

2.5 Traumatic Brain Injury

Position responsible: Medical Director
Approved by: CGC

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Related Documents None

Further information Royal College of Surgeons of England: Working party on the management of patients with severe head injury
AAGBI : recommendations for the transfer of patients with acute head injuries to neurosurgical units
Guidelines for Pre-hospital management of Traumatic Brain Injury, Brain Trauma Foundation
NICE Clinical Guidance 56, Head Injury 2007
CRASH 3 trial
Magpas Pre-hospital Emergency Anaesthesia SOP

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1.0 Background

1.1 Traumatic brain injuries (TBI) are common amongst the population of patients attended by the clinical team, and its management has an important bearing on reducing secondary brain injury and therefore patient outcome. The Magpas Policy on TBI details the reasons behind the actions in this SOP and should be read in conjunction with this.

2.0 Procedure

2.1 Assessment

- a) All patients should have an initial ABCD assessment, including an accurate assessment of
 - i. Glasgow Coma Score (GCS),
 - ii. pupils (size and reactivity), and
 - iii. focal peripheral neurology.

Patients should be treated based upon the greatest threat to life whilst aiming to prevent further harm.

- b) Individual components of the GCS should be clearly documented on the patient care record.
- c) Full monitoring (oxygen saturation, NIBP and 3 lead ECG) should ideally be applied during the assessment
- d) A blood glucose level should be measured.
- e) If a TBI is obvious or suspected, this SOP should be followed bearing in mind that the patient may also have other clinical needs.

2.2 Management – airway, ventilation and oxygenation

- a) All patients should receive high-flow oxygen via a non-rebreathing mask or bag-valve mask to maintain SpO₂ to greater than 94%.
- b) It is important that control is gained of the situation in those patients that are combative due to a TBI. Upon gaining IV access, a small amount of sedative (midazolam or ketamine) can be considered. This allows the application of monitoring, gaining more IV access and adequate pre-oxygenation prior to induction of anaesthesia. However the possible safety benefits of improved pre-oxygenation should be weighed against the risks of depression of consciousness (which may be unpredictable in these patients) and consequent compromised ventilation / hypercapnia.
- c) The airway should be secured in:
 - o all patients with severe TBI (GCS < 9), or
 - o those patients unable to maintain an adequate airway, or
 - o those patients with hypoxia not corrected by supplemental oxygen administration,
 - o It should also be considered in those patients with a high GCS but who are combative due to a presumed TBI.

Securing the airway is performed following the Pre-hospital Emergency Anaesthesia SOP

- d) At all times it is vital to avoid hypoxia as this is associated with poor outcome. Both hypocapnia and hypercapnia may be hazardous: once intubated, an end-tidal CO₂ between 4– 5kPa should be targeted. Lower EtCO₂ may be appropriate in patients with serious acute or chronic lung pathology

2.3 Management – circulation

- a) Even short episodes of hypotension are associated with poor outcome. Blood pressure should be maintained at all times (mean arterial > 90mmHg in isolated head injury or mean arterial > 70mmHg in multiply injured patients) through the use initially of IV 0.9% saline followed by judicious use of vasopressors and / or inotropes.
- b) Elderly patients may require even higher blood pressures, reflecting pre-existing hypertension.
- c) Maintenance of cerebral perfusion pressure may be difficult in the context of uncontrollable haemorrhage from other injuries. The priority will be to obtain urgent haemorrhage control e.g. by rapid evacuation and transportation.
- d) Induction agents often cause hypotension and those with a low GCS they are more vulnerable to swings in physiology. For this reason, reducing the dose of drugs should be performed for low GCS patients.
- e) Tranexamic Acid – a bolus of TXA should be given IV to all TBI patients with a GCS of 12 or below whose injury was within 3hrs. The dose is 1g for adults and 15mg/kg for children. This should be administered within 1hr of injury preferably.

2.4 Management – cervical spine

- a) All TBI patients should be considered as having a potential spine injury and therefore have appropriate cervical spine stabilisation.

2.5 On-going Management

- a) Adequate sedation, analgesia and paralysis must be maintained if intubated.
- b) Patients should be kept at normal body temperature, but not rapidly rewarmed.
- c) Hypoglycaemia must be rapidly detected. Treatment must be aggressive although undue hyperglycaemia must also be avoided.
- d) If the patient has an obvious depressed skull fracture or penetrating head injury, a loading dose of levetiracetam should be given.
- e) The Trauma Triage Tool should be followed for disposition. The Network Co-ordination Service is available for advice, bypass requests and pre-alerts in the east of England.

2.6 Pupil asymmetry

2.6.1 If the patient shows signs of acute cerebral herniation (asymmetric dilated pupil, bilateral fixed dilated pupils, bradycardia, blood pressure disturbance).

- Consider other causes of pupillary asymmetry e.g. direct orbital trauma. If there is any doubt, it should be considered a sign of raised intracranial pressure
- Ensure SpO₂, EtCO₂ and BP are optimised / adequate.
- Ensure muscle relaxation and analgesia / hypnosis are adequate.
- The head of the trolley should be raised to an angle of 30degrees where haemodynamically possible
- Ensure tube ties are not unduly tight. Loosen / consider removing any cervical collar

2.6.2 Reassess once these measures have been taken and if on-going critical intracranial hypertension is suspected:

- A single dose of 5% saline (hypertonic saline) should be given – 100ml in adults or 2ml/kg (up to a maximum of 100ml) in children.
- If there is no resolution of the problem, they should receive a 2nd bolus of 5% saline at the same dose and consideration given to being hyperventilated to an EtCO₂ 3.5-4.0kPa as a rescue strategy only.

2.6.3 A Procedural Aide Memoir is available for this situation, and advice can be sought from the Duty Advice Doctor.

3.0 Audit

3.1 All cases of TBI will be reviewed by the Clinical Directorate and audited against the standards in this SOP.

3.2 Constant sharing of information with Emergency Departments and NCCU aims to ensure high quality clinical care.

Appendix 1 – Summary of standards for Traumatic Brain Injury

Traumatic Brain Injury Standards

	GREEN	RED	Notes
SpO₂	>90%	<90%	Excluding those with pre-induction hypoxia
MAP	>85mmHg	<85mmHg without appropriate actions to address hypotension	Exclude those with suspected bleeding
EtCO₂	4.0-5.0kPa	>5kPa <4kPa	Within 15 minutes of induction
Temperature	>36 or mitigation applied	<36 and no mitigation applied	
Disposition	Trauma triage tool followed	Trauma triage tool not followed	
Neuroprotective measures applied	Loose c-collar Loose tube tie Head up 30'	Measures not applied	
Glucose	>4	<4	
Unequal pupils	Hypertonic saline given	No hypertonic saline given	
TXA	GCS 12 or less, TXA given within 1hr of injury		