Brief Resolved Unexplained Event

Emergency Department

Nationwide Children's — When your child needs a hospital, everything matters.

Center for Clinical Excellence

Inclusion Criteria:

- Well-appearing infants < 12 months old with a brief resolved event characterized by one or more of the following:
  - Cyanosis or pallor
  - Absent, decreased, or irregular breathing pattern
  - Marked change in tone (hyper- or hypotonia)
  - Altered responsiveness

Concern for BRUE

Perform BRUE specific **History & Physical**

and complete any indicated **Diagnostic Testing**

Exclusion Criteria:

- Age ≥ 12 mo
- Temperature ≥ 100.4°F or hypothermia (< 35.5°C / 96°F)
- History of any significant diagnosis, such as cardiac, neurologic, or metabolic disease
- Ongoing symptoms or ill-appearing

Explanation for event identified **and/or** patient has significant additional symptoms which influence management?

Yes → **Off Pathway - Not a BRUE** Manage as appropriate for symptoms, condition or diagnosis.

Fulfill ALL Lower Risk criteria?

- Age > 60 days
- GA ≥32 weeks or corrected GA ≥45 weeks if <32 weeks
- No CPR performed by trained provider
- First and single event, lasting <1 min
- No concerns identified by provider or SW assessment (including, but not limited to: Fam Hx including SIDS, sibling death)

Yes

- SW evaluation with **required psychosocial assessment**
- Consider observation on continuous pulse oximetry for 1-4 hours
- Consider **Testing** as clinically indicated
- Provide caregiver education about BRUEs
- Provide resources for caregiver CPR training

No

- Consider observation on continuous pulse oximetry for 1-4 hours and during feeding
- Review **Differential Diagnosis**
- Consider **Testing** as clinically indicated

Decision to Admit?

Considerations for Admission:

- Recurrent event or specific abnormality identified in ED?
- Observation needed to characterize events?
- Subspecialty consultation or additional testing needed?
- Provider or caregiver uncomfortable with discharge?

Yes → **Admit to Hospital Pediatrics**

No ← Meets **discharge criteria**?

Yes → **Discharge home**
PCP follow up within 1-3 days

Definition & Diagnosis

Definition:
A *brief resolved unexplained event* (BRUE) is defined as an incident that occurs in an infant younger than 1 year of age, when the observer reports a sudden, brief, and resolved episode of one or more of the following: cyanosis or pallor; absent, decreased, or irregular breathing; marked change in tone (hyper- or hypotonia); and altered level of responsiveness. A BRUE is a diagnosis of exclusion assigned when there is no explanation for a qualifying event *after* compiling an appropriate history and conducting a physical examination. Based on the clinician's characterization of features of the event and not on a caregiver's perception that the event was life-threatening.

Diagnostic Criteria:
- < 12 months of age
- Episode of one or more of the following:
  - central cyanosis or pallor
  - absent, decreased, or irregular breathing
  - marked change in tone (hyper- or hypotonia)
  - altered level of responsiveness
- Patient returned to his or her baseline state of health after the event
- Normal vital signs and appearance on exam
- Not explained by an identifiable medical condition

Consider alternate diagnosis when:
- Has not returned to his or her baseline after the event (exclusion criteria)
- Abnormal vital signs or appearance on exam (exclusion criteria)
- History or physical exam reveal an explanation (exclusion criteria)
- Underlying medical condition that could account for the event (exclusion criteria)
- Child Abuse: Multiple or changing versions of the history, event history is inconsistent with the child's developmental age, or unexplained bruising or a torn labial or lingual frenulum, previous CPS involvement with family
- Cardiac: Family history of sudden unexplained death, Long QT syndrome, or arrhythmia
- Other: Family history of SIDS, IEM or genetic disease
- Infection: Known exposure to pertussis

Algorithm

Historical Features to Consider

- The broad objective of the BRUE H&P is to characterize the event, assess the risk of recurrence, and determine the presence of an underlying disorder.
- The history should be taken (in person or by phone) from persons who observed the infant during or immediately after the event.
- A BRUE diagnosis should only be made when patient is meeting inclusion criteria, does not have any exclusion criteria and there is no explanation for the qualifying event.

Key components to identify an explanation for the event include:

- **HPI: Description of event**
  - What alerted the caregiver to a problem?
  - Behavioral state: awake or asleep
  - Color, Tone, Breathing & Responsiveness
  - Approximate duration of the event based on clinician's best estimation?
  - How did it stop: With no intervention, picking up, positioning, rubbing or clapping back, mouth-to-mouth, chest compressions, etc? End abruptly or gradually? Treatment provided by parent/ caregiver (eg, glucose-containing drink or food)? 911 called by caregiver?
  - State after the event
- **HPI: Circumstances and environment prior to event**
  - Recent history of illness or trauma
  - Sleep position-prone / supine / side and sleeping arrangement, chair, lounge, crib, car seat, bed as well type of bedding and clothing.
  - Environmental exposures: Housing: general, water damage, or mold problems? Exposure to tobacco smoke, toxic substances, drugs?
- **PMH, including**
  - Pre-/perinatal and Growth/development.
  - Newborn screen normal?
  - Previous ER visits or hospitalizations?
- **Medications**: including herbs, supplements etc, home remedies
- **Family history, including**
  - SIDS?
  - Unexplained car accident or drowning in first-or second degree family members before age 35, and particularly as an infant?
  - Apparent life-threatening event in sibling?
  - Long QT syndrome? Arrhythmia?
  - Inborn error of metabolism or genetic disease?
  - Developmental delay?
- **Physical Exam:**
  - Perform a thorough exam of undressed patient, focusing on skin (bruising or petechiae), HEENT (intact frenula, anatomic abnormalities), heart and nervous system to verify that patient is asymptomatic with negative PE findings.

Algorithm

Differential Diagnoses

	Potential Diagnoses	History	Physical Exam
Gastrointestinal	• GER, GERD • Laryngospasm • Overfeeding • Oropharyngeal dysphagia	• Event was around feeding time • Presence of milk or formula in nose or mouth during event • Coughing or choking with feeding • Chronic, severe, or recurrent feeding problems • Regurgitation or vomiting, irritability, feeding resistance, poor weight gain, and back arching	• Choking or gagging noises • Poor growth • Desaturations with feeds
Cardiac	• Arrhythmia: LQTS, WPW • Cardiomyopathy • Congenital heart disease	• Fatigue or diaphoresis with feeds • Recurrent cyanotic episodes • FHx: Arrhythmia (LQTS, WPW), sudden or unexplained death, SIDS, syncope	• Abnormal heart rate or rhythm • Murmur or weak pulses • Low oxygen saturation • Poor growth
Neurologic	• Seizure • Infantile spasms • CNS malformation • Elevated ICP	• Recurrent, paroxysmal or stereotypical events • Abnormal eye movements • Loss of consciousness or lethargy • Developmental delays or regressions • FHx: Infantile spasms, seizures, genetic or metabolic disorders, developmental delays	• Abnormal tone, reflexes, or neurological exam • Neurocutaneous findings • Dysmorphic features • Papilledema or bulging fontanelle • Micro- or macrocephaly
Airway and Respiratory	**Airway abnormalities** • Choanal atresia • Laryngomalacia • Tracheoesophageal fistula **Respiratory diseases:** • Central apnea (secondary to infection, CNS, CCHS, prematurity, or trauma) • Obstructive apnea (secondary to airway abnormality or poor tone) • Mixed apnea • Foreign body • Respiratory tract infection • Breath-holding spells • Periodic breathing	• Multiple or recurrent events • Respiratory pattern abnormalities (e.g., apnea or periodic breathing) • Work of breathing • Noisy breathing or snoring • Aspiration event	• Micrognathia • Poor tone • Tachypnea or periodic breathing • Stridor, or abnormal breath sounds • Focality on respiratory exam
Infectious	• Viral URTI/LRTI (e.g., RSV) • Pertussis • Bacterial pneumonia • Bacteremia, meningitis, UTI	• Additional episodes of gagging, gasping, color change with respiratory pause • Fever, hypothermia, respiratory or URTI symptoms • Poor oral intake or urine output • Foul-smelling urine or known CAKUT • Lethargy • Delivery complicated by prematurity, maternal GBS, PROM, maternal chorioamnionitis • Sick contacts • Under-immunized community • Previous bacterial infection	• Fever, tachycardia or tachypnea • Periods of apnea • Coryza • Irritability, lethargy or ill appearance • Poor perfusion

Algorithm

(Merritt et al. 2019; Nama et al. 2024; Westphal et al. 2022)

Diagnostic Testing

	Potential Diagnoses	Evaluation to Consider
Gastrointestinal	• GER, GERD • Laryngospasm • Overfeeding • Oropharyngeal dysphagia	• Bedside evaluation by a feeding specialist • Consider VFSS • Consider gastroenterology consultation
Cardiac	• Arrhythmia: LQTS, WPW • Cardiomyopathy • Congenital heart disease	• ECG and cardiology consult • Consider an echocardiogram
Neurologic	• Seizure • Infantile spasms • CNS malformation • Elevated ICP	• Neurology consultation • Consider EEG • Consider head imaging
Airway and Respiratory	**Airway abnormalities** • Choanal atresia • Laryngomalacia • Tracheoesophageal fistula **Respiratory diseases:** • Central apnea (secondary to infection, CNS, CCHS, prematurity, or trauma) • Obstructive apnea (secondary to airway abnormality or poor tone) • Mixed apnea • Foreign body • Respiratory tract infection • Breath-holding spells • Periodic breathing	• Otolaryngology and/or pulmonology consultation • Comprehensive polysomnography (if concerns regarding apnea) • Consider head imaging (if central apnea) • Consider CXR (if bacterial pneumonia)
Infectious	• Viral URTI/LRTI (e.g., RSV) • Pertussis • Bacterial pneumonia • Bacteremia, meningitis, UTI	• Viral respiratory panel (if it will affect management decisions) • Pertussis testing • Consider urinalysis and urine culture, blood culture +/- lumbar puncture
Metabolic	• Electrolyte abnormalities (e.g. hypocalcemia or hypoglycemia) • Inborn Errors of Metabolism	• Blood glucose, sodium, potassium, chloride, urea, creatinine, calcium, venous blood gas, ammonia, lactic acid • Biochemical genetics consult
Child Maltreatment	• Non-accidental head trauma • Smothering or suffocation • Poisoning or accidental ingestion • Factitious syndrome by proxy	• Consultation with child protection expert • Skeletal survey, head imaging, and retinal examination • Toxicology screen

(Merritt et al. 2019; Nama et al. 2024; Westphal et al. 2022)

Algorithm

Risk Assessment

Lower Risk BRUE Patients

- Definition: Patients who are unlikely to have a recurrent event or undiagnosed serious conditions and are at lower risk of adverse outcomes based on currently available evidence.
- Criteria: Meets ALL of the following:
  - Age > 60 days
  - GA ≥32 weeks or corrected GA ≥45 weeks if <32 weeks
  - No CPR by trained provider
  - Event lasted <1 min
  - First and single event
  - No concerns identified by MD H&P or SW evaluation including, but not limited to:
    - High-risk social situation
    - Family history of SIDS or previous sibling death.

Patients NOT meeting ALL Lower Risk Criteria

- A heterogeneous population of infants in which the history & physical exam may suggest the need for further observation, investigation, and treatment.
- Currently there is insufficient evidence to guide clinical decision making, including admission for BRUE. Clinical judgement, shared-decision making and individualized care is appropriate until further consensus and evidence is available.

Algorithm

Psychosocial Assessment

A Social Work evaluation is <u>required</u> for all patients who meet diagnostic criteria for a BRUE

- For patients anticipated to meet lower risk criteria, SW evaluation should be performed in the ED prior to discharge.
- For admitted patients, a SW consult should be performed after admission.
- A full psychosocial assessment should be performed to assess safety and need for resources

Algorithm

Treatment Recommendations

Recommended Treatments

- **SW consult** with full psychosocial assessment for all patients with a BRUE.
- Provide caregiver with, or offer resources for, **CPR training** in children presenting with a BRUE. The potentially lifesaving benefit of CPR training, compared to negligible reported risk and limited resources required, justifies the strong recommendation to train caregivers to perform CPR. *Evidence quality: Very low; Recommendation Strength: Strong*

Treatment NOT Recommended

Do NOT to start **empiric acid suppression** pharmacotherapy in patients with a GE reflux related BRUE. Strong recommendation is based on the NASPGHAN guidelines, AAP guidance, the lack of efficacy and risk of adverse effects of empiric acid suppression therapy for GER in patients with and without an BRUE diagnosis.
Evidence quality: Low; Recommendation Strength: Strong

Algorithm

Discharge Criteria

- Asymptomatic, normal vital signs, and no concerning PE findings.
- SW evaluation completed and no concerns identified OR concerns adequately addressed or resolved.
- PCP follow-up within 3 days.
- Provider and caregiver comfortable with discharge.

Algorithm

Admission Considerations

- Recurrent event of specific abnormality identified in ED?
- Observation needed to further characterize events?
- Subspecialty consultation or additional testing needed?
- Provider or caregiver uncomfortable with discharge?

Algorithm

Patient & Caregiver Education

- Provide caregiver education about BRUEs.
- Provide caregiver with CPR training or resources for obtaining CPR training after discharge

	Facts for healthcare providers 	Suggested translation for caregivers 
Explanatory diagnoses	1. The most common explanations are due to normal infant immaturity and are not life threatening. Examples of these include GER (18.5%), choking or gagging (8.2%), viral respiratory infections (4.4%), and breath holding spells (4.1%). 2. Approximately 4% of infants will eventually be diagnosed with a serious underlying condition, some of which include seizures requiring anti-epileptic medications (1.15%), airway abnormality (0.64%), and head trauma (0.34%).	*1. The most common causes of BRUEs are not life-threatening. Over 95% of infants do not have a serious underlying diagnosis.*
No increased risk of mortality	1. There is no increased risk of death after a BRUE over the baseline risk in the first year of life. There is no known relationship between BRUE and SIDS.	*1. Given these events are scary, many caregivers worry that their baby's life was or will be at risk. There is no increased risk of death and no known relationship between BRUE and Sudden Infant Death Syndrome.*
Importance of follow-up	1. Approximately 45% of serious diagnoses are made AFTER discharge from the ED or hospital. Careful outpatient follow-up is advised to help identify infants with ongoing medical concerns that would indicate further evaluation and treatment.	*1. Please make a follow-up appointment with your baby's pediatrician for about 2 days after discharge from the hospital. If your baby has another event or develops new problems, contact the baby's doctor. If you are concerned the event could be life-threatening, call 911.*

Algorithm

Helping Hands

- **Brief Resolved Unexplained Event (BRUE) Helping Hands**

Algorithm

References

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Algorithm

Quality Metrics

Outcome Measures
- ED LOS
- Admission rate

Process Measures
- Pathway Visualization
- Rate of SW consult

Balancing Measures
- 7 day return rate to ED
- 30 day return rate to ED
- Rate of labs and imaging

Algorithm

Pathway Team & Development

Pathway Development Team

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Origination Date: *January, 2025*

Next Revision Date: *January, 2028*

Clinical Pathway Development

This clinical pathway was developed using the process described in the NCH Clinical Pathway Development Manual Version 6, 2022. Clinical Pathways at Nationwide Children's Hospital (NCH) are standards which provide general guidance to clinicians. Patient choice, clinician judgment, and other relevant factors in diagnosing and treating patients remain central to the selection of diagnostic tests and therapy. The ordering provider assumes all risks associates with care decisions. NCH assumes no responsibility for any adverse consequences, errors, or omissions that may arise from the use or reliance on these guidelines. NCH's clinical pathways are reviewed periodically for consistency with new evidence; however, new developments may not be represented, and NCH makes no guarantees, representations, or warranties with respect to the information provided in this clinical pathway.

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Algorithm