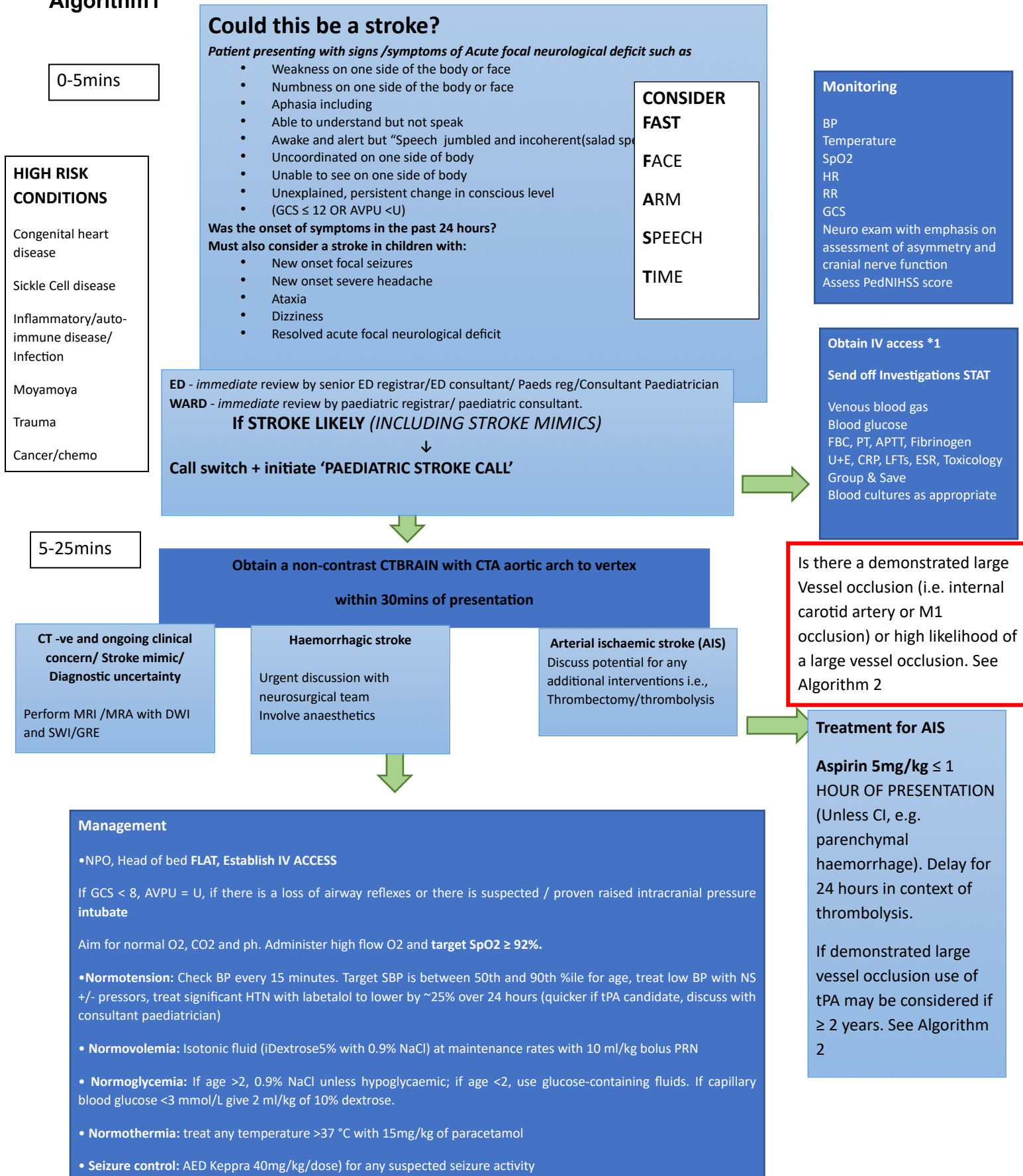


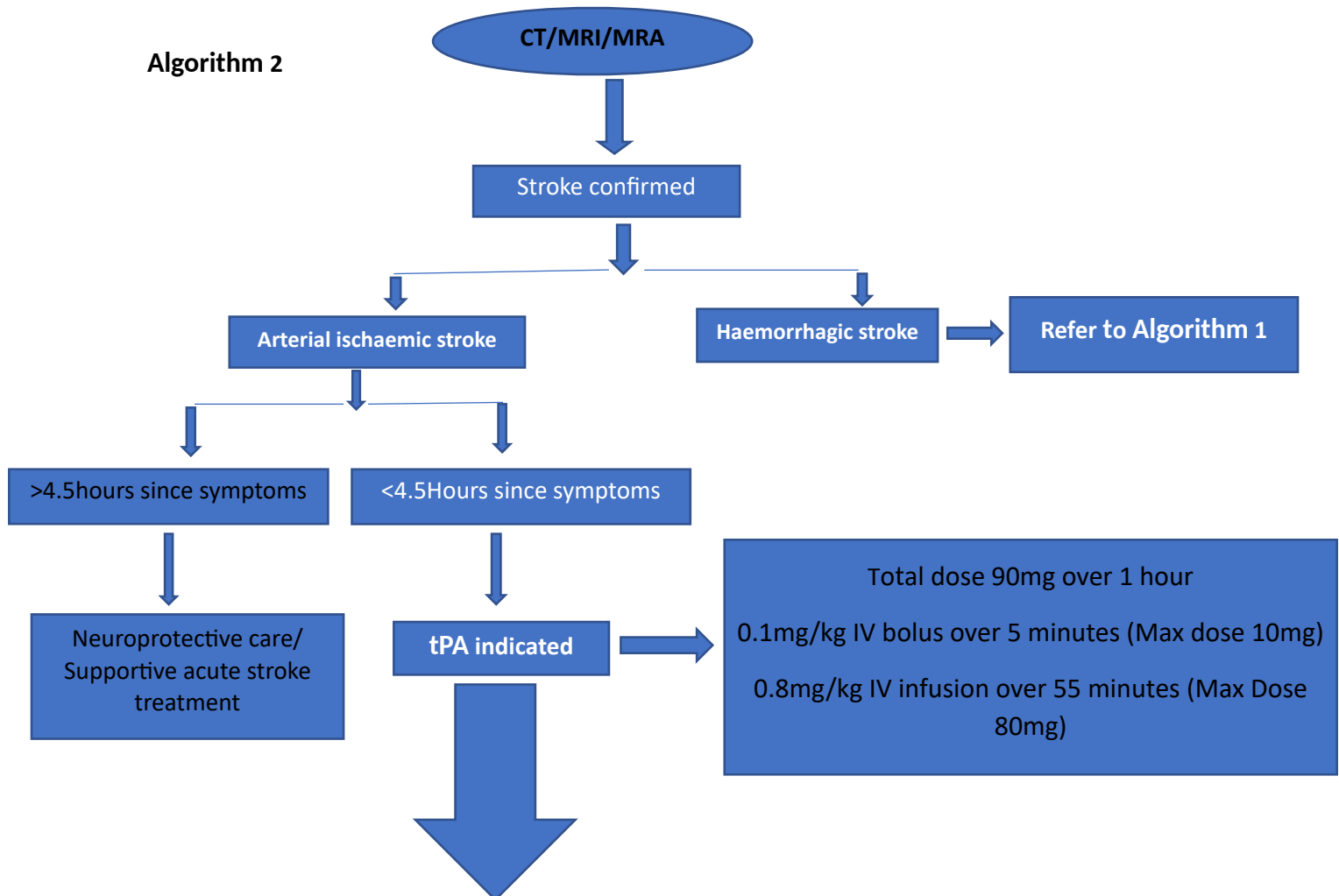
# PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY Algorithm1



Algorithm 1. CUH Paediatric Stroke Care Pathway

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

Algorithm 2



### Monitoring:

- 1-Monitor Prothrombin Time (PT), Partial Thromboplastin Time (PTT) and fibrinogen levels 4 hours after commencing infusion and every 6-8 hours thereafter.
- 2-Maintain fibrinogen levels >1g/L. If levels fall below this threshold, stop infusion and inform a senior member of the medical team without delay.
- 3-Hourly observations – temperature, pulse, blood pressure.
- 4-Monitor for signs of bleeding, If bleeding occurs, apply pressure, if appropriate, and stop infusion. Inform a senior member of the medical team without delay.
- 5-FBC, coagulation screen including D-dimers, urinalysis.

### Cautions:

- 1-Use with caution if risk of bleeding, external chest compression or hypertension.
- 2-Recent or concurrent use of drugs that increase the risk of bleeding.
- 3-Seizure in last 48hrs.
- 4-Give on unaffected side.

### Contraindications:

- 1-Major surgery or haemorrhage within 10days of therapy.
- 2-Severe Asphyxial reaction within seven days of the event.
- 3-Invasive procedure within 3 days of the therapy.
- 4-Prematurity <32weeks gestation.
- 5-Systemic septicaemia.
- 6-Active bleeding at the time of therapy.
- 7-Inability to maintain platelets >50-100 x 10<sup>5</sup> /L or fibrinogen >1g/L

Algorithm 2. Paediatric tPA pathway

# **PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY**

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# PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

## 3. Background / Definitions

Initial evaluation and clinical management. (See Algorithm 1.)

### Target Population/ Inclusion Criteria

Patients older than 1 month of age, with onset of signs/symptoms of focal neurological deficit within last 24-48 hours.

### Presentation

The presentation of a stroke in a child or young person can be variable.

**Urgent brain imaging** should be undertaken in any child with one or more of the following symptoms:

- Acute focal neurological deficit
- Aphasia
- Reduced level of consciousness (age-appropriate Glasgow Coma Scale 24 (GCS) less than 12 or AVPU ('Alert, Voice, Pain, Unresponsive') less than V) at presentation

**Consider urgent brain imaging (CTBRAIN WITH CT Angiogram aortic arch to vertex)** for children and young people presenting with the following symptoms which may be indicative of stroke:

- New onset focal seizures
- New onset severe headache
- Altered mental status including transient loss of consciousness or behavioural changes
- New onset ataxia, vertigo or dizziness
- Sudden onset of neck pain or neck stiffness
- Witnessed acute focal neurological deficit which has since resolved

Be aware that the following non-specific symptoms can be present in a child presenting with stroke:

- Nausea or vomiting
- Fever

Be aware that acute focal neurological signs may be absent, and that attention should be given to parental or young person concerns about the presentation of unusual symptoms.

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

### Focal neurological deficit:

Signs/symptoms of focal neurological deficit may include one or more of the following:

- Weakness on one side of body or face
- Numbness on one side of the body or face
- Aphasia, including:
  - Ability to understand, but not speak
  - Awake and alert, but “word salad” speech
- Incoordination on one side of body
- Unable to see on one side

**Note:** An acute clinical deficit may or may not represent an acute stroke. A large proportion of children will have a non-vascular diagnosis; however, an alternative diagnosis is indistinguishable prior to diagnostic imaging. Thus, all children who meet the above criteria must be treated in accordance with the acute stroke pathway.

### 4. Initial Triage for children in CUH (See Algorithm 1. Paediatric Stroke Care Pathway)

**If child displays symptoms in last 24-48HRS and meets the above criteria, the child should be evaluated by a senior clinician immediately.**

- If the child is located in CUH Emergency Department they must have an immediate review by senior EM (Emergency Medicine) registrar or consultant **AND** Paediatric Registrar/Consultant Paediatrician on call contacted
- If the child is in any other clinical area call SWITCH (dial 9) and ring Paediatric Registrar on call ‘Concern for Paediatric Stroke’.

**After review by *either* the EM registrar/consultant *OR* the paediatric registrar/consultant decision to initiate ‘PAEDIATRIC STROKE CALL’ is made.**

Switch to initiate ‘PAEDIATRIC STROKE CALL’ team to determine optimal patient evaluation, treatment, and disposition.

**‘Paediatric Stroke Call’ to include the following members**

- **Stroke CNS – contacted via FAST mobile (0868228122)**
- **ED registrar/ ED consultant**

## **PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY**

- **Paediatric registrar/ Paediatric consultant on call**
- **Radiology registrar**
- **CT radiographer**
- **If Sickle Cell Disease, also haematologist**

### **Roles and Responsibilities**

- The EM Registrar OR Paediatric Registrar is expected to evaluate patient ASAP and direct initial management. Responsibilities include:
  1. Document Paediatric NIH Stroke Scale score. (See Appendix A.) Online calculator available <https://www.mdcalc.com/calc/10270/pediatric-nih-stroke-scale-nihss>
  2. Inform EM consultant or Paediatric consultant ASAP of potential paediatric stroke
  3. If appropriate, and approved by consultant, mobilize and initiate 'PAEDIATRIC STROKE CALL'.

### **Note: Time from admission to CTB/CTA < 30mins**

- Consultant Paediatrician on take if prior to 5pm and on call Paediatrician after 5pm will attend with Paediatric Registrar on call.
- Consultant Paediatric Neurologist will assist and discuss with the Acute Stroke Consultant for any hyperacute treatment candidates, including thrombolysis and thrombectomy from initiation of 'PAEDIATRIC STROKE CALL' through treatment completion between 9am-5pm, Monday to Friday. Acute Stroke Consultant and Neuroradiologist will be available to assist with thrombectomy decision between 9-5pm.
- Primary team (EM/WARD) is expected to order initial laboratory tests and start basic stroke care. (See Algorithm 1.)
- Radiology registrar is expected to schedule CT B with CTA WITHIN 30MINS
- Radiology registrar is expected to immediately review acute imaging with Consultant Neuroradiologist oversight, and contact EM consultant/ Paediatric consultant with results.
- If diagnostic uncertainty exists, the indication for MRI Brain must be discussed on a case by case basis with the clinical team and neuroradiology team
- Clinical Nurse Manager is expected to identify bed and nursing support.
- Anaesthetic registrar/ consultant is expected to identify bed in ICU/ PICU (as appropriate) & prepare for possible post-tPA/IA therapy. If required, anaesthetics may facilitate sedation for MRI and general anaesthesia for thrombectomy.

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

- Haematology registrar/ consultant is expected to evaluate sickle cell disease (SCD) patients and/or known bleeding disorder ASAP. In these instances, the haematology team will direct management of all SCD patients.

### 5. Initial Evaluation and clinical management

**Stabilization of Patient: In Emergency Department (ED)/ Paediatric Ward/ ICU**

**Initial investigations:**

- FBC and film,
- Hb electrophoresis if black or Mediterranean ethnicity
- U+ E, LFTs, glucose
- Venous gas,
- ESR
- CRP
- Coagulation screen (INR, PT, APTT), D-dimer, fibrinogen, group and cross match
- BHCG as indicated

**Subsequent Investigations:**

- Thrombophilia screen (protein C, protein S, antithrombin, plasminogen, DRVVT, Apc Resistance ratio, TMTHFR and PT20210 gene mutations).
- Anticardiolipin antibodies
- Plasma amino acids, lactate
- Ammonia
- Total plasma homocysteine
- Cholesterol and triglycerides
- Plasma urate
- Transferrin electrophoresis
- Alpha galactosidase A ( to exclude Fabry disease)
- Serum globotriasoylceramide(to exclude Fabry disease)
- Serology: Mycoplasma, VZV, Borrelia

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

- Viral respiratory panel including COVID
- Save serum
- $\beta$ HCG when appropriate (serum/urine) and urine toxicology screen.
- ECG & Chest X-Ray
- Transthoracic echocardiogram
- Urine organic acids
- 

### Imaging:

- Obtain a non- contrast **CT brain with CTA aortic arch to vertex within <30mins of presentation** to hospital.

**Consider MRI Brain MRA circle of Willis and MRA Neck on a case by case basis following discussion with Neuroradiology team and Consultant Paediatrician/Paediatric Neurologist**

### Management<sup>6</sup>:

#### Neuroprotective measures

1. NPO until stable and SALT review
2. Head of bed FLAT unless increased intracranial pressure present
3. If GCS < 8, AVPU = U, if there is a loss of airway reflexes or there is suspected / proven raised intracranial pressure intubate
4. Aim for normal O<sub>2</sub>, CO<sub>2</sub> and ph. Administer high flow O<sub>2</sub> and target SpO<sub>2</sub>  $\geq$  94%.
5. Normotension: Check BP every 15 minutes. Target SBP is between 50th and 90th PERCENTILE for age, treat low BP with NS +/- pressors, treat significant HTN with labetalol to lower by ~25% over 24 hours (discuss with Consultant Paediatrician on call) .Avoid treatment of hypertension unless risk of secondary organ injury
6. Normovolemia: Isotonic fluid (i.e., Dextrose 5%/0.9% NaCl) at maintenance rates with 10 ml/kg bolus PRN, minimise blood loss
7. Normoglycemia: If capillary blood glucose <3 mmol/L give 2 ml/kg of 10% dextrose.
8. Normothermia range 35.5- 36 Celsius : treat any temperature >37 °C with 15mg/kg of paracetamol
9. Seizure control: AED (keppra load 40mg/kg/dose) for any suspected seizure activity.

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

### 10. Mechanical deep vein prophylaxis in high risk children

#### Post-Neuroimaging Review:

- Radiology registrar reviews CT Brain/CTA with consultant radiology oversight to identify evidence of early ischaemic changes/large vessel occlusion
- Consultant radiologist / paediatric consultant to discuss CTA/CT Brain findings, clinical presentation and treatment options.
- If there is consensus that the child should be considered for IV tPA and/or thrombectomy, then therapy may be offered.
- Neuroradiology to establish if any contraindications to tPA when appropriate.
- Registrar to complete IA/IV tPA criteria form, dose tPA, and educate family. Assistance from Stroke registrar/consultant if during 8am-8pm.
- Thrombolytic therapy (such as IV tPA) may be considered in appropriate cases with neurology and stroke consultation.
- If thrombolytic therapy use is being considered review the “tPA for stroke” checklist and obtain consent. IV tPA is currently available in the Neurology Interventional Radiology Suite and Emergency Room Resuscitation suite
- Acute medical interventions to be administered ASAP if IV tPA or thrombectomy not appropriate.

## 6. Treatment

### Management of an Acute Ischemic Stroke

#### TREATMENT for AIS

*If less than 4.5 hours from symptom onset and good intravenous (IV) **tissue Plasminogen Activator (tPA) candidate**, IV tPA will be offered if:*

- Consent is signed (Patient Informed Consent – IV-tPA for Stroke)
- Care team consensus is to offer therapy

*If less than 24 hours from symptom onset and good **endovascular therapy candidate**, therapy will be offered if:*

- Consent is signed (Patient Informed Consent - Mechanical Thrombectomy)
- Care team consensus is to offer therapy

## **PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)**

### **CLINICAL PATHWAY**

In special circumstances, i.e., basilar thrombosis, the decision to provide intra-arterial therapies beyond established guidelines may be made but are outside the scope of this guideline.

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

### Use of thrombolysis or anti-thrombotic therapy.

The off-label use of tissue plasminogen activator (tPA) could be considered in children presenting with AIS who **>8years** and may be considered for children aged between **2-8 years** on a case-by-case basis when the criteria detailed have been met:

- ✓ PedNIHSS  $\geq 4$  and  $\leq 24$
  - ✓ tPA can be administered  $\leq 4.5$  hours of symptom onset
  - ✓ CT has excluded intracranial haemorrhage
  - ✓ CTA demonstrates normal brain parenchyma or minimal early ischaemic change AND partial / complete occlusion of the intracranial artery corresponding to clinical / radiological deficit
- OR
- ✓ MRI and MRA showing evidence of acute ischaemia on diffusion weighted imaging + partial / complete occlusion of the intracranial artery corresponding to clinical / radiological deficit.

### ***PROVIDING THAT THERE ARE NO CONTRAINDICATIONS***

#### **\*\*tPA CONTRAINDICATIONS:-**

##### History

- > 4.5 hrs from last seen well
- Patients in whom time of symptom onset is unknown
- Stroke, major head trauma or intracranial surgery in the last 3 months
- History of prior intracranial haemorrhage, known AVM or aneurysm
- Major surgery or parenchymal biopsy within 10 days (discuss with surgeon who performed procedure)
- GI or GU bleeding within 21 days
- Patient with neoplasm/malignancy or within one month of completion of treatment for cancer.

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

- Patients with underlying significant bleeding disorder. Patients with mild platelet dysfunction, mild von Willebrand disease or other mild bleeding disorders are not excluded.
- Previously dx d primary angiitis of the central nervous system or secondary arteritis.

#### Patient Factors

- Patient who would decline a blood transfusion if indicated.
- Clinical presentation c/w acute myocardial infarction or post MI Pericarditis that requires evaluation by cardiology before treatment
- Arterial puncture at noncompressible site or lumbar puncture w/in last 7. days. Patients who have had cardiac catheter via a compressible artery are NOT excluded.

#### Etiology

- Stroke due to sickle cell disease
- Meningitis,
- Embolism (bone marrow, air or fat)
- Moya Moya disease.

#### Examination

- Persistent systolic blood pressure > 15% above the 95th percentile for age while sitting or supine
- Mild deficit (PedNIHSS <6) at start of tPA infusion
- Severe deficit suggesting very large territory stroke pre-tPA
- PedNIHSS >25, regardless of infarct volume seen on neuroimaging

#### *Imaging*

- Symptoms suggestive of sub-arachnoid haemorrhage even if CT or MRI of head are normal
- CT with hypodensity/sulcal effacement >33% of MCA territory or ASPECTS ≤7
- Intracranial cervicocephalic arterial dissection.

#### *Laboratory data*

- Glucose <2.8 mmol/L or >22 mmol/L
- Bleeding diathesis including Platelets <100,000, PT >15 sec (INR >1.4) or elevated PTT > upper limits of the normal range.

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

- Maintain adequate levels of hydration in patients with occlusive arteriopathies including Moya Moya, especially when fasting or during intercurrent illness.

### Management of tPA administration

- tPA will be given in a location that is safe for both the administration and monitoring of the child during its administration i.e., resus in ED/ ICU/ Room 10 in Puffin.

### Usual Dosage Range and Route for Systemic tPA

0.9 mg/kg to a maximum of 90 mg:

- First 10% of calculated dose given as intravenous bolus dose.
- Remaining 90% of calculated dose given in infusion over 1 hour.

### Indications for referral to interventional neuroradiology

- Patients with acute AIS causing a disabling neurological deficit (NIHSS score of 6 or more) may be considered for endovascular therapy with prior intravenous thrombolysis, unless contraindicated, **beyond an onset-to-arterial puncture time of five hours if**
  - a) PedNIHSS score is more than six
  - b) favourable profile on neuroimaging and salvageable brain tissue imaging has been proven,

**in which case treatment up to 24 hours after onset may be appropriate.**

### Treatment of patients not eligible for tPa administration

- Prescribe and deliver 5mg/kg of Aspirin up to a maximum of 300mg within 24 hours of diagnosis of AIS in the absence of contraindications (e.g. parenchymal haemorrhage).

After 14 days reduce dose of Aspirin to 1mg/kg to a max of 75mg.

### Additional Clinical Management Points

- If the child has symptoms for more than 24 hours call the paediatric registrar on call to discuss the case.
- If outside time window or excluded for other reasons and if stroke concern still exists but patient is not appropriate for acute intervention due to contraindication or timeline obtain neurology consult to decide upon further workup and disposition.

Admitted patients outside of the acute pathway (e.g. possible stroke outside of the 24 hour time-window or with a high suspicion Transient Ischemia Attack [TIA]) should receive

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

cerebral and neurovascular imaging within 24 hours of presentation as tolerated, or sooner if indicated. Exact timing of MRI (and consideration of interval head CT) for patients in this latter category should involve consultant-consultant discussion between paediatric EM/ paediatric neurology and radiology.

#### Transfer of patients

If the patient must be transferred

- Transport with 1 parent if possible, to facilitate rapid stroke treatment consent
- Frequent neurological checks (every 15 minutes) en route.

#### Appendix A. NIHSS Paediatric Stroke Scale

| Item # and Instructions                                                                                                                                                                                                                                                                                                               | Scale Definition and Scoring Guide                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1a. Level of Consciousness:</b> the investigator must choose a response, even 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>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, areflexic.</p> |

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

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| <p><b>1b. LOC Questions:</b> 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 or 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. Modified for children, age 2 years and up. A familiar Family Member must be present for this item: Ask the child "how old are you?" for question number one. Give credit if the child states the correct age, or shows the correct number of fingers for his/her age. For the second question, ask the child "where is XX?", XX referring to the name of the parent or other familiar family member present. Use the name for that person which the child typically uses, e.g. "mommy". Give credit if the child correctly points to or gazes purposefully in the direction of the family member.</p> | <p>0 = Answers both questions correctly.</p> <p>1 = Answers one question correctly.</p> <p>2 = Answers neither question correctly.</p> |
| <p><b>1c. LOC Commands:</b> The patient is asked to open and close the eyes and then to grip and release the non-paretic hand. For children one may substitute the command to grip the hand with the command "show me your nose" or "touch your nose". 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 them (pantomime) and score the result (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>             |

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

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| <p><b>2. Best Gaze:</b> 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. This score is given when gaze is abnormal in one or both eyes, but where forced deviation or total gaze paresis are not present.</p> <p>2 = Forced deviation, or total gaze paresis not overcome by the oculocephalic manoeuvre.</p>                          |
| <p><b>3. Visual:</b> Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting (for children &gt; 6 years) or visual threat (for children age 2 to 6 years) as appropriate. Patient must 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 answer question 11.</p>                                                             | <p>0 = No visual loss</p> <p>1 = Partial hemianopia</p> <p>2 = Complete hemianopia</p> <p>3 = Bilateral hemianopia (blind including cortical blindness)</p>                                                                                                                                                |
| <p><b>4. Facial Palsy:</b> 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 barrier obscures the face, these should be removed to the extent possible.</p>                                                                                                                                                                                                                                                                                                                                                                                             | <p>0 = Normal symmetrical movement</p> <p>1 = Minor paralysis (flattened nasolabial fold, asymmetry on smiling)</p> <p>2 = Partial paralysis (total or near total paralysis of lower face)</p> <p>3 = Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)</p> |

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

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| <p><b>5 &amp; 6. Motor Arm and Leg:</b> The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine) and the leg 30 degrees (always tested supine). Drift is scored if the arm falls before 10 seconds or the leg before 5 seconds. For children too immature to follow precise directions or uncooperative for any reason, power in each limb should be graded by observation of spontaneous or elicited movement according to the same grading scheme, excluding the time limits. 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 nonparetic arm. Only in the case of amputation or joint fusion at the shoulder or hip, or immobilization by an IV board, may the score be "9" and the examiner must clearly write the explanation for scoring as a "9". Score each limb separately.</p> | <p><b>5a. Left Arm 5b. Right Arm</b><br/>0 = No drift, limb holds 90 (or 45) degrees for full 10 seconds.</p> <p>1 = Drift, Limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support.</p> <p>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.</p> <p>3 = No effort against gravity, limb falls.</p> <p>4 = No movement</p> <p>9 = Amputation, joint fusion explain:</p> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p><b>6a. Left Leg 6b. Right Leg</b><br/>0 = No drift, leg holds 30 degrees position for full 5 seconds.</p> <p>1 = Drift, leg falls by the end of the 5 second period but does not hit bed.</p> <p>2 = Some effort against gravity; leg falls to bed by 5 seconds, but has some effort against gravity.</p> <p>3 = No effort against gravity, leg falls to bed immediately.</p> <p>4 = No movement</p> <p>9 = Amputation, joint fusion explain:</p>                                                                          |

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

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| <p><b>7. Limb Ataxia:</b> This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, insure 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. In children, substitute this task with reaching for a toy for the upper extremity, and kicking a toy or the examiner's hand, in children too young (&lt; 5 years) or otherwise uncooperative for the standard exam item. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion may the item be scored "9", and the examiner must clearly write the explanation for not scoring. In case of blindness test by touching nose from extended arm position.</p> | <p>0 = Absent</p> <p>1 = Present in one limb</p> <p>2 = Present in two limbs</p>                                                                                                                                                                                                                                                                                |
| <p><b>8. Sensory:</b> Sensation or grimace to pin prick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. For children too young or otherwise uncooperative for reporting gradations of sensory loss, observe for any behavioral response to pin prick, and score it according to the same scoring scheme as a "normal" response, "mildly diminished" or "severely diminished" response. 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," 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.</p>                                  | <p>0 = Normal; no sensory loss.</p> <p>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 he/she is being touched.</p> <p>2 = Severe to total sensory loss; patient is not aware of being touched in the face, arm, and leg</p> |

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

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| <p><b>9. Best Language:</b> A great deal of information about comprehension will be obtained during the preceding sections of the examination. For children age 6 years and up with normal language development before onset of stroke: The patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet, to repeat words from the attached list, and to read from the attached list of sentences (Table S1; Fig S1, S2, S3). 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 coma (question 1a=3) will arbitrarily score 3 on this item. The examiner must choose a score in 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. For children age 2 yrs. to 6 yrs. (or older children with premorbid language skills &lt; 6 yr. level), score this item based on observations of language comprehension and speech during the examination.</p> <p>The patient with brain stem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic score 2. Patients in coma (item 1a=3) are arbitrarily given a 2 on this item.</p> | <p>0 = No aphasia, normal</p> <p>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 material difficult or impossible. For example in conversation about provided materials examiner can identify picture or naming card from patient's response.</p> <p>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.</p> <p>3 = Mute, global aphasia; no usable speech or auditory comprehension.</p> |
| <p><b>10. Dysarthria:</b> 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 barrier to producing speech, may the item be scored "9", and the examiner must clearly write an explanation for not scoring. Do not tell the patient why he/she is being tested.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>0 = Normal</p> <p>1 = Mild to moderate; patient slurs at least some words and, at worst, can be understood with some difficulty.</p> <p>2 = Severe; 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.</p> <p>9 = Intubated or other physical barrier, explain:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS)

### CLINICAL PATHWAY

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>11. Extinction and Inattention:</b> 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 hemi-inattention to more than one modality. Does not recognize own hand or orients to only one side of space.</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Table S1. Language testing items for PedNIHSS**

|                  |                                                                                                                                                |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Repetition       | Each of 4 word-repetition tasks is presented<br>a) Stop<br>b) Stop and go<br>c) If it rains we play inside<br>d) The President lives in Dublin |
| Reading          | Each of 3 items is presented for the child to read in Fig 1.<br>Adjust expectations according to the child's age/school level                  |
| Naming           | Pictures are presented of a clock, pencil, skateboard, shirt, baseball, and bicycle (Fig 2.)                                                   |
| Fluency and word | The picture (Fig 3) is presented and the child is asked to describe what he/she sees.                                                          |

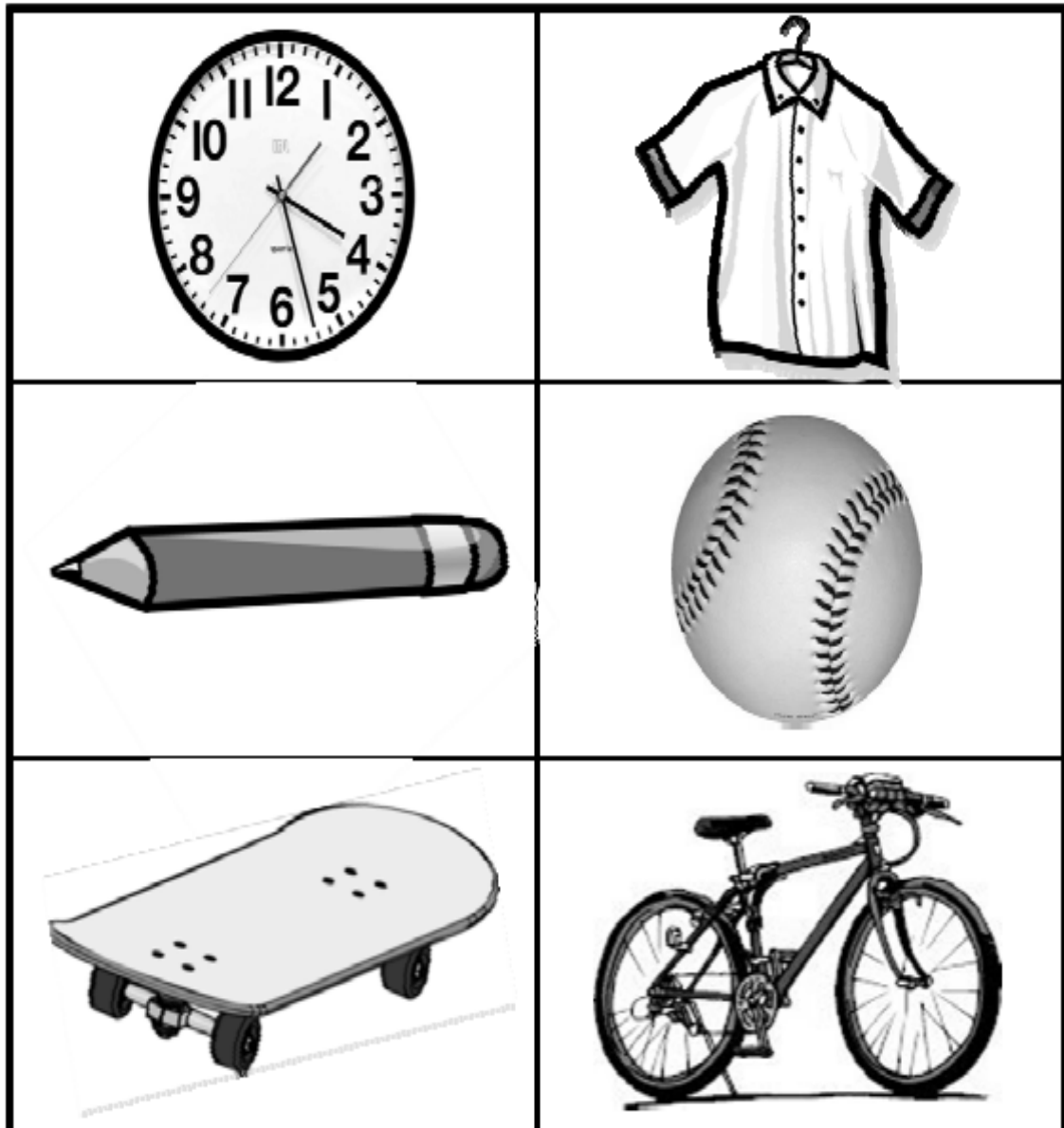
Fig S1 (reading items for PedNIHSS)

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

Stop

See the dog run

Little children like to play  
outdoors



## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

Fig 2. (Naming items for PedNIHSS)

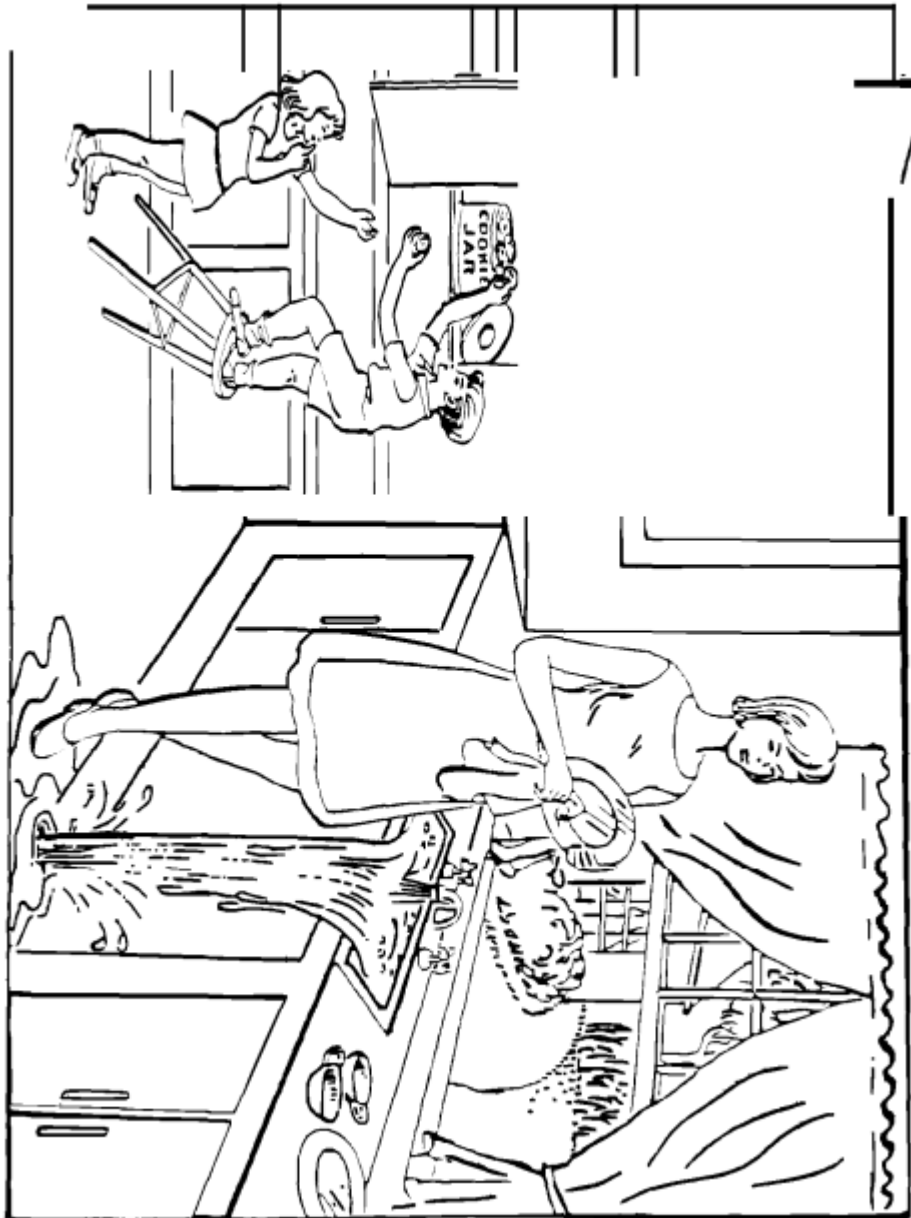


Fig 3. Picture to test story-telling for PedNIHSS

## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

### Appendix B. Blood Pressure Centiles

#### Systolic Blood Pressure Parameters - Female

| Age           | 50% | 95% | >15%<br>above<br>95% | >20%<br>above<br>95% |
|---------------|-----|-----|----------------------|----------------------|
| 1 – 4 years   | 90  | 111 | 128                  | 133                  |
| 5 years       | 94  | 113 | 130                  | 136                  |
| 6 – 10 years  | 96  | 121 | 139                  | 145                  |
| 11 – 18 years | 105 | 131 | 151                  | 157                  |
| >18 years     | 110 | 140 | 161                  | 168                  |

#### Systolic Blood Pressure Parameters - Male

| Age           | 50% | 95% | >15%<br>above<br>95% | >20%<br>above<br>95% |
|---------------|-----|-----|----------------------|----------------------|
| 1 – 4 years   | 90  | 112 | 129                  | 134                  |
| 5 years       | 95  | 113 | 130                  | 136                  |
| 6 – 10 years  | 96  | 121 | 139                  | 145                  |
| 11 – 18 years | 105 | 140 | 161                  | 168                  |
| >18 years     | 110 | 140 | 161                  | 168                  |

#### REFERENCES

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## PAEDIATRIC ARTERIAL ISCHAEMIC STROKE (AIS) CLINICAL PATHWAY

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