Pediatric Submersion with Trauma for Paramedics

Section 1: Case Summary

Scenario Title:	Pediatric Submersion with Trauma
Keywords:	Drowning, Submersion, Trauma, PALS, Cardiac arrest
Brief Description of Case:	A three-year-old child was found face-down submerged in the shallow end of the pool at their home by parents. It is unknown how long the child had been submerged, and when the child was pulled from the pool, she was unconscious and coughing up foam. Family immediately called 911. While en route to the hospital, the team is unable to obtain IV access despite multiple attempts, and an IO is successfully placed. Throughout the transport, the child is unconscious with increasing respiratory distress, requiring intubation. After successful intubation, her oxygen saturation improves, but she becomes bradycardic. The team should begin CPR and follow the PALS pediatric bradycardia algorithm. After one round of CPR, the patient's heart rate will increase and the crew will arrive at the hospital.

Goals and Objectives	
Educational Goal:	Solidify approach to pediatric bradycardia and the principles of the PALS algorithm.
Objectives: (Medical and CRM)	1. Apply crisis resource management principles including closed-loop communication and assigning roles to effectively lead the team through the care of a critically ill pediatric patient. 2. Use a shared mental model to communicate with team members management priorities. 3. Utilize the Handtevy handbook for pediatric medication doses and equipment. 4. Recognize cervical spine injury and route to the appropriate facility (trauma). 5. Effectively communicate patient condition when speaking with receiving hospital. 6. Practice IO skills placement.
EPAs Assessed:	***

Learners, Setting and Personnel				
Target Learners:	☐ Junior Learners	☐ Senior Learners	☐ Staff	
	☐ Physicians	☐ Nurses	☐ RTs	☐ Inter-professional
	☒ Other Learners: Paramedics and Paramedic students			
Location:	☒ Sim Lab/Station	☐ In Situ	☐ Other:	
Recommended Number of Facilitators:	Instructors: 2			
	Sim Actors: n/a			
	Sim Techs: 1			

Scenario Development	
Date of Development:	Jan 22, 2024
Scenario Developer(s):	Dr. Laurel Bolton, Dr. Jeffrey Katz
Affiliations/Institutions(s):	Nemours Children's Health, UCF/HCA Healthcare
Contact E-mail:	Laurel.bolton@nemours.org ; Jeffrey.katz@ucf.edu
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Revised By:	Jeffrey Katz
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Section 2A: Initial Patient Information

A. Patient Chart					
Patient Name: Layla			Age: 3 years	Gender: F	Weight: 15 kg
Presenting complaint: Respiratory Distress					
Temp: 34.5	HR: 67	BP: 85/40	RR: 40	O_2Sat: 90%	FiO_2: ***
Cap glucose: 172			GCS: 7 (E1 V2 M4)		
Triage note: 3-year-old previously healthy female found submerged in a backyard pool with respiratory distress.					
Allergies: NKDA					
Past Medical History: Born healthy at 39 weeks via scheduled C-section Vaccines UTD			Current Medications: none		

Section 2B: Extra Patient Information

A. Further History
Include any relevant history not included in triage note above. What information will only be given to learners if they ask? Who will provide this information (mannequin's voice, sim actors, SP, etc.)? A three-year-old child was found face-down submerged in the shallow end of the pool at their home by parent. They are unsure exactly how long the submersion was (they were in the bathroom). The child was unconscious but breathing spontaneously. She was coughing up a white frothy substance periodically. The dad brought the unconscious child to the pool deck, while the mom called the paramedics. It took approximately 10 minutes for EMS to arrive.

B. Physical Exam	
List any pertinent positive and negative findings	
Airway: frothy foam in the airway, coughing, protecting airway	Circulation: cool, clammy, cap refill < 2 secs, distal and central pulses palpable
Cardio: S1/S2, no murmurs	Neuro: eyes closed, groaning to pain, withdraws to pain, decreased movement of bilateral lower extremities, poor tone
Resp: noisy chest, bilateral crackles, and wheeze	Head & Neck: 5cm boggy hematoma on the left parietal scalp
Abdo: mildly distended, soft, non-tender	
MSK/skin: no bruising or rashes	
Other: looks stated age	

Section 3: Technical Requirements/Room Vision

A. Patient
☒ Mannequin *(child that can be intubate)*
☐ Standardized Patient
☒ Task Trainer – IO, IV arm
☐ Hybrid
B. Special Equipment Required
Defibrillator and pads EKG leads/wires BP cuff Pulse oximeter Intubation supplies IO kit IV bags/lines PALS algorithm/Handtevy
C. Required Medications
PALS medications
D. Moulage
Damp clothes Airway foam
E. Monitors at Case Onset
☐ Patient on monitor with vitals displayed ☒ Patient not yet on monitor
F. Patient Reactions and Exam
Include any relevant physical exam findings that require mannequin programming or cues from patient (e.g. – abnormal breath sounds, moaning when RUQ palpated, etc.) May be helpful to frame in ABCDE format. A – Frothy foam in the airway, not obstructing airflow but visualization during intubation, coughing, protecting airway B – increased work of breathing, crackles and diffuse wheeze C – cool, clammy, cap refill 2 secs, distal and central pulses palpable D – PERLA, GCS 7 (E1V2M4), no focality, decreased strength/movement of bilateral lower extremity E – no bleeding, no bruising, 5cm boggy hematoma on the left parietal scalp

Section 4: Sim Actor and Standardized Patients

Sim Actor and Standardized Patient Roles and Scripts	
Role	*Description of role, expected behavior, and key moments to intervene/prompt learners. Include any script required (including conveying patient information if patient is unable)*
	n/a

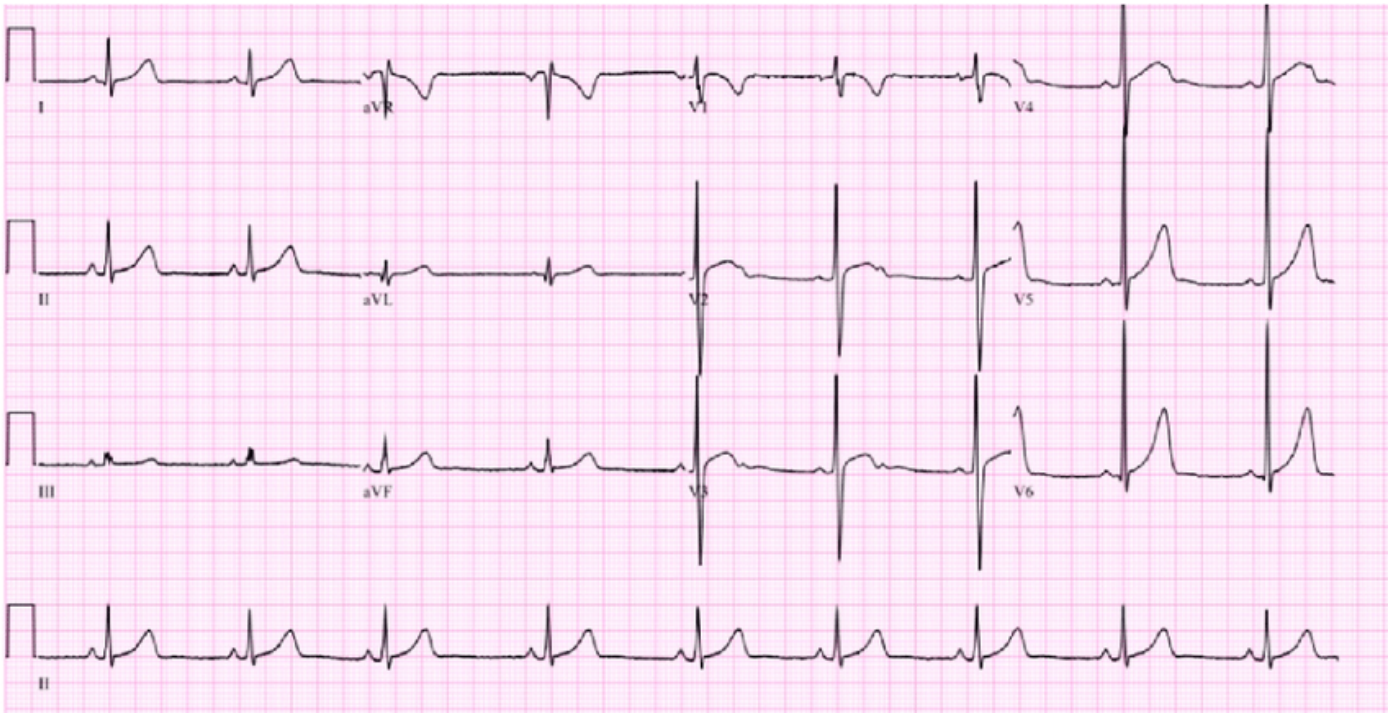
Section 5: Scenario Progression

Scenario States, Modifiers and Triggers				
Patient State/Vitals	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State		Facilitator Notes
1. Baseline State Rhythm: Sinus HR: 67 bpm BP: 85/40 RR: 38 O_2SAT: 90% with BVM, assisted respiration T: 34°C ETCO2: 24 GCS: E1V2M4	*The patient is obtunded (GCS 7), with increased work of breathing, coughing up foam, wheezes throughout, cool to touch*	Expected Learner Actions ☐ Apply monitors ☐ Full set of vitals ☐ Apply C-collar/backboard ☐ Attempt IV access, when unsuccessful, place IO ☐ Obtain POC glucose ☐ Place on supplemental oxygen with BVM	Modifiers - SP02 improves to 97% with BVM Triggers - Decision to intubate	If not moving to intubate, continue to have respiratory status deteriorate
2. Definitive airway Rhythm: Sinus HR: 67 bpm BP: 85/40 RR: 38 O_2SAT: 94% with BVM – will decrease it patient not intubated T: 36°C GCS: E1V1M1	*Optimize and intubate*	Expected Learner Actions ☐ Ensure good seal and 100% Fi02 for pre-oxygenation (max Sp02 94%) ☐ Recognize difficult airway (airway foam) ☐ Communicate an airway plan ☐ Weight based equipment for intubation (handtevy or other resource) ☐ Confirm intubation with EtCO2	Modifiers - If inadequate pre-oxygenation Sp02 will fall rapidly to 88% on first attempt - Following successful intubation have Sp02 increase to 97% Triggers - Once intubated proceed to next stage	Persistent suctioning is not helpful, and creates more foam. Weight-based airway equipment/meds - Cuffed 4.5 ETT - 2 straight/curved - 15 cm ETT depth
3. Bradycardia with poor perfusion Rhythm: Sinus HR: 50 bpm BP: 85/40 RR: RR 25 bagged	*Following intubation, the patient's heart rate falls to below 60.*	Expected Learner Actions ☐ Recognize pediatric bradycardia as an emergency ☐ Start CPR given HR < 60 bpm ☐ Give PALS Epi (0.01 mg/kg IV)	Modifiers - Triggers	Team should recognize hypoxia as the most likely cause of bradycardia, and in this scenario neurogenic shock (c-spine injury). They can consider a broad differential including hypothermia

O_2SAT: 97% on 100% FiO2 T: 36°C GCS: Sedated ETC02 20	*Child is intubated and has signs of poor perfusion*	☐Give PALS atropine dose (0.02 mg/kg)	- At second pulse check, HR increases to 80 bpm and the case ends.	(recheck temp), meds (sedating infusions), and glucose. Providers need to list transport destination (APH)

Appendix B: ECGs, X-rays, Ultrasounds and Pictures

Paste in any auxiliary files required for running the session. Don't forget to include their source so you can find them later!



EKG source:
https://www.researchgate.net/publication/343256394_Benign_arrhythmias_in_pediatric_patients?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6Il9kaXJlY3QifX0

Appendix C: Facilitator Cheat Sheet & Debriefing Tips

Include key errors to watch for and common challenges with the case. List issues expected to be part of the debriefing discussion. Supplemental information regarding any relevant pathophysiology, guidelines, or management information that may be reviewed during debriefing should be provided for facilitators to have as a reference.

Management questions:

1. When pediatric patients do not respond as we expect or continue to get sicker, it can be stressful. How did the resuscitation team manage this challenge? What tools did you use today (or have used in real life) that can help mitigate the stress of seeing a deteriorating child.

2. Drowning cases are rare but scary. What were you worried about given this was a drowning patient? What were you worried about given this was a trauma patient?

3. Complete a full and thorough review of the Handtevy book and app. Discuss medication dosages as well as appropriate equipment sizes for all ages. Ensure each paramedic and EMT can locate the book and the bag.

Cheat Sheet for Medical Management questions:

Drowning cases are rare but scary. It can be hard to conceptualize the differences in physiology in a drowning patient while a sick patient is in front of you. What were you worried about given this was a drowning patient?

Drowning is the process of respiratory impairment from immersion or submersion in a liquid. Drowning occurs when our airway is submerged or immersed in liquid and reflex inspiratory efforts occurs. When water enters the airway, bronchospasm and surfactant disruption ensues. Surfactant washout results in atelectasis, and water causes direct cellular injury causing further pulmonary edema. Surfactant washout can occur with even a small amount of water (just 3 – 4 cc/kg of water) and lead to decreased lung compliance, V/Q mismatch and intrapulmonary shunting.

Laryngospasm occurs when the liquid encounters our lower airways and our vocal cords reflexively close. Laryngospasm obstructs our airway protecting our lungs from water. Unfortunately, forceful breathing against a closed glottis can cause negative pressure pulmonary edema and lead to further hypoxemia.

"Surfactant foam" is a mixing of alveoli surfactant with small volumes of water. This foam is low density and does not produce physical obstruction. Rather than suctioning, you should ventilate through the foam. These pathways lead to progressive hypoxia resulting in neurologic ischemia and cardiovascular collapse.

References

1. BC Children's Hospital ECLS guidelines are available at http://policyandorders.cw.bc.ca/resource-gallery/Documents/BC%20Children%27s%20Hospital/CC.14.07%20Extracorporeal%20Life%20Support%20Guideline%20For%20Management%20Of%20The%20Patient%20On%20Ecls.pdf Accessed November 18, 2022.

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