Guideline for Patients with Severe Traumatic Brain Injury (GCS ≤8)

Call PICU: 1800 222 378

Airway

- Assess patient ability to maintain patent airway – clear and/or secure as per ATLS
- If Intubation needed: **Oro**-tracheal rapid sequence induction is ideal. ETT tapes **not** circumferential
- Cuffed ETT preferred due to risk of aspiration/nosocomial infection
- Lower doses of induction agent recommended – avoid hypotension

Breathing

- Keep oxygen saturations > 98%
- Use ABG to maintain PaO_2 10-14kPa & $PaCO_2$ 4.5 – 5.0kPa
- Ventilate with initial PEEP 5cmH_20. **CXR to confirm ETT position**.
- Continuous ETC02 mandatory to monitor airway patency and keep pCO_2 in target range
- Insert OGT to free drainage to empty and decompress stomach

Priority Two
Maintain Haemodynamic stability

- Out-rule ongoing haemorrhage as per ATLS
- Maintain **minimum** systolic BP ≥ [70mmHg + (age in years x2)] if 0-10yr & ≥90mmHg if >10yr old
- If Hypotensive/hypovolaemic – 10-20ml/kg 0.9% NaCl as IV push – reassess post bolus. Repeat x3
- If fluid resistant – consider inotropes – see full guideline. Noradrenaline is typically first line via good PIV if CVC unavailable
- IVF @ 100% maintenance for age– NaCl 0.9%. Add dextrose 5% if <1yr AND hypoglycaemic. Keep bld glucose >4mmol/L
- Maintain Hb >100g/L. FFP, platelets and tranexamic acid can be considered if blood loss significant or ongoing
- Catheterise to monitor U/O and avoid bladder distension.

Priority Three
Neuroprotection

- Adequate sedation – 1st line – morphine load 100mcg/kg then infusion @ dose 20mcg/kg/hr (range 20-60mcg/kg/hr) AND midazolam load 50mcg/kg then infusion @ 2mcg/kg/min (range 1-5mcg/kg/min)
- Treat seizures - as per APLS – lorazepam 0.1mg/kg x2 then Levetiracetam load 40mg/kg IV over 20minutes (max 2.5gram)
- Maintain normothermia (36 – 36.5°C). Monitor **core** temp (rectal/oesophageal). Cool aggressively if hyperthermic >37°C
- If shivering occurs – consider neuromuscular blockade (NMB).
- NMB will mask seizures but may be necessary to facilitate safe transfer. Ensure adequate sedation before paralysing
- Nurse with head in midline and head at 30° elevation if no C-spine precautions in place
- Perform non contrast CT brain and C spine when safe. Do **not** delay transfer for scan if head injury is obvious and timely CT unavailable – discuss with neurosurgical team/PICU team if unsure

Priority Four
Treatment of suspected raised ICP

- Suspect raised ICP if: Lateralising signs, pupillary dilatation, falling GCS, acute HR/BP changes, abnormal CT
- If clinical concern – reassess priorities 1-3. Assess need to suction – sedate for same. Use NBM if coughing
- Osmotic therapy –3% NaCl 5ml/kg **OR** mannitol 0.5gm/kg IV over 15- 20minutes – can be repeated
- If ongoing concern: Third line therapies → 3-5min targeted fall in paC02 of 1-2kpa – **prolonged use is harmful**

Time Critical Pre-Departure Checklist

Child with Elevated ICP

To be completed by referring team prior to departure

Contact with the accepting PICU intensivist via 1800 222 378
For advice during transfer

IPATS Irish Paediatric Acute Transport Service

CCRS Critical Care & Retrieval Services

Airway / Ventilation Considerations

- ☐ Appropriate Sized ETT well secured with spare intubation set available
- ☐ NGT inserted and attached to bile bag for drainage
- ☐ CXR performed and ETT & NGT position modified if required
- ☐ Vent set to achieve 6-8ml/kg/min Tv + RR to keep $ETCO_2$ in target. PEEP typically set to $5cmH_20$
- ☐ Patient in midline and elevated to 30° – 45° for transfer
- ☐ Blood gas (cap/ven/art) checked once on transport ventilator. Blood glucose reviewed.
- ☐ $ETCO_2$ in ventilation circuit and visible on transport monitor – targeting 4.5-5Kpa
- ☐ Oxygen titrated to achieve 0_2 sats between 94-98% - avoid hypoxia AND hyperoxia
- ☐ Appropriately sized ETT suction catheters available (uncuffed ETT size x2 = Catheter French)
  i.e. 3.5 cuffed ETT has same internal diameter as a 4.0 uncuffed ETT ∴ (4 x 2) = 8 F suction catheter
- ☐ Maintain normothermia – monitor core body temp

Circulation Considerations

It is always recommended that cardiac arrest medications are brought in addition to, and kept separate from, those suggested below

- ☐ Working Vascular Access x2 (IV/IO)
- ☐ Continuous ECG monitoring on transport monitor
- ☐ NIBP set to auto q3-5min if art line unavailable
- ☐ Maintain **minimum systolic BP ≥**
  0-10yr = [70mmHg + (age in years x2)]
  >10yr old = ≥90mmHg
- ☐ Rescue fluid available – 0.9% Saline
- ☐ **Noradrenaline infusion** prepared and connected to patient (if in use dose range is 0.02mcg/kg/min to 0.2mcg/kg/min)
- ☐ If patient already on Noradrenaline – discuss with PICU re additional inotrope to bring on transfer – likely Adrenaline/Vasopressin
- ☐ **Push dose pressors:** (to correct hypotension)
  Choice & dose at discretion of medically responsible consultant.

1. Adrenaline **1:100,000**
   Add 1ml Adrenaline 1:1,000 to 99ml NS = 10mcg/ml solution (label clearly)
   Dose - 0.1ml/kg = 1mcg/kg per dose
2. Phenylephrine 100mcg/ml
   Dose - >1mo - 12yrs = 5-20mcg/kg
   Dose - >12yrs = 100-500mcg/kg
3. Ephedrine diluted to conc. of 3mg/ml
   Dose – 1-12yr = 500mcg/kg
   Dose - >12yr = 3-7.5mg

Sedation / Neurosurgical Considerations

Deep sedation required:

- ☐ <2yr **or** haemodynamically unstable
  Morphine 20-40mcg/kg/hr AND
  Midazolam 3-5mcg/kg/min
- ☐ >2yr **and** haemodynamically stable
  Propofol 3-5mg/kg/hr +/-
  Remifentanil 0.1 – 0.2mcg/kg/min
- ☐ Intermittent/continuous NMB blockade

Suggested bolus CNS medications for transfer

Use & dose at discretion of medically responsible consultant.
Dose titration recommended if haemodynamically unstable

1. Ketamine 0.5-2 mg/kg
2. Rocuronium - 0.6-1.2 mg/kg
3. Propofol 1-2 mg/kg
4. Lorazepam Dose 0.1mg/kg max 4mg for seizures
5. Fentanyl 1-2mcg/kg

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The Irish Paediatric Acute Transport Service (IPATS) in conjunction has produced this clinical guideline with the Paediatric Intensive Care Unit and Neurosurgical Department, in Children's University Hospital, Temple Street. It has been designed for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.

This guideline represents the views of IPATS 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.