

Physiology of Breathing in Pediatrics (Normal)

Pediatric Airway Differences

- 📌 Obligate nose breathers (infants)
- 🗑️ Larger tongue relative to airway
- 🧠 Higher metabolic rate → ⬆️ O₂ demand
- 🫁 Less functional residual capacity → ⬇️ O₂ reserve
- 🩸 Higher heart rate and respiratory rate baseline

Normal Breathing Cascade

1. Air enters via nose/mouth
2. Down trachea → bronchi → alveoli
3. Oxygen diffuses into blood 🩸
4. CO₂ diffuses out → exhaled 🌬️
5. Brainstem monitors CO₂ to control rate & depth

Pathophysiology of Drowning in Pediatrics

Drowning Definition:

"Impairment from **submersion or immersion** in liquid with **respiratory compromise**."

What Happens During Drowning?

1. Initial Struggle 🏊
 - Panic → rapid breathing → possible water aspiration
 - Breath-holding leads to **hypoxia**

2. Laryngospasm 🫁

- Reflex closure of the airway to **protect lungs**
- 🚫 No air in or out → hypoxia worsens
- Eventually fatigue → laryngospasm releases → water floods alveoli

3. Pulmonary Effects

- 🌊 Water washes out **surfactant** → alveolar collapse (atelectasis)
- ⬇️ Gas exchange → severe **V/Q mismatch**
- Water in alveoli = **non-cardiogenic pulmonary edema**

4. Hypoxia Cascade

- 🧠 Brain suffers quickly → LOC, seizure, apnea
- ❤️ Bradycardia → asystole (peds arrest is usually hypoxic!)
- 🧊 Cold water = delayed cardiac deterioration but complicates resuscitation

Prehospital Management of Pediatric Drowning

On Scene:

- ◆ **Scene Safety First!**
- ◆ Remove from water ASAP
- ◆ Start with **ABC assessment**

Airway & Breathing

- **Position airway** → consider jaw thrust if spinal concern
- **Suction water/vomit**
- **Provide oxygen** 🧊 via NRB, BVM, or intubation if needed

- If apneic → start **rescue breaths** immediately
- Support **ventilation & oxygenation** (SpO₂ > 94%)

❤️ Circulation

- Check pulse for 10 seconds
- Begin **CPR immediately** if heart rate below 60bpm or pulseless
- Use **pediatric-sized pads** for defib if needed
- Prioritize **ventilation** over compressions (most are hypoxic arrests!)

🌡️ Rewarming

- Wet kid = cold kid
- Remove wet clothes, insulate, apply heat if available
- Hypothermia can **mask signs of life** — “**They’re not dead until they’re warm and dead**”

📦 Key Notes & Pearls

- 💡 Most peds drowning arrests are **hypoxic** → **ventilate early**
- 💡 Look for **seizures** post-ROSC — common due to cerebral hypoxia
- 💡 May still need **spinal precautions** if diving or unknown mechanism
- 💡 Don’t forget **blood sugar check** — hypoglycemia worsens brain injury
- 💡 **Transport all drowning patients** who lost consciousness, even if they “look fine” — complications (like pulmonary edema) can develop later

1. Drowning: Clinical Management – StatPearls

- **Summary:** An evidence-based resource outlining the pathophysiology of drowning, patient evaluation, and treatment options. It emphasizes the importance of coordinated care among healthcare professionals to ensure proper evaluation and management of drowning victims. [NCBI](#)
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2. Drowning in Children – Deranged Physiology

- **Summary:** This article provides a detailed overview of drowning definitions, common complications (such as hypoxic arrest and ARDS), and resuscitation considerations specific to pediatric patients. It also discusses predictors of poor neurological outcomes. [Deranged Physiology](#)
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3. Drowning in Pediatrics: Literature Review

- **Summary:** A systematic review focusing on the latest knowledge in the pathophysiology, management, and prevention of pediatric drowning incidents. It proposes a protocol for emergency department care tailored to pediatric patients. [cdn.publisher.gn1.link](#)
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4. Drowning: A Review of Epidemiology, Pathophysiology, Treatment, and Prevention

- **Summary:** This review article discusses the global burden of drowning, underlying pathophysiological mechanisms (highlighting hypoxia), treatment approaches, and prevention strategies. It underscores the importance of accurate neurological prognosis and timely intervention. [Resuscitation Journal](#)