
Clinical Guidance

Paediatric Critical Care: Drowning

Summary

This guideline is for staff to use when caring for a child following a drowning. It looks at resuscitation, management, investigations and prognostics.

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<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
May 2021	Reviewed. No changes required.	ELCGC June 2021

Paediatric Critical Care: Drowning

Drowning: Respiratory impairment following submersion/ immersion in a liquid medium¹

“Near drowning” and “wet/ dry drowning” terms are no longer used

PRE-HOSPITAL & CARDIAC ARREST MANAGEMENT

Early bystander CPR dramatically affects chances of survival.^{4,5,6} Emergency medical services (EMS) initiate A, B, C approach

A: Immobilise C-Spine. Ensure airway is clear. Administer 100% O₂.

B. Bag mask ventilation/ intubation by skilled personnel if required

C. Cardiac compressions 15:2. Obtain IV/ IO access if possible.

If cardiac arrest: use APLS algorithm and adjust if hypothermic¹²:

- **<30°C:** Aggressively rewarm (see right), avoid adrenaline/ amiodarone and max 3 defibrillation attempts until >30°C
- **30-35°C:** Defibrillate as usual, double dose interval for resus. drugs

MANAGEMENT: Discuss with PICU early

Protect Airway

- Assume cervical injury until proven otherwise
- High flow O₂ (trauma mask)^{1,6}
- Intubation with cuffed endotracheal tube

Protective lung strategy

- Target tidal volumes 6-8mL/kg. Limit PIP to 30cm H₂O
- Permissive hypercapnia (caution with head injury-see below)
- Permissive hypoxia saO₂ 90-94%
- Recruitment manoeuvres to establish open lung strategy
- Optimise PEEP to achieve oxygenation, may need 10-15cm H₂O¹⁰

Circulation^{4,6}

- Treat hypothermia to optimise resuscitation process (see rewarming methods)
- Target core temperature >35°C
- Central/ IO access and arterial access
- Restrict fluids to 50% maintenance (0.9% sodium chloride +/- glucose)
- Age appropriate MAP (inotropes): cerebral perfusion pressure
- Arrhythmias common and may require treatment. Discuss with STRS

Neuroprotection^{4,6,8}

- 30 degree head up tilt
- Normoglycaemic
- 2.7% sodium chloride (2-5mL/kg over 30mins – target sodium 145-150mmol/l)
- Ventilate to ETCO₂ target 4-5 kPa
- If haemodynamically stable: slow rewarming to 35°C advised¹⁰
- May need seizure control: load phenytoin

Full secondary survey

Early referral to tertiary centre for definitive care

PROGNOSTICATORS OF OUTCOME

GOOD

- Short submersion time. GCS>5, cardiac output and spontaneous respiration in A&E

BAD

- Age <3yrs^{2,3,5} Submersion >5 min No CPR >10 mins, asystole at the scene, resuscitation of cardiac arrest > 30mins⁹, Multiorgan dysfunction¹¹

REWARMING METHODS

Warm patient with core temp <28°C^{7,8}

If CVS stable aim to rewarm at 0.5°C per hour to 35°C

- Warm IV fluids (38-40°C)
- Heated humidified ventilator gases
- Radiant heaters/ warming blanket
- Intravascular temperature control devices

If cardiovascularly unstable/ in cardiac arrest:

Aggressive rewarming

- Bladder irrigation/ pleural lavage warm fluids
- Intravascular temperature control devices
- CVVH
- CPB/ ECMO if available

Prolonged, profound hypothermia may make resuscitation and rewarming impossible

INVESTIGATIONS

- Blood gas and glucose FBC, Coagulation
- U&E's: correct any electrolyte abnormalities
- CK may be ↑↑ if child has struggled in hypoxic conditions LFT's & C-reactive protein. Serum osmolality
- Consider drug and alcohol screen
- Chest x-ray, Trauma panel if indicated
- CT Scan/ MRI brain if warranted

ONGOING

- Multi organ dysfunction common in paediatric drowning victims who require PICU (54%)¹¹
 - Respiratory, neurological, cardiovascular
- Maintain normothermia if post cardiac arrest
- Antibiotics not started routinely – send BAL and treat if concerns. Use of antibiotics does not improve outcome.
- No evidence for the use of corticosteroids^{1,2,7,10}

References

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