Near Drowning and Inhalation Injuries in Children

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Financial Disclores

- None

Introduction

- Definition of near drowning and inhalation injuries
- Importance of early recognition and intervention
- Pediatric vulnerability: anatomy & physiology

Epidemiology of Drowning

- **Leading cause of unintentional injury-related death in children**
- **Common in toddlers (1-4 years)**
- **Seasonal trends and geographic distribution**
- **Socioeconomic and cultural disparities**

Pathophysiology of Drowning

- **Initial panic and breath-holding → Hypoxia**
- **Aspiration → Laryngospasm, airway obstruction**
- **Loss of consciousness and cardiac arrest → Anoxic injury**
- **Pulmonary complications: aspiration pneumonitis, ARDS**

Freshwater vs. Saltwater Drowning

- **Freshwater: Hypotonic → Hemolysis, electrolyte imbalance**
- **Saltwater: Hypertonic → Pulmonary edema**
- **Both result in hypoxia, respiratory failure**

Systemic Effects of Near Drowning

- Pulmonary: ARDS, pneumonia
- Cardiac: arrhythmias, hypotension
- Neurological: cerebral hypoxia, seizures
- Renal: AKI, electrolyte imbalance

EMS Management of Near Drowning

01

Ensure scene safety, rapid extrication

02

Clear airway, initiate oxygenation

03

Begin CPR if pulseless

04

Prevent hypothermia, rapid transport to ED

ED Management of Near Drowning

Airway, breathing, circulation assessment

Obtain CXR, ABGs, bloodwork

Use CPAP/BiPAP or intubate as needed

Monitor for ARDS, aspiration pneumonia

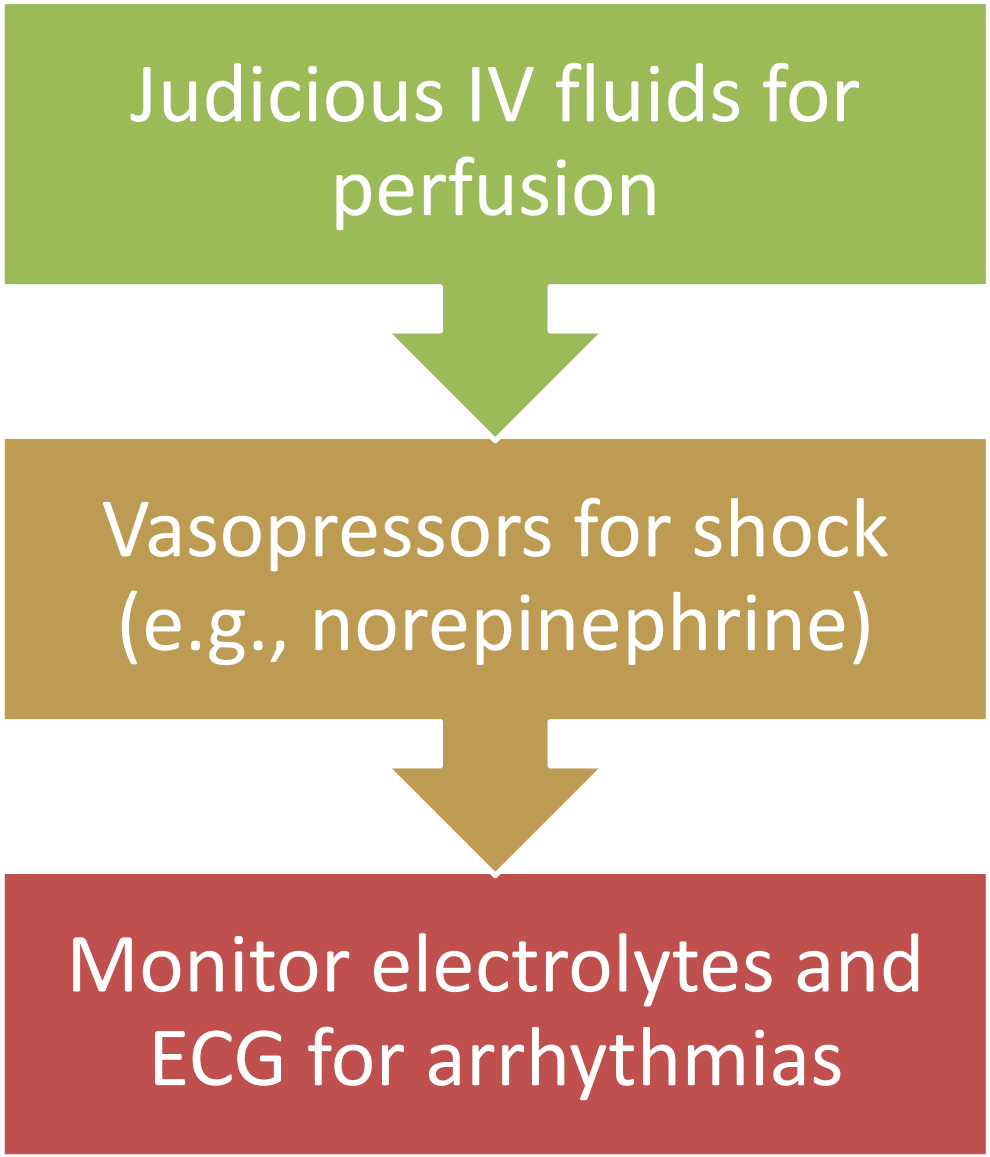
PICU Monitoring of Near Drowning

- Continuous cardiac and SpO2 monitoring
- Serial ABGs, CXRs, and neuro exams
- EEG monitoring for seizure activity
- Temperature regulation

PICU Respiratory Interventions

- Mechanical ventilation with lung-protective strategy
- HFOV or ECMO for refractory ARDS
- Bronchoscopy if aspiration suspected

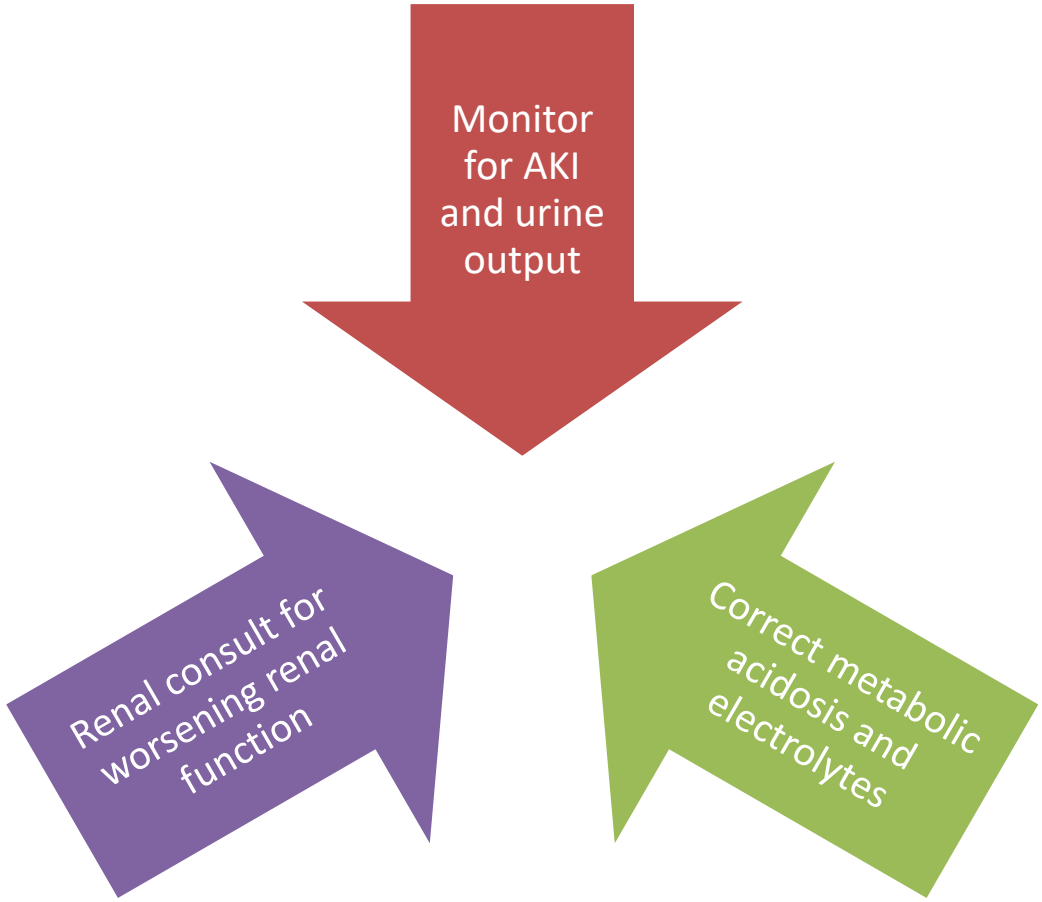
PICU Cardiovascular Support



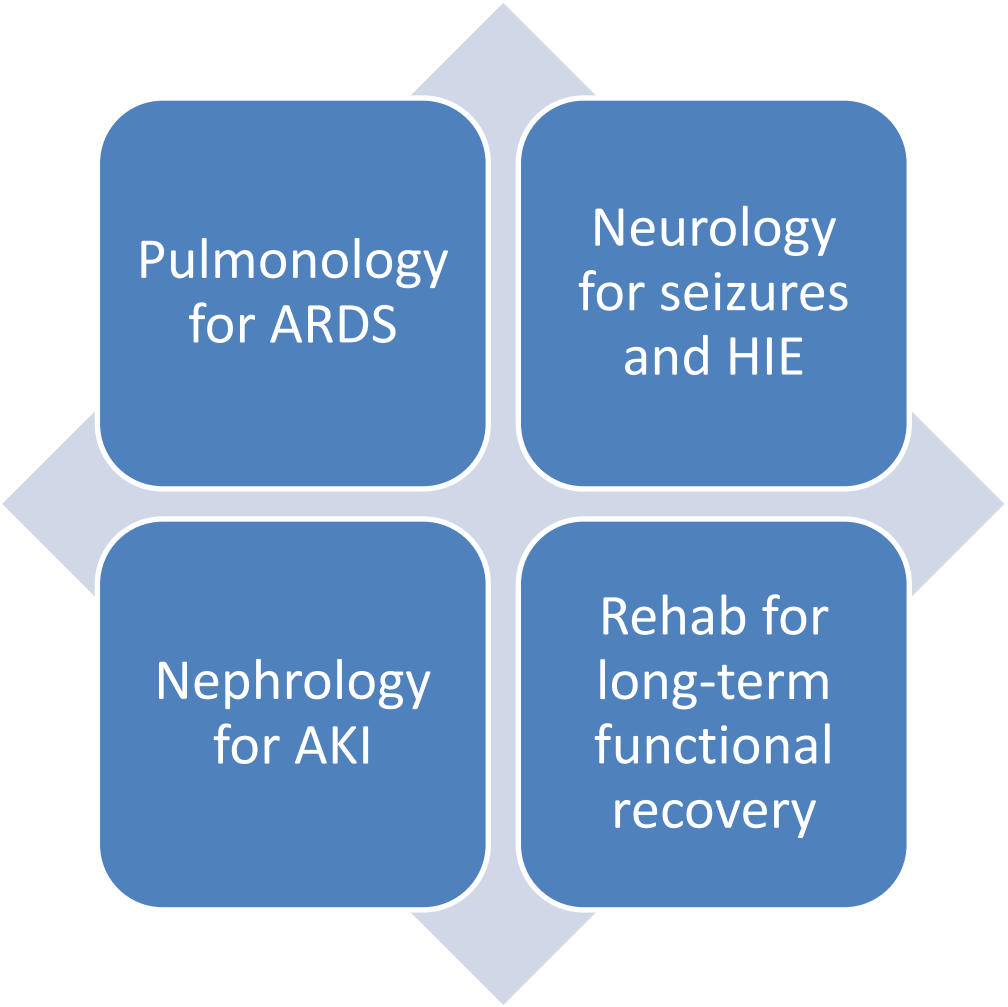
PICU Neurologic Management

- Consider therapeutic hypothermia
- ICP monitoring in cerebral edema
- Continuous EEG, seizure prophylaxis
- Neurology consult

Renal & Metabolic Considerations



Multidisciplinary Approach



Prognosis & Family Support

- Frequent updates and counseling
- Palliative care if prognosis is poor
- Early neurodevelopmental evaluation

Neuro Outcomes After Near Drowning

Variable based on duration of hypoxia

Risks: seizures, motor and cognitive delays

Requires long-term neurodevelopmental monitoring

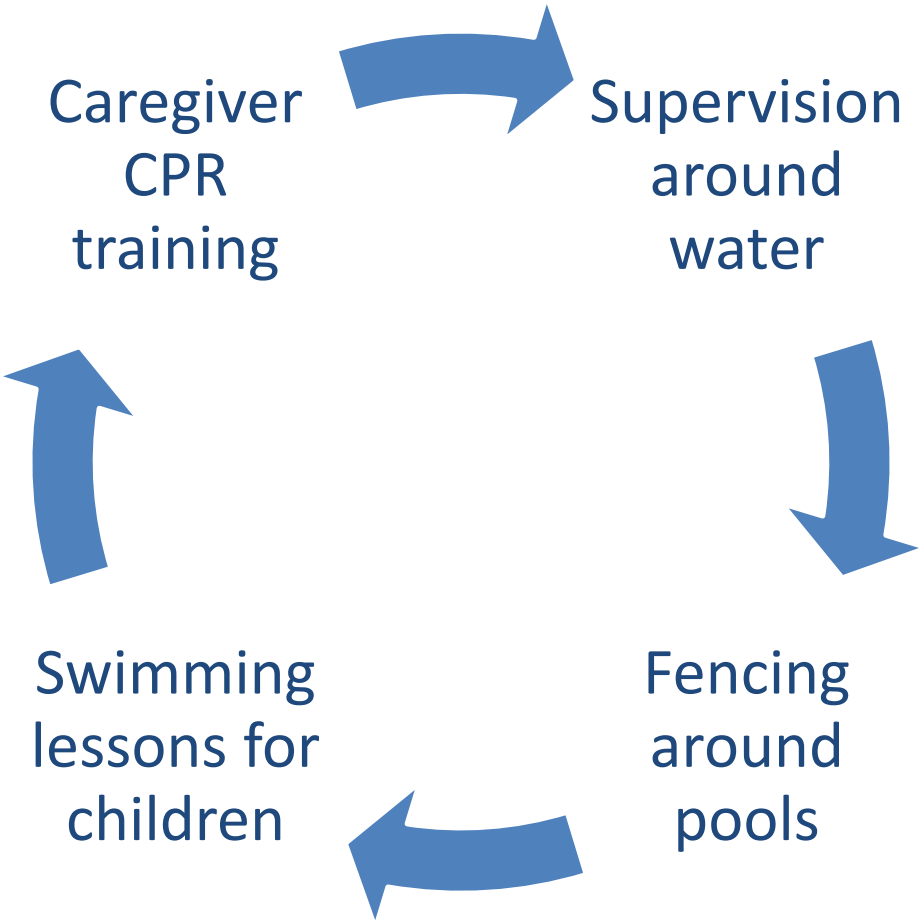
Rehabilitation After Drowning

PT/OT for motor recovery

Speech and cognitive therapy

Family support and education

Drowning Prevention Strategies



Case Study: Near Drowning

- 4-year-old pulled from pool after 5 mins submersion
- CPR by EMS, intubated in ED
- PICU: cooling protocol, EEG, full recovery
- Discharged with outpatient rehab

Pathophysiology of Inhalation Injuries

- Thermal injury to airway from heat/smoke
- Chemical injury from toxins (e.g., CO, cyanide)
- Systemic toxicity and inflammation

EMS Management of Inhalation Injuries

Ensure scene safety

Assess airway: hoarseness, stridor, facial burns

Administer 100% oxygen via NRB mask

Early intubation if signs of airway compromise

ED Management of Inhalation Injuries

Secure	Secure airway early if signs of obstruction
Monitor	Monitor for CO poisoning, give 100% O2
Check	Check carboxyhemoglobin and lactate
Consider	Consider cyanide antidote if suspected

PICU Monitoring of Inhalation Injuries

CARDIORESPIRATORY MONITORING (SPO2, ETCO2)

SERIAL ABGS AND CHEST IMAGING

ICP MONITORING IF ALTERED MENTAL STATUS

PICU Respiratory Interventions

- Mechanical ventilation with lung-protective strategy
- Bronchodilators and mucolytics
- Bronchoscopy for airway clearance
- HFOV or ECMO in severe cases

PICU Toxicologic & Metabolic Management

Hyperbaric oxygen for CO poisoning

Hydroxycobalamin for cyanide toxicity

Fluids and vasopressors for hemodynamic support

Consultants for Inhalation Injuries

- Pulmonology for airway injury and ventilation
- Toxicology for poisoning management
- Burn specialist for thermal injury
- Rehab for post-ICU recovery

Neuro Outcomes After Inhalation Injury

- CO-induced cognitive and behavioral changes
- Potential memory and executive function deficits
- Psychological follow-up needed

Rehabilitation After Inhalation Injury

Pulmonary rehab and respiratory exercises

Psychological support

Monitor for chronic lung disease

Inhalation Injury Prevention

1. Smoke detectors in home
2. Avoid smoke exposure
3. Educate families on CO risks
4. Ensure proper home ventilation

Case Study: Inhalation Injury

- 5-year-old in house fire with facial burns
- Intubated early, CO poisoning treated
- Bronchoscopy revealed soot, required ventilation
- Recovered with minor airway injury

Summary and Takeaways

- Early intervention is key in both scenarios
- Multisystem effects require multidisciplinary care
- Rehab is essential for optimal recovery
- Prevention through education saves lives

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