



Clinical Guidelines

Acute Neurosurgical Emergency Transport

Document Control Information

Author	C. Roberts D. Lutman	Author Position	ANP Head of Clinical Service
Document Owner	E. Polke	Document Owner Position	Service Coordinator
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1. Assessment

An acute neurosurgical emergency is time-critical.

This usually means that the patient must reach a neurosurgical centre for *urgent surgery without delay*, as soon as possible, and certainly within 4 hours of injury.

In order to achieve a timely transfer, the transport to a neurosurgical centre will need to be undertaken by the referring hospital team (SBNS and RCoA 2010, Anaesthesia 2019).

Urgent conference call between receiving neurosurgeon and CATS

For these reasons, early identification and appropriate management of an acute neurosurgical emergency is crucial.

A CT scan will usually help in identifying such situations. However, it is important to clinically consider the possibility of a neurosurgical emergency even before the CT scan is performed.

Useful pointers (but not a comprehensive list):

Following trauma

- A. Rapid loss of consciousness
- B. Initial lucid interval followed by rapid loss of consciousness
- C. Unequal pupils
- D. Cushing's triad: hypertension, bradycardia and abnormal respiration
- E. Focal neurological deficit e.g. hemiparesis
- F. Obvious external injury e.g. depressed skull fracture
- G. Suspicion of Non accidental injury (NICE HI pathway)

Non-traumatic

- A. Suspected VP shunt block
- B. Rapid loss of consciousness in previously well patient
- C. Unexplained cardio-respiratory arrest in young infant
- D. Focal neurological deficit, including focal seizures in an older child
- E. Antecedent severe headache and vomiting

2. Initial management

Initial management should be in accordance with APLS/ATLS guidelines:

- Stabilise airway and cervical spine, breathing and circulation (ABC) as a priority. These take precedence over other injuries. **Hypotension and hypoxaemia are strongly associated with poor outcome**
- Establish 2 points of intravenous access (consider intraosseous access if difficult)
- Pass urinary catheter and orogastric tube
- Consider NAI, especially in children < 2 years of age

3. Indications for intubation

- GCS of ≤ 8 or rapid decrease in GCS
- Signs of raised ICP: pupillary asymmetry, Cushing's triad
- Loss of airway reflexes
- Ventilatory insufficiency
- Spontaneous hyperventilation ($\text{PaCO}_2 \leq 3.5$)

4. Management following intubation

- Continue complete in-line cervical immobilisation with properly fitting collar, sandbags and tape (this is a visual reminder regarding C spine clearance)
- Secure airway with Melbourne strapping or tape. Ensure equal air entry
- Sedate and paralyse adequately with morphine, midazolam and vecuronium infusions
- Ventilate to a normal PaCO_2 (4.0 – 5.0 kPa), with mandatory ETCO_2 monitoring
- Aim for saturations of $\geq 94\%$
- Maintain MAP to maintain CPP, use adrenaline or noradrenaline

Age	Mean Arterial Pressure (MAP)
<2 yrs	>60 mmHg
2-6 yrs	>70 mmHg
>6 yrs	>80 mmHg

- Consider mannitol (0.25 to 0.5 g/kg = 1.25 – 2.5 ml/kg of 20% solution) and/or 2.7% NaCl (3 ml/kg over 20 minutes, aim for serum Na 145) if concerns about raised ICP or rapid changes in clinical signs (e.g. pupillary changes). Discuss with CATS consultant and neurosurgical team
- Frequent attention to pupil size and vital signs is essential

5. Transport considerations

- Decision regarding the most time effective method of transporting the patient to tertiary centre should be made in joint consultation with the CATS consultant and neurosurgical team. **National guidance suggests that for a neurosurgical emergency, transport by the referring hospital team is the most appropriate.**
- Staff most familiar with inter-hospital transport and capable of managing the airway should perform the transport. This will usually be a member of the anaesthetic team from the referring hospital
- Mandatory monitoring during transport should include: ECG, SpO₂, blood pressure (non invasive or invasive) and end tidal CO₂
- Child should be fully sedated (morphine and midazolam infusions) and muscle relaxed for the transport
- Fentanyl boluses (1-2 mcg/kg), mannitol and/or 2.7% saline should be available during transport for rapid changes in ICP

References

ALSG 2016

Paediatric Trauma – Stabilisation of the Cervical Spine. Royal College of Emergency Medicine 2017

Guidelines for safe transfer of the brain-injured patient: trauma and stroke, 2019. Nathanson et al. Anaesthesia 2019.

**CHECKLIST TO AID TRANSPORT OF NEUROSURGICAL EMERGENCIES FOR THE
DISTRICT GENERAL HOSPITAL**

Appropriate staff identified

Local ambulance service notified

State ventilated neurosurgical emergency patient transport
Expect ASAP response time

Essential equipment

Airway bag (tape, face mask, T piece, bag valve mask, ETT,
laryngoscopes, scissors)
Drug bag (Fluid boluses, mannitol and/or 2.7% saline, fentanyl)
Ventilator and oxygen
Infusion pumps (sedation, muscle relaxant, vasoactive infusions)
2 points of IV/IO access

Adequate monitoring

ECG
SpO₂
Blood pressure (NIBP cuff or arterial)
End tidal CO₂

Physiological targets

SpO₂ ≥94%
Mean BP = age appropriate target
End tidal CO₂: 4.0-5.0 kPa
Full sedation and paralysis

