South West Paediatric Major Trauma Network
Drowning in Children:
Guideline for Initial Management and Transfer

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DROWNING: Respiratory impairment following immersion/submersion in a liquid medium.

Prognosticators

Positive: GCS >5, cardiac output and spontaneous breathing in ED

Negative: age <3yrs, submersion >10mins, time to CPR>10mins, CPR >30mins, time to spontaneous breathing >40mins, core temp <33°C on arrival , pH <7.1 / PaO_2 <8kPa despite treatment

PRE-HOSPITAL & CARDIAC ARREST MANAGEMENT

Early bystander CPR dramatically affects chance of survival. If cardiac arrest: APLS algorithm and adjust if hypothermic.

<30°C: Aggressively rewarm (see Rewarming); avoid adrenaline/amiodarone and max 3 defib attempts until >30°C

30-35°C: Defibrillate as usual; resus drugs every 8 mins . **Continue CPR until >32°C or temp not risen despite active re-warming**

ASYMPTOMATIC DISCHARGE CRITERIA: Hourly monitoring. Minimum of 8h obs in hospital: normal RR, HR/pulse & BP, sats >94% in air; return to normal mobility; caregiver willing to return to hospital if deterioration.

SYMPTOMATIC with SPONTANEOUS BREATHING: Admit to HDU until obs normal. Hourly monitoring.

B: If sats <94% in air: CXR & O_2; if sats <94% on oxygen call WATCh: consider HFNC/NIV (+ salbutamol nebs for wheeze) C: 20mls/kg bolus as required.

A

Maintain airway with C-spine control (Manual In-Line Stabilisation)

Indications for intubation: Airway compromise; Inadequate spontaneous breathing; Sats <90% despite high flow oxygen; GCS ≤8

Intubation with cuffed ET tube (Use local checklist: prepare for risk of malignant arrhythmias)

Insert gastric tube to drain stomach

B

Ventilate with "Protective lung strategy"

- Optimise PEEP to achieve oxygenation, may need 10+cm H_2O
- Target tidal volumes 6-8mls/kg; limit PIP to 30cmH_20
- Permissive hypoxia: Sats 88-94%
- If struggling, hand ventilate as appropriate

C

Treat hypotension and hypovolaemia

- At least two IV/IO access sites; consider arterial line
- 2/3 maintenance fluids of 0.9% saline / plasmalyte / Hartmann's

Adrenaline: Start at 0.1 mcg/kg/min (1ml/h central; 10ml/h peripheral) (http://www.watch.nhs.uk/drug-sheet/)

D

Assess & document (prior to RSI):

Pupil size & reactivity; GCS; Focal neurology; Posturing or seizure

Avoid seizures: Load Keppra (20mg/kg) or Phenytoin (20mg/kg)

E

Treat hypothermia, target core temp >35°C (see rewarming)

Check glucose (aim > 3mmol/l)

Treat with iv co-amoxiclav, only if grossly contaminated liquid

RE-WARMING

Passive external: careful handling; remove wet clothes; warm blankets

Active external: Air blanket re-warmer; radiant heat

Active internal: Warmed intravenous fluids (40-44°C); Pleural/bladder (10ml/kg)/stomach/peritoneal lavage

OBJECTIVES:

- **Maintain oxygenation/ventilation & circulation**
- **Minimise Secondary Brain Injury**
- **Rewarm but avoid hyperthermia**

COMMUNICATION & TRANSPORT

Paediatric Trauma Team Leader (Consultant ED PMTC)

Call: 0300 0300 789, choose Option 2

PTTL must include WATCh consultant on conference call

WATCh WILL UNDERTAKE TRANSFER TO PICU

RAPID SEQUENCE INDUCTION Use local RSI checklist

Suggested Induction: Ketamine 1-2 mg/kg +/-
Fentanyl 1-3 micrograms/kg

Muscle relaxant: Rocuronium 1-2 mg/kg

Maintenance: Morphine, midazolam and rocuronium infusions

NEUROPROTECTION

Aim to ventilate to End-Tidal CO_2 of 4.0 - 4.5 kPa

Analgesia, sedation, muscle relaxants.

Head midline (protect C-spine but no collar). Head up to 30°

Critical ICP: ↓HR, ↑BP, dilated pupil

Bolus Hypertonic saline 3ml/kg of 5% or 5ml/kg of 2.7%

Subsequent doses 1-3ml/kg, do not exceed [Na^+] >150mmol/l

INVESTIGATIONS: (consider medical cause of drowning, e.g. arrhythmias, long QT, seizures, intoxication, NAI)

Bloods: *ABG; FBC, coagulation; U&Es, glucose, LFTs, CRP, CK. Consider drug/alcohol screen.*

Radiology: *CXR, CT head & c-spine (+/- chest)*

12-lead ECG