DISCLOSURE

I do not have any relevant financial relationship with commercial interest to disclose.
OBJECTIVES

• Describe the decision making process in the management of babies with unexplained events
  • Discuss historical framework and epidemiology
  • Describe ALTEs vs BRUE
  • List the important points of patient history and physical examination
  • Discuss risk stratification and new recommendations
INTRODUCTION

- Many no. of infants present to ER with history of an acute event like unexpected change in appearance, breathing, color or behavior
- It is not a specific diagnosis, but rather a “chief complaint” that brings an infant to medical attention
- The clinical challenge is to identify the infant who may benefit from further testing and prolonged observation, based on factors that suggest an identifiable underlying diagnosis or risk for subsequent events
**EPIDEMIOLOGY**

- Studies estimated that ALTE occur in 3:10,000 to 41:10,000 infants.
- The main risk factors for the acute events in infants described as ALTE are feeding difficulties, recent URTI symptoms, age younger than 2 months, and a history of previous episodes.
- Some studies report that the rate of ALTE is higher among post-mature infants or first-born infants.
Lesser risk factors include premature birth, low birth weight and maternal smoking.

In older studies focusing on the broad category of ALTE, the most explanatory diagnosis were, GER, neurologic problem (seizures), and respiratory infection.
Case

Jana is a 4 months old female baby brought in by EMS. According to mam, about 1 hour prior to arrival, this little angle had finished her bottle and the mother was carrying her in her arms while she was on the phone. She looked down and the child seemed limp, mother could not discern if she was breathing or not. She drooped the phone and lay baby down, and after 10-20 seconds the baby began to cry. By the time EMS arrived, she was back to her baseline. The mother reports the whole episode lasted less than a minute but really scared her.
PAST MEDICAL HISTORY

• Term baby and product of uneventful labor and delivery
• No major medical problems
• First baby, the parents seem reasonable and attentive
• Child has been growing well with normal milestone
• She has never missed a scheduled well-child check
• Immunization up to age
• **Family history** is negative for sudden cardiac death, SIDS, seizure or major medical problems

• **Physical exam** is positive for a cute child with toothless smile, all four extremities moving at once to show how happy she is to get your attention, with no concerning findings
The best approach is:

1. To admit the child for cardiorespiratory monitoring for 12hr
2. Keep the child for observation and order basic labs with chest radiograph & ECG
3. To prescribe acid suppression therapy with GI referral
4. To reassure the parents and discharge with home cardiorespiratory monitoring
5. Non of above
What was an Apparent Life Threatening Event?
Before 1986, incidents of infantile apnea (preceding the term ALTE) were classified as a near-miss for sudden infant death syndrome (SIDS). However, a key distinction between SIDS and infantile apnea was made when no direct correlation between the 2 was found, leading to the term ALTE (Apparent life-threatening event) replacing near miss SIDS.
DEFINITION OF ALTE

An episode in the first year of life that appears potentially life threatening to the observer and is characterized by some combination of:

• Color change
• Apnea
• Alteration in muscle tone
• Choking or gagging

**DIFFERENTIAL DIAGNOSIS OF ALTE**  
Systemic Review of 8 studies (N=643)

<table>
<thead>
<tr>
<th>MOST COMMON</th>
<th>LESS COMMON</th>
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<tbody>
<tr>
<td>• Idiopathic (26-50%)</td>
<td>• Child maltreatment (&lt;1%)</td>
</tr>
<tr>
<td>• GER (26-54%)</td>
<td>• Pertussis (0.05-9%)</td>
</tr>
<tr>
<td>• Respiratory infection (8-11%)</td>
<td>• Cardiac arrhythmias (&lt; 1%)</td>
</tr>
<tr>
<td>• Seizure (9-11%)</td>
<td>• Bacterial infection (0-8%)</td>
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<td></td>
<td>• Metabolic Disorders (1.5%)</td>
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AN ALTE IS **NOT** A WARNING SIGN FOR SIDS

- **Time of occurrence**
  - SIDS death 80% occur between midnight-6AM
  - ALTE episodes 82% occur between 8AM-8PM

- **The peak of incidence**
  - SIDS is between 2-4 months
  - ALTE is during the first 2 months of life

- **Interventions** to reduce SIDS have not reduced ALTEs (eg. supine sleeping)

- SIDS and ALTEs have **different risk factors**
SYSTEMIC REVIEW REDUX : 2013

37 studies 1970-2011; 18 prospective and 19 retrospective observational

For infants that are well appearing upon presentation

- Historical and PE features can identify risk
- Testing tailored to these risks may be of value
- True risk of a subsequent event or underlying disorder cannot be determined
- A more precise definition of an ALTE is needed
- Further research is warranted

Tieder JS et al J Pediatric 2013 AAP
2016 AAP Committee released a new clinical guideline that recommended:

- The replacement of the term ALTE with a new term (BRUE) brief resolved unexplained events
- To provide clearly defined symptoms, allowing physician to assess the level of risk for patient (low vs high) and provide management recommendations for low risk infant
BRUE DEFINITION

It is a description of a sudden, brief, and now resolved episode in an infant that includes one or more of the following features:

- Cyanosis or pallor
- Absent, decreased, or irregular breathing
- Marked change in tone (hyper- or hypotonia)
- Altered level of responsiveness

## ALTE vs BRUE

<table>
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<tr>
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<th>BRUE</th>
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Tieder JS et al. *J Pediatric* 2013
## ALTE vs BRUE

<table>
<thead>
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<th>BRUE</th>
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</table>
| - Both chief complaint and diagnosis  
- Not always life-threatening  
- Caregivers perception  
- Can have ongoing symptoms (e.g., fever, URTI)  
- Can have a diagnosis (e.g., meningitis, bronchiolitis) | - Diagnosis of exclusion  
- Excludes patients with an explanation or diagnosis (e.g., GER)  
- Clinician characterization  
- Excludes symptomatic infants (i.e., just an event) |
RISK FACTORS FOR RECURRENCE

- 10-15% in different reports and less for infants with BRUE
- Prematurity
- Viral respiratory tract infection
- Multiple acute events preceding the hospital admission
- Infants younger than 2 months of age
PROGNOSIS

- The risk for subsequent death in ALTE is less than 1%, and substantially lower for those meeting criteria for BRUE.
- Infants with recurrent events requiring CPR have a very high risk of subsequent death 10-30%.
CLINICAL EVALUATION
HISTORY

• Who observed the event?
• What was the description of the event?
  Color
  Respiration
  Muscle tone
• Intervention
  Gentle or vigorous stimulation
  CPR
  Duration of the intervention
HISTORY

Past history

• Prior events
• Medical history
• Medications
• Birth history term vs preterm
• Family history of similar events or early death in first degree relatives
• Social history (smoke, drugs or alcohol), possible child maltreatment in the past
HISTORY POINTERS TOWARDS SPECIFIC DIAGNOSIS

Gastroesophageal reflux (GER) and/or laryngospasm:

- Gross emesis or oral regurgitation that occurred during the event and that the episode was characterized by obstructive apnea
- Acute events caused by laryngospasm typically occur during feeding, or shortly after feeding, especially if the infant is in a supine position
- If symptoms are recurrent and/or the infant has underlying neurologic or developmental abnormalities, further evaluation for swallowing dysfunction may be warranted
Respiratory tract infection:
- nasal congestion, cough, and/or fever

Seizure:
- loss of muscle tone and unresponsiveness during the events, and no history of gagging or choking.

Child abuse:
- previous episodes of severe events, especially if the events occurred in the presence of a single caretaker and required CPR, or siblings with unexplained events or deaths, or a prior report for child maltreatment
RED FLAG HISTORY FOR CHILD ABUSE

- No history or denial of trauma despite severe injury
- Implausible history for degree or type of injury
- Unexplained or excessive delay in seeking care
- Injury attributed to in-home resuscitation efforts
- Caregivers histories that change with retelling or conflict with versions from other observers
- Severe injury explained as self-inflicted or blamed on other young children or pets
PHYSICAL EXAMINATION

- General appearance
- Measurement of height, weight, and head circumference
- Measurement of vital signs, including pulse oximetry
- Examination for physical signs of trauma (bruising, subconjunctival or retinal hemorrhage, bleeding from the nose or mouth, bulging anterior fontanel)
HISTORY & PE ARE CRITICAL TO DIAGNOSE BRUE
PHYSICAL EXAMINATION

• Neurological examination, including alertness, responsiveness and tone
• Evaluation of respiratory distress or upper airway obstruction, including assessment of facial dysmorphism
• Developmental assessment, including reflexes
RISK STRATIFICATION & RECOMMENDATIONS FOR LOWER- RISK
LOW RISK BRUE

- Age > 60 days
- Gestational age ≥ 32 weeks and postconceptional age ≥ 45 weeks
- Occurrence of only one BRUE (no prior BRUE, and did not occur in clusters)
- Duration of BRUE < 1 minute
- No cardiopulmonary resuscitation (CPR)
- No concerning historical features
- No concerning physical examination findings
HIGH RISK BRUE

- Anything other than low risk criteria
- Beyond the scope of the committee`s recommendations
- History and Physical examination suggest the need for further investigations, monitoring and/or treatment.
- Recommendations are not offered because of insufficient evidence or the availability of guidance from other clinical practice guidelines specific to their presentation or diagnosis
D/D HIGH RISK ALTE\BRUE

- GER/laryngospasm
- Seizures
- Respiratory tract infections
- Child abuse
- Cardiac disease
- Upper airway obstruction
- Bacterial infection
- Metabolic disorders
- Toxin ingestion
Patient presents for initial medical assessment after a brief, resolved event that was observed by caregiver in a child <1 year of age.

Patient is well-appearing.

Clinician characterizes the event as a sudden, brief and now resolved episode of one or more of the following:
- Cyanosis or pallor
- Absent, decreased, or irregular breathing
- Marked change in tone (hyper-hypotonia)
- Altered responsiveness

Event criteria present.

Perform appropriate history and PE.

Event criteria absent.

Explanation for event identified (e.g., GER, feeding difficulties, or airway abnormality).

No explanation for event identified.

Diagnosis of BRUE is made.

Patient has additional symptoms or abnormal vital signs (e.g., cough, respiratory difficulties or fever).

Not a BRUE.

Out of guideline scope; manage accordingly.
Diagnosis of BRUE is made

No concerns identified from history and PE *

Apply risk stratification (are all of the below true?)
- Age >60 days
- Born >32 weeks gestation and corrected gestational age ≥45 weeks
- No CPR by trained medical provider
- First event

Yes

Lower risk patient

Concerns identified from history or PE (e.g., FH of sudden cardiac death or subtle, non-diagnostic social, feeding or respiratory problems)

Higher risk patient

No
Management recommendations for lower risk patients

**Should**
- Educate caregivers about BRUEs and engage in shared decision-making to guide evaluation, disposition, and follow-up
- Offer resources for CPR training to caregiver

**May**
- Obtain pertussis testing and 12 lead ECG
- Briefly monitor patients with continuous pulse oximetry and serial observations

**Should not**
- Obtain WBC count, blood culture, or CSF analysis or culture, serum sodium, potassium, chloride, blood urea nitrogen, creatinine, calcium, ammonia, blood gases, urine organic acids, plasma amino acids or acylcarnitines, chest radiograph, echocardiogram, EEG, studies for GER or laboratory evaluation for anemia
- Initiate home cardio-respiratory monitoring
- Prescribe acid suppression therapy or anti-epileptic medications

**Need not**
- Obtain viral respiratory test, urinalysis, blood glucose, serum bicarbonate, serum lactic acid or neuroimaging
- Admit the patient to the hospital solely for cardiorespiratory monitoring
KEY ACTION STATEMENTS FOR LOWER- RISK BRUE
PULMONOLOGY

• **Need not** admit the patient to hospital *solely* for cardiorespiratory monitoring (Weak)

• **May** briefly monitor patients with continuous pulse oximetry and serial observations (Weak)

• **Should not** obtain a chest radiograph (Moderate)

• **Should not** obtain measurement of blood gases (Moderate)

• **Should not** initiate home cardio-respiratory monitoring (Moderate)

• **Should not** obtain overnight polysomnography (Moderate)
CARDIOLOGY

• **May** obtain a 12-lead electrocardiogram. (Weak)
• **Should not** echocardiography (Moderate)
CHILD ABUSE

• **Need not** obtain neuroimaging (CT, MRI, US) to detect child abuse (Weak)

• **Should** obtain an assessment of social risk factors to detect child abuse (Moderate)
NEUROLOGY

• Should not obtain neuroimaging (CT, MRI, US) to detect neurologic disorders (Moderate)
• Should not obtain an EEG (Moderate)
• Should not prescribe anti-epileptic medications (Moderate).
INFECTIONOUS DISEASE

- Should not obtain a WBC, blood culture, or CSF analysis to identify occult bacterial infection (Strong)
- Should not chest radiograph to assess for pulmonary infection (Moderate)
- Need not obtain a urine analysis bag or catheter (Weak)
- Need not obtain respiratory viral testing in infants (Weak)
- May obtain test for pertussis (Weak)
GASTROENTEROLOGY

• Should not obtain investigations for GER (Moderate )
• Should not prescribe acid suppression therapy (Moderate )
INBORN ERROR OF METABOLISM

• Need not obtain blood glucose (Weak )
• Need not obtain serum lactic acid or bicarbonate (Weak )
• Should not obtain serum electrolytes, or ammonia (Moderate)
• Should not obtain venous or arterial blood gas (Moderate )
• Should not obtain urine organic acids, plasma amino acids, or plasma acylcarnitines (Moderate )
ANEMIA

• Should not obtain laboratory evaluations for anemia (Moderate )
PATIENT AND FAMILY-CENTERED CARE

- Should offer resources for CPR training to caregiver (Moderate)
- Should educate caregivers about BRUEs (Moderate)
- Should use shared decision-making (Moderate)
WHAT DO WE NEED IN FUTURE?

- Guidance on High risk BRUEs
- Better identification of child abuse
- Understand epidemiology and risk
- Understand patient and family-centered outcomes
- Empiric GER treatment
- Strategies for timely follow-up and surveillance
ANY QUESTIONS?
TAKE HOME POINTS

• ALTEs and BRUEs very different from SIDS
• **Remember** child abuse can present as an ALTE\BRUE
• Use you super skills for the history and physical exam-is this a BRUE or something else that is brewing?
• Don`t order a million tests, just based on true, rather than perceived risk
• Use shared decision making and inform caregivers of potential harm to testing\hospitalization
• **Always** believe the parents, even if their reports don`t seem to match with your exam
References

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