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Peer reviewed

SIMULATION

Febrile Seizure

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ABSTRACT:

Audience: This simulation session is appropriate for medical students, community physicians, or residents in emergency medicine, neurology, pediatrics, or family medicine.

Introduction: Febrile seizures are the most common form of seizures in childhood; they are thought to occur in 2-5% of all children.¹⁻³ Febrile seizures are defined as a seizure in association with a febrile illness in children without a central nervous system infection, previous afebrile seizure, known brain disorder, or electrolyte abnormalities.^{1,2} They typically occur between 6 months and 18 months of age though they can occur up to 5 years of age.³ Febrile seizures are categorized as: simple (generalized seizure lasting less than 15 minutes in a child aged 6 months to 5 years, and less than 1 in a 24 hour period) or complex (a focal seizure or generalized seizure lasting greater than 15 minutes, or multiple seizures in a 24 hour period).^{1,3} Treatment for febrile seizures is based on treating the underlying cause of the fever and giving reassurance and education to the parents.² Mortality is extremely rare, and there is no difference in the patient's cognitive abilities after a febrile seizure, even when the seizure is prolonged.¹

Objectives: At the end of this simulation session, the learner will be able to: 1) discuss the management of febrile seizures 2) discuss when placement of an advanced airway is indicated in the management of a febrile seizure 3) list the risk factors for febrile seizures 4) prepare a differential diagnosis for the causes of febrile seizures 5) educate family members on febrile seizures.

Methods: This educational session is a high-fidelity simulation.

Topics: Fever, seizure, febrile seizure, pediatrics, simulation, meningitis, lumbar puncture.





USER GUIDE

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Learner Audience:

Medical students, interns, junior residents, senior residents, faculty, community physicians.

Time Required for Implementation:

Instructor Preparation: 30-60 minutes
Time for case: 10-15 minutes
Time for debriefing: 15-30 minutes

Recommended Number of Learners per Instructor:

2-5

Topics:

Fever, seizure, febrile seizure, pediatrics, simulation, meningitis, lumbar puncture

Objectives:

At the end of this simulation session, the learner will be able to:

1. Discuss the management of febrile seizures
2. Discuss when placement of an advanced airway is indicated in the management of a febrile seizure
3. List the risk factors for febrile seizures
4. Prepare a differential diagnosis for the causes of febrile seizures
5. Educate family members on febrile seizures.

Results and tips for successful implementation:

This case can be completed as a high- or moderate- fidelity simulation, or could be incorporated as a mock oral board case.

It is important that the patient's mother and paramedics are available during the scenario so that learners will be able to obtain accurate history in this pediatric case. The simulation case was piloted on 12 PGY-1 through PGY-3 residents. The case received excellent verbal feedback. After the pilot implementation, we have made a few adjustments to the case, specifically for clarification of the scenario and learning points.

Learner responsible content (optional): There is no LRC; however, learners can be directed to any book chapter on febrile seizures or to the references below for further reading.

References/suggestions for further reading:

1. Patel N, Ram D, Swiderska N, Mewasingh LD, Newton RW, Offringa M. Febrile seizures. *BMJ*. 2015;351:h4240-h4247. doi: 10.1136/bmj.h4240
2. Steering Committee on Quality Improvement and Management, Subcommittee on Febrile Seizures. Febrile seizures: clinical practice guideline for the long-term management of the child with simple febrile seizures. *Pediatrics*. 2008;121(6):1281-1286. doi: 10.1542/peds.2008-0939
3. Subcommittee on Febrile Seizures, American Academy of Pediatrics. Febrile seizures: guideline for the neurodiagnostic evaluation of the child with a simple febrile seizure. *Pediatrics*. 2011;127(2):389-394. doi: 10.1542/peds.2010-3318

Linked objectives and methods:

Febrile seizures are the most common neurologic disorder of infants and young children. They are an age-dependent phenomenon, occurring in 2 to 4 percent of children younger than five years of age. By using simulation, learners will diagnose and manage a patient presenting with a febrile seizure. During the case, the patient's mother will become distraught; thus, learners will need to demonstrate effective communication strategies to educate the patient's family member on febrile seizures.

Recommended pre-reading for instructor:

Any resource to review febrile seizures would be appropriate, including book chapters. For suggestions, see the reference list provided below.



INSTRUCTOR MATERIALS

Case title: Febrile Seizure

Case Description & Diagnosis (short synopsis): A 15-month-old female with no past medical history is brought into the emergency department by ambulance after having a 1-2 minute seizure and then returning to baseline. The patient has no history of febrile seizures and has been well until the episode today. The patient's mother will note that the patient received her vaccinations yesterday. The learner should consider the differential diagnosis for seizure in this age group, and appropriately note the fever.

The mother will be very anxious and the learner will need to discuss the differential diagnosis, most likely diagnosis, and work up with her. The mother will refuse all blood work and lumbar puncture but will allow urine to be collected. The learner should give the patient antipyretics and recommend observation in the emergency department until the fever improves and the patient is back to baseline. Upon discussion of discharge the mother should again become very anxious and question what she needs to watch for at home.

Equipment or Props Needed:

High-fidelity pediatric simulator

Infusion pumps

Normal saline

Acetaminophen/Ibuprofen

Benzodiazepines

Intubation/airway tray

Monitors

Blood pressure cuff

Cardiac monitor

Two-lead electrocardiogram (ECG)

Pulse oximeter

Confederates needed:

- Paramedic who brings the patient into the room
- Parent (who will become anxious during the case and require calming)



INSTRUCTOR MATERIALS

Stimulus Inventory:

#1 UA

Background and brief information: The patient is a 15-month-old female brought in to the emergency department (ED) by ambulance for fever x 1 day. Patient woke up from a nap approximately one hour ago, and subsequently had 1-2 minutes of generalized tonic-clonic activity. The patient's mother noted that the patient was acting normal yesterday, though she did receive vaccinations yesterday. Review of systems is negative for any other abnormalities such as cough or rash. Participants will need to consider the differential diagnosis for seizure in an infant, including serious bacterial infection, meningitis, and febrile seizure. They must then determine what labs, imaging and/or procedures, if any, they would like to perform.

Initial presentation: The patient is brought in by ambulance after seizure; patient is fussy but consolable and found to be febrile.

How the scenario unfolds: A paramedic will bring the patient into the treatment room, accompanied by the patient's worried mother. Participants should ask the paramedics and mother to stay in order to obtain additional history about the patient. The patient will initially be fussy but consolable. Initially the patient will be tachycardic, tachypneic, and febrile to 39.8°C. The physical exam will otherwise be unremarkable. Participants should then discuss the differential diagnosis of seizure and fever in a pediatric patient. A urinalysis may be performed, which will be negative for infection. If the participants attempt to draw serum studies or perform a lumbar puncture, the parents will refuse. Participants should administer acetaminophen and/or ibuprofen to help lower the patient's temperature; if they do not, the mother will ask what is being done for the patient's fever. Participants should observe the patient in the ED for several hours. The patient's fever will defervesce with antipyretics, at which time parents will state that patient seems back to her normal self. Participants should educate the parents on febrile seizures, ensure that the patient has adequate follow up, and provide return precautions before discharge.



INSTRUCTOR MATERIALS

Critical Actions:

1. Recognize that patient likely had a febrile seizure, consider febrile seizure in the differential diagnosis
2. Evaluate airway, breathing, and circulation
3. Obtain history and perform physical exam
4. Obtain temperature/vital signs
5. Order urinalysis
6. Administer acetaminophen and/or ibuprofen to treat the fever
7. Calm, reassure and educate parents on febrile seizures



INSTRUCTOR MATERIALS

Case title: Febrile Seizure

Chief Complaint: 15-month-old female with fever for one day, and possible seizure lasting 1-2 minutes.

Vitals: Heart rate (HR) 191 Blood pressure (BP) not taken Respiratory rate (RR) 32
Temperature (T) 39.8°C Oxygen saturation (O₂Sat) 100%

General Appearance: Female infant who appears stated age. Crying in minimal distress, non-toxic appearing.

Primary Survey:

- **Airway:** patent, protected, and phonating
- **Breathing:** normal rate and breath sounds, mild tachypnea noted, no increased work of breathing
- **Circulation:** normal cap refill, strong pulses

History:

- **History of present illness:** 15-month-old female with no past medical history is brought into the emergency department by ambulance after having a seizure lasting 1-2 minutes. Patient woke up from a nap approximately one hour ago, and subsequently had a possible seizure. The patient's mother noted the patient to be shaking and staring, which lasted for 1-2 minutes, followed by one episode of emesis, and then the patient started crying and moving all extremities. The patient's mother states that the patient received vaccinations yesterday and was acting normally afterwards. The patient's mother denies any rash, cough, ear-pulling, diarrhea, blood in the stool, or hematuria. The patient's mother reported the patient had a fever last night to 101.3F prior to going to bed, then woke up early this morning. The patient is back to baseline now. The patient's mother denies any history of trauma. The patient has been tolerating PO well, and has been having a normal number of wet and dirty diapers.
- **Past medical history:** Born full-term, no past medical problems, up-to-date on vaccinations
- **Past surgical history:** Negative
- **Patient's medications:** None
- **Allergies:** No known drug allergies



INSTRUCTOR MATERIALS

- **Social history:** Lives at home with mother, father, and older brother. No tobacco, alcohol or IV drug abuse at home.
- **Family history:** No family history of seizures
- **Review of Systems:** Negative other than as stated in history of present illness

Secondary Survey/Physical Examination:

- **General Appearance:** crying though easily consolable, in minimal distress, non-toxic appearing.
- **HEENT:** normocephalic atraumatic, fontanelle closed, pupils equal, round and reactive to light, moist mucous membranes, tympanic membrane clear, naso-oropharynx clear.
- **Neck:** infant is able to range her neck without pain, no evidence of meningismus.
- **Heart:** tachycardic, regular rate and rhythm, no murmurs, rubs, or gallops.
- **Lungs:** clear to auscultation bilaterally. No wheezes, rales, or rhonchi. No cough noted throughout exam.
- **Abdomen:** soft, nontender, no rebound, no guarding, no peritoneal signs, no organomegaly. Positive bowel sounds.
- **Genitourinary:** no acute abnormalities noted, normal external genitalia, no diaper rash.
- **Rectal:** referred.
- **Extremities:** moving all four extremities without difficulty or apparent pain, no cyanosis, no edema, 2+ pulses in all 4 extremities.
- **Back:** no acute abnormalities noted.
- **Neuro:** moving all four extremities without difficulty, alert, appropriate for age, acting appropriately per mother.
- **Skin:** no rashes noted.
- **Lymph:** no acute abnormalities noted, no lymphadenopathy noted throughout.



INSTRUCTOR MATERIALS

Results:

#1 Urinalysis

Appearance	Clear
Color	Light yellow
Glucose	Negative
Ketones	Negative
Specific gravity	1.015
Hemoglobin	Trace
pH	6.1
Protein	Trace
Nitrite	Negative
Leukocyte	Negative
White blood cell (WBC)	0/high powered field (HPF)
Red blood cells (RBC)	0/HPF
Squamous cells	0/HPF
Bacteria	None



OPERATOR MATERIALS

SIMULATION EVENTS TABLE:

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
0:00 (Baseline)	Paramedics bring patient into the room	Patient sitting on her mother's lap on gurney, patient crying.	T 39.8°C HR 191 BP not taken RR 38 O2 100% room air
1:00	Obtain focused history and physical from paramedics and parents Assess airway, breathing and circulation Place patient on monitors	Patient still crying but consolable by mother. Mother is very anxious and tearful, requesting to know what is happening. If ordered mother will refuse IV line, prompting participants to explain why they want an IV line. Mother will still refuse.	T 39.8°C HR 184 BP not taken RR 33 100% room air
3:00	Urinalysis ordered Oral fluids ordered Acetaminophen and/or ibuprofen ordered Discuss with the patient's mother the differential of seizures, including what can cause a febrile seizure	Patient tearful but consolable. Mother's anxiety will increase until the participants counsel her on febrile seizures. If antipyretics are not given the patient's mother will ask what is being done for her child's fever, prompting the learner to give antipyretics. Nurses will state that they are unable to get a bagged urine and ask if they should perform a catheterization.	T 39.8°C HR 174 BP not taken RR 30 100% room air
4:00	Urinalysis is available.	Patient sleeping in mother's arms.	T 39.8°C HR 167 BP not taken RR 30 100% room air



OPERATOR MATERIALS

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
6:00-8:00	Re-assess patient	Patient smiling, playing, happy, babbling.	T 37.5°C if antipyretics are given. HR 145 BP not taken RR 28 100% room air
9:00	Participants should educate parents on febrile seizures; return precautions.	Mom is anxious about going home, concerned about febrile seizures and asking many questions. If learners do not educate mother, instructor can have mother ask “why did it happen? What can I do to prevent it in the future?”	Case ends

Diagnosis: Simple febrile seizure

Disposition: Discharge patient after several hours of observation in the emergency department and normalization of vital signs. Educate parents on febrile seizures and make return precautions clear.



DEBRIEFING AND EVALUATION PEARLS

Febrile Seizure

Epidemiology

- Febrile seizures are the most common neurologic disorder of infants and young children.
- Occurs in about 2-4% of children younger than five years of age
- Peak incidence between 12 and 18 months of age.
- Most events occur at or above 39°C, about 25% occur between 38°C and 39°C.

Pathophysiology

- Underlying pathophysiology is unknown
- Possibly related to vulnerability of developing nervous system
- Genetic predisposition has been recognized but exact mode of inheritance is not known

Risk factors

- Age
- Genetics
- Maximum height of fever
- Associated with viral infections
- Immunizations
- Prenatal exposure to nicotine

Presenting Signs and Symptoms

- Characterized as:
 - Simple febrile seizure – most common, generalized clonic, lasting less than 15 minutes, quick return to baseline and do not recur in 24hr period.
 - Complex febrile seizure – focal onset, prolonged (greater than 15 mins) or recurrent within 24hrs.
 - Febrile status epilepticus – Continuous seizures or intermittent seizures without neurologic recovery, lasting for a period of 30 minutes or longer.

Diagnosis

- Febrile seizure is a clinical diagnosis
- Defined by the following features:
 - Convulsion associated with elevated temperature greater 38°C
 - Child older than 3 months and younger than six years of age
 - Absence of central nervous system infection or inflammation
 - Absence of acute systemic metabolic abnormality that may produce convulsions
 - No history of previous afebrile seizures



DEBRIEFING AND EVALUATION PEARLS

Treatment

- Simple febrile seizures typically spontaneously resolve by the time the child is evaluated and do not need to be treated
- Fever should be treated symptomatically
- Prolonged seizures or status epilepticus may require abortive treatment with benzodiazepines

References/Further Reading:

1. Patel N, Ram D, Swiderska N, Mewasingh LD, Newton RW, Offringa M. Febrile seizures. *BMJ*. 2015;351:h4240-h4247. doi: 10.1136/bmj.h4240
2. Steering Committee on Quality Improvement and Management, Subcommittee on Febrile Seizures. Febrile seizures: clinical practice guideline for the long-term management of the child with simple febrile seizures. *Pediatrics*. 2008;121(6):1281-1286. doi: 10.1542/peds.2008-0939
3. Subcommittee on Febrile Seizures, American Academy of Pediatrics. Febrile seizures: guideline for the neurodiagnostic evaluation of the child with a simple febrile seizure. *Pediatrics*. 2011;127(2):389-394. doi: 10.1542/peds.2010-3318



SIMULATION ASSESSMENT

Febrile Seizure

Learner: _____

Assessment Timeline

This timeline is to help observers assess their learners. It allows observer to make notes on when learners performed various tasks, which can help guide debriefing discussion.

Critical Actions

1. Recognize that patient likely had a seizure, consider febrile seizure in the differential diagnosis
2. Evaluate airway, breathing, and circulation
3. Obtain history and perform physical exam
4. Obtain temperature/vital signs
5. Order urinalysis
6. Administer acetaminophen and/or ibuprofen to treat the fever
7. Calm, reassure and educate parents on febrile seizures

0:00



SIMULATION ASSESSMENT

Febrile Seizure

Learner: _____

Critical Actions:

- Recognize that patient likely had a seizure, consider febrile seizure in the differential diagnosis
- Evaluate airway, breathing, and circulation
- Obtain history and perform physical exam
- Obtain temperature/vital signs
- Order urinalysis
- Administer acetaminophen and/or ibuprofen to treat the fever
- Calm, reassure and educate parents on febrile seizures

Summative and formative comments:

Milestones assessment:

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
1	Emergency Stabilization (PC1)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Recognizes abnormal vital signs	<input type="checkbox"/> Recognizes an unstable patient, requiring intervention Performs primary assessment Discerns data to formulate a diagnostic impression/plan	<input type="checkbox"/> Manages and prioritizes critical actions in a critically ill patient Reassesses after implementing a stabilizing intervention



SIMULATION ASSESSMENT

Febrile Seizure

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
2	Performance of focused history and physical (PC2)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Performs a reliable, comprehensive history and physical exam	<input type="checkbox"/> Performs and communicates a focused history and physical exam based on chief complaint and urgent issues	<input type="checkbox"/> Prioritizes essential components of history and physical exam given dynamic circumstances
3	Diagnostic studies (PC3)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Determines the necessity of diagnostic studies	<input type="checkbox"/> Orders appropriate diagnostic studies. Performs appropriate bedside diagnostic studies/procedures	<input type="checkbox"/> Prioritizes essential testing Interprets results of diagnostic studies Reviews risks, benefits, contraindications, and alternatives to a diagnostic study or procedure
4	Diagnosis (PC4)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Considers a list of potential diagnoses	<input type="checkbox"/> Considers an appropriate list of potential diagnosis May or may not make correct diagnosis	<input type="checkbox"/> Makes the appropriate diagnosis Considers other potential diagnoses, avoiding premature closure
5	Pharmacotherapy (PC5)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Asks patient for drug allergies	<input type="checkbox"/> Selects an medication for therapeutic intervention, consider potential adverse effects	<input type="checkbox"/> Selects the most appropriate medication and understands mechanism of action, effect, and potential side effects Considers and recognizes drug-drug interactions



SIMULATION ASSESSMENT

Febrile Seizure

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
6	Observation and reassessment (PC6)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Reevaluates patient at least one time during case	<input type="checkbox"/> Reevaluates patient after most therapeutic interventions	<input type="checkbox"/> Consistently evaluates the effectiveness of therapies at appropriate intervals
7	Disposition (PC7)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Appropriately selects whether to admit or discharge the patient	<input type="checkbox"/> Appropriately selects whether to admit or discharge Involves the expertise of some of the appropriate specialists	<input type="checkbox"/> Educates the patient appropriately about their disposition Assigns patient to an appropriate level of care (ICU/Tele/Floor) Involves expertise of all appropriate specialists
9	General Approach to Procedures (PC9)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Identifies pertinent anatomy and physiology for a procedure Uses appropriate Universal Precautions	<input type="checkbox"/> Obtains informed consent Knows indications, contraindications, anatomic landmarks, equipment, anesthetic and procedural technique, and potential complications for common ED procedures	<input type="checkbox"/> Determines a back-up strategy if initial attempts are unsuccessful Correctly interprets results of diagnostic procedure
20	Professional Values (PROF1)	<input type="checkbox"/> Did not achieve Level 1	<input type="checkbox"/> Demonstrates caring, honest behavior	<input type="checkbox"/> Exhibits compassion, respect, sensitivity and responsiveness	<input type="checkbox"/> Develops alternative care plans when patients' personal beliefs and decisions preclude standard care



SIMULATION ASSESSMENT

Febrile Seizure

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
22	Patient centered communication (ICS1)	<input type="checkbox"/> Did not achieve level 1	<input type="checkbox"/> Establishes rapport and demonstrates empathy to patient (and family) Listens effectively	<input type="checkbox"/> Elicits patient's reason for seeking health care	<input type="checkbox"/> Manages patient expectations in a manner that minimizes potential for stress, conflict, and misunderstanding. Effectively communicates with vulnerable populations, (at risk patients and families)
23	Team management (ICS2)	<input type="checkbox"/> Did not achieve level 1	<input type="checkbox"/> Recognizes other members of the patient care team during case (nurse, techs)	<input type="checkbox"/> Communicates pertinent information to other healthcare colleagues	<input type="checkbox"/> Communicates a clear, succinct, and appropriate handoff with specialists and other colleagues Communicates effectively with ancillary staff