

Eligibility for endovascular clot retrieval

NSW Referral Guide

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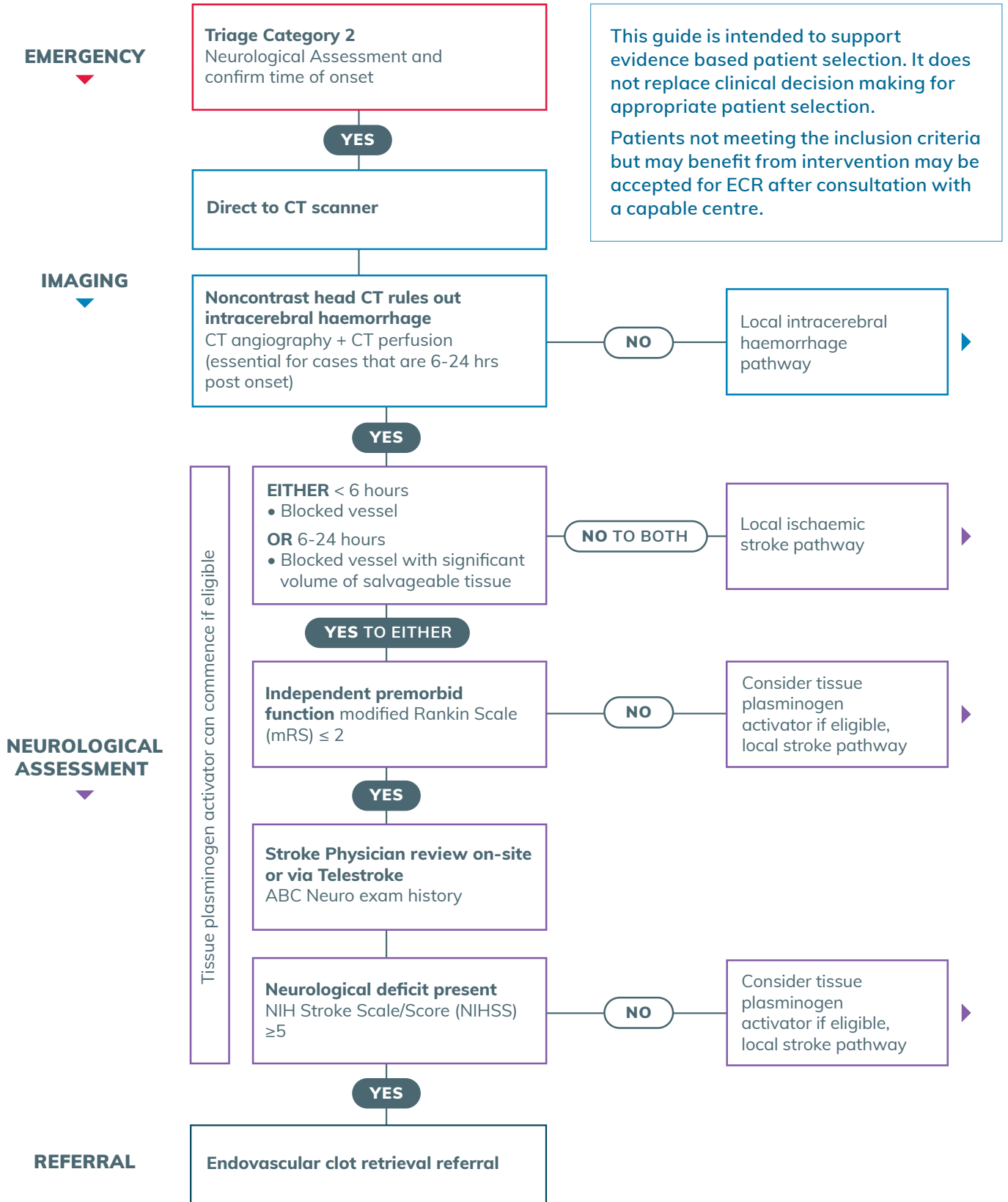
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Endovascular clot retrieval referral pathway at a glance



Patient selection for endovascular clot retrieval

Inclusion criteria

1. Ischaemic stroke with confirmed large vessel occlusion on computed tomography angiography (CTA)
 - internal carotid artery
 - middle cerebral artery
 - M1 segment
 - proximal M2
 - basilar artery.
2. Previously independent with minimal assistance. Able to manage own affairs, should consider independence in driving, shopping and banking. High prospect of meaningful functional recovery based on premorbid function e.g. modified Rankin scale (mRS) ≤ 2 . (Appendix 1).
3. Patients with a significantly disabling neurological deficit (National Institutes of Health Stroke Scale (NIHSS) ≥ 5 , or e.g. major aphasia).(Appendix 2).
4. Time window: Ability to start endovascular clot retrieval (ECR) within 24 hours from symptom onset.
 - Under six hours – procedure can be started with blocked vessel and broad clinical and imaging criteria.
 - Between 6 to 24 hours – blocked vessel with significant volume of salvageable tissue on computed tomography perfusion (CTP) as per national and international guidelines.
 - Basilar artery revascularisation may be considered up to 48 hours.
5. Intravenous tissue plasminogen activator (tPA) should be administered to all eligible patients in parallel with CTA, perfusion acquisition and ECR decision making to avoid delays.

This guide is intended to support evidence based patient selection. It does not replace clinical decision making for appropriate patient selection.

Patients not meeting the above inclusion criteria but may benefit from intervention may be accepted for ECR after consultation with a capable centre for example:

- Patients with low NIHSS but large vessel occlusion may fluctuate clinically and should be reviewed by an ECR capable centre stroke team.
- Patients with improving symptoms but large volume of tissue at risk from large vessel occlusion. Such patients may be at significant risk of subsequent deterioration (the risk of deterioration and significant disability in such patients with initially rapidly improving symptoms is probably significantly greater than the peri-procedural risk).
- Patients with a higher mRS due to mobility but independent with good quality of life. mRs = 3
- Any distal occlusion site outside of the inclusion criteria with a clinically significant deficit.

A local process should review all patients who are treated outside of the guidelines. A regular formal cross-district review meeting is recommended to regularly discuss these patients.

Introduction

Over the past two decades, treatment for ischaemic stroke has been transformed from a management approach that primarily provided supportive care, to one that actively seeks to restore blood flow to the brain, reducing mortality and disability.

Intravenous thrombolysis, the use of clot busting drugs, was first trialled in the late 1990s and represented a step change in stroke care. The use of thrombolysis is well established in NSW with 22 acute thrombolytic centres and is increasingly provided through the use of Telestroke. Telestroke is the application of telehealth in a hyper-acute stroke setting.

More recently endovascular clot retrieval (ECR) techniques achieved another major step forward. Compared with best medical treatment, ECR within six hours of stroke was shown to result in a 20% absolute reduction in death and disability.

Knowledge about stroke care and the supporting evidence base continues to develop. Indications for stroke reperfusion therapy are likely to widen following the results of recent studies that show the time window for effective treatment could be extended to up to 24 hours after stroke onset for a defined subset of patients.

ECR is not appropriate for all stroke patients and it is not a procedure that can be performed in non-specialist settings. This document provides information and advice on ECR services from three perspectives.

- A patient perspective – describing the patient journey in stroke and placing ECR in a broader context.
- Clinical consideration for hyper-acute stroke care – supporting clinical decision making by outlining eligibility criteria regarding appropriate patient referral for ECR.
- An organisation and system perspective – identifying ECR-capable facilities in NSW and minimum requirements for referring hospitals.

The Agency for Clinical Innovation (ACI) Stroke Network has developed this document by drawing on the evidence base, consultation with clinical experts, and a review of arrangements in other jurisdictions.

Acute stroke care is defined as the care within the first week of stroke onset or until discharged (or formally transferred to inpatient rehabilitation)

Hyper-acute stroke care is the care delivered in the initial 24 hours after the onset of stroke symptoms.

Stroke unit (SU) care is organised care within a specific ward in a hospital provided by a multidisciplinary team who specialise in stroke management

Endovascular Clot Retrieval Centre (ECRC): Centre providing access to ECR 24/7

Telestroke is the application of telehealth in a hyper-acute stroke setting.

Stroke physician: A medical specialist with experience in stroke management who has been credentialed to provide strokes services

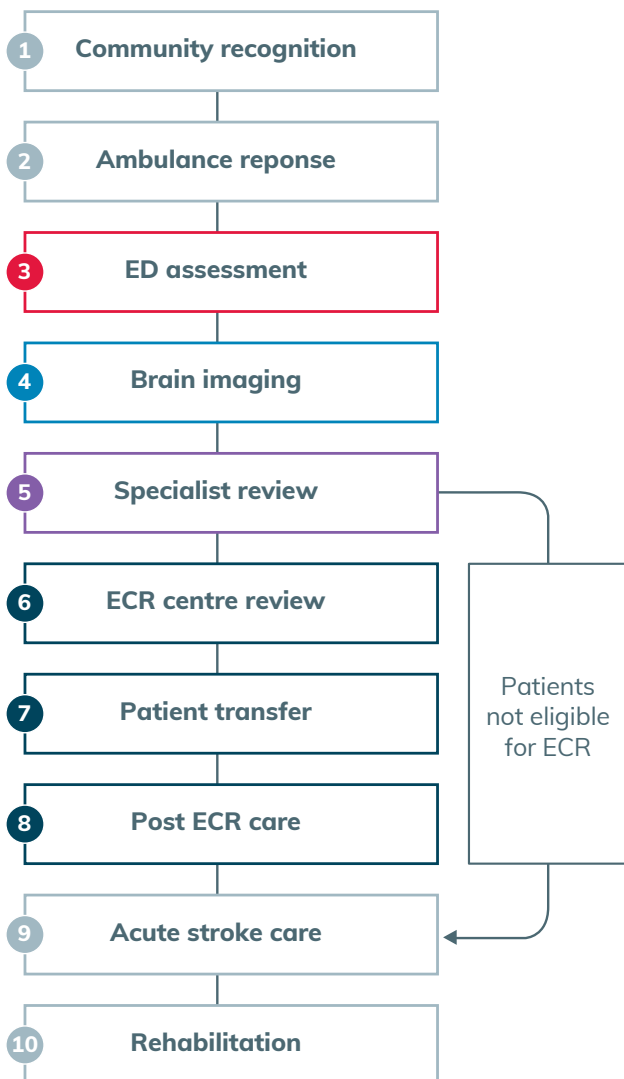
Ischaemic stroke – key evidence summary

- Timely restoration of cerebral blood flow using reperfusion therapy is the most effective treatment for salvaging brain tissue. The benefit of reperfusion diminishes over time, so there is a narrow window within which to initiate treatment.
- Thrombolysis treatment should be initiated for eligible patients without delay even if ECR is being considered. For acute ischaemic stroke, intravenous Alteplase (recombinant tissue plasminogen activator or tPA) is first-line therapy, provided that treatment is initiated within 4.5 hours of symptom onset).
- ECR is indicated for patients with acute ischemic stroke due to a large artery occlusion in the anterior circulation (this represents about 10% of all ischaemic strokes)
 - Evidence from the MR CLEAN, DAWN and DEFUSE trials have shaped ECR eligibility criteria.
 - MR CLEAN established that in patients with a proximal intracranial arterial occlusion, mechanical thrombectomy within 6 hours improved functional outcome at 90 days.
 - DAWN and DEFUSE 3, evaluated ECR beyond 6 hours using imaging-based criteria for patient selection.

Section 1: Patient journey perspective

Patients with a suspected stroke require multi-stage, multidisciplinary care which in its initial stages is time critical. The patient journey relies upon coordination of services and information flow.

The stroke patient journey – key stages



All patients with stroke are candidates for thrombolysis and ECR until proven otherwise

1. Community recognition

Patients with suspected stroke should be rapidly identified in the community using the Face, Arm, Speech, Time positive (FAST+) approach leading to a 000 call.

2. Ambulance response

Ambulance NSW (ANSW) paramedics apply the FAST+ to assess suspected strokes. Currently the pre-hospital focus is on rapid transport to the nearest thrombolysis capable hospital (within a 90 minute drive time).

ANSW use the 'Hunter 8' screening tool on all FAST+ patients, and make this additional information available in a handover sheet to the receiving emergency department (Appendix 3). Pre-notification with clinical details to the receiving emergency department is required.

3. Emergency department assessment

On arrival to the emergency department, rapid clinical handover will include the provision of clinical information and the Hunter 8 score (Appendix 3). A Hunter 8 score of ≥ 8 most accurately discriminates between patients with and without a large vessel occlusion and should prompt the local stroke team to consider selection for referral for ECR.

Patients with Hunter 8 scores of <8 may also have a large vessel occlusion, and should not be excluded from referral to ECR if indicated. Where possible, patients are met by the local stroke team on ambulance arrival. Direct transport on the ambulance stretcher to the CT scan is preferred. Where a telestroke service is operating, contact is made with the virtual neurologist or stroke physician as soon as possible.

4. Brain imaging

Routine brain imaging generally includes a non-contrast CT brain and CTA from the aortic arch to the vertex. CTP is suggested for patients presenting under six hours, but is required for patients presenting 6-24 hours. If there is any doubt about the appropriate imaging protocol this should be discussed as early as possible with the onsite stroke physician, neurologist or telestroke physician. **Image review by accepting teams is essential prior to the decision to transfer.**

5. Specialist review

Stroke physician or stroke neurologist review of imaging and completion of full NIHSS.

6. ECR centre review

Close cooperation and integrated care between the neurointerventionalist and referring stroke teams is required to maximise the benefit to patients. The neurointerventionalist makes the final clinical decision regarding ECR. Assessment requires remote PACS access at referral sites.

7. Patient transfer

Patients should be transferred from the referring hospital to the ECR centre as quickly as possible, minimising time to initiate retrieval teams and patient handover. ANSW will determine the fastest mode of transport. This may be via road, helicopter, fixed-wing aircraft, singly or in some combination. Standard ambulance transport (not medical retrieval) is appropriate for the majority of stroke patients. An ambulance transfer should be arranged as a time-critical inter-hospital transport.

Transfers should be specifically requested as urgent to ensure 'lights and sirens' response and to minimise delays. The patient should also be ready to transport, with all necessary transfer documentation completed prior to the ambulance crew arrival. Handover to the transfer team must include key clinical information, to ensure continuity of care and safe transfer. If consent for ECR has been obtained prior to transfer, documentation should be included to expedite the process. For patients receiving thrombolysis in transit, infusion should start en route.

A nurse or doctor escort is not required solely for the purpose of managing medication. ANSW authorises paramedics (clinical level P1 and above) to transport patients for ECR therapy with medication that may not be covered by NSW Ambulance Pharmacology in line with Clinical Safety Notice 246/17 Interfacility transfer of patients for endovascular clot retrieval.

Time can be reduced by making preparations prior to the retrieval team's arrival, and also by the retrieval team conducting only necessary investigations and interventions prior to departure.

Being intubated at the referring site dramatically raises the chances of futile treatment, i.e. larger core infarcts. Where intubation is necessary (e.g. basilar occlusion with decreased loss of consciousness), all steps should be taken to maintain blood pressure close to baseline during intubation and transfer.

The patient's details should be provided to the ECR capable centre to allow medical records to be prepared. An updated estimated time of arrival should be provided to the receiving centre when the patient leaves the referring centre and again when the patient is en route.

Following assessment on arrival, patients who are not candidates for ECR should be repatriated.

8. Post ECR care

Patients usually remain in the ECR centre for 24 hours for monitoring. Local arrangements to ensure expedient repatriation and local escalation protocols should be in place.

9. Acute stroke care

All stroke patients should receive care in an acute stroke unit.

10. Rehabilitation

Patients should have access to rehabilitation when indicated either as an inpatient or in a community setting.

Section 2: Clinical considerations for hyper-acute stroke management

Primary stroke centres (including acute thrombolytic centres and acute stroke units) should have pre-notification pathways in place so that patients with suspected stroke are assessed on arrival at the emergency department.

Pre-morbid function

Establishing premorbid functional level is essential for ensuring appropriate patient selection. Patients who are dependent prior to their stroke generally have poorer outcomes than patients that are previously independent. The modified Rankin scale (mRS, Appendix 1) is used to score level of disability. This can then be used as an exclusion criteria, although this needs to be done on a case-by-case basis. The range of the mRS scale is 0-6 where 0 is no disability and 6 is death.

Patients who are able to start treatment within 0-24 hours of stroke onset, or last known well time, are assessed for treatment eligibility using the following criteria.

0-6 hours from onset of symptoms – criteria for referral

For patients presenting in 0-6 hours, routine brain imaging would include an urgent non-contrast CT brain and CTA from the aortic arch to the vertex. This excludes large established stroke and haemorrhagic strokes and identifies large vessel occlusions.

A CTP or magnetic resonance imaging (MRI) study is not essential to determine eligibility in this time window however if available, would be desired.

6-24 hours from onset of symptoms, multimodal imaging (CTA and CTP) – criteria for referral

For patients presenting in 6-24 hours post-stroke symptom onset, imaging includes an urgent non-contrast CT scan, a CTA (or magnetic resonance angiography (MRA)) including the aortic arch to vertex and a CTP (or MRI) study. Patients with perfusion imaging showing a significant mismatch between ischaemic core and penumbra are eligible for referral to ECR. Some studies have used CTP and specialised post processing software, RAPID, to support clinical decision making. These demonstrated the benefit of mechanical thrombectomy >6 hours from stroke symptom onset.

0-24 hours from onset of symptoms – neurological assessment and stroke severity

An assessment of neurological deficit is required. The NIHSS is recommended in the American Heart Association/American Stroke Association's *Guidelines for the Early Management of Patients with Acute Ischaemic Stroke: A Guideline for Healthcare Professionals 2018*. The NIHSS scores range from 0 to 42, and are used to measure the severity of the stroke, with higher scores indicating a more severe deficit. Published evidence indicates inclusion for patients in the 6-24 hours with NIHSS > 5; this is a moderate to severe stroke with eligibility for ECR. (See Appendix 2 National Institutes of Health Stroke Scale).

Anterior and posterior circulation selection

Circulation	0-6 Hours	6-24 Hours	Evidence level
Anterior	Internal carotid artery Carotid artery Middle cerebral artery M1 and M2 divisions	Internal carotid artery M1 Middle cerebral artery	Level 1
Posterior	Basilar artery occlusions	Basilar artery occlusions	Level IIB

Brain imaging for suspected stroke

Non-contrast CT brain

Diagnoses intracerebral haemorrhage, established ischaemic stroke, mimics (such as a tumour), subtle early ischaemic changes and hyperdense thrombus in the arteries.

Note: In addition to standard thick axial slices, thin (~1mm) slices improve detection of hyperdense thrombus and should be a standard reconstruction.

CT perfusion

Improves diagnostic sensitivity for ischaemic stroke.

Note: Reperfused stroke may have normal CT perfusion. CT perfusion has limited sensitivity for lacunar stroke.

Indicates brain tissue viability (extent of irreversible injury and tissue at risk)

- Essential for treatment beyond six hours after the time last known to be well.
- Increases appropriate use of intravenous thrombolysis for mild or 'rapidly improving' patients with occlusion.
- Prognostic and reduces the incidence of futile ECR.

CT angiogram (aortic arch to brain vertex)

Provides immediate knowledge of carotid stenosis and proximal vasculature.

Provides critical information regarding vascular access if considering transfer for ECR.

For intracerebral haemorrhage, CTA can demonstrate underlying structural vascular abnormality requiring intervention and risk of ongoing haematoma enlargement, 'spot sign' representing contrast extravasation.

When to perform CT perfusion and angiography:

- time of onset (last seen well) within 24 hours
- potentially disabling clinical deficit
- do not wait for creatinine results. If there is known kidney disease with eGFR < 30 mL/min consider risk-benefit and use IV normal saline hydration if proceed with contrast.

CT contrast is acceptable if the patient is already on haemodialysis.

Consider risk-benefit and premedication if history of contrast allergy.

Section 3: Requirements for the delivery of hyper-acute stroke care

In NSW there are six ECR capable centres, four of which provide 24/7 operations. There are significant distances between regional locations and ECR centres. Regional stroke hospitals need to be enabled to provide a time critical hyper-acute stroke care. This care results in a documented treatment plan that may include provision of thrombolysis and referral for consideration of ECR.

Stroke care should be delivered in accordance with the NSW Guide to the Role Delineation of Clinical Services (www.health.nsw.gov.au/services/Pages/role-delineation-of-clinical-services.aspx). In addition to the service requirements listed in the guide, the following requirements need to be in place to assess eligibility for ECR.

Services that do not meet the requirements outlined in the role delineation guide may be able to assess for ECR eligibility, with the enhancement of Telestroke, provided appropriate networked solutions for transferring patients for ongoing appropriate care.

Minimum clinical requirements to support assessment for ECR eligibility

- Access to non-contrast computed tomography 24/7
- Access to CT angiography (CTA) 24/7.
- CT perfusion 24/7 and automated perfusion maps.
 - Required for assessment of patients post 6 hours from symptom onset. Services should work towards this capability.
- In-hospital organised 'stroke code' with specialised assessment team able to provide review within 30-minutes of call (this may be delivered on site or via Telestroke).
- Access to neurologist or experienced stroke physician review 24/7 (on site or telehealth) to:
 - review images
 - review patient
 - inform differential diagnosis.
- Staff trained in the performance and application of the NIHSS.
- Staff trained in the administration of thrombolysis.
- Post thrombolysis management protocols or networked arrangements for post thrombolysis care
- Presence of a stroke unit (or stroke beds in rural or regional services) or a networked arrangement with a centre with a stroke unit.

* Neurologist or experienced stroke physician according to local stroke protocols.

Best practice targets

1. All patients receive a hyper-acute stroke review within 30 minutes of a stroke call.
2. All patients are assessed and considered for both thrombolysis and ECR.
3. Stretch target 15% to 25% of all ischaemic stroke patients receive thrombolysis.
4. Door-to-needle for thrombolysis time less than 60 minutes.

In order to expedite timely transfer of patients to an ECR capable centre, coordination is essential. Rapid and reliable pathways are required between referring hospitals and receiving hospitals to ensure:

- appropriate patients are identified
- brain imaging is completed
- brain imaging is reviewed locally (onsite or via Telestroke)
- patients are reviewed by a stroke physician
brain imaging is electronically transferred and made available to the ECR capable centre in a timely fashion
- patient are reviewed by a stroke physician or neurologist
- consultation with ECR capable centre
- urgent transportation.

ECR is a highly technical procedure. Evidence consistently demonstrates an association between higher procedural volumes and fewer complications. The procedure of ECR is technically challenging, performed by highly trained neurointerventionalists and is only available at a limited number of tertiary hospitals.

All districts and networks should follow their established referral pathways, including referral to interstate services where appropriate.

The current contact details for the ECR sites can be found at www.aci.health.nsw.gov.au/networks/stroke/about

- Ambulance NSW inter-hospital transfers: **131 233**
- Aeromedical control centre: **1800 650 004**

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Key supporting documents

1. Guide to the Role Delineation of Clinical Services (Forthcoming Stroke Standard 2019)
<https://www.health.nsw.gov.au/services/Pages/role-delineation-of-clinical-services.aspx>
2. National Acute Stroke Services Framework 2019
[file:///C:/Users/60079594/Downloads/National%20Acute%20Stroke%20Services%20Framework%202019%20\(2\).pdf](file:///C:/Users/60079594/Downloads/National%20Acute%20Stroke%20Services%20Framework%202019%20(2).pdf)
3. Policy Directive: NSW Critical Care Tertiary Referral Networks and Transfer of Care (ADULTS) PD2018_011
https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2018_011.pdf
4. Policy Directive: Inter-facility Transfer Process for Adults Requiring Specialist Care PD2011_031
https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2011_031.pdf
5. CSN246/17 Interfacility transfer of patients for Endovascular Clot Retrieval
6. Australian Commission on Safety and Quality in Health Care Acute Stroke Clinical Care Standard 2015
<https://www.safetyandquality.gov.au/our-work/clinical-care-standards/acute-stroke-clinical-care-standard/>
7. Clinical Guidelines for Stroke Management
<https://strokefoundation.org.au/What-we-do/Treatment-programs/Clinical-guidelines>
8. Endovascular Clot Retrievals for Acute Stroke Statewide service protocol for Victoria 2018
https://bettersaferecare.vic.gov.au/sites/default/files/2018-10/PROTOCOL_ECR%20for%20acute%20stroke_October%202018_0.pdf

Appendices

Appendix 1: Modified Rankin Scale (mRS)


Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead
TOTAL (0 – 6)	

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Appendix 2: National Institutes of Health Stroke scale



Patient Identification. _____

Pt. Date of Birth ____/____/____

Hospital _____ (____-____)

Date of Exam ____/____/____

Interval: Baseline 2 hours post treatment 24 hours post onset of symptoms ±20 minutes 7-10 days
 3 months Other _____ (____)

Time: ____:____ []am []pm

Person Administering Scale _____

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).

Instructions	Scale Definition	Score
<p>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.</p>	<p>0 = Alert; keenly responsive.</p> <p>1 = Not alert; but arousable by minor stimulation to obey, answer, or respond.</p> <p>2 = Not alert; requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped).</p> <p>3 = Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, and areflexic.</p>	_____
<p>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.</p>	<p>0 = Answers both questions correctly.</p> <p>1 = Answers one question correctly.</p> <p>2 = Answers neither question correctly.</p>	_____
<p>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.</p>	<p>0 = Performs both tasks correctly.</p> <p>1 = Performs one task correctly.</p> <p>2 = Performs neither task correctly.</p>	_____
<p>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.</p>	<p>0 = Normal.</p> <p>1 = Partial gaze palsy; gaze is abnormal in one or both eyes, but forced deviation or total gaze paresis is not present.</p> <p>2 = Forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver.</p>	_____

Rev 10/1/2003

N I H STROKE SCALE

Patient Identification. _____

Pt. Date of Birth ____/____/____

Hospital _____ (____-____)

Date of Exam ____/____/____

Interval: Baseline 2 hours post treatment 24 hours post onset of symptoms ±20 minutes 7-10 days
 3 months Other _____ (____)

<p>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 quadrantanopia, 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.</p>	<p>0 = No visual loss. 1 = Partial hemianopia. 2 = Complete hemianopia. 3 = Bilateral hemianopia (blind including cortical blindness).</p>	<p>_____</p>
<p>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.</p>	<p>0 = Normal symmetrical 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).</p>	<p>_____</p>
<p>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.</p>	<p>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: _____</p> <p>5a. Left Arm</p> <p>5b. Right Arm</p>	<p>_____ _____</p>
<p>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.</p>	<p>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: _____</p> <p>6a. Left Leg</p> <p>6b. Right Leg</p>	<p>_____</p>

Rev 10/1/2003

N I H STROKE SCALE

Patient Identification. _____ - _____ - _____

Pt. Date of Birth ____/____/____

Hospital _____ (____-____)

Date of Exam ____/____/____

Interval: Baseline 2 hours post treatment 24 hours post onset of symptoms ±20 minutes 7-10 days
 3 months Other _____ (____)

<p>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.</p>	<p>0 = Absent. 1 = Present in one limb. 2 = Present in two limbs. UN = Amputation or joint fusion, explain: _____</p>	<p>_____</p>
<p>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.</p>	<p>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.</p>	<p>_____</p>
<p>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.</p>	<p>0 = No aphasia; normal. 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. 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 response. 3 = Mute, global aphasia; no usable speech or auditory comprehension.</p>	<p>_____</p>
<p>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.</p>	<p>0 = Normal. 1 = Mild-to-moderate dysarthria; patient slurs at least some words and, at worst, can be understood with some difficulty. 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. UN = Intubated or other physical barrier, explain: _____</p>	<p>_____</p>

Rev 10/1/2003

N I H STROKE SCALE

Patient Identification. _____ - _____ - _____

Pt. Date of Birth ____/____/____

Hospital _____ (____-____)

Date of Exam ____/____/____

Interval: Baseline 2 hours post treatment 24 hours post onset of symptoms ±20 minutes 7-10 days
 3 months Other _____ (____)

<p>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.</p>	<p>0 = No abnormality.</p> <p>1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities.</p> <p>2 = Profound hemi-inattention or extinction to more than one modality; does not recognize own hand or orients to only one side of space.</p>	<p>_____</p>
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Appendix 3: NSW Ambulance stroke process sheet



NSW Ambulance

Stroke Process Sheet

Date _____ Incident Number _____ Destination _____	Pre Notification to ED Yes <input type="checkbox"/> No <input type="checkbox"/>
Patients Name <u>Surname</u> _____ First Name _____	Record on eMR _____
Relative's Contact Name _____	Relative with Patient? <input type="checkbox"/>
Relative's Contact Number _____	

FAST Positive	Yes <input type="checkbox"/> No <input type="checkbox"/>	Patient on anticoagulant/antiplatelet medication	Yes <input type="checkbox"/> No <input type="checkbox"/>
Patient is >18 years old	Yes <input type="checkbox"/> No <input type="checkbox"/>	Name of anticoagulant	_____
Onset <4.5 hours to ED	Yes <input type="checkbox"/> No <input type="checkbox"/>	Name of antiplatelet	_____
Last time seen well	_____	Pre morbid modified Rankin Scale (see below)	_____
BGL >4mmol/L and <22mmol/L	Yes <input type="checkbox"/> No <input type="checkbox"/>	Hunter 8 Score (see reverse)	_____
BGL	_____		

FAST positive stroke patients are a time critical medical emergency – consider all modes of transport.

The Modified Rankin Scale is a functional assessment of stroke. A pre morbid (ie how the patient normally functions) modified Rankin Scale assists in the assessment of suitability for hyper acute treatment, including endovascular clot retrieval. This information should be sought from a relevant/carer known to the patient.

Score	Modified Rankin Scale Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability, unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability, bedridden, incontinent and requiring constant nursing care and attention

WHERE POSSIBLE the patient should be transferred to hospital with their current medications and an 18g cannula in the ACF.



NSW Ambulance

Hunter 8 Stroke Score			
Hunter 8 Item	Scoring Definition	Score on Scene	Score on Arrival
1. LOC Observations	<ul style="list-style-type: none"> 0 Alert (A) 1 Rousable to minor stimulation (V) 2 Rousable only to painful stimulation (P) 3 Reflex response or unrousable (U) 		
2. LOC Questions Ask patient's age and current month (must be exact)	<ul style="list-style-type: none"> 0 Both correct 1 One correct or dysarthria, foreign language 2 Neither correct 		
3. Commands – opens/close eyes, grip and release non paretic hand then other hand (1 step commands or mimic ok)	<ul style="list-style-type: none"> 0 Both correct (OK if impaired by weakness) 1 One correct 2 Neither correct 		
4. Best Gaze – test horizontal eye movements-tracking object/face	<ul style="list-style-type: none"> 0 Normal 1 Partial gaze, abnormal gaze in 1 or both eyes 2 Forced eye deviation or total paresis which cannot be overcome 		
5. Facial Palsy – show teeth, close eyes tight, raise eyebrows. If stuporous, check symmetry of grimace to pain	<ul style="list-style-type: none"> 0 Normal 1 Minor paralysis, flat nasolabial fold, asymmetrical smile 2 Partial paralysis (lower face) 3 Complete paralysis (upper & lower face) 		
6. Motor Arm – arms outstretched 90° sitting or 45° (supine) for 10 seconds. Encourage best effort. Score for Left and then right arm.	<ul style="list-style-type: none"> 0 No drift for 10 seconds 1 Drift but does not hit bed 2 Some effort against gravity but can't sustain 3 No effort against gravity 4 No movement at all X Unable to assess due to amputation, fusion Explain _____	Left Right	Left Right
7. Dysarthria – read or repeat list of words (see word list below)	<ul style="list-style-type: none"> 0 Normal 1 Mild-mod slurred speech but intelligible 2 Unintelligible or mute X Intubated or mechanical barrier 		
8. Extinction/Neglect – simultaneously touch patient on both hands or legs with their eyes closed. Show fingers in both visual fields	<ul style="list-style-type: none"> 0 Normal none detected 1 Neglect or extinction to double simultaneous stimulation in any modality (sensory, visual) OR visual/sensory loss on one side. 2 Profound neglect in both visual and sensory modalities 		
Total Score		/24	/24

MAMA TIP-TOP FIFTY-FIFTY THANKS HUCKLEBERRY BASEBALL PLAYER

Glossary

ACI	Agency for Clinical Innovation
ANSW	Ambulance NSW
CTA	Computed tomography angiography
CTP	Computed tomography perfusion
ECR	Endovascular clot retrieval
FAST	Face, arm, speech, time
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
mRS	Modified Rankin scale
NIHSS	National Institutes of Health Stroke Scale
PACSS	Picture archiving and communication systems
tPA	Tissue plasminogen activator

Acknowledgements

Thank you to all attendees who participated in the Reperfusion Workshop December 2017.

This document has been developed by the NSW Agency for Clinical Innovation Reperfusion and Telestroke Working Group and been through broad open consultation.

The document has been distributed to all local health districts, primary health networks, ACI clinical networks and relevant departments within the NSW Ministry of Health.

Final endorsement has been via NSW Stroke Network Executive. Interstate consultation has been requested and incorporated.

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The Agency for Clinical Innovation (ACI) is the lead agency for innovation in clinical care.

We bring consumers, clinicians and healthcare managers together to support the design, assessment and implementation of clinical innovations across the NSW public health system to change the way that care is delivered.

The ACI's clinical networks, institutes and taskforces are chaired by senior clinicians and consumers who have a keen interest and track record in innovative clinical care.

We also work closely with the Ministry of Health and the four other pillars of NSW Health to pilot, scale and spread solutions to healthcare system-wide challenges. We seek to improve the care and outcomes for patients by re-designing and transforming the NSW public health system.

Our innovations are:

- person-centred
- clinically-led
- evidence-based
- value-driven.

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*Our vision is to create the future of healthcare,
and healthier futures for the people of NSW.*