e. GI haemorrhage, retroperitoneal haemorrhage.
   a. Suspend Alteplase infusion. It should be noted that Alteplase has a very short half-life and has no reversal agent.
   b. Take venous blood for full blood count, APTT, INR, fibrinogen, electrolytes, urea, creatinine, blood group and save. Notify the hospital transfusion service immediately. Early local measures to control the bleeding where possible are essential (e.g. upper GI bleeding)
   c. If bleeding becomes critical, activate and manage as per hospital Critical Bleeding / Massive Transfusion Protocol (MTP). This will guide the optimal timing of fresh frozen plasma (FFP), platelets and cryoprecipitate in relation to red cells, in conjunction with on call haematologist.
   d. Consider antifibrinolytic therapy with intravenous, tranexamic acid\(^\text{12}\) (1-2 gm over 10-20 minutes) - consult with on call haematologist. Tranexamic acid should not be given in the same IV line as blood products. Note antifibrinolytic therapy may cause thrombosis.
   e. Arrange urgent imaging of suspected bleeding site.
   f. Discuss with appropriate duty surgeon/gastroenterologist/interventional radiologist.
Management of Alteplase Related Angioedema

Angioedema (rapid swelling of soft tissues) is a rare (1-2%) but potentially life-threatening complication of thrombolysis, usually occurring towards the end of the infusion. It is more common in patients on pre-existing angiotensin converting enzyme inhibitor therapy and may involve the lips, tongue, oropharynx or larynx. Isolated angioedema should be distinguished from anaphylaxis (see below). Angioedema threatening the airway warrants urgent medical review and the following actions:

1. Consider ceasing Alteplase immediately (depending on severity of stroke and reaction).
2. Administer oxygen, monitor saturation.
3. Monitor airway, check stridor, prepare for possibility of intubation or cricothyrotomy.
4. Administer adrenaline 0.5mg intramuscular injection (IMI) but note that ANGIOEDEMA IN SETTING OF rtPA/ACE-I RESPONDS POORLY TO ADRENALINE, ANTIHISTAMINES AND CORTICOSTEROIDS. Do not continue to give adrenaline if no response to initial dose.
5. Consult duty immunologist regarding use of icatibant (Firazyr) 30mg SC. This is a bradykinin antagonist. Angioedema should cease progression/reduce in 30-60 minutes.

Management of Alteplase Related Anaphylaxis:

Anaphylaxis (usually 2 or more of erythema, urticaria, angioedema, hypotension, tachycardia, bronchospasm) is rarer than isolated angioedema and occurs through an immunological mechanism.

1. Consider ceasing Alteplase immediately (depending on severity of stroke and reaction).
2. Administer oxygen, monitor airway, administer adrenaline 0.5mg IMI, fluid resuscitation if hypotensive, nebulised salbutamol for bronchospasm, repeat adrenaline 0.5mg IMI if no response
3. Consider adrenaline infusion if inadequate response.
4. Call medical emergency team (MET).
Intracranial Haemorrhage Protocol

Intracranial haemorrhage is a heterogeneous condition that encompasses subdural, subarachnoid and intracerebral haemorrhage. Within each subtype are varying aetiologies that governs appropriate management. The following protocol should be applied to all patients suspected with non-traumatic intracranial haemorrhage and continued until clinically stable.

Emergency Assessment of Intracranial Haemorrhage

All patients presenting to EDs with suspected intracranial haemorrhage should be considered as a medical emergency as early neurological deterioration (associated with poor outcome) is common in the first few hours after onset. Rapid workup and diagnosis is essential and early referral to specialist care is recommended (unless advance care directive to the contrary). Patients presenting within 4 hours of symptoms onset are clinically indistinguishable from ischaemic stroke.

The following evaluation is recommended for all patients with non-traumatic intracranial haemorrhage:

History:
1. Time of symptom onset or time patient last seen well
2. Progression of symptoms
3. Vascular risk factors
4. Medication including use of antiplatelet agents, anticoagulants, antihypertensives, decongestants, stimulants, sympathomimetics, statin therapy
5. Recent trauma or surgery
6. Premorbid cognitive function
7. Alcohol intake and illicit drug use
8. History of seizures
9. History of malignancy or haematological disorder

Examination:
1. Vital signs
2. General physical examination
3. Thorough but time urgent neurological examination
4. Baseline Glasgow Coma Scale
5. NIHSS

Investigations:
1. Full blood examination
2. Electrolytes, urea, creatinine
3. APTT, INR
4. Urine drug screen - in young or middle aged patients if illicit drug use is suspected
5. Urine pregnancy screen - in women of childbearing age
6. 12 lead ECG
7. Chest X-ray
Neuroimaging:

1. An urgent non-contrast CT brain should be performed in all patients with suspected intracranial haemorrhage.

2. Where subarachnoid haemorrhage is observed, a CT angiography of the Circle of Willis should be performed.

3. In the presence of non-traumatic intracerebral haemorrhage, CT perfusion is not recommended. Intracranial CT angiography is recommended in all patients (unless contraindicated) in the following scenarios:
   a. To help determine the risk of haematoma expansion (i.e. presence of the spot sign) if imaging can be performed within 6 hours of symptom onset.
   b. To determine the presence of underlying vascular pathology (e.g. aneurysm or vascular malformation) in patients where the apparent aetiology is uncertain.

Criteria for Neurosurgical Care

The following scenarios should prompt contact with the on-call neurosurgeon in view to immediate transfer to a Neurosurgical Unit.

1. Subarachnoid haemorrhage*.
2. Intracerebral haemorrhage with subarachnoid extension.
3. Intracerebral haemorrhage with suspicion of an underlying lesion.
4. Subdural haemorrhage.
5. Intracerebral haemorrhage with signs of raised intracranial pressure requiring intracranial pressure monitoring, external ventricular drainage and/or surgical evacuation.
6. Cerebellar haemorrhage with altered neurological state, brainstem compression and/or obstructive hydrocephalus.
7. Lobar haemorrhage >30ml and within 1cm of the brain surface (haematoma volume can be calculated by the “AxBxC/2” formula for an idealised ellipse (A, B, and C being the haematoma diameter in three dimensions).

* Subarachnoid haemorrhage considered secondary to amyloid angiopathy excluded

Transfer will be considered on a case by case basis following consideration of the information obtained during emergency assessment. Patients not eligible for transfer to a neurosurgical unit should be admitted to ICU/HDU or a Stroke Unit. For non-Stroke Unit hospitals, consideration should be given to transfer to the nearest Stroke Unit hospital (see Inter-hospital Transfer Protocol, page 11).

Stroke Unit versus Intensive Care Unit

In selected cases (i.e. patients with signs of raised intracranial pressure and considered appropriate for full treatment measures) management should be undertaken within an ICU environment where sedation, ventilation and neuromuscular blockade can be safely delivered. For patients admitted to a Stroke Unit, a minimum 1:2 nurse: patient ratio is recommended during the acute phase (i.e. initial 48hrs). Management in a general medical ward is not recommended.
General Principles of Intracranial Haemorrhage Management

The principles of early management of intracranial haemorrhage include general supportive care, reversal of coagulopathy, close neurological monitoring and early detection and management of complications. Application of these principles should be determined on a case by case basis following discussion with the patient, next of kin or family. This should include stroke subtype, aetiology, management and the risk of complications. An agreed management pathway should then be documented following consideration of the patient's Advance Care Directive, age, pre-morbid function, co-morbidity, stroke severity, presence of complications and likelihood of good functional outcome.

In general, patient management will fall into one of the following three pathways:

**Full Treatment Measures**

This involves implementation of full supportive measures as specified in the Acute Stroke Care Protocol (page 36), reversal of coagulopathy and management of complications (see page 29). In the event of complications, patients are considered appropriate for mechanical ventilation, ICU/HDU support, neurosurgery and full resuscitation measures (unless advance care directive to the contrary).

**Best Ward Management**

This includes patients with an Advance Care Directive for no invasive measures that prolong life, including intubation. Management entails implementation of supportive measures as specified in the Acute Stroke Care Protocol (page 36), reversal of coagulopathy and best ward management of complications. The patient is deemed unsuitable for intubation, ICU/HDU transfer or neurosurgery and resuscitation and care planning should be initiated, discussed with patient (if able) or the patient’s appointed substitute decision maker/s or persons responsible and documented.

**Palliative Care/End of Life Care**

This may be considered in patients with poor pre-morbid function, multiple co-morbidities or severe neurological deficit where the likelihood of a good functional outcome is remote. Management is focussed on patient comfort and may include hydration (if conscious), pain relief and sedation. All other active treatment measures are usually withdrawn. The patient is deemed unsuitable for intubation, ICU/HDU transfer or neurosurgery and a "Not For Resuscitation" order should be documented in the event of cardio-respiratory arrest.

**Additional Disease Specific Supportive Measures**

Supportive measures as listed in the Acute Stroke Care Protocol (page 36) should be applied to all patients with intracerebral haemorrhage. In addition, the following measures are recommended in the acute phase.

**Head positioning:**

Patients considered at risk of raised intracranial pressure should remain supine with their head elevated at 20-30 degrees to promote venous return and minimise cerebral oedema. Lowering head position below torso should be avoided.

**Hydration:**

Intravenous normal saline should be administered at a rate to maintain euvoelemia and this should be monitored via fluid balance chart and clinical surveillance. Glucose solutions should be avoided as to minimise the risk of cerebral oedema.

**Neurological monitoring:**

Glasgow Coma Scale (GCS) should be recorded hourly for the first 24 hours then 2-4 hourly for next 48 hours if stable. A decrease in GCS of ≥ 2 points from baseline defines significant neurological decline warranting urgent medical assessment. A GCS ≤ 8 is predictive of impending cardiorespiratory arrest.
and mandates immediate medical attention. A mNIHSS may also be used for neurological monitoring by nursing staff with an increase of ≥ 4 points from baseline considered as significant.

Continuous surveillance for clinical features of raised intracranial pressure (reduced consciousness, headache, nausea, vomiting, visual disturbance) and seizures should be performed and urgent medical attention sought if observed (see Management of Intracerebral Haemorrhage Related Complications below).

**DVT prophylaxis:**

A sequential compression device, with or without thigh length compression stockings, should be applied and spontaneous lower limb exercises encouraged.

Prophylactic low dose unfractionated heparin or low molecular weight heparin should be avoided in the first 48 hours. DVT prophylaxis may be considered thereafter following documented stability of intracranial haemorrhage. Prophylactic unfractionated heparin (5000U subcutaneous injection, twice daily) is recommended allowing for rapid reversal in the event of recurrent intracranial haemorrhage.

**Reversal of Coagulopathy**

Patients with coagulopathy or thrombocytopenia should receive appropriate factor replacement therapy and platelet transfusion respectively in consultation with a haematologist. In non-coagulopathic patients, acute management with recombinant Factor VIIa is not recommended. The usefulness of platelet transfusion in patients with a history of antiplatelet therapy is unclear but may be considered.

Patients on warfarin with an elevated INR require urgent reversal of coagulopathy. The following protocol should be applied:

1. Cease warfarin
2. Administer intravenous Vitamin K (5-10 mg) + Prothrombinex (35-50 IU/kg) + Fresh Frozen Plasma (150-300mL – 1 unit)
3. Recheck INR within one hour of infusion and administer further Prothrombinex and Fresh Frozen Plasma if INR not normalized in consultation with a haematologist.

Early consultation with haematology for patients taking rivaroxaban, apixaban or dabigatran is recommended. Haemodialysis may be required.

**Management of Intracerebral Haemorrhage Related Complications**

**Hypertension**

Uncontrolled hypertension in the acute phase is associated with poor outcome via its effect on haematoma expansion, peri-haematoma oedema and re-bleeding. Recent evidence suggests improved outcome with tight blood pressure control (target < 140/80 mmHg) if instituted within 6 hours of symptom onset.

Patients with hypertensive readings should be initially assessed for pain or urinary retention (may need bladder scan) and managed accordingly. Blood pressure should be confirmed with a second reading using a sphygmonomanometer after 5 minutes and managed according to the following:

1. Systolic blood pressure ≥ 150 mmHg or mean arterial pressure (MAP) ≥ 110 mmHg:
   
   All patients should be considered for aggressive antihypertensive therapy (target systolic blood pressure of 140 mmHg or MAP 105 mmHg) using the following intravenous regimens:

   a. Intravenous labetalol 10-20mgs via slow injection over 1-2 minutes. This may be repeated every 10-20 minutes to a maximum total dose of 300mgs in any six hour period **OR**
b. Intravenous labetalol 10 mgs over 1-2 minutes follow with continuous labetalol infusion at a rate of 2-8 mg/minute to a maximum total dose of 300mgs in any six hour period \textbf{OR}

c. Intravenous GTN - 30mg in 100ml. Commence 3ml/hr and titrate by 1ml/hr at 5-10 minute intervals to desired BP. Note GTN must be administered via separate intravenous line using non-PVC giving set via a controlled dose infusion device.

In the event of persistent hypertension, despite the above measures, consider transfer to HDU or ICU for treatment, within their protocols, and/or consider:

a. Nitroprusside 0.5 micrograms/kg/min IV infusion (as initial dose and titrate to desired blood pressure) \textbf{OR}

b. Hydralazine as a slow bolus 5mg intravenously, repeated as required every 20 minutes (maximum 5 boluses in any six hour period)

\textbf{NB: If intravenous medications are unavailable (due to ICU bed unavailability) oral nifedipine (10-20mg) can be considered with caution (noting peak antihypertensive effect in 1-2 hours and potential for end-organ hypoperfusion).}

If hypertension is associated with deterioration of neurological status (decrease in GCS of $\geq 2$ points or increase in mNIHSS $\geq 4$ points from baseline or GCS $\leq 8$ points) consider possibility of raised intracranial pressure. Antihypertensive therapy in this setting should be used with caution as it may reduce cerebral perfusion pressure resulting in further neurological decline. Such patients should be considered for ICU transfer and intracranial pressure monitoring to maintain a cerebral perfusion pressure $\geq 60$ mmHg whilst administering antihypertensive therapy.

\textbf{Raised Intracranial Pressure}

Patients with reduced consciousness, headache, nausea, vomiting, visual disturbance or significant neurological decline (decrease in GCS of $\geq 2$ points or increase in mNIHSS $\geq 4$ points from baseline or GCS $\leq 8$ points) should be suspected for raised intracranial pressure and managed according to the following:

1. An urgent non-contrast CT brain should be repeated to determine the presence of intraventricular extension, obstructive hydrocephalus, haematoma expansion or peri-haematoma oedema resulting in midline shift or transtentorial herniation.

2. In selected patients (i.e. full treatment measures considered appropriate) confirmation of the above should prompt urgent consultation with the duty neurosurgeon.

3. Such patients should be transferred to an intensive care unit with neurosurgical support allowing for insertion of a parenchymal intracranial pressure monitor and management with pain relief, sedation, neuromuscular blockade and mechanical ventilation to achieve normocarbia (target intracranial pressure 20-25 mmHg, cerebral perfusion pressure 50-70 mmHg).

4. Patients with intraventricular haemorrhage or obstructive hydrocephalus should be considered for insertion of an external ventricular drain.

5. Patients refractory to the above measures should be considered for intravenous hypertonic saline or mannitol (0.25-1.0gm/kg) +/- proceed to hemicraniectomy.
Intra-Arterial Mechanical Embolectomy Protocol

General Considerations

Intra-arterial mechanical embolectomy may be considered in carefully selected patients and should only proceed following recommendation by a Stroke Consultant. Current trial data suggests equipoise and therefore (unless rtPA is contraindicated) patients should generally be considered for enrolment in a clinical trial.

If neurointervention is contemplated, careful assessment of the patient's history, neurological findings, neuroimaging and subsequent discussion with the interventional neuroradiologist are mandatory. The procedure should proceed following informed consent by the patient or next of kin (see patient information sheet, page 75). Conscious sedation with anaesthetics support is the preferred option for the procedure however, if not possible, then general anaesthesia (with careful maintenance of BP at induction) may be used. This will generally require the patient to be monitored in an ICU or HDU environment for at least 24 hours post procedure. Patients managed with intravenous Alteplase who subsequently demonstrate signs of further deterioration (i.e. increase mNIHSS ≥ 4 points from baseline) should have a repeat non-contrast CT brain scan prior to the procedure to exclude symptomatic intracranial haemorrhage.

Eligibility Criteria

Inclusion criteria:

(All 6 criteria must be met for eligibility)

1. Clinical and radiological features of life-threatening (e.g. perfusion defect >150mL) ischaemic stroke, in the physiologically young patient.

NB: a lower threshold can be considered for patients with thrombolysis contraindication, as opposed to high-risk of thrombolysis failure

2. Procedure can be initiated within 6 hours of symptom onset in the setting of acute basilar or anterior circulation stroke if:

   a. Intravenous alteplase is contraindicated due to bleeding risk OR
   b. Proven or likely lack of response to intravenous alteplase (rescue therapy).

   OR: Procedure can be initiated within 12 hours of symptom onset in patients with slowly evolving basilar artery occlusion in exceptional circumstances.

3. Occlusion of major vessel (internal carotid artery (ICA), basilar or proximal MCA (M1) demonstrable on CT angiography.)

4. Patient’s CT brain scan does not show haemorrhage or non-vascular cause of stroke.

5. Patient’s CT perfusion study shows a favourable ischaemic penumbra to core ratio.

6. Informed consent available from the patient, substitute decision maker/s (if any) or persons responsible (close family/friend).

Exclusion criteria:

Absolute (Mechanical embolectomy should not be performed if any of the following is true)

1. Uncertainty about time of stroke onset if last seen well > 6 hours.

2. Hereditary or acquired coagulopathy (INR>4.0, platelet count ≤30,000µL)

4. Hypoglycaemia (BGL≤3.5mmol/L) or hyperglycaemia (BGL≥22.2), where more normal levels cannot be achieved within the 8 hour window.

5. Hypertension: systolic blood pressure ≥185 mmHg or diastolic blood pressure > 110 mmHg on repeated measures despite treatment.†

6. CT evidence of extensive middle cerebral artery (MCA) territory infarction (sulcal effacement or blurring of grey-white junction in greater than 1/3 of MCA territory, evidence of similarly-sized core infarction (>70-80mL) on CT perfusion, ASPECTS score <8).6-8

7. Pre-existing dementia or dependency (modified Rankin score >2).

8. Minor or rapidly improving neurological deficit.

9. Severe comorbidity limiting life expectancy or posing treatment risk.

10. Known contrast hypersensitivity.

11. Known refusal of life-sustaining treatment/outcomes to be avoided.

Relative (mechanical embolectomy should be performed with caution)

1. Age > 80 years.

2. Age < 18 years (mechanical embolectomy can be considered in physiologically adult adolescents, but should not be performed in children).

3. Seizure at symptom onset.

4. Severe renal impairment (i.e. eGFR<30).

5. Heparinisation within 48 hours and APTT ≥ 2 x normal, or therapeutic dose LMWH within the last 12 hours).

†Management of pre-treatment hypertension:

In patients who are eligible for mechanical embolectomy but have systolic BP>185 mmHg or diastolic BP>110 mmHg, 10-20mg of intravenous Labetalol may be administered via slow injection over 1-2 minutes (can be repeated once after 10 minutes). Note cardiac monitoring is essential. Record blood pressure every 5 minutes. If BP remains >185/110 mmHg despite aggressive treatment, management with mechanical embolectomy is contraindicated.
Post Procedural Management

Post procedure patients should be monitored in a HDU or ICU environment for at least 24 hours.

The following nurse observation and task schedule is recommended:

<table>
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<tr>
<th>Time</th>
<th>Activity</th>
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</thead>
</table>
| 0-2 hrs  | 15 minutely observation: mNIHSS, BP, Pulse, SpO₂, Temperature, arterial puncture site.  
Nil by mouth – commence 0.9 % sodium chloride intravenous fluids  
Insert nasoenteric tube, if oral loading dose aspirin required (300mg) or alternatively administer via per rectum route and usual medication  
Hourly Fluid Balance Chart  
Strict Bed Rest; Safety Precautions: falls prevention (ongoing) |
| 2-6 hrs  | 30 minutely observation: mNIHSS, BP, Pulse, SpO₂, Temperature  
Hourly Fluid Balance Chart  
Strict Bed Rest; Safety Precautions: falls prevention, pressure area care |
| 6-12 hrs | Hourly observation: mNIHSS, BP, Pulse, SpO₂, Temperature  
Hourly Fluid Balance Chart  
Strict Bed Rest; Safety Precautions: falls prevention, pressure area care |
| 12-24 hrs| Two hourly observation: mNIHSS, BP, Pulse, SpO₂, Temperature  
Hourly Fluid Balance Chart  
Patient can sit out of bed if able / Physiotherapy review if available  
Swallow screen assessment by speech pathologist if available |

Management should aim to maintain euvolemia, normal oxygenation and temperature. If the procedure has been performed as a ‘rescue’ to thrombolysis aspirin is contraindicated unless stenting has occurred. Otherwise aspirin may be considered (unless rtPA was contraindicated because of high bleeding risk).

Venous thromboembolism prophylaxis with unfractionated heparin or LMWH is recommended on day one (excluding patients managed with intravenous alteplase – such patients should commence in 24 hours if there is no evidence of intracranial haemorrhage, but sequential compression devices should be considered, with or without thigh length compression stockings).

Management of Complications

Hypertension

Uncontrolled hypertension following intra-arterial mechanical embolectomy in the first 24 hours may result in intracranial haemorrhage. Early recognition and management is therefore critical.

In the advent of a blood pressure reading > 180/110 mmHg the following measures should be taken:

1. Confirm reading manually using a sphygmomanometer.
2. Check the patient is not in pain or urinary retention (may need bladder scan) and manage accordingly.
3. If hypertension is associated with deterioration of neurological status consider possibility of symptomatic intracerebral haemorrhage. Contact Stroke Medical Officer in view to urgent non-contrast CT Brain. Continue with BP management protocol as specified below.
4. Recheck blood pressure 5 minutes after first reading - if second reading is >180/110 mmHg proceed with antihypertensive therapy:

5. Intravenous labetalol 10-20mgs via slow injection over 1-2 minutes. This may be repeated every 10-20 minutes to a maximum total dose of 300mgs in any six hour period **OR**

6. Intravenous labetalol 10 mgs over 1-2 minutes follow with continuous labetalol infusion at a rate of 2-8 mg / minute to a maximum total dose of 300mgs in any six hour period **OR**

7. Intravenous GTN - 30mg in 100ml. Commence 3ml/hr and titrate by 1ml/hr at 5-10 minute intervals to desired BP. Note GTN must be administered via separate intravenous line using non-PVC giving set via a controlled dose infusion device.

In the event of persistent hypertension despite the above measures (i.e. > 180/110 mmHg) consider transfer to HDU or ICU for treatment with:

   a. Nitroprusside 0.5 micrograms/kg/min IV infusion (as initial dose and titrate to desired blood pressure) **OR**

   b. Hydralazine as a slow bolus 5mg intravenously, repeated as required every 20 minutes (maximum 5 boluses in any six hour period)

**NB:** If intravenous medications are unavailable (due to ICU bed unavailability) oral nifedipine (10-20mg) can be considered with caution (noting peak antihypertensive effect in 1-2 hours and potential for end-organ hypoperfusion).

**Neurological deterioration**

An increase in mNIHSS ≥ 4 points from baseline is considered significant and may represent intracerebral haemorrhage, evolving oedema or recurrent infarction. Urgent medical review and repeat CT brain scan is recommended.
Decompressive Craniectomy Protocol

General Considerations

Large middle cerebral artery territory infarctions with mass effect lead to an 80% mortality rate and uniformly severe disability in survivors. In selected patients, hemicraniectomy performed within the first 48 hours improves survival and increases the chance of a favourable functional outcome. Hemicraniectomy appears more beneficial when surgery is expedited – in regards to both time from stroke onset and time from first neurological deterioration (i.e. drowsiness).

Eligibility Criteria - Hemicraniectomy

**Inclusion criteria**

1. Age ≤ 60 years.
2. Within 48 hours of stroke onset.
3. Clinically large MCA territory infarction involving (on CT) ≥ 50% of the MCA territory, or >145cm² on MRI diffusion weighted imaging*.
4. A decrease in level of consciousness from “alert” to “non-alert” (i.e. requiring some stimulation to rouse, or worse).

All patients aged less than 60 with clinical signs consistent with a large MCA stroke should have repeat CT at 12 hours or (preferably) magnetic resonance imaging (MRI) between 6 and 12 hours after stroke onset to determine the likelihood of deterioration (if completed stroke is not present on initial imaging). If the stroke is of sufficient size, stroke unit doctors should contact neurosurgery, obtain provisional consent from patient or substitute decision maker or person responsible and arrange to monitor in HDU.

**Exclusion criteria**

1. Patients older than 60, unless circumstances are exceptional (treatment in this setting may be life-saving but at the cost of severe disability (rarely unable to mobilise independently).
2. Pre-existing functional impairment.
3. Two fixed dilated pupils.
4. Large volume contralateral ischaemia or other brain lesion that could affect outcome.
5. Life expectancy <3 years.
6. Known coagulopathy or systemic bleeding disorder.

Surgery should be expedited in patients meeting criteria. Decompressive surgery should involve a bone flap at least 12 cm in diameter (including frontal, temporal, and parietal bones). Additional temporal bone should be removed to reach the middle cerebral fossa floor. The dura should be opened and a dural patch inserted and secured to enlarge the intradural space.

*Infarct volume can be calculated by the following formula: \((\text{axbxc})/2\), where a, b and c are the maximal transverse, anterolateral and coronal dimensions (for coronal dimensions multiply number of slices involved by the slice thickness plus gap).

Posterior Fossa Decompression

Posterior fossa decompression is also appropriate in physiologically young patients with large cerebellar strokes (either ischaemic or haemorrhagic lesion > 3 cm in diameter), GCS<14, minimal brainstem involvement or compression +/- hydrocephalus from resultant oedema/mass effect. Selected patients with large cerebellar strokes should be transferred to a hospital with neurosurgical support for close neurological surveillance.
Acute Stroke Care Protocol

Notification of Stroke Admissions

The Stroke Team is notified as soon as a patient with stroke (PWS) is admitted. While medical and stroke nursing staff are notified from ED via the Code Stroke Protocol paging system, an additional communication system will promptly notify the rest of the team of new admissions. For out-of-hours admissions the stroke coordinator and allied health staff are notified at the start of next shift. On weekends and public holidays a cover system should ensure medical, nursing and allied health with appropriate stroke expertise are available for new admissions (especially thrombolysis skilled nurse and doctor, SP, DN & PT).

Through a hospital-specific communication system, the team will be aware of stroke patients admitted anywhere in the hospital, not just stroke unit admissions. All outlying stroke patients should be moved to the stroke unit as a priority, and the stroke team will provide an outreach/consultant service until this can be arranged.\textsuperscript{18-20}

Patient’s Team Identified

Acute Stroke Team

Each PWS/family will have a team of relevant professionals allocated to provide the initial assessment, develop individualised care plans, set goals, and provide interventions. This team of medical, nursing, and allied health professionals work in a coordinated manner, sharing information and decision making with each other and with the PWS, or substitute decision makers or persons responsible.\textsuperscript{20, 21}

Key Worker

Each PWS will have a Key Worker appointed from within the stroke team, within 24 hours of admission. The Key Worker roles can be spread across the broader Stroke Team, to individuals from any discipline who have credibility/experience in stroke management and can confidently guide the PWS and family/friends through the processes. In hospitals with small numbers of stroke admissions, the stroke nurse coordinator may take on the Key Worker role.\textsuperscript{22, 23}

This coordination model accommodates the following:

a. Reduces duplication in assessments by undertaking the collection of social information and pre-morbid status required by multiple team members (an interdisciplinary assessment).

b. Allows for the family and PWS to have ‘one contact’ for organisational or general inquiries or to direct their specific inquiries.

c. Remains a constant for the PWS and their family for the admission duration.

d. Facilitates the smooth flow of the acute care pathway, ensures appropriate referrals are made, assessments completed (including the Assessment for Rehabilitation Tool), meetings are scheduled and occur within the necessary timeframes, and discharge arrangements are in place.

e. Ensures that important information is received by the PWS and family such as relevant literature, My Stroke Care Plan (NSF), post-discharge plans.

f. Facilitates patient-centred care by ensuring meaningful communication and decision making between the PWS, substitute decision maker / family / friend and the rest of the stroke team.
Stroke Severity Assessment

If not done in ED, an initial screen of stroke severity is conducted early in admission and again at discharge. The recommended tool is the National Institute of Health Stroke Scale (NIHSS) (page 65). Use of a common tool will facilitate transfer of information and comparisons across stroke settings. Staff assessing with the NIHSS should undertake online training and accreditation. An assessment of disability should also be performed at discharge (NIHSS and the modified Rankin score).

Acute Domain Assessments

Initial domain assessments are performed by the acute stroke care team members allocated to care for the PWS. Every effort will be made to avoid unnecessary duplication – this will require team communication and planning so that information required across professionals is only gathered once. The findings, actions, recommendations and goals arising from acute assessments should:

a. Be communicated to the whole stroke team via the patients’ medical records and important issues shared at formal and informal team meetings.

b. Be discussed with the PWS/family by the professionals undertaking the assessment or by the relevant Key Worker.

c. Inform the Assessment for Rehabilitation Tool (ART; page 87).

Clinicians should use validated and reliable assessment tools or measures that meet the needs of the patient to guide clinical decision making.

Initial Investigations and Stroke Classification

**NB:** Management recommendations listed below are applicable to all PWS unless they have received intravenous Alteplase (see page 16), or intra-arterial mechanical embolectomy (page 31) or they have had an intracranial haemorrhagic stroke (see page 26).

All patients with suspected stroke should have an urgent brain CT or MRI ("urgent" being immediately where facilities are available but within 24 hours).

The following investigations should be routinely carried out in all patients with suspected stroke:

a. 12 lead electrocardiogram

b. Full blood count, coagulation studies, electrolytes, renal function, fasting lipids and glucose, erythrocyte sedimentation rate and/or C-reactive protein.

c. Selected patients may require additional investigations including vasculitis and prothrombotic screens.

d. Additional investigations should be performed as soon as possible to determine the aetiology and allow for classification of stroke subtype. This includes cardiac telemetry, intracranial and extracranial vascular imaging (ultrasound, CT angiography or Magnetic Resonance angiography) and cardiac imaging (trans-thoracic +/- trans-oesophageal echocardiography).

e. Brain Natriuretic Peptide (BNP) blood test may be considered in patients with cardioembolic stroke where the suspicion of unknown source is high.

It is recommended that all PWS receive an aetiological classification guiding acute management and secondary prevention. Suggested classification criteria are listed below (potential causes may coexist):
Intracerebral Haemorrhage secondary to:  

a. Vascular lesion  
b. Medication  
c. Amyloid angiopathy  
d. Systemic disease (i.e. clotting disorder, thrombocytopenia)  
e. Arteriolsclerosis (i.e. ‘Hypertensive’ intracranial haemorrhage)  
f. Undetermined aetiology  

Ischaemic Stroke secondary to:  

a. Large vessel disease (intracranial or extracranial)  
b. Small vessel disease  
c. Cardioembolic  
d. Dissection  
e. Other rarer cases (e.g. vasculitis, antiphospholipid syndrome)  
f. Undetermined  

Physiological Assessments and Monitoring  

Patients should have their neurological status (e.g. mNIHSS) and vital signs (including pulse, blood pressure, temperature, oxygen saturation, and glucose levels), cardiac rhythm and respiratory pattern monitored and documented regularly during the acute phase (see table below). Observations should be undertaken by trained personnel and documented in the medical record in a manner that will prompt necessary action.  

Physiological and neurological monitoring should be undertaken routinely as follows. Deterioration in status should be managed according to the Recognising and Responding to Clinical Deterioration Policy Directive, developed by the Quality & Safety Unit of SA Health.  

<table>
<thead>
<tr>
<th>Observation</th>
<th>0-24 hours</th>
<th>24-48 hours</th>
<th>48-72 hours^</th>
<th>3-5 days</th>
<th>5 days+</th>
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</thead>
<tbody>
<tr>
<td>Neuro Obs mNIHSS</td>
<td>1-4 hourly</td>
<td>4 hourly</td>
<td>6 hourly^</td>
<td>6 hourly^</td>
<td>stop^</td>
</tr>
<tr>
<td>BP,TPR, SpO2</td>
<td>1-4 hourly</td>
<td>4 hourly</td>
<td>6 hourly^</td>
<td>6 hourly^</td>
<td>12 hourly^</td>
</tr>
<tr>
<td>Cardiac telemetry</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Yes*^</td>
<td>Yes*^</td>
<td></td>
</tr>
<tr>
<td>Blood glucose</td>
<td>4 hourly</td>
<td>4 hourly</td>
<td>6 hourly^</td>
<td>If&gt;6mmols continue 6 hourly^</td>
<td>If&gt;6mmols continue 6 hourly^</td>
</tr>
</tbody>
</table>

*May not be required if known to have atrial fibrillation or if cardioembolic aetiology considered unlikely.  
^Observations after 48 hours should be based on individual patient status.
Neurological Monitoring

The modified National Institute of Health Stroke Severity (mNIHSS) scale is a recommended neurological observation tool. Observations should be taken and recorded by trained personnel.23

Oxygenation

Patients who are hypoxic (i.e. <95% oxygen saturation) should be given supplemental oxygen. The routine use of supplemental oxygen is not recommended in acute stroke patients who are not hypoxic.

New onset of hypoxia should be managed as per SA Health’s Deteriorating Patient Protocol (RADAR). Consider pulmonary embolus, left ventricular failure, aspiration pneumonia, other sepsis.

Consider investigation of undiagnosed sleep apnoea.

Pyrexia

Antipyretic therapy, comprising regular paracetamol and/or physical cooling measures, should be used routinely when fever occurs.

Antipyretic therapy commences when fever >37.5˚C. Temp >38˚C → contact MO, consider blood cultures, septic screen (Chest X-ray, MSSU, sputum, other).30

Blood pressure

Pre-existing antihypertensive therapy should be continued (orally or via nasoenteric tube) provided there is no symptomatic hypotension or other reason to withhold treatment. In ischaemic stroke (in those not eligible for intravenous thrombolysis or mechanical embolectomy), if blood pressure is more than 220/120 mmHg antihypertensive therapy can be started or increased, but blood pressure should be cautiously reduced (e.g. by no more than 10-20% every 24 hours) and the patient should be monitored for neurological deterioration.

Heart rate and rhythm

Cardiac monitoring is recommended to screen for atrial fibrillation and other potential serious cardiac arrhythmias for at least 24 hours (unless alternative stroke aetiology immediately apparent). If pulse rate >120 bpm or <50bpm should be managed as per SA Health’s Deteriorating Patient Protocol.

Respiration

Abnormal respiration rate >15 or <10 → review position upright if conscious, encourage deep breathing, cough, huffing hourly, oral suction if necessary. Tachypnoea is an early sign of both pneumonia and pulmonary embolism. Deterioration in respiration should be managed as per SA Health’s Deteriorating Patient Protocol (RADAR) Consider infection, left ventricular failure, pulmonary embolus, chest X-ray. Nil by mouth if aspiration suspected and perform swallowing assessment.

Glycaemic control

On admission, all patients should have their blood glucose level monitored and appropriate glycaemic therapy instituted as per FeSS Sugar Protocol (see page 82). Dextrose containing solutions should be avoided as may cause cerebral oedema.30

Functional Assessments

Timely functional assessments should be completed and documented, unless receiving end of life care at this time. Where-ever available, validated assessment tools should be used.

To avoid over-taxing the PWS, functional assessments should be staggered according to priority for the individual. This will often mean that swallowing, hydration and mobility/falls risk assessments have some priority. Assessments should be completed and documented as per the following table and appropriate care plans communicated to the team.
<table>
<thead>
<tr>
<th>On admission or &lt; 4 hours</th>
<th>Within 24 hours</th>
<th>Within 48 hours</th>
<th>Prior to rehabilitation decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swallow screen (nil by mouth until swallow cleared)</td>
<td>Swallow assessment by SP if screen failed</td>
<td>Motor function: tone, strength, coordination, dyspraxia</td>
<td>ADLs</td>
</tr>
<tr>
<td>Hydration</td>
<td>Mobility assessment: transfers, gait</td>
<td>Communication</td>
<td>Behaviour</td>
</tr>
<tr>
<td>Risk of falls</td>
<td>Visual, sensory &amp; perceptual assessment</td>
<td>Mood: emotion psychological</td>
<td></td>
</tr>
<tr>
<td>Nutrition screen</td>
<td>Nutrition assessment by DN if screen failed</td>
<td>Carer support</td>
<td></td>
</tr>
<tr>
<td>Continence</td>
<td>Pressure care risk assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk of shoulder subluxation/injury</td>
<td></td>
<td>Cognition (MoCA; Montreal Cognitive Assessment)</td>
<td></td>
</tr>
</tbody>
</table>

**Screening tools:**

The use of screening tools by trained team members is encouraged to identify PWS who are at risk, and who require more detailed specialist assessment and intervention. Screening has the advantage of freeing up specialist staff time to concentrate on those PWS who will benefit most from specialist skills. Who conducts the screen will vary according to local practice. The use of screening tools must be backed by systematic training programs that are repeated regularly to capture staff turn-over and reinforce understanding and reliability. Screening tools that have proven validity and reliability in stroke populations should be chosen. Below is a list of some screening tool examples, noting that other validated screening tools may be available:

**Swallow Screen**

Swallow screening should occur for all PWS prior to oral intake. Made nil-by-mouth if issues are identified and urgent notification to the SP. Examples include:

- GUSS - Gugging Swallow Screen
- ASSIST - Acute Screen of Swallow in Stroke or TIA (Hunter New England Health) (includes the 100mL Water Swallow Test).

**Nutritional screening**

Nutritional screening is used to identify pre-admission nutritional problems; refer to DN if issues detected are detected. An example is the MUST – Malnutrition Universal Screening Tool.
Communication screening

> WAB – Western Aphasia Battery (short version)

Mood screening

Mood screening for patients with longer admissions, with medical staff notified if problems detected. Examples include:

> PHQ-9 – Screen patients with a validated tool e.g. Geriatric Depression Scale, the Hamilton Tool or the Patient Health Questionnaire 9 (PHQ9) as appropriate. The SADQ-H10 can be considered for patients with stroke-related communication problems. 63

Pharmaceutical Assessment

Pharmaceutical assessment of previous medication should be undertaken. A medication prescription/plan should be made through consultation between medical staff and pharmacist.

Psychosocial Assessments

A comprehensive psychosocial screen (premorbid profile) should be undertaken within 48 hours of admission to capture information relevant to the acute care and forward planning for the PWS and their family. It is recommended that the Key Worker for each PWS undertakes this assessment, and shares information with the Stroke Team, to avoid duplication and to establish a relationship with the PWS/family. Important areas to cover include pre-stroke living arrangements, family contacts, functional level, social and work activity, driving, community support services used, informal supports used, any Power of Guardianship and Advance Care Directives, and the PWS and family’s initial goals or concerns regarding discharge. A simple tick-box assessment format can add efficiency.

Acute Care and Complication Management

Management recommendations listed below are applicable to all PWS unless they have received intravenous Alteplase (see page 16), or intra-arterial mechanical embolectomy (page 31) or they have had an intracranial haemorrhagic stroke (see page 26).

Antithrombotic Therapy

Aspirin orally or via nasoenteric tube or suppository (for those with dysphagia) should be given as soon as possible after the onset of stroke symptoms (within 48 hours) if neuroimaging excludes haemorrhage. The first dose should be 300mg.

The routine use of early anticoagulation in unselected patients following stroke/TIA is not recommended.

Seizure Management

Anticonvulsant therapy is indicated in patients with observed seizures or in patients with a change in mental status associated with electroencephalographic changes in keeping with seizure activity.

For patients with intracerebral haemorrhage empirical prophylactic anticonvulsant therapy is not recommended. In such patients with seizures, sodium valproate should be avoided given its adverse effect on platelet function.

Nutrition & Hydration

All patients should have their hydration status assessed, monitored and managed. Appropriate fluid supplementation should be provided to prevent dehydration. 39-41, 47, 48, 64, 65

Strategies including making fluid accessible, offering preferred fluid and providing supervision during meals should be adopted to optimise fluid intake. 64 If additional hydration is required, fluid should be administered via intravenous, subcutaneous or enteral routes.
All patients at risk of malnutrition, including those with dysphagia, should be seen by a dietitian (DN) for assessment and management. Nutritional supplementation should be offered to patients whose nutritional status is poor or deteriorating. Non-palliated patients who do not have a functional swallow should not wait longer than 2-3 days before tube feeding is instituted. Nasoenteric tube feeding is the preferred method during the first month post-stroke for patients who have not yet recovered a functional swallow.

Food intake should be monitored for all patients with acute stroke to indicate if referral to a DN is required, for example using a nutrition observation chart. The DN should continue to monitor intake using Food Intake Charts as clinically indicated. All patients should be weighed within 24 hours of admission and at weekly intervals. 49

**Urinary Incontinence**

All stroke survivors with suspected continence difficulties should be assessed by trained personnel using a structured functional assessment. A portable bladder ultrasound scan can be used to assist in diagnosis and management of urinary incontinence. PWS with confirmed continence difficulties should have a continence management plan formulated and documented, implemented and monitored. 55-57

The use of indwelling catheters should be avoided as an initial management strategy except in acute urinary retention.

If incontinence persists the PWS should be re-assessed and referred for specialist review.

The following is recommended for patients with urge incontinence:

- a. A prompted or scheduled voiding regime program/ bladder retraining should be trialled (in conjunction with findings from the mobility assessment).
- b. Anticholinergic drugs can be trialled (note: these medications can cause confusion or cognitive deterioration).
- c. If continence is unachievable, containment aids may assist with social continence.

The following is recommended for patients with urinary retention:

- a. The routine use of indwelling catheters is not recommended. However if urinary retention is severe, then intermittent catheterisation (IC) should be used to assist bladder emptying during hospitalisation. If retention continues, IC is preferable to indwelling catheterisation.
- b. If using IC, then a closed, sterile catheterisation technique should be used in hospital.
- c. Any patient discharged with either intermittent or indwelling catheterisation will require education of patient / carer for management, where to access supplies and a contact point in case of problems.

For people with functional incontinence, a whole-team approach is recommended.

**Bowel Management**

Routine Bowel Management

Accurate observation, recording, and active bowel management is required to avoid constipation. 55 Use of the Bristol Stool Chart is recommended (Appendix 8, page 79).

The charting of aperients should be routinely considered at admission for all patients.

Adequate hydration and the use of aperients and stool softeners will need to be carefully managed/ modified to suit the requirements of PWS with swallowing difficulties.

Constipation that does not resolve or if there is abdominal pain or vomiting requires notification to the medical officer.
Faecal Incontinence

All stroke survivors with suspected faecal continence difficulties should be assessed by trained personnel using a structured functional assessment. For those with constipation or bowel incontinence, a full assessment (including a rectal examination) should be carried out and an appropriate management plan of constipation, faecal overflow or bowel incontinence established, and targeted education provided.

Bowel habit retraining using diet, regulating dietary habits and exploiting the gastrocolic reflex may be used for people who have bowel dysfunction. If continence is unachievable, containment aids may assist with social continence.

Education and careful discharge planning and preparation is required for any patient being discharged with bowel incontinence. Faecal incontinence > 5 times a day may indicate infection → notify MO, collect stool sample. Consider constipation with overflow.

Deep Vein Thrombosis & Pulmonary Embolus (PE)

Early mobilisation and adequate hydration should be encouraged in all acute stroke patients to help prevent DVT and PE.

Antiplatelet therapy should be used for all people with ischaemic stroke to prevent DVT/PE. Low molecular weight heparin or heparin in prophylactic doses should be used for ischaemic stroke patients at high risk of DVT/PE (e.g. patients with decreased mobility, history of malignancy etc.). If low molecular weight heparin is contra-indicated or not available, unfractionated heparin should be used.

After documentation of cessation of bleeding in ICH patients with lack of mobility, low-dose subcutaneous low-molecular weight heparin or unfractionated heparin may be considered for prevention of venous thromboembolism in patients who are immobile after 1 to 4 days from onset.

Anti-thrombotic stockings are NOT recommended for the prevention of DVT/PE post-stroke.

A Sequential Compression Device (SCD), with or without thigh length compression stockings, is recommended for ICH patients, or those post thrombolysis (first 24 hours), or others at high risk of DVT.

Pressure care

All stroke survivors should have a pressure care risk assessment and regular evaluation completed by trained personnel.

Patients assessed as high risk should be provided with appropriate pressure relieving aides and strategies, including a pressure relieving mattress as an alternative to a standard hospital mattress or appropriate seating systems.

Falls

Falls risk assessment should be undertaken using a validated tool on admission to hospital. An interdisciplinary management plan should be initiated for all those identified as at risk of falls.

Shoulder Subluxation

For people with severe weakness who are at risk of a subluxed or injured shoulder, management should include one or more of the following interventions: firm support devices; electrical stimulation; education for the patient, family/carers and clinical staff on how to correctly handle and position the affected upper limb.

Strategies to highlight the ‘at risk’ arm should be instituted early after admission such as a highlighted body chart above the bed, or a brightly coloured arm band (has advantage of travelling with the patient).
Oral Hygiene

All patients, especially those with swallowing difficulties, should have assistance and/or education, by nursing staff, to maintain good oral and dental hygiene (including dentures). PWS with poor dentition or ill-fitting dentures should be referred to a dental service. 71

Team Communication and Decision Making

Team communication and decision making will occur at various levels.

Formal Team Meetings

To facilitate the rapid patient flow required by acute settings, the stroke team should meet twice weekly. 24 The purpose of these meetings is to enable good team communication and collaborative decision making around the key issues for each PWS. This would usually include sharing key points from important initial assessments, important changes in status, updating the Assessment for Rehabilitation Tool (ART), reaching consensus on team-wide patient goals, updating progress toward goals, discharge planning and referrals as required.

Discharge planning commences at the first team meeting for the PWS and is progressed at subsequent meetings. Potential barriers to smooth discharge are identified early and addressed. Discharge planning meetings should be coordinated by a nominated staff member to maximise effectiveness. A meeting agenda template is recommended.

Decisions from formal team meetings are documented in the medical record. Important information from team meetings is communicated back to the PWS/family, usually via their Key Worker.

Daily Handover Meetings

Brief handovers from nursing staff at the start of the day update the rest of the stroke team e.g. new admissions, changes in patients’ status overnight, priority matters requiring attention.

Informal Team Communication

Discussions occur informally between team members which may influence the care and plans for the PWS/family. Care must be taken to ensure that all relevant team members, and especially the PWS/family, are included or consulted if the information will affect them.

Informal discussions that result in decisions for the management of the PWS, or changes to previously agreed plans should be documented in the medical records, and the Key Worker informed.

Family Meetings

Formal Family Meetings 21, 24

Family meetings may be formal, involving multiple family members, the PWS and most of their treating team. Formal meetings are not always needed, but may be required at critical times for some PWS/families such as for complex discharge planning, where there is family disagreement, where PWS/family goals do not align with discharge options, some end-of-life decisions. These meetings are chaired (ideally by a team social worker), minuted (those present, decisions, goals/actions and concerns raised), and records are kept in the medical record. Copies of meeting records should not be provided to the PWS/and/or family. They should be encouraged to take their own notes.

The Key Worker role is important for family meetings. As the link for the PWS and family they can provide information about the option of having a family meeting, and provide information relevant to the outcomes of the family meeting (such as NSF literature).
Informal Family Meetings

Family meetings may also be informal and brief, face-to-face or by phone. This level of two-way communication should occur frequently between the PWS/family and members of the treating team, and especially the Key Worker for that PWS. Any outcomes from these communications that are relevant to patient care and planning or are significant decisions/information from these meetings should be documented in the medical records.

Goal setting

Goal setting should begin informally between acute stroke team members and the PWS/family as the assessments occur. Goal setting should be directed towards small goals to achieve within short timeframes or treatment sessions, as well as broader long-term goals such as discharge destination. PWS will vary in their ability to identify goals achievable within the acute setting, and may be assisted by using directed choices or a ‘goals menu’. Some goals will be shared across team members (such as discharge destination goal), whilst others may be more therapist/nurse specific.

Goals that affect multiple team members, and appropriate goal achievement strategies, are agreed by all parties and documented. This occurs within formal team meetings or at informal discussions between team members and the PWS/ family. PWS and family goals feed into the ART and are to be considered at all phases of discharge planning.

Resuscitation Planning

The Resuscitation Plan 7 Step Pathway provides a statewide best practice process for decision-making and clinical care planning for resuscitation and end-of-life care across SA Health. The Resuscitation Plan 7 Step Pathway supports safe and high quality resuscitation planning and end-of-life care that is patient centred and, wherever possible, is aligned with the values, needs and wishes of the individual. The seven steps are: Trigger (when and why); Assessment; Consultation; Document the clinical care plan; Transparency and communication; Implementation; and Support.

Discharge Planning

Discharge planning should follow the framework set out in the Stroke Rehabilitation Pathway (page 52). It is assumed that all PWS are assessed for rehabilitation using the ART (page 87), and are referred to either; inpatient rehabilitation, rehabilitation in the home, or outpatient rehabilitation as well as ongoing monitoring. The only exceptions are PWS who make a full recovery, are on a palliative care pathway, are unresponsive or who decline rehabilitation.

Rehabilitation in the Acute Setting

The domain assessments completed early in admission inform the ART. For each domain where rehabilitation is indicated, the rehabilitation process should start in the acute setting as soon as the PWS is medically safe and/or able to participate and is managed by the appropriate team therapist. Targeted rehabilitative therapy is structured to enable the PWS as much practice as possible, aiming for a total minimum of one hour total active practice per day at least 5 days/week. Practice opportunities will be facilitated by an inter-disciplinary approach, and may include assistance from family members where appropriate.

Rehabilitation therapies are aimed at skill retraining by facilitating neuroplasticity and/or teaching compensatory skills, and take into account the impacts of pre-existing and stroke-related deficits. To maximise recovery, consideration needs to be given to creating an enriching environment, to foster maximum engagement in the rehabilitation process with the PWS and to address salient functions as much as possible with maximum intensity.

Rehabilitation interventions will be individualised for the PWS. The aims of rehabilitation and strategies based on recommendations in the Guidelines include:
Dysphagia
Optimising safe swallow function. Speech pathologists should actively manage compensatory strategies such as positioning, modification of fluids/food. Active therapy should be considered including targeting specific muscle groups, thermo-tactile stimulation, and electro-stimulation (applied according to published parameters) by experienced clinicians.

Hydration and Nutrition
Dietitians should lead the team in facilitating the recovery of adequate self-managed intake, including provision of oral or enteral nutrition support, provision of altered consistency or other therapeutic diets, and education of the PWS and family regarding appropriate food choices to meet nutritional requirements. Consider environmental barriers to feeding that may impact on hydration and nutrition.

Continence
Nursing staff should actively manage bowel/bladder retraining. The PWS and family should be educated in self-management techniques/aides and strategies – especially important for those being discharged directly home.

Mobility
The team should use strategies to maximise the PWS’s activity levels and independence. For example PWS assisted to walk to the bathroom if appropriate rather than use pan/commode; sitting in an upright chair rather than reclined in ‘Cloudchairs’; prompted to move/roll in bed rather than be moved passively.

Physiotherapists should provide or oversee the active rehabilitation of balance (e.g. practice reaching in sitting, repetitive task-specific work in standing with feedback); transfers (practice and feedback for rolling, lie to sit, sit to stand, bed to chair etc); walking (repetitive practice of walking and/or components of walking, mechanically assisted gait, joint position feedback).

Mobility aides (including ankle-foot orthoses) should be provided early in admission according to individual needs.

Motor Functions Including Upper Limb Activity
Occupational therapists and physiotherapists should provide or oversee active rehabilitation of function through repetitive task-specific training, strengthening (progressive resistance exercises, electrical stimulation, biofeedback), mirror therapy, bilateral training, mental practice, constraint-induced movement therapy.

ADLs Including Personal care, Extended ADLs, Eating & Drinking
Occupational therapists should provide and oversee the active rehabilitation of ADLs. The team should facilitate the PWS to maximise independence. Therapists and nurses should encourage the rehabilitation of ADLs through task-specific practice and training in the use of appropriate aides. Tailored interventions and strategies should be initiated for deficits such as confirmed limb apraxia or visual field loss.

Communication
Maximising communication skills and opportunities. Speech pathologists should provide or oversee targeted rehabilitation of aphasia (e.g. language interventions based on cognitive neuropsychological models, use of gesture, constraint-induced language therapy, supported conversation techniques, computer delivery of therapy); dyspraxia of speech (e.g. targeted articulatory placement/transitioning/rate/rhythm, the use of cuing and feedback, PROMPT therapy); dysarthria (e.g. targeted strategies to improve clarity of speech). Training should be provided in augmentative or alternative communication modalities if necessary.
Vision

Recovery of functional vision or compensatory skills for visual field loss. Occupational therapists and physiotherapists should provide or oversee rehabilitation or compensatory training (e.g. task specific practice, computer based visual training, scanning techniques, prism glasses). 91, 92

Sensory Systems/ Perception/ Neglect

Recovering functional ability or the use of compensatory strategies. Occupational therapists and physiotherapists should provide or oversee individualised sensory-specific therapy for sensory loss, or training in compensatory techniques. Interventions for unilateral neglect such as cueing, sensory stimulation, scanning practice, prism glasses, mental imagery and feedback should be considered. 81, 93-95

Cognition

Recovering functional cognition or learning compensatory strategies. Therapy staff will lead the team in the provision of rehabilitation or compensatory strategies targeting arousal, attention, concentration, memory, executive functions. Compensatory techniques to reduce disability may include orientation boards, diaries, calendars, iPad apps. 57-59, 96

Emotional/ Psychological

The team should be alert to signs of emotional distress or depression and actively manage these through appropriate interventions to normalise mood and ease distress. Therapy should be tailored to increase motivation and engagement or participation in rehabilitation. 97-99

Burden of Care/ Carer Support

The team should consider carer needs as part of the ART, through liaison by the Key Worker, and at family meetings. Prior to discharge home, carers should be educated and trained in essential skills (e.g. communication strategies, physical handling techniques, safe swallowing, dietary modifications, management of behaviours, personal care). Carers should be referred to community support services as appropriate, and informed about stroke-specific and generic support networks that may be useful. 21

Palliative Care

More than 10% of PWS may die in the acute setting and thus best-practice palliative care practices must be incorporated into stroke team practices, consistent with the Standards for Providing Quality Palliative Care for All Australians.

All patients with severe stroke, or who are deteriorating, should have an accurate assessment of prognosis or need for palliative care. Decisions are led by a Medical Consultant and should involve discussions with the PWS/family or the family’s knowledge of the wishes of the PWS. Decisions for care should ideally involve other team members such as the SW, SP, DN (oral intake issues), to ensure holistic consideration and support for the PWS/family. Practical end-of-life issues should be discussed, such as the use of advance care directives, 7 step pathway and/or organ donation where appropriate. 100, 101

The PWS and family should have access to specialist palliative care teams as needed. Palliative care pathways suitable for stroke can be used to support the patient and family and improve care for people dying after stroke (e.g. The Stroke Palliative Approach Pathway, Victorian Department of Health).

The stroke team or Key Worker should ensure that the family have information/ contacts for bereavement follow-up.
Secondary Prevention

Lifestyle Modification

Every stroke patient will be assessed and informed of their risk factors for further stroke and possible strategies to modify identified risk factors. Individualised interventions should be delivered using behavioural techniques (educational or motivational counselling). Risk factors and interventions include:

a. Stopping smoking: nicotine replacement therapy, bupropion or nortriptyline therapy, nicotine receptor partial agonist therapy and/or behaviour therapy. 102-105
b. Improving diet: a diet low in fat (especially saturated fat) and sodium but high in fruit and vegetables e.g. the Mediterranean diet. 106-108
c. Increasing regular exercise. 109-110
d. Avoiding excessive alcohol (i.e. no more than two standard drinks per day). 111-112

Adherence to Pharmacotherapy

Interventions to promote adherence with medication regimes are often complex and should include combinations of the following: Reminders, self-monitoring, reinforcement, counselling, family therapy, telephone follow-up, supportive care and dose administrations aids, education in hospital and in the community. 113-115

Blood Pressure Lowering

All stroke and TIA patients, whether normotensive or hypertensive, should receive blood pressure lowering therapy, unless contraindicated by symptomatic hypotension. 116

New blood pressure lowering therapy should commence before discharge for those with stroke or TIA, or soon after TIA if the patient is not admitted. Caution should be taken for PWS who are at high risk of symptomatic hypotension e.g. the elderly. 117, 118

Antiplatelet Therapy

Long-term antiplatelet therapy should be prescribed to all people with ischaemic stroke or TIA who are not prescribed anticoagulation therapy. 119

Low-dose aspirin and modified release dipyridamole or clopidogrel alone should be prescribed to all people with ischaemic stroke or TIA, taking into consideration patient co-morbidities and PBS criteria. 120

Aspirin alone can be used, particularly in people who do not tolerate aspirin plus dipyridamole or clopidogrel. 119

Anticoagulation Therapy

Anticoagulation therapy for secondary prevention for people with ischaemic stroke or TIA from presumed arterial origin should NOT be routinely used. 121, 122, 123

Anticoagulation therapy for long-term secondary prevention should be used in people with ischaemic stroke or TIA who have atrial fibrillation or other cardioembolic stroke. 121, 122, 123

Anticoagulation should be delayed in patients with large infarctions (optimal delay is unclear), but should be commenced within 14 days. In patients with TIA, anticoagulation therapy should begin once CT or MRI has excluded intracranial haemorrhage as the cause of the current event.

For patients with non-valvular atrial fibrillation, current state formulary guidelines recommend apixaban 5mg twice daily in patients over 75, with dabigatran 150mg twice daily being optional for patients under 65 without myocardial ischaemia or history of GI bleeding. Warfarin and rivaroxaban may also be considered in certain circumstances.
Cholesterol Lowering

Therapy with a statin should be used for all patients with non-cardioembolic ischaemic stroke or TIA, and may be considered in cardioembolic stroke if there are no vascular comorbidities. Statins should NOT be used routinely for haemorrhagic stroke. 124, 125

Carotid Surgery 126-130

Carotid endarterectomy should be undertaken in patients with non-disabling carotid artery territory ischaemic stroke or TIA with ipsilateral carotid stenosis measured at 70-99% (NASCET criteria) only if it can be performed by a specialist surgeon with low rates (<6%) of peri-operative mortality/morbidity.

Carotid endarterectomy can be undertaken in highly selected ischaemic stroke or TIA patients (considering age, gender and co-morbidities) with symptomatic carotid stenosis of 50-69% (NASCET criteria) or asymptomatic carotid stenosis >60% (NASCET criteria) only if it can be performed by a specialist surgeon with very low rates (<3%) of peri-operative mortality/morbidity.

Eligible stable patients should undergo carotid endarterectomy as soon as possible after the stroke event, but not hyperacutely (i.e. between 2-14 days post-event).

Carotid endarterectomy should only be performed by a specialist surgeon in centres where outcomes of carotid surgery are routinely audited.

Carotid endarterectomy is NOT recommended for those with symptomatic stenosis <50% (NASCET criteria) or asymptomatic stenosis <60% (NASCET criteria).

Carotid stenting should NOT routinely be undertaken for patients with carotid stenosis, but can be considered in younger patients and in patients too medically unstable for carotid endarterectomy.

Diabetes Management

Patients with glucose intolerance or diabetes should be managed in line with national guidelines for diabetes.

Patent Foramen Ovale 131

All patients with ischaemic stroke or TIA, and a patent foramen ovale should receive antiplatelet therapy as first choice. Anticoagulation therapy can also be considered taking into account other risk factors and the increased risk of harm.

There is insufficient evidence to recommend patent foramen ovale closure, although this can be considered in patients where paradoxical embolism is clearly demonstrated (i.e. coexisting DVT/PE) or in patients with recurrent cryptogenic embolic strokes despite antiplatelet therapy.

Hormone Replacement Therapy

Following a stroke event, hormone replacement therapy should be stopped. The decision whether to start or continue hormone replacement therapy in patients with a history of previous stroke or TIA should be discussed with the individual patient and based on an overall assessment of risk and benefit. 132-134

Oral contraception

The decision whether to start or continue oral contraception in women of child-bearing age with a history of stroke should be discussed with the individual patient and based on an overall assessment of risk and benefit. Non-hormonal methods of contraception should be considered. 135-37
Discharge from Acute Care

Education for PWS and Family

Individually tailored information, education or training should be provided to the PWS/family as required, especially for those returning directly to home. This may be provided by the Key Worker or specific specialist team members. Hospital pharmacists should provide education on discharge medications. In addition to face-to-face education and training the provision of the following is recommended:

- a. My Stroke Care Plan pack as developed by the NSF, or other written information about any referrals or appointments that have been arranged for post-discharge.
- b. Information on fitness to drive for the PWS.
- c. Appropriate written information and leaflets developed by the NSF.
- d. A copy of the GP discharge summary.

Transition Information and Handover

A seamless transition from the acute setting to inpatient rehabilitation, residential care facilities or back to the community is facilitated by timely referrals and comprehensive discharge information (medical, nursing & allied health information). Every attempt should be made to avoid the duplication of assessments and tests already conducted in the acute setting.

Irrespective of the discharge destination, the relevant GP should receive a comprehensive handover summary within 48hrs of acute discharge which includes diagnoses, relevant test results, functional status on discharge, medications, referrals made and follow-ups arranged or required.

For PWS transferred to rehabilitation services or community support services, a discharge letter as above is provided to the rehabilitation/service providers along with the Assessment for Rehabilitation Tool. These providers may also receive information about advance care directive (if in place, including person who provides consent), and a further detailed summary of recently assessed functional abilities, assistance required, identified goals and other relevant information such as rehabilitation strategies used in the acute setting.
Stroke Rehabilitation Pathway

The Statewide Stroke Clinical Network Steering Committee appointed Associate Professor Susan Hillier to chair a workgroup to develop a stroke rehabilitation pathway, based on the National Stroke Foundation Guidelines, to enable consistent best practice stroke rehabilitation care across South Australia. The following pathways are the result of this work. The Stroke and Rehabilitation Clinical Networks recommends this pathway be incorporated into stroke rehabilitation care to provide good patient outcomes.

The Assessment for Rehabilitation Tool (ART) has been developed to assist in the decision making process and provides a place where the PWS needs only tell their story once. A medical record has been developed based on the ART and can be found at Appendix 15 (page 87).
<table>
<thead>
<tr>
<th>Comprehensive Stroke Unit</th>
<th>PWS receives acute stroke care, including rehabilitation from day one (Acute Stroke Care Protocol, page 36) until their acute phase is passed.</th>
</tr>
</thead>
</table>
| Yes, Rehabilitation for all stroke patients. | PWS assessed in the stroke unit to receive rehabilitation unless he/she meet the exception rules.  
The default is that all PWS should receive rehabilitation unless the exceptions apply. This is based on the literature that confirms there is evidence that all can benefit from rehabilitation and there is no evidence that particular groups do NOT benefit from rehabilitation.  
The decision for the model of care for rehabilitation is driven by  
- client preference and need, i.e. ability to function in their own versus an alternate environment, as well as  
- expert opinion and  
- best available evidence.  
The model provides flexibility and is inclusive. Decision making about where rehabilitation occurs is based on the ART. This requires analysis of where the identified needs are best met for the various domains. The evidence supports that early supported discharge home is preferable if possible.  
The ART becomes the rehabilitation plan and forms the basis for all subsequent reviews. |
| Home | The aim for discharge (transition) is for the PWS to return home either directly from the stroke unit as early supported discharge OR via an inpatient unit.  
Access to rehabilitation either at home or as a day/out patient is available to all patients as appropriate.  
Home may be a residential aged care facility and if there is no access to rehabilitation or resources there, then they may access other options as described. |
| Rehabilitation in the home | PWS receives (multi-disciplinary) rehabilitation in their home, with flexibility to be able to access day patient or out patient services in a hybrid model. This option is preferred based on the evidence. |
| Outpatient Day patient | PWS is able to attend (day) hospital or clinic rehabilitation services as a day patient or an out patient. Transport options are available should they be required. |
| Inpatient Sub-acute | The PWS is assessed as requiring inpatient care using the ART. The PWS is transferred to a specialist rehabilitation centre where they receive care and regular assessments with the view to going home |
| Exceptions to receiving rehabilitation | 1. Return to pre-morbid function: PWS has made a 'full' recovery in all aspects, such as functional (physical, communication etc), emotional/psychological and cognitive.  
2. Palliation: Death is imminent, refer to palliative care team.  
3. Coma and/or unresponsive, not simply drowsy.  
4. Declined rehabilitation.  
All exceptions feed into monitoring/surveillance and re-entry so they can receive rehabilitation should their circumstances change. |
**Monitoring, Surveillance and re-entry**

All PWS have the ability to re-access any rehabilitation services at any time during their ongoing recovery or long-term care. Overall aim is to promote/maintain the best level of function in all domains.

**Principles to drive processes**
- Focus on PWS and their supports
- Available and accessible
- Maintain relationship with expert team
- Link with NSF registry
- All information travels with PWS/family as well as maintained at the facility they attend. This includes discharge/transition summaries. This may also be held at web-based system in future.
- Self-referral is available (via central number for appointment with closest facility/team)

**Two functions of monitoring, surveillance and re-entry**
1. Monitor status/needs for change and update plan/pathway;
   - Improving → continue
   - Static – follow most appropriate path – continue or re-enter
   - Declining → re-enter pathway

**Two tiers of monitoring:**
1. Complex - requires access to all/part of MD team
2. Simple – single discipline review (e.g. GP)

*Process* is that review appointment is always scheduled at the completion of any stage in the pathway. The level of monitoring is also established as complex or simple at this time and the appointment made with the relevant staff. The staff then utilise the ART to evaluate across all domains and flag status/need.

**Special need flags:**
These flags are not exclusionary, but may indicate more intensive rehabilitation or referral to specialist areas, such as psychiatry or complex medical. Flags may be:
- Pre-morbid conditions
- Non-compliance
- Decreased pre-morbid function
- Decreased social support
- Incontinence (urinary and faecal)
- Decreased engagement
- Conversion disorders
- Decreased accommodation options
- Co-morbidities
- Apathy
Home and Inpatient Pathway

Yes, Rehabilitation

Inpatient Rehabilitation

Establish Team

Domain assessments

Goal setting

Management

Long-term management plan

Monitoring & Surveillance

Home Rehabilitation

Review cycle

Review cycle
| Yes, Rehabilitation for all stroke patients. | All patients from the stroke unit are referred to receive rehabilitation unless they meet the exception rules. The model of care for rehabilitation is driven by client preference and level of need, i.e. level of support/ability to function in their own environment. The model provides flexibility and is inclusive. Decision making about where rehabilitation occurs is based on the ART. |

| Establish team and key worker identified | Identifying the likely rehabilitation team. This includes the designation of a Key Worker as well as the possible/main disciplines as suggested by the needs analysis. The Key Worker model |
| | - allows for the family and PWS to have “one contact” for organisational or general inquiries or to direct their specific inquiries |
| | - facilitate all aspects of the rehabilitation plan, ensure meetings etc are scheduled and occur within the necessary timeframes and with the salient people/processes |
| | - remains a constant for the PWS and their family for the service duration |
| | - has credibility/experience in stroke rehabilitation and can confidently guide the PWS and family through the process/es |
| | - Key Worker roles spread across specialist team – alternate model may be one coordinator. |

| Domain Assessment | This is performed by the identified personnel and will build on the initial needs analysis in the relevant domains. Every effort will be made to avoid duplication – this will require team communication and planning so that information required across personnel is only gathered once (e.g. demographics, FIM, stroke severity, home situation etc). It is anticipated that each discipline/personnel will also have specific assessments to inform the management plan/s. |

| Goal Setting | This process begins informally between the individual team members and the PWS/family as the assessment occurs. It may be facilitated by the PWS being given a “goals menu” to consider. Goals are documented and agreed to by all parties in a scheduled meeting between the PWS/family and the relevant team members. The emphasis will be on client-centred goals. Various models may be used including Goal Attainment Scaling; SMART goals etc. |

<p>| Management | Based on the best available evidence and wherever possible following the NSF Clinical Guidelines for Stroke Management. Key features are: |
| | - Intensity – maximise engagement and opportunities for practice at all times – including weekends. |
| | - Carer training and education. |
| | Stroke team has at least one senior/experienced stroke clinician for each core discipline (medical, nursing and each AH). These lead clinicians can mentor younger/less experienced team members. |
| | - Access to specialty clinical areas for screening/ support/ intervention including: psychology; neuropsychology, dental, dietary/nutrition and neuro-ophthalmology. |</p>
<table>
<thead>
<tr>
<th>Management continued</th>
<th>Access to complex interventions/management: spasticity management (BOTOX, splinting/casting); Driving clinic; Vocational rehabilitation; sexuality issues.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enabling environment - quiet rooms; physically accessible, appropriate communication strategies (taking into account cultural factors, language skills and literacy levels); assistive technology.</td>
</tr>
<tr>
<td></td>
<td>Rehabilitation is task specific – functionally orientated with opportunities for practice and feedback.</td>
</tr>
<tr>
<td></td>
<td>Participate in Australasian Rehabilitation Outcomes Centre (AROC) benchmarking, NSF auditing for accountability.</td>
</tr>
<tr>
<td></td>
<td>Encourage and promote research – both initiating and participating in research that furthers stroke rehabilitation.</td>
</tr>
<tr>
<td></td>
<td>Establish network (requisite skills and knowledge) to enable long term planning / lifestyle approach.</td>
</tr>
<tr>
<td></td>
<td>Secondary prevention is on going – medical management as well as lifestyle approach with self-management.</td>
</tr>
<tr>
<td>Review Cycle</td>
<td>This is an ongoing cycle of review that occurs informally between the individual team members and the PWS, and occurs formally at case conferences between team members and at family meetings. Goals are reviewed and amended and if a transition point (e.g. discharge home) is imminent this is also planned for and action plans will result.</td>
</tr>
<tr>
<td>Monitoring, Surveillance and re-entry</td>
<td>All PWS have ability to re-access any rehabilitation services at any time during their ongoing recovery or long term care. See above for details.</td>
</tr>
<tr>
<td>Long term management plan</td>
<td>Involves various other agencies – community integration focus includes self-management. Refer to relevant working group within Australian Stroke Coalition.</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>Still allows for rehabilitation monitoring/re-entry.</td>
</tr>
</tbody>
</table>
References


43. Godecke E. Efficacy of aphasia therapy in the acute setting. Perth: Curtin University of Technology; 2009.


Appendix 1: NIH Stroke Scale

Date and time of NIHSS: ___ / ___ / _____ (mm/dd/yyyy)  ___ : ___ (hh:mm, 24 hr clock)

Administer stroke scale items in the order listed. Record performance in each category after each subscale exam. Do not go back and change scores. Follow directions provided for each exam technique. Scores should reflect what the patient does, not what the clinician thinks the patient can do. The clinician should record answers while administering the exam and work quickly. Except where indicated, the patient should not be coached (i.e., repeated requests to patient to make a special effort).

<table>
<thead>
<tr>
<th>Instructions</th>
<th>Scale Definition</th>
<th>Score</th>
</tr>
</thead>
</table>
| 1a. Level of Consciousness: The investigator must choose a response if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation. | 0 = Alert; keenly responsive.  
1 = Not alert; but arousable by minor stimulation to obey, answer, or respond.  
2 = Not alert; requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped).  
3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, and flexic. | ____ |
| 1b. LOC Questions: The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier, or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be graded and that the examiner not “help” the patient with verbal or non-verbal cues. | 0 = Answers both questions correctly.  
1 = Answers one question correctly.  
2 = Answers neither question correctly. | ____ |
| 1c. LOC Commands: The patient is asked to open and close the eyes and then to grip and release the non-paretic hand. Substitute another one step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to command, the task should be demonstrated to him or her (pantomime), and the result scored (i.e., follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored. | 0 = Performs both tasks correctly.  
1 = Performs one task correctly.  
2 = Performs neither task correctly. | ____ |
| 2. Best Gaze: Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored, but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be 1. If a patient has an isolated peripheral nerve paresis (CN III, IV or VI), score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness, or other disorder of visual acuity or fields should be tested with reflexive movements, and a choice made by the investigator. Establishing eye contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy. | 0 = Normal.  
1 = Partial gaze palsy; gaze is abnormal in one or both eyes, but forced deviation or total gaze paresis is not present.  
2 = Forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver. | ____ |
| 3. Visual: Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat, as appropriate. Patients may be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrantopia, is found. If patient is blind from any cause, score 3. Double simultaneous stimulation is performed at this point. If there is extinction, patient receives a 1, and the results are used to respond to item 11. | 0 = No visual loss.  
1 = Partial hemianopia.  
2 = Complete hemianopia.  
3 = Bilateral hemianopia (blind including cortical blindness). | ____ |
### Instructions

<table>
<thead>
<tr>
<th>Scale Definition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal symmetric movements.</td>
<td>0</td>
</tr>
<tr>
<td>Minor paralysis (flattened nasolabial fold, asymmetry on smiling).</td>
<td>1</td>
</tr>
<tr>
<td>Partial paralysis (total or near-total paralysis of lower face).</td>
<td>2</td>
</tr>
<tr>
<td>Complete paralysis of one or both sides (absence of facial movement in the upper and lower face).</td>
<td>3</td>
</tr>
</tbody>
</table>

#### 4. Facial Palsy
- Ask – or use pantomime to encourage – the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barriers obscure the face, these should be removed to the extent possible.

- **0** = Normal symmetric movements.
- **1** = Minor paralysis (flattened nasolabial fold, asymmetry on smiling).
- **2** = Partial paralysis (total or near-total paralysis of lower face).
- **3** = Complete paralysis of one or both sides (absence of facial movement in the upper and lower face).

#### 5. Motor Arm
- The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine). Drift is scored if the arm falls before 10 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.

- **0** = No drift; limb holds 90 (or 45) degrees for full 10 seconds.
- **1** = Drift; limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support.
- **2** = Some effort against gravity; limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity.
- **3** = No effort against gravity; limb falls.
- **4** = No movement.
- **UN** = Amputation or joint fusion, explain: __________________

  - a. Left Arm
  - b. Right Arm

#### 6. Motor Leg
- The limb is placed in the appropriate position: hold the leg at 30 degrees (always tested supine). Drift is scored if the leg falls before 5 seconds. The aphasic patient is encouraged using urgency in the voice and pantomime, but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic leg. Only in the case of amputation or joint fusion at the hip, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice.

- **0** = No drift; leg holds 30-degree position for full 5 seconds.
- **1** = Drift; leg falls by the end of the 5-second period but does not hit bed.
- **2** = Some effort against gravity; leg falls to bed by 5 seconds, but has some effort against gravity.
- **3** = No effort against gravity; leg falls to bed immediately.
- **4** = No movement.
- **UN** = Amputation or joint fusion, explain: __________________

  - a. Left Leg
  - b. Right Leg

#### 7. Limb Ataxia
- This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, ensure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion, the examiner should record the score as untestable (UN), and clearly write the explanation for this choice. In case of blindness, test by having the patient touch nose from extended arm position.

- **0** = Absent.
- **1** = Present in one limb.
- **2** = Present in two limbs.
- **UN** = Amputation or joint fusion, explain: __________________

  - a. Left Leg
  - b. Right Leg

#### 8. Sensory
- Sensation or grimace to pinprick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas (arms [not hands], legs, trunk, face) as needed to accurately check for hemisensory loss. A score of 2, “severe or total sensory loss,” should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will, therefore, probably score 1 or 0. The patient with brainstem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic, score 2. Patients in a coma (item 1a=3) are automatically given a 2 on this item.

- **0** = Normal; no sensory loss.
- **1** = Mild-to-moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware of being touched.
- **2** = Severe to total sensory loss; patient is not aware of being touched in the face, arm, and leg.
### Instructions

9. **Best Language:** A great deal of information about comprehension will be obtained during the preceding sections of the examination. For this scale item, the patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet and to read from the attached list of sentences. Comprehension is judged from responses here, as well as to all of the commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in a coma (item 1a=3) will automatically score 3 on this item. The examiner must choose a score for the patient with stupor or limited cooperation, but a score of 3 should be used only if the patient is mute and follows no one-step commands.

<table>
<thead>
<tr>
<th>Scale Definition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = No aphasia; normal.</td>
<td></td>
</tr>
<tr>
<td>1 = Mild-to-moderate aphasia; some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided materials difficult or impossible. For example, in conversation about provided materials, examiner can identify picture or naming card content from patient's response.</td>
<td></td>
</tr>
<tr>
<td>2 = Severe aphasia; all communication is through fragmentary expression; great need for inference, questioning, and guessing by the listener. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient's response.</td>
<td></td>
</tr>
<tr>
<td>3 = Mute, global aphasia; no usable speech or auditory comprehension.</td>
<td></td>
</tr>
</tbody>
</table>

10. **Dysarthria:** If patient is thought to be normal, an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barriers to producing speech, the examiner should record the score as untestable (UN), and clearly write an explanation for this choice. Do not tell the patient why he or she is being tested.

<table>
<thead>
<tr>
<th>Scale Definition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Normal.</td>
<td></td>
</tr>
<tr>
<td>1 = Mild-to-moderate dysarthria; patient slurs at least some words and, at worst, can be understood with some difficulty.</td>
<td></td>
</tr>
<tr>
<td>2 = Severe dysarthria; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric.</td>
<td></td>
</tr>
<tr>
<td>UN = Intubated or other physical barrier, explain:</td>
<td></td>
</tr>
</tbody>
</table>

11. **Extinction and Inattention (formerly Neglect):** Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.

<table>
<thead>
<tr>
<th>Scale Definition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = No abnormality.</td>
<td></td>
</tr>
<tr>
<td>1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities.</td>
<td></td>
</tr>
<tr>
<td>2 = Profound hemi-inattention or extinction to more than one modality; does not recognize own hand or orients to only one side of space.</td>
<td></td>
</tr>
</tbody>
</table>

### Total NIHSS:
## Appendix 2: Modified NIH Stroke Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>Item Name</th>
<th>Scoring Guide</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b</td>
<td>LOC Questions</td>
<td>0 = Answers both correctly. 1 = Answers one correctly. 2 = Answers neither correctly.</td>
<td></td>
</tr>
<tr>
<td>1c</td>
<td>LOC Commands</td>
<td>0 = Performs both tasks correctly. 1 = Performs one task correctly. 2 = Performs neither task.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Gaze</td>
<td>0 = Normal. 1 = Partial gaze palsy. 2 = Total gaze palsy.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Visual Fields</td>
<td>0 = No visual loss. 1 = Partial hemianopia. 2 = Complete hemianopia. 3 = Bilateral hemianopia.</td>
<td></td>
</tr>
<tr>
<td>5a</td>
<td>Left Arm Motor</td>
<td>0 = No drift 1 = Drift before 10 seconds 2 = Falls before 10 seconds 3 = No effort against gravity 4 = No movement UN = Amputation or joint fusion, explain:</td>
<td></td>
</tr>
<tr>
<td>5b</td>
<td>Right Arm Motor</td>
<td>0 = No drift 1 = Drift before 10 seconds 2 = Falls before 10 seconds 3 = No effort against gravity 4 = No movement UN = Amputation or joint fusion, explain:</td>
<td></td>
</tr>
<tr>
<td>6a</td>
<td>Left Leg Motor</td>
<td>0 = No drift 1 = Drift before 5 seconds 2 = Falls before 5 seconds 3 = No effort against gravity 4 = No movement UN = Amputation or joint fusion, explain:</td>
<td></td>
</tr>
<tr>
<td>6b</td>
<td>Right Leg Motor</td>
<td>0 = No drift 1 = Drift before 5 seconds 2 = Falls before 5 seconds 3 = No effort against gravity 4 = No movement UN = Amputation or joint fusion, explain:</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sensory</td>
<td>0 = Normal 1 = Abnormal</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Language</td>
<td>0 = Normal 1 = Mild aphasia 2 = Severe aphasia 3 = Mute or global aphasia</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Neglect</td>
<td>0 = Normal 1 = Mild 2 = Severe</td>
<td></td>
</tr>
</tbody>
</table>


Total Score (out of 31)
STROKE

1. PRINCIPLE

Rapid early assessment and intervention in cases of stroke are associated with significant improvement in patient outcome, especially if managed in a comprehensive stroke unit (CSU).

The ROSIER scale (recognition of stroke in the emergency room) is the preferred stroke recognition/assessment tool of the SA state-wide stroke clinical network and should be used in addition to a thorough history and clinical assessment to identify stroke and eligibility for thrombolysis.

Transport directly to a facility with a CSU or stroke thrombolysis service (STS) should be considered for all eligible patients experiencing stroke symptoms that are within 60 minutes travel time.

2. GUIDELINE

- Basic care including a ROSIER assessment & blood glucose level
- If stroke is clinically suspected and;
  - onset of symptoms >4hrs, OR
  - ROSIER Score is negative, OR
  - The patient has diminished pre-morbid independent living
    then the patient is NOT considered eligible for thrombolysis. Consider transport to closest comprehensive stroke unit, or, if this would create an excessive travel time, to the closest hospital.

- If stroke is clinically suspected and;
  - ROSIER score is positive i.e. ≥1, AND
  - The patient had a pre-morbid level of independent functioning, AND
  - Arrival at a CSU/STS will be within 4 hours of onset of symptoms, AND
  - Travel time to the closest CSU/STS is less than 60mins
    transport patient directly to the closest hospital with a CSU/STS for consideration for thrombolysis (consider the use of emergency driving procedures if required);

- If transporting a patient to a CSU/STS that is eligible for thrombolysis:
  - Ensure the correct identity of the patient and obtain telephone contact details of the patients medical guardian, close relative, or carer
  - Notify the CSU/STS stroke coordinator via mobile phone using the mnemonic ISBAR including confirmation of the above criteria and ETA.
Call 1300 365 211
- If the phone number is not answered, request notification of the stroke coordinator via GRN to the receiving hospital Emergency Department
- During transport, consider the following, provided that it does not delay transport time:
  - Preferably at least 18G IV access in each arm
  - Acquire a 12 lead ECG

The four metropolitan CSU destinations are:
- Flinders Medical Centre
- Lyell McEwin Health Service (limited STS service: Mon-Sat 0830 – 1630)
- Queen Elizabeth Hospital
- Royal Adelaide Hospital

The three country hospitals with STS are:
- Mount Gambier Hospital (0830 – 1630)
- Whyalla Hospital (0830 – 1630)
- Riverland General Hospital - Berri (0830 – 1630)

3. REFERENCES/ASSOCIATED DOCUMENTS
Australian Resuscitation Council, Guideline 9.2.2 Stroke, December 2007 (accessed 2013)

4. VERSION CONTROL

<table>
<thead>
<tr>
<th>Version</th>
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<th>Description</th>
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<td>1.0</td>
<td>00701</td>
<td>Endorsed and approved document</td>
<td>R Elliott</td>
</tr>
<tr>
<td>2.0</td>
<td></td>
<td>Endorsed and approved document</td>
<td>R Lansen</td>
</tr>
<tr>
<td>3.0</td>
<td>110039</td>
<td>Structural changes and additions to CSU facilities</td>
<td>Paramedic Clinical Advisory Committee</td>
</tr>
<tr>
<td>4.0</td>
<td>030914</td>
<td>Changes to formatting to match ICP guidelines and include country stroke thrombolysis services</td>
<td>R Elliott</td>
</tr>
</tbody>
</table>

The controlled and most up-to-date version of this document is available on SAASNet
ROSIER Stroke Assessment Scale

This tool is to be used as part of a thorough stroke clinical assessment - all information must be included in a code stroke notification.

Assessment Date ________ Time ________
Symptom onset Date ________ Time ________

GCS E [ ] V [ ] M [ ] BP [ ] BGL [ ]

Has there been loss of consciousness or syncope? [ ] Yes (-1) [ ] No (0)
Has there been seizure activity? [ ]

Is there a NEW ACUTE onset (on or awakening from sleep):
Asymmetric facial weakness [ ]
Asymmetric arm weakness [ ]
Asymmetric leg weakness [ ]
Speech disturbance [ ]
Visual field defect [ ]

Total ROSIER Score (2 to +2)

Pre-morbid independence? [ ] Yes [ ] No

Witness / family contact phone no: ________________________________

All information above must be recorded on the PCR.

Stroke Paramedic

Version 3.0

Page 3 of 3

The controlled and most up-to-date version of this document is available on SAASNet

Document No: CPG-018
Effective Date: 02-Oct-2014
Next Review Date: Oct-2016

Approval Authority: Acting General Manager Clinical Effectiveness & Patient Safety

Page 71 of 94
Appendix 4: Consensus Guidelines for Acute Stroke Multimodal Imaging

September 2012

The neuro-imaging working subgroup met as part of the acute working group to come to a recommended consensus of the use of imaging in acute stroke in particular its use in acute reperfusion therapies. Literature on multi-modal imaging was presented to the entire group and the following consensus reached. It was felt that because of the strength of the evidence and the unanimous agreement of the group with representatives from all 3 regions as well as all craft groups including stroke neurologists/physicians, radiologists, interventional neuro-radiologists and radiographers involved in acute stroke care that these recommendations should be universal across the state.

Consensus Statements

1. Multimodal CT and MR imaging may be used to identify ischemic but potentially viable brain tissue and thus guide acute therapy.

2. Any imaging in acute stroke must achieve the following outcomes: a) make a diagnosis of ischemic vs hemorrhagic stroke; b) exclude hemorrhage; c) identify thrombus that can be targeted for therapy; d) identify infarcted tissue and e) identify penumbra that can be salvaged.

3. Following a review of the literature concerning plain CT, CT combined with CTA and CT perfusion, and MRI brain with MRA, gradient echo sequences and MR perfusion the following table was endorsed:

<table>
<thead>
<tr>
<th></th>
<th>Plain Non Contrast CT Brain</th>
<th>MRI, MRA, gradient echo, perfusion</th>
<th>Plain CT, CT perfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dx of ischemia (&lt; 4.5 hours)</td>
<td>-</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Exclude hemorrhage</td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Identify a thrombus</td>
<td>+/- (hyperdense sign)</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Define a volume of infarct core</td>
<td>-</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Demonstrate a penumbra of viable tissue</td>
<td>-</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Time taken</td>
<td>1-2 mins</td>
<td>20 mins</td>
<td>10 mins</td>
</tr>
</tbody>
</table>

Key: (-) indicates the imaging modality cannot define this parameter. (+) indicates that the modality can define the parameter and the number of "+" indicates the relative weighting of the imaging modality in accurately defining the parameter.

4. Based on the above and also on the availability of equipment and personnel in each of the 3 comprehensive stroke centres it was recommended that in all cases of stroke where reperfusion therapy was considered that plain CT brain followed by CT perfusion and CTA of the neck and
circle of Willis provided there were no medical contra-indications or did not unduly delay the deployment of systemic thrombolytic.

5. It was felt that the benefit that multimodal imaging conveyed in terms of information that would aid clinical decision making for the stroke consultant far outweighed the potential detrimental effects of the excess radiation. Similarly the 10 minute excess in scanning time as compared to plain CT brain was acceptable provided that an acceptable door to needle time was reached. The current American Academy of Neurology endorsed door to needle time for the administration of thrombolytic is 60 minutes, with a door to radiology report time of 45 minutes.

6. Given the variation in CT equipment and software present in each Comprehensive Stroke Unit Hospital it was felt inappropriate to mandate a single CT perfusion technique. Similarly, the optimal definition of the infarct core and penumbra is still being refined; various definitions exist, without any being clearly superior. The working group were thus happy to allow individual stroke unit directors and neuro-radiologists at each centre to define their own protocols, provided they are evidence based. An example of an evidence based definition of core would be 2 mL per 100 g of CBV and that of penumbra would be a MTT delay of > 145% compared to the asymptomatic side.
Appendix 5: Information Sheet: Clot Busting Medication for Acute Ischaemic Stroke

*What is acute ischaemic stroke?*

This type of stroke is caused by a clot in an artery (blood vessel) which has stopped the blood, oxygen and nutrients reaching the brain tissue. If it is left untreated, you may suffer lasting damage that may lead to a permanent disability.

In order to try and prevent lasting brain damage your consultant will consider whether it is safe to give you a powerful clot busting drug called Alteplase. This drug treatment can only be given in the first few hours from the first signs your stroke. The sooner the drug is given the better the outcome.

*Brain Scans and contrast*

A brain scan, called a CT, helps the doctors know which type of stroke you have had. A special sequence of CT scans is done very quickly; this provides lots of information about your brain and the blood vessels. It can often show if there is a blockage (or more rarely a bleed) in your brain. In order to see the blood vessels in your brain in great detail, a special contrast fluid will be injected into a small needle in your arm. This can cause a hot feeling, and you may feel the need to urinate. These feelings do not last very long. In very rare cases people may have an allergic reaction to the contrast fluid.

*Making sure that Alteplase the clot busting drug is the right drug for you.*

The drug can only be given if very strict guidelines are followed.¹ For example the drug cannot be given to anyone with a bleed in their brain, or if they have had recent surgery or injury. It cannot be given to people who are on warfarin or other special blood thinning medications, or to anyone who has blood clotting disorders or bleeding from their stomach, intestines, kidneys or bladder. Other exclusions will also checked by the Doctors.

*About Alteplase, the clot busting drug*

Alteplase (or, by its brand name, Actilyse) is a type of drug called a thrombolytic, which works by rapidly dissolving the clot which has lodged in the blood vessel in your brain.

Once the clot has been dissolved, blood flow returns to normal. The amount of drug you are given depends on your body weight. It is given over 60 minutes into a small plastic needle in your arm, and must be given within a short time of the first signs of your stroke symptoms.
While the drug is being given, and for 24 hours afterwards, you will be closely observed to check how your arms, legs, speech and brain are working. Your blood pressure and other general checks will be also done very frequently to check how you are.

Risks and Consent for Treatment

Many trials have been undertaken around the world using this medication, which show that it significantly improves the chance of making a good recovery. However, it is important to understand the risks associated with this clot busting treatment. The Doctor or nurse will explain this risk to you, and obtain your verbal or written consent.

The main risk associated with Alteplase is bleeding. This can range from minor bleeding from a cut or scratch which can be easily controlled to much more serious bleeding into your brain or in to any other organ. The risk of a very serious bleed into the brain is about 1.7%. A small number (2-5%) of people experience a serious allergic reaction to the medication. All of these serious complications can be fatal.

In Australia this drug is licensed to be given within 3 hours. However, a large European Study has shown that this time window has been extended to 4.5 hours. The consultant may decide that it is appropriate for you to receive the drug within this extended window.

In some cases the drug is unable to dissolve the clot so the damage in the brain continues to occur. If this occurs your consultant will decide whether any further emergency treatments are suitable.

Any questions?

Please ask your Doctor or Nurse if you require any further information.

References

Appendix 6: Information Sheet: Mechanical Clot Retrieval in Acute Ischaemic Stroke

What is acute ischaemic stroke?

This type of stroke is caused by a clot in an artery (blood vessel) which has stopped the blood, oxygen and nutrients reaching the brain tissue. If it is left untreated, you may suffer lasting damage that may lead to a permanent disability.

In order to try and prevent lasting brain damage your consultant will decide what the best treatment options are. The sooner a treatment is started the better the outcome.

Brain Scans and contrast

A brain scan, called a CT, helps the doctors know the type of stroke you have had. A special sequence of CT scans is done very quickly; this provides lots of information about your brain and the blood vessels. It can show if there is a blockage (or more rarely a bleed) in your brain. In order to see the blood vessels in great detail, a special contrast fluid will be injected into a small needle in your arm. This can cause a hot feeling, and you may feel the need to urinate. These feelings do not last very long. In very rare cases some people may have an allergic reaction to the contrast fluid.

Mechanical clot extraction.

If possible, clot busting ("thrombolysis") medication is injected into a vein. However, in some cases this does not restore the flow of blood. In other cases, it is not possible to use this treatment as the time window of 4½ hours has passed. If the threatened stroke is severe or life-threatening mechanical extraction of the clot may be used.

What does the procedure involve?

The procedure is performed under sedation or a general anaesthetic that is given by an anaesthetist. Once you are asleep or sedated the radiology consultant places a catheter (a fine plastic tube) into the femoral artery (a major blood vessel in your groin). Using specialised x-ray and equipment the radiologist guides the catheter through a series of blood vessels to where the thrombus (clot) has lodged in your brain. Once at the affected site the device is used to retrieve the thrombus (clot) allowing the return of blood supply to your brain tissue. A blood thinning medication called Heparin may be injected into your blood supply to reduce the risks of further clots forming and travelling during the procedure.
After the procedure

Another CT Scan of your brain will be done to check that the blood supply has been returned to the brain tissue. You will be transferred to either the ward or the High Dependency Unit for very close monitoring of your condition over the next 24-48 hours.

Sometimes a device called a sheath is left in place to help prevent bleeding from the small hole that has been made in the artery in your groin. The sheath will be removed by a nurse on the ward in the next 24 hours.

It is essential that you do not move the leg where the sheath is, as movement may cause damage to the artery or dislodge the sheath, which may cause you to bleed.

What are the risks?

Both the intra-arterial procedure and the retrieval system have a complication rate of 5-10%. These complications may be life threatening, and include:

- Bleeding into the brain. This usually occurs within the first 24 hours
- Bleeding in other areas of the body, most frequently at the groin catheter site.
- Perforation or puncturing of the blood vessel
- Tearing and bruising of the blood vessel
- Part of the original clot may break off and travel further along the artery
- Damage to other blood vessel which supply blood around your body

Potential Benefits

This is an unproven treatment, however indirect evidence suggests in your case that treatment may be more beneficial than harmful,

Consent and further information

The Doctors caring for you and undertaking the procedure will obtain your written or verbal consent, and will speak to a family member or guardian if possible. If you have any questions or require further information please ask the Doctor or Nurse.
### ASSIST: Acute screening of swallow in stroke/TIA

**Print name and profession:** ______________________________

**Signature:** ____________________________________________

MRN No. __________________________________________________

Name: ____________________________________________________

Address: __________________________________________________

Date of birth: ____________________ Sex: ____________________

Please fill in if the patient label is unavailable

**Date:** ___ / ___ / ___ **Time of screen:** ___:___ (Please use 24-hour clock)

1. Is the patient able to:
   - Maintain alertness for at least 20 minutes? [ ] Yes [ ] No
   - Maintain posture/positioning in upright sitting? [ ] Yes [ ] No
   - Hold head erect? [ ] Yes [ ] No

   **STOP HERE** if you answered NO to ANY part of Q1. Place patient nil by mouth (NBM) and review when all of the parameters in section 1 are answered YES. Consider alternative means for nutrition, hydration and medication in consultation with the treating medical team and dietitian.

2. Does the patient have any of these?
   - Suspected brainstem stroke [ ] Yes [ ] No
   - Pre-existing swallowing difficulty [ ] Yes [ ] No
   - Facial weakness/droop [ ] Yes [ ] No
   - Slurred/absent speech [ ] Yes [ ] No
   - Coughing on saliva [ ] Yes [ ] No
   - Drooling [ ] Yes [ ] No
   - Hoarse/absent voice [ ] Yes [ ] No
   - Weak/absent cough [ ] Yes [ ] No
   - Shortness of breath [ ] Yes [ ] No

   **STOP HERE** if you answered YES to ANY part of Q2. Place patient NBM and refer to speech pathology. Please refer to follow-up plan over page.

3. Test the patient with a sip (10 mL)* of water and observe:
   - Any coughing/throat clearing [ ] Yes [ ] No
   - Change in vocal quality [ ] Yes [ ] No
   - Drooling [ ] Yes [ ] No
   - Change in respiration/shortness of breath [ ] Yes [ ] No

   **STOP HERE** if you answered YES to ANY part of Q3. Place patient NBM and refer to speech pathology. Please refer to follow-up plan over page.

4. Observe the patient drink a cup of water:
   - Any coughing/throat clearing [ ] Yes [ ] No
   - Change in vocal quality [ ] Yes [ ] No
   - Drooling [ ] Yes [ ] No
   - Change in respiration/shortness of breath [ ] Yes [ ] No

   **STOP HERE** if you answered YES to ANY part of Q4. Place patient NBM and refer to speech pathology. Please refer to follow-up plan over page.

5. Commence personified oral diet
   - Nursing staff to observe patient with first meal
   - Staff member reviewing first meal: ___________________________ Time: ___ : ___ Date: ___ / ___ / ___

   A spike in temperature and/or deterioration in chest condition may indicate silent aspiration. Place patient NBM and refer to speech pathology.

© Managers of Gosford Hospital Speech Pathology Services in NSW Health – Dysphagia Framework

*VESP modifications to the original ASSIST tool
## Bristol Stool Chart

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Separate hard lumps, like nuts (hard to pass)</td>
</tr>
<tr>
<td>2</td>
<td>Sausage-shaped but lumpy</td>
</tr>
<tr>
<td>3</td>
<td>Like a sausage but with cracks on its surface</td>
</tr>
<tr>
<td>4</td>
<td>Like a sausage or snake, smooth and soft</td>
</tr>
<tr>
<td>5</td>
<td>Soft blobs with clean-cut edges (passed easily)</td>
</tr>
<tr>
<td>6</td>
<td>Fluffy pieces with ragged edges, a mushy stool</td>
</tr>
<tr>
<td>7</td>
<td>Watery, no solid pieces. Entirely Liquid</td>
</tr>
</tbody>
</table>
# Appendix 9: Gugging Swallowing Screen - GUSS

![GUSS (Gugging Swallowing Screen)](image)

## 1. Preliminary Investigation / Indirect Swallowing Test

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VIGILANCE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(The patient must be alert for at least 15 minutes)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>COUGH and/or THROAT CLEARING</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Voluntary cough? Patient should cough or clear his or her throat below)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>SALIVA SWALLOW</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- SWALLOWING SUCCESSFUL</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>- Drooling</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>(Herausspucken von Speichel aus dem Mund)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- VOICE CHANGE</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>(hoarse, gurgly, coarse, weak, choking on own saliva)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SUM:** 5

*The Gugging Swallowing Screen. *Jahrbuehler 2003:202:2518 Michela Tregi, SLT, MS; Paul Enders, MD; MS; Monika Rovelli, MD; Yvonne Taschler, MD; Karl Hitzi, MD; Alexandra Ochsenhauer, PhD Michael Burki, MD*
Appendix 10: THE ‘MUST’ EXPLANATORY BOOKLET

A Guide to the ‘Malnutrition Universal Screening Tool’ (‘MUST’) for Adults

http://www.bapen.org.uk/pdfs/must/must_explan.pdf
FeSS Sugar Protocol

The QASC Sugar Protocol consists of monitoring the patient’s blood glucose levels for the first 72 hours following admission to the stroke unit, and the prompt treatment of a blood glucose level > 10mmol/L in the first 48 hours.

The QASC sugar protocol shown here has been modified slightly in response to feedback from participating sites, and to concord with the incoming Australian Diabetes Society Guidelines for routine glucose control in hospital.

This protocol was used in conjunction with the other FeSS protocols and the FeSS implementation strategies and not as a stand-alone protocol.

Developed for use in the Quality in Acute Stroke Care (QASC) Trial (www.acu.edu.au/QASC) and used with permission of Australian Catholic University. All rights reserved.
Formal venous glucose & HbA1c required on admission to hospital. If this was not done in the Emergency Department it should be done on admission to the Stroke Unit. If fingerprick BGL on admission to stroke unit >10, formal glucose should be repeated.

FeSS Sugar Protocol

Initial fingerprick Blood Glucose Level (BGL) on admission to stroke unit NB: all BGL readings given in mmol/L

All type 1 diabetes patients unable to swallow should follow the red box.

T=0 hr

BGL ≤10

Non-diabetic

Fasting & after meals fingerprick BGL testing. If not eating test BGL 6 hourly

Known Diabetes

Before & after meals & bedtime fingerprick BGL testing. Continue routine diabetes medication if eating. Cease usual diabetes medications if not eating and test BGL 4-6 hourly

Insulin/glucose infusion for first 48 hours, with hourly BGLs (reduce to q2h if stable for 4 hours). Suspend oral diabetic medications. Titrte insulin to maintain BGL 5-10 or as per local iteration algorithm.

T=48 hrs

No further treatment

Any BGL >10 in first 48 hrs go back to red boxes

Any BGL >10 in first 48 hrs go back to red boxes

T=72 hrs

Usual management

Not previously known to be diabetic

Seek Endocrinology team advice re further management

Developed for use in the Quality in Acute Stroke Care (QASC) trial (www.acu.edu.au/QASC) and used with permission of

Page 83 of 94
Appendix 12: Montreal Cognitive Assessment (MOCA)

**Montreal Cognitive Assessment (MOCA)**

**Version 7.1 Original Version**

**VISUOSPATIAL / EXECUTIVE**

[Diagram showing a tree-like structure with letters and numbers]

**NAME:** 

**Date of birth:** 

**Sex:** 

**Eyes:** 

**Date (CLOCK: Ten past eleven 11:10am):** 

**Contours:** 

**Numbers:** 

**Hands:** 

**/5**

**NAMING**

[Images of a rhinoceros and a camel with corresponding numbers]

**MEMORY**

Read list of words, subject must request them. Do 2 trials, even if still unsuccessful. Do a recall after 5 minutes.

**FACE**

**VELVET**

**CHURCH**

**DAISY**

**RED**

1st trial: [ ] ✔ [ ] [ ] [ ] [ ] [ ]

2nd trial: [ ] [ ] □ [ ] [ ] [ ]

**/3**

**ATTENTION**

Read list of digits in digital order. Subject has to repeat them in the forward order.

[Sequence: 1 2 3 4 5]

Subject has to repeat them in the backward order.

[Sequence: 5 4 3 2 1]

**SERIAL 7 SUBTRACTION starting at 100:**

[ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65

**/3**

**LANGUAGE**

Repeal: I only know that animals breathe to help today.

The cat always hide under the couch when dogs were in the room.

**/2**

**ABSTRACTION**

Similarity between e.g. banana - orange - fruit

[ ] 1 pt. - bicycle [ ] 2 pt. - watch [ ] ruler

**/2**

**DELAYED RECALL**

List banned words

**ORIENTATION**

[ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City

**/6**

**TOTAL** **/30**

© Z.Nosratinia MD www.mocatest.org  Normal ≥ 26.7/30

Administered by: ____________________________

Add 1 point if BDI ≥ 15.
## Appendix 13: Modified Rankin Scale (MRS)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No symptoms at all</td>
</tr>
<tr>
<td>1</td>
<td>No significant disability despite symptoms; able to carry out all usual duties and activities</td>
</tr>
<tr>
<td>2</td>
<td>Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance</td>
</tr>
<tr>
<td>3</td>
<td>Moderate disability; requires some help, but able to walk without assistance</td>
</tr>
<tr>
<td>4</td>
<td>Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance</td>
</tr>
<tr>
<td>5</td>
<td>Severe disability; bedridden, incontinent and requiring constant nursing care and attention</td>
</tr>
<tr>
<td>6</td>
<td>Dead</td>
</tr>
</tbody>
</table>

TOTAL (0–6): _____

### References


*Provided by the Internet Stroke Center — www.strokecenter.org*
# PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

**NAME:** __________________________  **DATE:** _________________

Over the last 2 weeks, how often have you been bothered by any of the following problems? (use "✓" to indicate your answer)

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Several days</th>
<th>More than half the days</th>
<th>Nearly every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Little interest or pleasure in doing things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. Feeling down, depressed, or hopeless</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. Trouble falling or staying asleep, or sleeping too much</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. Feeling tired or having little energy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5. Poor appetite or overeating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7. Trouble concentrating on things, such as reading the newspaper or watching television</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8. Moving or speaking so slowly that other people could have noticed, or the opposite—being so fidgety or restless that you have been moving around a lot more than usual</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9. Thoughts that you would be better off dead, or of hurting yourself</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

(add columns)  

**TOTAL:** 

(Healthcare professional: For interpretation of TOTAL, please refer to accompanying scoring card)

<table>
<thead>
<tr>
<th>10. If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?</th>
<th>Not difficult at all</th>
<th>Somewhat difficult</th>
<th>Very difficult</th>
<th>Extremely difficult</th>
</tr>
</thead>
</table>

Copyright © 1999 Pfizer Inc. All rights reserved. Reproduced with permission. PRIME-MD® is a trademark of Pfizer Inc. A2663B 10-04-2005
Appendix 16: Thrombolysis for acute ischaemic stroke in patients treated with dabigatran

Introduction

Oral anticoagulation reduces the risk of acute ischaemic stroke in patients with non-valvular atrial fibrillation (AF), but the risk is not entirely eliminated. Warfarin, for example, reduces the risk of ischaemic stroke by at least 65%, but the residual risk is estimated at 1.4 to 1.9% per year. Patients with AF taking oral anticoagulants might also experience an ischaemic stroke arising from other risk factors, especially atherosclerotic cerebrovascular disease.

Timely thrombolysis with recombinant tissue plasminogen activator (r-tPA) is an effective treatment for acute ischaemic stroke, increasing survival free of dependency. If patients are fully anticoagulated, by any medication, then thrombolysis is contraindicated. However, thrombolysis may be considered in some circumstances if the level of anticoagulation is subtherapeutic.

Although there is growing evidence on the use of thrombolysis for acute ischaemic stroke in patients treated with warfarin and discussion in clinical guidelines on the use of r-tPA in patients treated with warfarin, there is limited experience with thrombolysis in patients who have taken novel oral anticoagulants (NOACs) including dabigatran, rivaroxaban or apixaban.

This document provides information for clinicians considering thrombolysis in patients with acute ischaemic stroke who have been treated with dabigatran, and was developed by an expert working group with support from an unrestricted educational grant by Boehringer Ingelheim. Please check for updates after January 2014.

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Neurologist, The Prince Charles Hospital
Senior Lecturer, University of Queensland
Dabigatran

The direct thrombin inhibitor dabigatran at a dose of 150 mg twice daily is superior to warfarin in preventing strokes in patients with AF and is associated with a similar rate of major haemorrhage. A dose of 110 mg twice daily is non-inferior to warfarin in stroke prevention and has a significantly lower rate of any bleeding including major haemorrhage. The reduced dose of 110 mg twice daily is recommended in patients aged 75 and above, and may also be considered in patients with moderate renal impairment (as 80% of dabigatran excretion occurs through the kidneys) or a potentially higher risk of major bleeding.

In healthy volunteers, peak plasma concentrations of dabigatran are reached 0.5–2 hours after oral dosing. The anticoagulant effect commences within minutes of administration. When at steady state, dabigatran has a half-life of 13 to 17 hours in patients with normal renal function. The time to peak plasma concentrations and the half-life may be extended in patients with renal impairment.

Dabigatran is approved in Australia for the prevention of stroke and systemic embolism in patients with non-valvular atrial fibrillation (AF) and at least one additional risk factor for stroke. Dabigatran is also indicated for the prevention of venous thromboembolic events in adults who have undergone elective total hip or knee replacement.

More than 25,000 Australian patients were treated with dabigatran under a patient familiarisation program managed by the medication’s sponsor. The PBS listing of dabigatran in September 2013 for the prevention of stroke in patients with non-valvular AF is likely to markedly expand the number of people exposed to the medication.

Existing guidance

The approved Product Information for both dabigatran and rt-PA indicates that clinicians may “consider” concomitant treatment with dabigatran and thrombolysis for acute ischaemic stroke in some circumstances. The Product Information for Pradaxa (dabigatran) states:

- The concomitant use of PRADAXA with fibrinolytic treatments has not been studied and may increase the risk of bleeding. The use of fibrinolytic agents for the treatment of acute ischaemic stroke may be considered if the patient presents with a thrombin time (TT), or ecarin clotting time (ECT), or activated partial thromboplastin time (aPTT) not exceeding the upper limit of normal (ULN) according to the local reference range.

The Product Information for Actilyse (rt-PA) states:

- Patients receiving oral anticoagulant treatment: The use of ACTILYSE may be considered when appropriate test(s) of anticoagulant activity for the product(s) concerned show no clinically relevant activity.

Guidelines from the European Heart Rhythm Association discuss the treatment of patients presenting with an acute ischaemic stroke while taking dabigatran or other NOACs. They urge caution unless anticoagulant activity can reliably be excluded:

"Until there are reliable and sensitive rapid point-of-care tests for the individual NOAC, we would discourage the use of thrombolytics in situations with uncertainty about the anticoagulation status. Therefore, we believe that only in exceptional single cases in which reliable coagulation assessment is within the normal reference range, the use of fibrinolytic agents can be considered.

Similarly, a recent review of acute ischaemic stroke in patients receiving anti-platelet treatment advised that, in a patient who took dabigatran at least 12 hours ago and laboratory markers of anticoagulation were normal or only slightly raised, treatment with thrombolysis could be considered if established exclusion criteria for thrombolysis were ruled out. The severity of stroke symptoms, the vessel status and the perfusion deficit might be helpful in decision-making."
Clinical experience

Seven case reports have been published describing patients with ischemic stroke treated with thrombolysis while taking dabigatran. Nine Six patients experienced an improvement in their stroke symptoms. All had a normal or slightly elevated activated partial thromboplastin time (aPTT) — see below for more information on coagulation tests. Four had taken dabigatran 7 to 18 hours previously, but the time of dosing was unknown in the other two cases. One of the seven patients, who had a mildly elevated aPTT and took dabigatran 6 hours previously, experienced a fatal intracerebral hemorrhage after thrombolysis.

Coagulation assays for dabigatran

An advantage of NOACs is that, unlike warfarin, they do not require routine monitoring of coagulation. However, an assessment of exposure to the medications and their anticoagulant effect may be required in emergency situations including an apparent ischaemic stroke. In contrast to the international normalised ratio (INR) used to assess coagulation in patients treated with warfarin, the results of coagulation tests will depend on the timing of the last dose as there is a close correlation between the plasma dabigatran concentration and the degree of anticoagulant effect. Anticoagulant activity may still be increasing if the dose was taken only 1-2 hours before the blood sample was taken. In addition, renal impairment is likely to prolong the elimination half-life of dabigatran.

The interpretation of coagulation tests is not influenced by whether the patient has been taking 110 mg or 150 mg of dabigatran.

The role of coagulation tests in quantitatively and qualitatively assessing current dabigatran activity are summarised below:

- **Prethrombin time (PT/INR)**
  Dabigatran causes only a small prolongation of PT and the dose-response curve is relatively flat; PT, expressed as INR, is too insensitive to reliably detect the anticoagulant activity of dabigatran and is not useful as a monitoring tool. If the PT/INR is prolonged, the reason for this needs to be determined before thrombolysis is considered.

- **Thrombin clotting time (TT)**
  Dabigatran, a direct thrombin inhibitor, causes a substantial prolongation of TT. The dose response between dabigatran and TT is linear but the test is too sensitive to monitor the plasma concentration, as even a clinically insignificant concentration can prolong the TT two to three times. High concentrations of dabigatran may prolong TT to such an extent that it exceeds the maximum measurement time of coagulometers. A normal TT effectively excludes any dabigatran activity.

- **Diluted thrombin time (dTT)**
  A dTT calibrated for dabigatran can be measured by the HemoStat™ test. The dTT has a direct linear relationship with the dabigatran plasma concentration and is suitable for the quantitative assessment of dabigatran concentrations. When trough levels of dabigatran are reached at about 6 hours post the last dose, a dTT greater than 100 ng/mL, or greater than 65 seconds suggests an excess risk of bleeding. A normal dTT result indicates there is no clinically-relevant dabigatran activity.

- **Ecarin clotting time (ECT)**
  Dabigatran causes a substantial prolongation of ECT, a specific assay for thrombin generation. When dabigatran is dosed twice daily, a prolongation of ECT to >3 times the upper limit of normal at trough is associated with excess bleeding risk. ECT is used largely as a research tool and has limited availability. A commercial kit which is standardised or validated for dabigatran is not yet available.

- **Activated partial thromboplastin time (aPTT)**
  The relationship between aPTT and dabigatran plasma concentrations is curvilinear, flattening at higher concentrations. It is, therefore, unable to provide a quantitative assessment of dabigatran concentrations. In practice, it is a useful qualitative tool. aPTT x2 times the upper limit of normal at trough (typically >65 seconds) suggests an increased bleeding risk. The sensitivity of aPTT reagents is variable, so the results must be interpreted according to the specific normal values of the laboratory. aPTT may be prolonged by factors other than anticoagulation, including diseases such as lupus that increase levels of acute phase proteins.
Practical considerations

- In general, thrombolysis for acute ischaemic stroke is contraindicated in patients who are fully anticoagulated with dabigatran because the risk of bleeding complications, particularly intracerebral haemorrhage, is significantly increased.

- However, in patients who would otherwise be eligible for thrombolysis, uncertainty around dabigatran intake or time of dosage creates new clinical challenges. A history of treatment with dabigatran should not cause stroke patients to be inappropriately denied the opportunity of benefiting from thrombolytic therapy. For example, clinical judgment might support the use of thrombolysis if there is clear evidence that the patient has normal renal function, has not taken any dabigatran for at least the past 12 hours, and coagulation assays are consistent with an absence of dabigatran or a very low level of dabigatran activity. Other factors to consider in assessing the likely risks and benefits of thrombolysis include the severity of stroke symptoms and the extent of any perfusion deficit as assessed by imaging.

- If there is any uncertainty about the timing of the last dabigatran dose, coagulation assays must account for the possibility that the patient has taken the medication in the last few hours before obtaining the blood sample. Dabigatran concentrations, and anticoagulant activity, may continue to increase for 2-3 hours after dosing.

- Urgent coagulation assays should be requested if thrombolysis is being considered in patients known to have been prescribed dabigatran in the recent past. The availability of assays will vary between centres, but aPTT is widely available, and whenever possible additional tests such as Hemoclot or TT should also be requested:
  - Clinically-significant anticoagulant activity of dabigatran is excluded by normal TT, ECT or Hemoclot. A normal aPTT supports the absence of dabigatran but does not completely exclude current dabigatran activity because the aPTT is dependent on factor VIII activity which can be elevated in response to an acute ischaemic event. For that reason we recommend that both a TT and an aPTT are requested where the ECT or Hemoclot test is not available.

- A low level of dabigatran activity is suggested by TT less than twice the upper limit of normal, or a Hemoclot less than 40 ng/ml. There is insufficient data to provide clear guidance on ECT to establish acceptable limits above normal.

Whether a low residual level of dabigatran activity excludes the patient from thrombolysis is a matter of clinical judgment, weighing up potential benefit, possible risk and likely natural history of stroke syndrome untreated.

- Prior dabigatran therapy is unlikely to influence the treatment of bleeding complications following rt-PA treatment. Protocols for managing haemorrhage in patients treated with anticoagulants are well-established, and generally limited to supportive therapy for an intracerebral haemorrhage, specific interventions for cerebellar and intraventricular haemorrhage, and standard measures such as compression, surgery and resuscitation for extra-cranial haemorrhage.

- The occurrence of stroke while on anticoagulant treatment strengthens, rather than reduces, the need for continuing anticoagulation. There are established guidelines for re-initiating anticoagulation, for example, the European Heart Rhythm Association recommends recommencing anticoagulation in patients with 1 day after a transient ischaemic attack, 3 days after a small non-disabling infarct, 6 days after a moderate stroke and 2 or 3 weeks after a large infarct.15

These practical considerations are summarised in the flow chart overleaf.
Flow chart

Patient presents with suspected acute ischaemic stroke and may be eligible for thrombolysis

Dabigatran prescribed within previous year

NO

Manage as usual

YES

Dabigatran taken in previous 12 hours

YES

Thrombolysis contraindicated

NO OR UNSURE

Order urgent coagulation studies: aPTT and, in parallel, either thrombin time (TT) or preferably Hemoclot (if available)

aPTT normal AND normal TT or Hemoclot

YES

aPTT normal or prolonged AND TT >2x ULN OR Hemoclot >40 ng/mL

Administer thrombolysis if other eligibility criteria satisfied

NO

aPTT normal or prolonged AND TT >2x ULN OR Hemoclot >40 ng/mL

Administer thrombolysis if favoured by clinical judgment of risks and benefits, considering factors such as stroke features, age, comorbidities, and if eligibility criteria are satisfied

Thrombolysis contraindicated
Future developments

Resolving the clinical challenges of thrombolysis for acute ischaemic stroke in patients already receiving dabigatran and other anticoagulants will be facilitated by systematic accumulation of data. In the meantime, clinicians must continue to exercise their careful judgment about the risks and benefits of thrombolysis, accounting for the individual features of their patients.

References
9. PRADA/AA. Approved Product Information.
Appendix 17: Weblink to Recognising & Responding to Clinical Deterioration Policy Directive