PROTOCOL COVER PAGE

PROTOCOL NAME: Outcome of a lecture before vs after simulation-based education on pediatric status epileptics: A randomized controlled pilot trial

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Funded By: Not applicable

Current Protocol Version: Protocol Version #0.1, Aug 16, 2023
H Number: H22-03760

1 Protocol Summary

1.1 Synopsis

Title: Comparing teaching before vs after simulation education on pediatric status epileptics: A randomized controlled trial

Study Description: The study will test whether simulation preceding didactic teaching leads to improved knowledge and performance retention compared to a didactic lecture proceeding simulation. Participants will be randomized to one of two different groups: 1) didactic teaching followed by simulation or 2) simulation then didactic teaching.

Primary Outcomes:

1. Resuscitation performance retention score 3 months post-initial training

Secondary Outcomes:

2. Knowledge assessment 3 months post-initial training
3. Learner satisfaction

Hypothesis:

1. Didactic teaching after simulation-based training will be more effective in maintaining retention of knowledge and skills in the management of pediatric status epilepticus compared to didactic teaching prior to simulation

Study Population: Second year medical students from the University of British Columbia – Vancouver Campus

Description of Sites: The intervention will take place at BC Children's Hospital Simulation Centre with trained facilitators and high-realism simulation equipment.

Description of Study Intervention: One arm of the study will receive a 60-minute lecture on pediatric status epilepticus management and then complete a simulation scenario immediately after. The second arm will complete a simulation scenario on pediatric status epilepticus without knowing the topic beforehand and will complete a 60-minute lecture immediately after the simulation session. Both groups will complete a knowledge test directly after the intervention. Both groups will be reassessed in three months with a repeat simulation scenario on pediatric status epilepticus and repeat knowledge test.

Study Duration The study will enroll participants for 2 months and then complete the educational intervention over 3 months.

Participant Duration: The participants will participate in one 60-minute lecture and two ten-minute simulation sessions and one focused 15 minute debrief over the course of four months' time.

1.2 Schema:

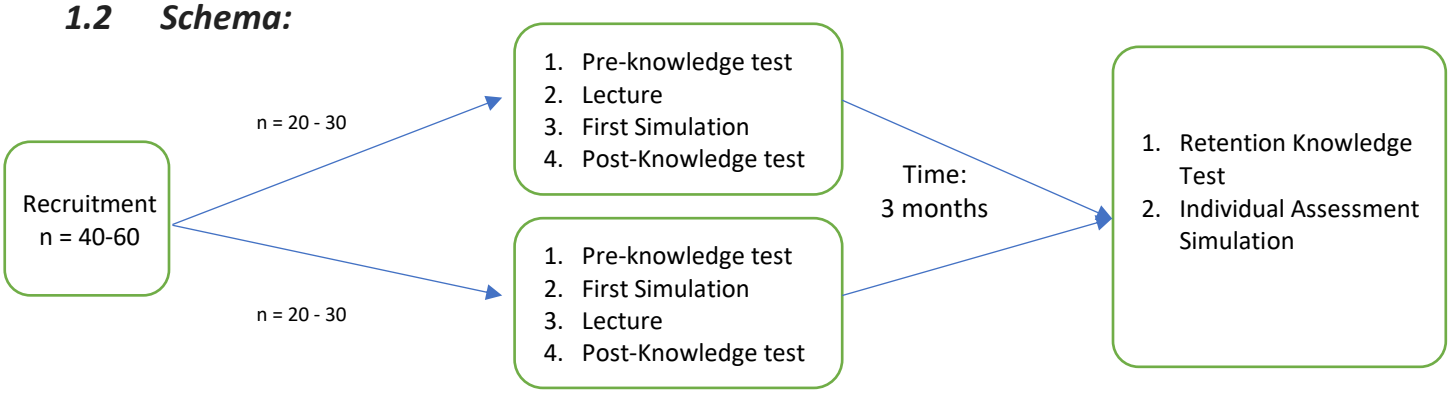

Figure 1: Flow of participants through the research project

2 Introduction

2.1 Background Information & Rationale

Simulation is a revolutionary tool in medical education and specifically pediatrics with the rarity of life-threatening situations. It provides learners with the opportunity to practice high-stress crucial medical scenarios in a safe and supportive environment where mistakes are instead valuable teaching for future experiences. Simulation has been shown to be an effective teaching method in medical education however how best to optimize retention and patient outcomes remains unclear[1–3]. Medical education interventions are typically evaluated at one stage of Kirkpatrick's framework for learning which include reaction (level 1), learning (level 2), behavior (level 3) and results (Level 4)[4]. Patient outcomes remains the strongest measure however is difficulty to effectively design projects to show this[5,6]. In pediatrics procedures and adult ACLS retention of knowledge and skills have been shown to decline by as early as 3-months' time in two systematic reviews[7,8]. In our assessment, it remains unclear what the best method of teaching associated with simulation is and when the best time to facilitate this teaching to improve retention for medical expert knowledge and resuscitation performance.

Pre-simulation assignments may be an effective way to prime participants for learning in simulation. Different methods including reading, written assignments, plan of care mapping, pre-quizzes, scenario demonstration, virtual reality, lectures and online games have been described[9–16]. No method has been identified as superior[17,18]. Pre-simulation preparation was felt to improved learning in one systematic review however the strength of the evidence was weak and primarily level 1 and 2 outcomes were assessed[17,19]. There remains contention in the literature with one study finding adding simulation to a flipped classroom teaching model improving 3-month retention though multiple studies examining a flipped classroom model in rapid-cycle deliberate practice models found no improvement[11,20,21]. New evidence suggests there may be better immediate knowledge gain from simulation preceding didactic teaching compared to didactic teaching before simulation[22,23]. For procedural skills it has been shown the practical sessions before theory-based lectures resulted in increased skill and knowledge retention at one month for transesophageal echocardiography[24].

Pediatric seizure is a common acute care pediatric scenario with numerous published simulation scenarios[25–27] and evaluation rubrics available as well as multiple high-quality national pediatric status epilepticus management algorithms available[28,29]. The effect of pre and post simulation teaching remains debated in medical education literature as well as the ongoing concern of knowledge and performance degradation. This study aims to investigate the effect of pre and post teaching on knowledge degradation, and how to best optimize knowledge retention to improve medical education and theorized patient care. The specific objectives are to assess whether teaching before or after a simulation leads to medical students' improved knowledge and resuscitation performance retention at two to fourth months post educational intervention for managing pediatric status epilepticus.

2.2 Risk/Benefit Assessment

2.2.1 Known Potential Risks

As this is a medical education study there are minimal risks to the participants. The participation in simulation could cause increased stress to the learner but this will be minimized with structured pre-brief and debrief sessions.

2.2.2 Known Potential Benefits

The participants will benefit from two simulation teaching sessions with a trained simulation expert and FRPC certified pediatric emergency medicine physician. They will also receive an additional lecture providing them with didactic teaching on status epilepticus.

3 Objectives

The primary objective is to assess the resuscitation performance retention difference between the two educational intervention arms at two to four months following teaching.

The secondary objectives are to assess the difference in knowledge between both study groups immediately after and two to four months after the educational intervention. In addition, we will measure the comfort of learners performing the initial simulation scenario.

3.1 Outcome Measures

The primary outcome will be the resuscitation performance retention assessed using the post-teaching the final global rating scale score (1-7 performance score) for medical management and flow during each simulation as well as the following "time-to" metrics; glucose check, IV access, chemistry panel order, first-line anti-epileptic administration[30], second line anti-epileptic administration. This will be adjusted for baseline score.

The secondary outcome measures for knowledge retention assessment will be the post-teaching knowledge test score assessed on a 15 Question MCQ test administered at the final assessment adjusted for the baseline score.

Comfort/Confidence will be assessed using the change in Likert scale item after each simulation and debrief.

4 Study Population

4.1. Inclusion Criteria

1. Second year medical students at the University of British Columbia – Vancouver Campus

4.2 Expected Duration of Subject Participation

A participant will already be expected to attend a 60 min teaching session on status epilepticus. They will also be required to participate in two 10-25 min simulation sessions which will include a 10-minute simulation and 15 debrief for the first and only a 10-minute simulation the second time.

4.3 Recruitment and Retention

The study participants will be recruited from the second-year medical student cohort at the University of British Columbia Vancouver campus. A medical student assisting in the research project will be the primary point for recruiting medical students and will post regularly in medical student communication channels including but not limited to Slack, Facebook and word of mouth. The participants names and contact information will be saved at this stage to allow for scheduling of the simulation and teaching sessions.

The consent form will be emailed to participants to complete prior to participation and researchers will be available for questions.

5 Study Design

5.1 Overall Design

This is a parallel randomized control trial in medical education that will be conducted at the BC Children's Hospital. The participants will be masked to the other arm of the intervention and the outcome measures of the study.

5.2 Data Collection

The simulation sessions will be recorded to ensure accuracy in time to intervention recordings and global rating scales. Two experienced pediatric acute care specialists with simulation experience masked from the intervention arms will review the videos and determine the global rating scale for each simulation and they will review videos for the "time to metrics". Time zero will be immediately after the scenario description is completed.

The knowledge tests and anxiety/confidence assessment will be completed using a redcap-hosted survey. Basic demographic information including age, previous experience with simulation and a background in ED nursing or EMS will also be collected using a demographic survey. The names and contact information will not linked to the demographic or simulation information. This survey can be found in appendix A.

5.3 Didactic Lecture and Simulation Development:

The lecture and two simulation scenarios were developed by the primary researcher, a first-year pediatric emergency medicine fellow with guidance from the principal investigators, a pediatric intensivist and pediatric emergency medicine specialist who both have expertise in simulation and curriculum development. Both the lecture and simulations were peer-reviewed by a pediatric emergency medicine specialist with simulation expertise who was not involved with research project.

The lecture was developed using existing pediatric seizure management guidelines from Trekk and the Canadian Pediatric Society[28,29]. The lecture learning objectives mirrored the research outcome measures and focused on acute management of pediatric seizures with supporting discussions on possible etiologies. It did not discuss crisis-resource management skills, long-term management or prognosis of seizures or other acute pediatric scenarios. The lecture can be found in PDF form in Appendix B.

The simulation scenarios were developed using published pediatric seizure scenarios as a baseline and set at a level appropriate for trainees with limited clinical experience. The pediatric status epilepticus scenarios can be found in appendix C.

5.4 Study Protocol:

The participants will be randomized into two groups: Lecture-> Simulation -> Evaluation Simulation(LS) and Simulation->Lecture -> Evaluation Simulation (SL) using blocked randomization with varied block size. The randomization allocation sequence will be completed by RedCap and the researchers will be masked to this.

The LS group will complete the 60-minute focused lecture immediately prior to their initial simulation. The SL group will complete the 60-minute focused lecture immediately after their initial simulation. The LS group will complete a pre-intervention knowledge test prior to the lecture and the SL group will complete a knowledge test prior to the initial simulation.

Both groups will complete the initial simulation in groups of 3-4 with one member acting as the leader and others acting as team members. The simulation will last for 10 minutes followed by a structure debrief using the +/delta method lasting up to 20 minutes. The debrief will be completed by a pediatric emergency medicine specialist with experience in leading simulation debrief. The leader of the group will be recorded for later subgroup analysis.

Every individual will complete a second evaluatory simulation 3 months after the initial simulation to evaluate the primary outcome of resuscitation performance retention. Each participant will act as the simulation leader with two actors who will function as a highly trained nurse and second physician but will not provide advice. The simulation will be videotaped. The participants will also complete a knowledge test prior after the second simulation.

Simulation videos will be reviewed as per the above data collection method to determine outcome measures. The simulations will be completed in the BCCH simulation center with a trained pediatric simulation expert and simulation facilitator. A high-fidelity mannequin will be used. It can seize and has appreciable chest rise and breath sounds. The participants will be instructed to assume all medications requested are drawn up in a syringe to the dose desired in the medication tray to decrease variability in time to metrics from difficulty in drawing up medications.

6 Statistical Consideration

6.1 Sample Size Determination:

The one paper assessing knowledge and skill retention comparing SL and LS structured teaching found a 13.42% difference in skill performance on transesophageal echocardiography[24] with the following means and std; LS group 71.90 (18.59) and SL group 85.32(15.63). Using a sample size calculator estimates a sample size of 60 with an alpha of 0.05 and power of 0.8[31].

6.2 Statistical Analysis:

The recorded simulation sessions will be reviewed by two separate pediatric emergency medicine and simulation experts who will evaluate the participants on the simulation global rating scale, a validated assessment tool for simulation. Inter-rater reliability will be calculated via Pearson correlation and ICC statistics, and the final reported value will be the mean of both reviewers.

The recorded sessions will also be reviewed to the time to metrics by two reviewers with a masked co-investigator serving as the tie breaker in times of significant discordance. Time zero for the "time to" metrics will be when the facilitator finishes the scenario description.

The mean and 95% confidence interval of the metrics will be calculated for each group. Post randomization scores will be compared using a paired t-test, and with mixed effects linear models using pre-randomization score as a covariate. Time-to-event measures will be displayed with Kaplan Meier graphs and median time, and tested with the log-rank test, and secondarily using Cox proportional hazards models. Regression models may include adjustment for baseline variables imbalanced between arms or prognostic of outcome. Secondary Likert outcomes will be assessed with a proportional odds model. All results will be presented with appropriate 95% confidence intervals. Statistical analysis will be completed with statistician support using R statistical software.

Protocol Deviations:

All deviations will be reported to the REB in a timely manner.

7 Data Handling and Record Keeping:

7.1 Data Management Responsibilities:

The data will be stored on a secure redcap data-server. The server will be password protected and only the research team will have access to the data. Participant data will only be stored de-identified. The video recordings will be stored on an encrypted external hard drive kept in the PI's office locked office in a locked drawer. The original video data would be deleted from the simulation center.

7.2 Record Retention

The data will be stored for 5 years after the publication of the study following which it will be destroyed. The data will be stored by BCCH.

8 Budget & Finance:

Statistician and redcap access will be covered by the hospital/university due to being a fellow led project.

9 Dissemination\Publication Plan:

Our knowledge translation plan includes manuscript publication in a peer-reviewed journal, and presentation at emergency medicine and/or pediatrics focused research conferences such as the PERC annual meeting.

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Appendix A:
Demographics:
Please enter your age:

What is your experience with medical simulation?
a) No experience b) 1-5 simulation experiences c) 5-10 simulation experiences d) >10 simulation experiences

Before entering medicine please check any roles that apply?

- Background in ED Nursing
- Background as a paramedic or first responder?

Confidence Quiz:
Please rate your anxiety in the simulation experience from 1 to 5?
1 – Extremely anxious 5 – Not anxious at all

Please rate your confidence in managing pediatric seizures in the future?
1 – Not confident at all, 5 – extremely confident

Please rate your satisfaction with the educational experience (Simulation + Debrief + Lecture)?
1 – extremely dissatisfied , 5 extremely satisfied

Appendix B

Pediatric Status Epilepticus

John Ramsay – 2023

Case Presentation

You are working in the ED and a 4 year old girl is brought in who has been having generalized tonic-clonic movements and head deviation for the past 10 minutes.

- What is the diagnosis?
- What might be the underlying cause?
- How do you stabilize this patient?
- What's the best way to stop this seizure?
- Are there any tests or investigations you need to think about?

What is status Epilepticus?

Recognition of Status Epilepticus

An unresponsive patient with either one of the following has convulsive status epilepticus:

- Seizure >5 min and/or ongoing seizure on presentation to EMS/ED
- 2 or more seizures without full recovery of consciousness between seizures

Early Status Epilepticus: >5 mins and ongoing seizure
Status epilepticus: Longer than 30 minutes, can start to have permanent neurologic damage

What is on your differential for a seizure?

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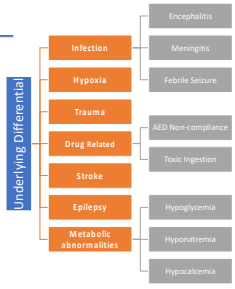
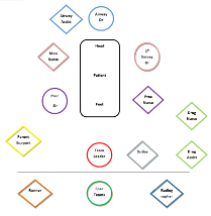
Differential for Seizures

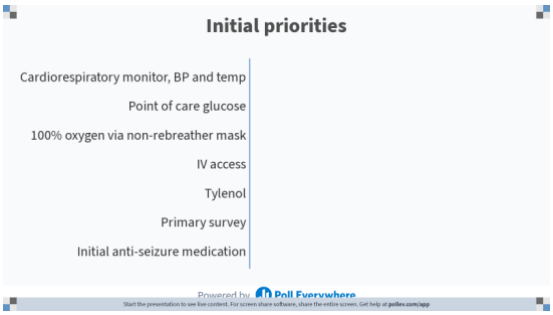
Important aspects to consider:

- EMS handover
- SAMPLE History:
  - Signs & Symptoms
    - *Fever*
    - *head injuries*
  - Allergies
  - Medications
    - *Taking*
    - *Medication at home*
  - Past Medical History
  - ~~Last meal~~
  - Events leading up to presentation



What are your priorities?





Stabilization

Initial Management

- Initiate ABCs, cardiorespiratory and BP monitoring
- O_2 10-15 L/min via non-rebreather mask
- Prioritize giving the first dose of benzodiazepine as early as possible, followed by checking blood glucose
- Monitor for respiratory depression, hypotension, arrhythmias
- Give acetaminophen 15 mg/kg/dose (MAX 650 mg) PR if febrile
- **Consider other investigations:**
  - Electrolytes, blood gas, calcium, CBC, serum glucose
  - Other: anticonvulsant drug levels, LFTs, blood & urine culture

Primary Survey – A - Airway

	Recognize	Assess for	Manage
A	**Airway Obstruction**	• Position (hyper/hypo extension) • Patency (Blood, Vomiting) • Need for protection	• Oral Suction • Sniffing Position • Oral Airway • Jaw thrust • Bag-mask ventilation

Primary Survey – B - Breathing

	Recognize	Assess for	Manage
B	**Respiratory Failure**	• Apnea/poor effort • Increased work of breathing • Air entry • Added Sounds: Wheeze/Crackles • SpO2, RR, End-tidal CO2	• Bag-mask ventilation • Positive Pressure (HFNC, CPAP, BiPAP) • Prepare for intubation if needed • Medications for respiratory distress (Asthma) • Pneumothorax – Needle decompression, Chest tube

Respiratory issues are typically secondary to airway compromise in seizures

Primary Survey – C - Circulation

	Recognize	Assess for	Manage
C	**Shock**	• Tachycardia, Bradycardia • Cap Refill (Fast/Slow) • Pulses • Hypotension (late sign) • Hepatomegaly • Check pelvis stability	• Think about access - IV, IO, Central Line • Isotonic Fluid Bolus – 10-20ml/kg at a time • Consider epinephrine or norepinephrine

Seizing patients should be tachycardic and normotensive or slightly hypertensive.

Hypotension and/or bradycardia is very concerning.

Primary Survey – D - Disability

	Recognize	Assess for	Manage
D	• **Severe Head injury** • **Raised ICP** • **Seizure**	• GCS less than or equal to 8 • Respond only to pain/unresponsive • Cushing's Triad (Bradycardia, Hypertension, Irregular resp)	• Head of bed elevation, head midline • Intubation/Sedation • 3% hypertonic saline – 5ml/kg • Hyperventilation if herniation (Blown Pupil) • Neurosurgery consult

AVPU: Alert → Verbal → Pain → Unresponsive

Primary Survey – E - Exposure

	Recognize	Assess for	Manage
E	• Rashes • Signs of Trauma	• Purpura • Bruising • Abrasions	• Maintain Normothermia

Not always a core component of seizure assessment but may give clues to etiology

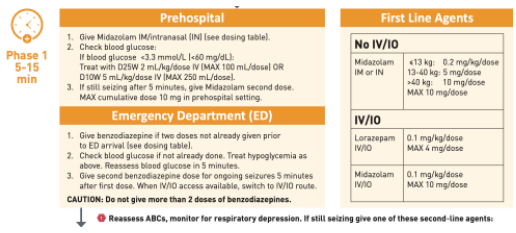
Estimating your patients weight

Breslow Tape

Practical Estimation based on Age:

- **Infants <12mo:** (age in months + 9)/2
- **Children 1-5:** (age + 5) x 2
- **Children 5-14:** Age x 4

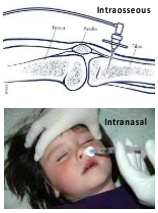
First line Treatment



Benzodiazepines – First Line

Drug and route	Dose	Maximum
Midazolam • IV, IO	0.1 mg/kg	5 mg
• IM	0.2 mg/kg	10 mg
• Buccal	0.5 mg/kg	10 mg
• Intranasal	0.2 mg/kg	10 mg (5 mg per nostril)
Lorazepam • IV, IO, Buccal	0.1 mg/kg	4 mg
Diazepam • IV, IO	0.3 mg/kg	5 mg (< 5 years) 10 mg (≥ 5 years)
• PR	0.5 mg/kg	20 mg

MAX DOSES: TWO



Side Effects of too many Benzodiazepines

- Respiratory depression
- Hypotension
- Sedation

Second Line Treatment

Repeat one different second line medication 5 mins after infusion

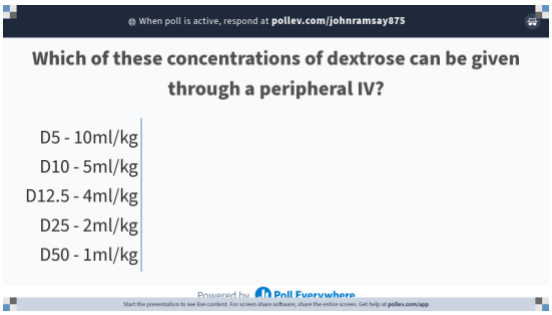
Phase 2 15-20 min

Drug	Dose	Age	Comments/Cautions
Levetiracetam	60 mg/kg/dose IV/IO (MAX 3000 mg/dose) Infuse over 5 minutes	Any age	↓side effects/drug interactions, low risk of psychosis
Fosphenytoin	20 mg phenytoin equivalent (PE)/kg/dose IV/IO/IM (MAX 1000 mg PE/dose) Infuse over 10 minutes	Any age	↓BP, ↓HR, arrhythmia; avoid in toxicologic seizures; choose alternate drug if on phenytoin at home or consider partial loading dose of 10 mg PE/kg/dose
Valproic Acid	40 mg/kg/dose IV/IO (MAX 3000 mg/dose) Infuse over 10 minutes	>2 years	In Canada, only available via Health Canada Special Access Program; caution in patients with liver dysfunction, mitochondrial disease, urea disorder, thrombocytopenia or unexpected developmental delay
Phenytoin	20 mg/kg/dose IV/IO (MAX 1000 mg/dose) **Infuse over 20 minutes**	Any age	↓BP, ↓HR, arrhythmia; avoid in toxicologic seizures; choose alternate drug if on phenytoin at home or consider partial loading dose of 10 mg kg/dose; use only if Fosphenytoin not available
Phenobarbital	20 mg/kg/dose IV/IO (MAX 1000 mg/dose) **Infuse over 20 minutes**	**<6 mos**	Respiratory depression, especially in combination with benzodiazepines

Reassess ABCs, monitor for respiratory depression. If still seizing:

Equal Efficacy of all options

Levetiracetam can be given the fastest with the best side effect profile



Hypoglycemia

Normal Range: 3.9 – 5.5 mmol/L

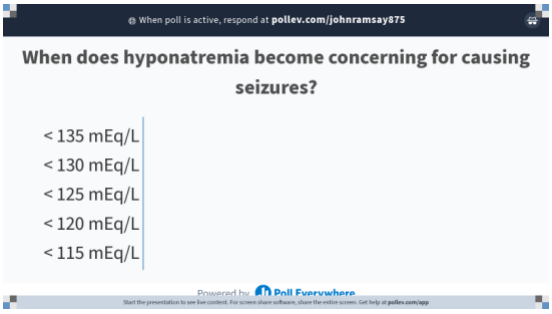
POCT BG < **3.3mmol/L**

Conscious & Asymptomatic
- Confirm symptoms if possible
- 15g or rapid acting carbohydrates
  - ~125ml of juice
- Recheck glucose 15-30min post

No response or Refuses PO

Impaired consciousness or seizure
- Dextrose bolus: rule of 50
  - 5ml/kg of D10 – up to 250ml
  - 4ml/kg of D12.5
  - 2ml/kg of D25
- Repeat glucose q5 min until normal
- Repeat bolus as needed
- D5-10NS @ maintenance

< 2.8 mmol/L send a **Critical Sample**



Hyponatremia

Normal Range: 135 – 145 mmol/L

Hyponatremia: < 135mEq/L

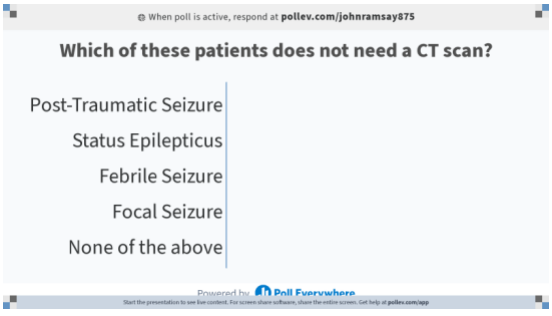
Is sodium less than: < 120mEq/L

NO

Unlikely to be cause of seizure
- Consider hypertonic saline if not improving

YES

3% Hypertonic Saline
- 5ml/kg bolus over 10-15 mins
- Will raise sodium by ~5mEq/L

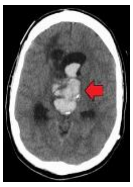


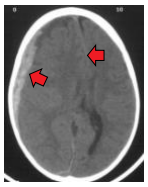
Raised ICP/Trauma/Stroke

Necessary Investigations:
- Non-Contrast CT Scan

Band-Aids:
- Head of bed elevation
- Sedation
- Hypertonic saline
- Mannitol
- Hyperventilation

Managing secondary brain injury:
- Normothermia
- Normotension
- Normoglycemia





Definitive Management – NEUROSURGERY

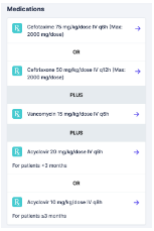
Infection

Febrile Seizure:
- Between 6 months and 6 year with a temp >38.0C
- Absence of CNS infection/Inflammation and no acute systemic abnormalities
- Seizures typically 5-10 mins with shorter post-ictal period of 5-10 mins.

Febrile Status Epilepticus
Consider Meningitis/Encephalitis
- Blood Culture
- Urine Culture
- Consider LP/CSF if stable

Start antibiotics as soon as possible

Firstline Clinical Decisions



If very sick: Don't delay antibiotics for cultures
Blood culture is still typically able to be obtained with IV

Disposition

Discharging:
- Ensure neurology follow up
- Outpatient EEG
- +/- Outpatient MRI

Brief Febrile Seizure – No further investigations needed

Admission Investigations:
- Neurology Consult
- MRI Brain
- Lumbar Puncture
- EEG
- Metabolic Workup

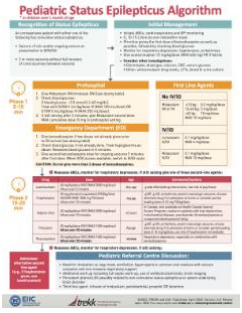
Children should be admitted to the hospital if they have prolonged seizures, refractory seizures or do not return to their baseline within 4-6 hours.

Resources

trekk
Translating Emergency Knowledge for Kids

Canadian Paediatric Society

Firstline Clinical Decisions



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BC Children's Hospital

QUESTIONS?

Contact Info: John Ramsay – ramsay.s.john@gmail.com

The quiz answers will be available at the end of the study should you be interested.

Appendix C

Scenario 1

Case Title: Status epilepticus in an 8-year-old child **Author:** John Ramsay **Date Last Updated:** 2022-11-30

Reason for Development: Simulation research scenario

Target Population: 2nd year medical students

Target Duration: 10 minute simulation

Learning Objectives:
1. ABC approach in a sick child
2. Initiation of seizure management and review of Trekk Algorithm
3. Initiation of basic seizure investigations

Core Competencies Checklist:

Medical Expert: ☒ Professional: ☒ Communicator: ☒ Collaborator: ☐ Leader: ☒ Health Advocate: ☐ Scholar: ☐

Crisis Resource Management Skills:

Know Environment: ☒ Anticipate & Plan: ☒ Call for help early: ☒ Distribute workload: ☐ Exercise leadership & Followership: ☐

Mobilize all available resources: ☐ Use all information: ☒ Re-evaluate case: ☒ Prevent & Manage Fixation errors: ☐ Use good teamwork: ☒

Communicate effectively: ☒ Allocate attention: ☒ Set priorities dynamically ☒

Scenario Setup:

Clinical Setting: ED Resus Room: ☐ Sim Lab: ☒ Other: ☐ Ward

System: Low fi infant: ☐ Low-fi Child: ☒ High-Fi Infant: ☐ High-fi Child: ☒

Equipment Needs:

☒ Bed
☒Medication Cart
☐ IV Pump + Pole
☐ Defibrillator/Pacer/ECG Leads
☒ O_2 delivery (NP, NRB mask, BVM)
☐ Airway cart (Laryngoscope, ETT, etc)
☒ IV Catheters
☒ Vitals: chest leads, pulse ox, Bp cuff
☐ PPE
☐ IO Setup
☐ Chest tube set up
☐ Three-way stopcock
☐ Foley Catheter

Adjuncts Needed:

ECG: ☐ Bloodwork: ☒ Appendix A Guidelines: ☒ Appendix B

Imaging: ☐ Videos/Photos: ☐ Flowsheets: ☐

Age: 8 yrs **Sex:** Male **Wt:** 30kg

Case Summary (For Facilitator):

8-year-old male presenting to the ED who has been having seizure for the past 10 minutes. His seizures will resolve following the administration of a second line anti-epileptic. The scenario is complicated by inability to obtain IV access for the first dose and worsening airway protection and desaturation as the case progresses. IV access can be obtained after an initial intranasal dose of midazolam is given.

Case Intro/Clinical Vignette (Read out loud to participants):

The paramedics are about to arrive with Rahul an 8-year-old male who is unresponsive and has been having tonic-clonic movements of his limbs for the past 10 minutes.

Additional Hx (if asked):

HPI: previous well
PMH: Nil
Meds: Nil
Algs: Nil

Stage 1:

Patient Condition	Simulator Parameters	Effective Management	Consequences of ineffective management	Notes:
General: Unresponsive, no work of breathing, normal colour **Airway:** No stridor, neck flexed, **Breathing:** No WOB, normal chest rise **Circulation:** Normal pulses, cap refill <3, warm extremities **Disability:** Unresponsive, Pupils dilated, reactive **P/E:** Cardio: Unremarkable Resp: Unremarkable Abdo: unremarkable Neuro: Pupils dilated, no reflexes, stiff tone, repeated flexion of arms, head deviation to one side	**HR:** 122 **RR:** 10 **SaO_2:** 90% **BP:** 110/75 **Temp:** 37.7C	**A:** • Attempt better positioning • Jaw thrust • Suction • Oral Airway **B:** • O_2 by non-rebreather or facemask **C:** • Attempt IV access • Cycle BP's **Monitors:** • Chest leads, sat monitor, BP Cuff **Investigations:** • POC Glucose (4.0) • Blood work		• IV access is unsuccessful

		Medications: • Intranasal Midaz or Diazepam PR		

Stage 2:

Patient Condition	**Simulator Parameters**	**Effective Management**	**Consequences of ineffective management**	**Notes:**
General: 5 minutes have passed, and patient is continuing to seize **Airway:** No intervention: Mild stridor, poor position Intervention: supported effectively **Breathing:** If no jaw thrust mild work of breathing, otherwise unremarkable **Circulation:** Normal pulses, normal cap refill **Disability:** Unresponsive **P/E:** Unchanged	**HR:** 126 **RR:** 12 **SaO_2:** 84% if no intervention 95 if O_2 and airway management **BP:** 112/80 **Temp:** 37.8	**A:** • Airway management above if not completed **B:** • Nil **C:** • Obtain IV access **Medication:** • Lorazepam IV • Keppra IV or other second line agent	Need to get to second line agent to abort seizure	

Expected / Critical Actions	**Unacceptable Actions:**
• Attempted IV access and repeat attempt later	• No airway management when patient is stridulous

• Transition to Non-IV medication when access unavailable • Call for support (Neuro) if seizure continues	

Medical Expert Points to bring up for discussion:

- Intranasal midazolam vs IV Lorazepam and effectiveness
- Importance of airway management
- Work-up for unknown seizure (Glucose, lytes)

Lab	Result	Normal Range
CBC		
WBC	7 x 10^9	4-12x10^9
Hgb	130	130 – 160
Plt	320	150 – 450
Glucose	5.7	
Electrolytes & Extended electrolytes:		
Sodium (Na^+)	140	135 – 145
Potassium (K^+)	4.2	3.5 – 5.5
Chloride (Cl^-)	103	102 – 112
Ionized Calcium (iCa)	1.18	1.15 – 1.3
Phosphate ($PO4^{-2}$)	1.5	1.16 – 1.81
Magnesium (Mg^{2+})	0.8	0.66 – 0.91

Scenario 2

Case Title: Status epilepticus in a 1-year-old child **Author:** John Ramsay **Date Last Updated:** 2022-11-30

Reason for Development: Simulation research scenario

Target Population: 2nd year medical students

Target Duration: 10 minute simulation

Learning Objectives:
1. ABC approach in a sick child
2. Initiation of seizure management and review of Trekk Algorithm
3. Initiation of basic seizure investigations

Core Competencies Checklist:

Medical Expert: ☒ Professional: ☒ Communicator: ☒ Collaborator: ☐ Leader: ☒ Health Advocate: ☐ Scholar: ☐

Crisis Resource Management Skills:

Know Environment: ☒ Anticipate & Plan: ☒ Call for help early: ☒ Distribute workload: ☐ Exercise leadership & Followership: ☐

Mobilize all available resources: ☐ Use all information: ☒ Re-evaluate case: ☒ Prevent & Manage Fixation errors: ☐ Use good teamwork: ☒

Communicate effectively: ☒ Allocate attention: ☒ Set priorities dynamically ☒

Scenario Setup:

Clinical Setting: ED Resus Room: ☐ Sim Lab: ☒ Other: ☐ Ward

System: Low fi infant: ☐ Low-fi Child: ☐ High-Fi Infant: ☒ High-fi Child: ☐

Equipment Needs:

☒ Bed	☐ Airway cart (Laryngoscope, ETT, etc)	☐ Chest tube set up
☒Medication Cart	☒ IV Catheters	☐ Three-way stopcock
☐ IV Pump + Pole	☒ Vitals: chest leads, pulse ox, Bp cuff	☐ Foley Catheter
☐ Defibrillator/Pacer/ECG Leads	☐ PPE	
☒ O_2 delivery (NP, NRB mask, BVM)	☐ IO Setup	

Adjuncts Needed:

ECG: ☐	Bloodwork: ☒ Appendix A	Guidelines: ☒ Appendix B
Imaging: ☐	Videos/Photos: ☐	Flowsheets: ☐

Age: 1 yr **Sex:** Female **Wt:** 10kg

Case Summary (For Facilitator):

1-year-old girl presenting on the ward who has been having seizure for the past 5 minutes. Her seizures will resolve following the administration of a second line anti-epileptic. The scenario is complicated by inability to obtain IV access for the first dose and worsening airway protection and desaturation as the case progresses. IV access can be obtained after an initial intranasal dose of midazolam is given.

Case Intro/Clinical Vignette (Read out loud to participants):

The nurse calls you about with Zoe a 1-year-old girl who is unresponsive and has been having tonic-clonic movements of her limbs for the past 5 minutes. She was admitted for gastroenteritis and pulled her IV out earlier today.

Additional Hx (if asked):

HPI: previous well
PMH: Nil
Meds: Nil
Algs: Nil

Stage 1:

Patient Condition	Simulator Parameters	Effective Management	Consequences of ineffective management	Notes:
General: Unresponsive, no work of breathing, normal colour **Airway:** No stridor, neck flexed, **Breathing:** No WOB, normal chest rise **Circulation:** Normal pulses, cap refill <3, warm extremities **Disability:** Unresponsive, Pupils dilated, reactive **P/E:** Cardio: Unremarkable Resp: Unremarkable Abdo: unremarkable Neuro: Pupils dilated but reactive,, no reflexes, stiff tone, repeated flexion of arms, head deviation to one side	**HR:** 170 **RR:** 14 **SaO_2:** 90% **BP:** 95/55 **Temp:** 37.6C	**A:** • Attempt better positioning • Jaw thrust • Suction • Oral Airway **B:** • O_2 by non-rebreather or facemask **C:** • Attempt IV access • Cycle BP's **Monitors:** • Chest leads, sat monitor, BP Cuff **Investigations:** • POC Glucose (2.0) • Blood work **Medications:** • Intranasal Midaz or Diazepam PR Call for help		• IV access is unsuccessful

Stage 2:

Patient Condition	Simulator Parameters	Effective Management	Consequences of ineffective management	Notes:
General: 5 minutes have passed, and patient is continuing to seize **Airway:** No intervention: Mild stridor, poor position Intervention: supported effectively **Breathing:** If no jaw thrust mild work of breathing, otherwise unremarkable **Circulation:** Normal pulses, normal cap refill **Disability:** Unresponsive **P/E:** Unchanged	**HR:** 126 **RR:** 12 **SaO_2:** 84% if no intervention 95 if O_2 and airway management **BP:** 112/80 **Temp:** 37.8	**A:** • Airway management above if not completed **B:** • Nil **C:** • Obtain IV access **D:** • IV D10W **Medication:** • Lorazepam IV • Keppra IV or other second line agent	- Need to get to second line agent to abort seizure - Should correct glucose to stop seizure.	

Expected / Critical Actions	Unacceptable Actions:
• Attempted IV access and repeat attempt later • Transition to Non-IV medication when access unavailable • Call for support (Neuro/Staff) if seizure continues	• No airway management when patient is stridulous

Medical Expert Points to bring up for discussion:

- Intranasal midazolam vs IV Lorazepam and effectiveness
- Importance of airway management
- Work-up for unknown seizure (Glucose, lytes)

Lab	Result	Normal Range
CBC		
WBC	8 x 10^9	4-12x10^9
Hgb	145	130 – 160
Plt	270	150 – 450
Glucose	4.2	
Electrolytes & Extended electrolytes:		
Sodium (Na^+)	144	135 – 145
Potassium (K^+)	4.5	3.5 – 5.5
Chloride (Cl^-)	103	102 – 112
Ionized Calcium (iCa)	1.2	1.15 – 1.3
Phosphate ($PO4^{-2}$)	1.4	1.16 – 1.81
Magnesium (Mg^{2+})	0.8	0.66 – 0.91