

Emergency Department

Acute Stroke Guideline

Aim

The aim of this guideline is to provide an evidence-based pathway for the assessment, investigation and early treatment of children presenting with clinical signs of acute stroke to the Emergency Department.

This guideline aims to

1. Identify those with acute stroke symptoms
2. Identify those who need acute neuroimaging
3. Advice on the appropriate laboratory investigations which should be done
4. Select those who may be suitable for thrombolysis therapy and or thrombectomy
5. Offer guidance regarding best disposition for paediatric stroke patients

Definition of terms

AIS – Arterial Ischaemic Stroke

HS – Haemorrhagic Stroke

SCD – Sickle Cell Disease

PedNIHSS – Paediatric National Institute of Health Stroke Scale

TPA – Tissue Plasminogen Activator

Target Patient Population

This guideline is aimed for use in children who present to the Emergency Department with signs and/or symptoms suggestive of acute stroke.

NOTE: This guideline does not apply to children with sickle cell disease (SCD) who present with symptoms of stroke – separate guidance should be sought for this population via the haematology specialist service.

Target Users

This guideline is directed at health-care professionals engaged in the care of children presenting with acute stroke to the Emergency Department

If a patient presents with an acute neurological deficit or acute unexplained altered level of consciousness – Think Stroke

Recognition of acute stroke can be difficult, particularly in younger children as neurological signs may be relatively subtle. It is difficult to distinguish between symptoms of real stroke versus 'stroke mimics' on history and clinical examination alone, therefore imaging is essential to diagnosis. It is recognised that 30 to 50% of children and young people with stroke-like presentations will have a non-vascular diagnosis (1).

Signs/Symptoms

- Focal Neurological Deficit-cranial nerve palsy, hemiplegia, sensory loss
- Altered mental status
- Aphasia
- Ataxia
- Headache-sudden onset
- Seizure-usually focal

- Vomiting-usually associated with acute neurological deficit or sudden onset headache
- Altered conscious level
- Acute visual disturbance

Risk Factors

Up to 25% of children presenting with acute stroke will have an underlying risk factor:

- **Cardiac-** Patent foramen ovale, post-cardiac catheterisation/ intervention, long-standing cyanotic lesions leading to polycythaemia, embolic clots in cardiomyopathies, endocarditis and prosthetic valves
- **Haematological-** Sickle cell disease, prothrombotic disorders (eg Protein C/S deficiency)
- **Oncological-** Acute leukaemia, lymphoma, chemotherapy (methotrexate)
- **Infection-** Varicella, HIV vasculitis, acute bacterial meningitis and viral encephalitis
- **Vascular-** Arteriovenous malformations (AVMs) which can be associated with Moyamoya, neurofibromatosis, Sturge-Weber and other conditions
- **Traumatic-** Head and neck trauma, leading to carotid or vertebral dissection
- **Drug-related-** e.g. Anticoagulants, recreational drugs- cocaine, methamphetamines
- **Other Conditions-** Marfans, vasculitis, tuberous sclerosis, hypertension mitochondrial, urea cycle defects, homocysteine, Fabry's

Management

Acute Stroke Suspected

- Take history and establish time of onset of symptoms
- Thrombolysis window is currently within **4.5 hours** of symptom onset



- ABC
- GCS and check blood sugar
- If GCS < 8 or absent airway reflexes consider intubation
- Attach cardiac monitoring
- IV Access take FBC, Urea and Electrolytes, LFTs, Coagulation screen, take Group and Save – flag as urgent with lab
- IV fluid bolus of 10-20ml/Kg of 0.9 % normal saline
- Perform ECG
- Contact ED Consultant on Call



- 1) Perform PEDNIHSS Score (See Attachment) this should be before calling neurology
- 2) Contact Neurology Consultant on Call
- 3) Following Consultant review (PEM or Neurology) arrange Neuroimaging-MRI with diffusion-weighted imaging and MRA brain and neck (If MRI not available within one hour arrange CT brain and CTA of brain and neck)



If stroke confirmed follow algorithm below. If no evidence of stroke admit medically for further work-up and neurology review.

Confirmed STROKE



Nurse patient in Resus
Continuous Cardiac Monitoring
Half Hourly Neuro Observations
Half hourly Blood Pressure Recordings



Confirmed Arterial Ischaemic Stroke (AIS)

Confirmed Haemorrhagic Stroke (HS)

If within 4.5 hours symptom onset, and imaging demonstrates partial or complete occlusion of intracranial artery, administration of thrombolysis therapy can be considered if the inclusion and exclusion criteria are met-see **Appendix 1** Alteplase dosing for acute stroke is available on the CHI Paediatric formulary.

(Thrombectomy can be considered in this group dependent on consultant decision)

If more than 4.5 hours from symptom onset administer aspirin at 5mg/kg if no contraindications.

(Thrombectomy can be considered in this group dependent on consultant decision)

Consult Neurosurgery
Consult PICU
Consider ICP Monitoring

Disposition/Ongoing Care

- All patients with confirmed stroke whether AIS or HS should be discussed with PICU.
- All patients receiving thrombolysis should be cared for in a PICU setting (of note as thrombolysis is time dependent, alteplase administration should begin in the ED).
- All patients with confirmed stroke need continuous monitoring with particular emphasis on consciousness level and blood pressure.
- **Extreme caution should be exercised about any use of antihypertensive medication in a child with acute ischaemic stroke.** Antihypertensive treatment only to be commenced after discussion with Neurology and PICU teams ⁽¹⁾. High BP post-stroke may reflect physiological attempts to perfuse surrounding tissue. If BP is high, one should also consider if it may be a symptom of increased intracranial pressure post-stroke.
- All children with a large area of ischaemic infarction are at risk of developing malignant MCA syndrome and should have close observations; if symptoms worsen or they have signs increased ICP neurosurgical opinion should be considered.
- All children with confirmed stroke should be kept nil per mouth until a speech and language assessment has been performed to check their swallow.
- Potential causes for stroke should be considered in the post resuscitation setting with consideration for further laboratory investigations, imaging and echocardiogram dependent on risk factors.
- As stroke rehabilitation is a multi-disciplinary approach, other health professionals such as physiotherapy, speech and language and occupational therapy should be involved early in the patient's care pathway.

Indications for consideration of thrombolysis therapy as per RCPCH (see additional RCPCH guidelines for additional information):

- An acute focal neurological deficit consistent with arterial ischaemia

AND

- Paediatric National Institute of Health Stroke Scale (PedNIHSS) more than or equal to 4 and less than or equal to 24

AND

- Treatment can be administered within 4.5 hours of known onset of symptoms

AND

- Intracranial haemorrhage has been excluded

AND

- CT and CTA demonstrates normal brain parenchyma or minimal early ischaemic change **AND** CTA demonstrates partial or complete occlusion of the intracranial artery corresponding to clinical or radiological deficit
- or MRI and MRA showing evidence of acute ischaemia on diffusion-weighted imaging **AND** MRA demonstrates partial or complete occlusion of the intracranial artery corresponding to clinical or radiological deficit

AND

- There are no contraindications - See below.

Contraindications to thrombolysis therapy ⁽¹⁾⁽²⁾

Patient factors:

- Unknown time of symptoms onset
- Pregnancy
- Clinical presentation suggestive of subarachnoid haemorrhage (SAH), even if brain imaging is negative for blood. e.g if history is more suggestive of a subarachnoid haemorrhage with sudden onset thunderclap headache
- Patient who would decline blood transfusion, if indicated
- History of prior intracranial haemorrhage
- Known cerebral arterial venous malformation, aneurysm or neoplasm
- Persistent hypertension which is greater than the expected physiological response
- Glucose less than 2.78mmol/L or greater than 22.22mmol/L
- Prior stroke, major head trauma, or intracranial surgery within the past 3 months
- Major surgery or parenchymal biopsy within 10 days (relative contraindication)
- Gastrointestinal or urinary bleeding within 21 days (relative contraindication)
- Arterial puncture at non-compressible site or LP within seven days (relative contraindication). Patients who have had a cardiac catheterization via a compressible artery are not excluded
- Patient with malignancy or within one month of completion of treatment for cancer
- Patients with an underlying significant bleeding disorder. Patients with a mild platelet dysfunction, mild von Willebrand disease, or other mild bleeding disorders are not excluded

Drug-related exclusions:

- Known allergy to recombinant tissue plasminogen activator
- Patient who has received heparin within previous four hours must have activated partial thromboplastin time (aPTT) in normal range
- INR > 1.7 in context of patient on warfarin
- thrombolysis contraindicated within 48 hours of dose of one of new oral anticoagulants.

Stroke factors:

- Mild deficit – PedNIHSS less than 4
- Severe deficit suggesting large territory stroke, with pre-tPA PedNIHSS more than 24
- Stroke suspected to be because of subacute bacterial endocarditis, moyamoya, sickle cell disease, meningitis, bone marrow, air, or fat embolism
- Intracranial haemorrhage on pre-treatment head CT and MRI
- Intracranial dissection (defined as at or distal to the ophthalmic artery)
- Large infarct volume, defined by the finding of acute infarct on MRI involving one-third or more of the complete middle cerebral artery (MCA) territory involvement.

Bleeding factors:

- Bleeding diathesis including platelets less than $100 \times 10^9/L$, prothrombin time (PT) more than 15s or elevated activated partial thromboplastin time (aPTT) more than upper limits of the normal range

Companion Documents

[PedNIHSS Guide](#)

[Link to Reference List](#)