
Clinical Guidance

Paediatric Critical Care: Time Critical Neurosurgical Transfer

Summary

This guideline is for the management of patients with intracranial pathology and raised intracranial pressure requiring emergency transfer to a neurosurgical centre. The goal is for a quick and safe transfer. A practical checklist is also provided.

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Relevant external law, regulation, standards	
<p>This clinical guideline has been produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.</p> <p>This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.</p>	

Change History		
Date	Change details, since approval	Approved by
03/19	Checklist added, hyperlink for hypertonic sodium chloride added	PICU team.

Time Critical Neurosurgical Transfer

- CT scan should be done within 30 minutes of the suspicion of mass lesion
- Delay in the transfer to a neurosurgical centre risks serious brain injury or death
- Transfer for emergency neurosurgery should normally be performed by the local team NOT STRS
- Departure to neurosurgical centre should occur within a **MAXIMUM** of 60 minutes from end of scan

Responsibilities of Paediatric Team

- CONSULTANT should be present
- Commence resuscitation and inform anaesthetic team ASAP
- Organise URGENT CT, report and send to neurosurgeon
- Referral to neurosurgery – 'is this a time critical lesion?'
- Referral to STRS
- Contact emergency ambulance service via 999 stating 'Paediatric neurosurgical critical care transfer' with ETD
- Support anaesthetic team: nurse or Dr in transfer team

Responsibilities of STRS and receiving PICU

- Secure bed on PICU and facilitate neurosurgical referral
- Advise DGH on patient management
- Encourage swift transfer

Responsibilities of Anaesthetic Team

- Continue resuscitation
- Commence respiratory support as needed
- Mobilise team: ODA/consultant/ICU outreach nurse
- Decide who in team will transfer the child
- Setup portable monitor and ventilator
- Monitor child closely and transfer ASAP

Responsibilities of Neurosurgical Team

- Diagnosis : 'This is a time critical lesion'
- Feedback to local DGH within 30 minutes of referral
- Liaise with receiving PICU
- Inform DGH what site in receiving hospital the child should be taken e.g. theatre or PICU

Stabilisation Priorities: SAFE but SWIFT transfer: do not delay for unnecessary procedures

AIRWAY

- Need for intubation to be determined by local team
- ETT secured (oral/nasal correct size and position)
- Avoid nasal if possible basal skull fracture or coagulopathy
- C spine immobilisation for any trauma patient, keep midline
- Gastric tube on free drainage if ventilated

BREATHING

- Monitor end tidal CO₂ (aim 4-5 kPa)
- Urgent CXR post intubation for tube position/complications
- Exclude tube problems if hypoxia or hypercapnia
- Standard settings for ventilator: PEEP 5 / rate 15 to 20 / Insp time 1.0 sec, PIP to move chest

CIRCULATION

- Two patent well-secured intravenous lines
- Do NOT delay for difficult central or arterial access
- Consider intraosseous line
- Maintain BP around age appropriate targets* (see right)
- Use fluid bolus and peripheral dopamine to maintain BP
- If CVL in place use noradrenaline to support BP if needed

DISABILITY and everything else

- MONITOR PUPIL RESPONSE @ 15 mins intervals minimum
- Do not tape over the eyelids
- Sedate adequately
- Keep midline and elevate bed to 30 degree angle
- Phenytoin load if seizure noted
- Trauma patients: other injuries excluded/stabilised/sutured

TRANSFER TO AMBULANCE and onward journey

- Child secured on ambulance trolley
- Ambubag and mask on trolley
- Drugs for transfer (sedation/muscle relaxation)
- FULL portable oxygen cylinder on trolley + spare
- Switch to vehicle oxygen supply ASAP
- Request as smooth a journey as possible
- Seatbelts worn when vehicle moving

STRATEGY: AVOID HYPOXIA AND HYPOTENSION

- Arterial saturations > 98%
- Maintain systolic BP: approximate targets for age*

< 1 yr	>80
1 -5 yr	>90
5-14 yr	>100
>14 yr	>110
- Maintain end tidal CO₂ between 4-5 kPa
- Keep temperature 36-37C : treat hyperthermia
- Identify and treat seizures
- Maintain normal blood sugar
- Maintain plasma Sodium > 140 mmol/l
- Identify associated injuries (falling Hb/hypotension)

INTRACRANIAL HYPERTENSIVE CRISIS

BRADYCARDIA/HYPERTENSION/PUPIL DILATATION

- Ensure end tidal CO₂ between 4-4.5 kPa
- Give 3 mls/kg of hypertonic sodium chloride (2.7 or 3%)*
- Sedate
- Do not delay urgent transfer: keep moving

DOCUMENTATION

- Copy notes with results and observation charts
- Image link all X-rays and CT scans or place on CD or have hard copies

PARENTS

- Directions to destination hospital and PICU
- Telephone number of receiving PICU
- Make sure transfer team have parents contact details

PRE DEPARTURE AND ON ROUTE

- Inform receiving PICU of departure from DGH
- Check where the child is expected (theatre /PICU)
- Receiving PICU should inform neurosurgeon
- Record observations every 15 minutes
- Update PICU or neurosurgeon if any deterioration

Print drug calculator for patient weight from STRS website

* Hypertonic sodium chloride: most departments have 2.7%, If not available make up 3% with below recipe:

3% sodium chloride – Discard 36mls from 500ml bag 0.9% sodium chloride and insert 36mls of 30% sodium chloride into bag
Dosage – 3-5mls/kg over 20 minutes

PAEDIATRIC TIME-CRITICAL NEUROSURGICAL TRANSFER CHECKLIST

This checklist will assist you to carry out the time-critical transfer in a safe and timely manner

AIRWAY

- ETT secure(correct size & length/avoid nasal)
- Position of ETT and NGT confirmed (ETT tip at T2 on CXR ideal for transfer)
- Appropriate HME filter for patient size
- C-spine immobilised**
- Orogastric tube on free drainage

BREATHING

- Avoid hypoxia - SpO₂ >92%
- Attach ETCO₂ monitoring (aim 4-5kPa)
- Standard ventilator settings : PEEP 5/ Rate 15-30 / Ti 0.8 / PIP to move chest

CIRCULATION

- Minimum 2 points of IV access for transfer
 - Discuss inotropes with transport consultant
 - Consider IO access – no transfer delay for CVC
- Maintain age appropriate systolic BP
- Regular BP - no transfer delay for arterial line
- Consider obtaining a blood group/cross match sample to accompany patient (fully labelled)

DISABILITY AND EXPOSURE

- CT Head <30min
- Adequate sedation and muscle relaxants
- Position head tilt 20-30°
- 15min pupillary monitoring**
- C-Spine protection (if necessary)
- Identify and treat seizures
- Maintain normal blood glucose
- Aim plasma sodium >140 mmol/L
- Intracranial hypertensive crisis – Bradycardia/hypertension/pupillary dilatation**
 - Aim pCO₂/EtCO₂ 4-5kPa
 - Hypertonic sodium chloride (HTC- 2.7 or 3%) 3ml/kg over 15min
 - Repeat HTC if required
 - Mannitol 0.25-0.5g/kg (If no HTS)
 - Sedate adequately (bolus pre-suction)
 - Keep moving – don't delay
- Maintain normothermia - regular/core temperature monitoring
- Secondary survey (if trauma)

PREPARATION, PACKAGING & TRANSFER

- Request urgent 999 Ambulance transfer (Category RED1 or RED2)
- Emergency airway & breathing equipment portable suction/fluids/drugs/adequate O₂
- Ensure patient & equipment is adequately secured to ambulance trolley
- Ensure smooth journey due to effects on haemodynamics and ICP
- Travel safe –seatbelt on at all times
- Transfer letter with photocopy of relevant notes, results, drugs charts, anaesthetic charts etc
- PACS/copy of all imaging
- Document and highlight any safeguarding issues
- Keep parents up to date
- Phone receiving team with ETA and inform them if there are any changes in the patient's condition or you are concerned that the patient is deteriorating further**