Paediatric anaesthetic management of acute stroke patients <15 years of age

Identifying and treating stoke in children can be a challenge. Any patient with sudden onset neurological deficit should be treated as an emergency, early intervention may reduce the neurological deficit "time is brain". Once a treatable stroke has been confirmed getting the patient to intervention as soon as possible is key. We do NOT have a paediatric anaesthetic team on standby so early contact with the anaesthesia coordinator is essential to mobilise staff. This may involve calling in a second team (SMO + technician). A higher proportion of children have pre-existing cardiac issues a cardiac anaesthetist may be required.

Risk factors for stroke in children include cardiac disorders, vascular disease, infection, sickle cell disease, head and neck trauma and haematological disorders.

Acute management

- All children should receive neuroprotective cares.
- Urgently consider the eligibility for reperfusion therapy
    - Thrombolysis window 0 - 4.5 hours from symptom onset
    - Clot retrieval window 0 - 6 hours (6-24 hours in highly selected patients)

Neuroprotective cares

All patients should receive neuroprotective cares regardless of stroke aetiology, to minimise brain injury, optimize neurological outcome and prevent stroke extension.

- **Normotension control**
  Maintain target SBP between 50th and 90th percentile for age (only treat hypertension in discussion with paediatric neurologist)
- **Glycaemic control**
  Children with suspected or confirmed stroke should have their blood glucose level monitored for the first 72 hours, and appropriate glycaemic therapy instituted to treat hyperglycaemia (glucose levels greater than 10 mmol/L) to achieve normoglycaemia. Monitor urine volume.
- **Temperature control**
  In all children with suspected or confirmed stroke, active steps should be made to avoid hyperthermia as it significantly increases cerebral metabolic rate. Treat temperature >37.5 C with antipyretics. Targeted temperature management should be considered if signs of raised ICP are present.

- **Normovolaemia control**
  Administer isotonic fluids at maintenance requirements with fluid bolus as indicated

- **Oxygen supplementation**
  If the child is hypoxemic, supplementation oxygen is to be administered to maintain oxygen saturation of 92% or higher. Careful consideration of oxygen supplementation is required for children with stroke associated with sickle cell anaemia.

- **Seizure control**
  Continually monitor for seizures in all children with suspected or confirmed stroke. The neurologist should be notified of any seizures. Intravenous levetiracetam, phenytoin or other anticonvulsant treatment will be considered. For status epileptics ALPS and/or hospital guidelines should be followed - see Status Epilepticus guideline.

- Monitor ICP – if available

- Continually assess need for further diagnostic studies/ intervention.

Neuroimaging

MRI /MRA +/- MR perfusion are the modality of choice given the greater frequency of stroke mimics in childhood. See Stroke Imaging protocol

Where there is concern for haemorrhagic stroke or limited access to MRI, CT / CT-A +/- CT-P can be performed. See Stroke Imaging protocol

Contrast given via 5 second injection using power injector. Cannula size needs to be at least 22G

If CT brain negative, consider need for acute MRI when available. There is a 50% false negative rate with early CT. (CT-A will identify patients suitable for urgent reperfusion treatment).

- In most instances the initial CT/CT-A can be performed with or without sedation from ED and will not require a GA ** anaesthesia may be contacted to assist with this initial scan.*

Following the neuroimaging there will be a discussion between the neurologist/ radiologist/ neuro-interventionalist/Anaesthesia/ PICU if Alteplase or Clot retrieval is indicated.

Overall process after treatable stroke confirmed.

These patients present as time critical emergencies, akin to evacuation of an extradural haematoma. Delays worsen patient outcome. Organisation of getting to level 5 and pre-assessment of the patient should be done as quickly as possible to avoid delay.

- Neuro-interventionalist to contact Starship Anaesthesia Coordinator – advise age/ NHI, timing and which DSA to be used (commonly DSA2)
    - Name and phone numbers of neuro- interventionalist and neurologist to be given to on-call anaesthesia SMO
- Starship Anaesthesia to call in SSH anaesthesia technician via switchboard.
- Anaesthesia technician to check anaesthesia machine and set up equipment on arrival.
- Patient should be held in ED or PICU with neuro protective care until anaesthesia teams are expected to arrive at the hospital – can then be transferred to level 5
- Neurologist to give clinical handover to anaesthesia team in radiology suite including neurological status, premorbid level of function, comorbidities, medications, allergies, weight and height and any other pertinent information.
- Neurology team to book patient on Starship acute board SCOPE
- Anaesthesia consent to be done with family.
- Combined Sign in /Time out completed by anaesthesia and Neuo-interventionalist doing the procedure and theatre team.
    - This should include.
        - **Hard Limits on fluid and contrast** to be discussed and documented at time of time out based on weight of the child.
        - Hemodynamic targets – BP targets usually within 20% of BP for age.
        - Heparin requirements - not often needed, dose 50-100U/Kg as bolus (100U/kg is cardiac catheterisation dose aiming for ACT >200sec at 1 hour.)

Preferred anaesthetic technique.

Tracheal intubation, maintain FiO2 to maintain sats >92%, Ventilation adjusted to maintain normocarbia

Continuous arterial monitoring is recommended, the femoral artery cannulated by INR can be used if radial or brachial artery cannulation is conferring delay.

A CVL may be preferred, is not essential and should not delay the start of the procedure.

NIBP should be measured every 1-3 min until IABP is secured.

Maintain systolic blood pressure (SBP) within 20% of expected BP for age using fluid and vasopressor * monitor total amounts of fluid given including that used by INR. If full recanalization is achieved, SBP targets may need to be adjusted/reduced by 10-20% of pre induction levels.

There is emerging evidence that TIVA is beneficial in adult patients over volatile, while we await stronger evidence the choice between TIVA and volatile should be determined by the individual anaesthetist, Muscle relaxant and opioid is recommended to achieve a still, stable patient. The use of BIS/Sedline is not practical during the procedure.

Temperature probe – to ensure normothermia consider rectal or bladder temp if probe is likely to interfere with scanning

POST OP

These patients should be transferred to PICU intubated and ventilated, maintaining neuroprotective cares. They will be extubated after discussions with neurologist, INR and PICU and transferred to 26A

Essential Contacts

Starship Anaesthesia Coordinator SMO (021) 334 344 (Day time hours). After-hours answered by anaesthesia registrar who will contact the SMO on call.

Starship Anaestheisa technician (021) 893 865 (day time hours only) - after hours use switchboard