CLINICAL GUIDELINE | BRIEF RESOLVED UNEXPLAINED EVENT (BRUE)

(Infants age < 1 year)

Children's MINNESOTA

Aim: To reduce variation in management and unnecessary resource utilization for patients with BRUE.

Sudden, brief and *now resolved* episode of ≥ 1 of the following:

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

↓

Cause apparent (e.g., choking episode/reflux) after detailed history and physical exam?
See Table 1 (page 4) for examples

Yes → **Not a BRUE**
Manage off-guideline

No ↓

All low-risk features met? (Note 1)

- Age > 60 days
- Gestational age ≥ 32 weeks **and** postconceptional age ≥ 45 weeks
- Occurrence of only 1 BRUE (no prior BRUE ever and not occurring in clusters)
- Duration of BRUE < 1 minute
- No CPR by medical provider required
- No concerning historical features **(See Note 1)**
- Normal physical exam/well-appearing

Yes → **LOW-RISK BRUE**
See page 2

No ← **HIGH-RISK BRUE**
See page 2

EXCLUSION CRITERIA

Patients **excluded** from this guideline:

- Critically ill or episode **not** resolved
- Complex chronic condition
- Apparent cause to episode (e.g., choked on milk, obvious reflux event, bronchiolitis, periodic breathing)
- Young infants with a temperature < 36.0 or ≥ 38.0 should be evaluated per febrile infant guideline.

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HIGH-RISK BRUE

If seeing patient in outpatient clinic, refer patient to ED or direct admission (612-343-2121)

- Consider further workup based on H+P, screening tests not guided by H+P are not recommended.
- Consider head CT if any concern for non-accidental trauma **(See Note 3)**
- Consider pertussis testing (if apnea)
- Consider EKG if cardiac FH
- Consider hematocrit
- Consider blood glucose, bicarb or VBG, lactate

Diagnosis explaining event identified?

- Yes → No longer BRUE, manage condition off-guideline
- No → **Admit to observation/inpatient; consider direct admission 612-343-2121 if seeing patient in clinic and no signs clinical instability or urgent intervention needed:**
  - Pulse-ox, reflux precautions
  - Screen for abuse
  - Consider informal/formal feeding evaluation (if history of abnormal feeding)
  - Offer/arrange CPR/apnea/reflux training as appropriate **(See Note 2)**
  - Consider further targeted workup guided by H+P if ongoing episodes **(Note 5)**
  - **If etiology discovered, manage accordingly off-guideline**

LOW-RISK BRUE

- Barrier to outpatient care?
- High ongoing caregiver anxiety surrounding event? **(See Note 2)**
- Social concern?

Yes → **Admit to observation/inpatient; consider direct admission 612-343-2121 if seeing patient in clinic and no signs clinical instability or urgent intervention needed:** (see above)

No →

- Consider 1–4 hr observation in clinic/ED on pulse-oximeter with observed feeding
- Consider EKG, pertussis testing (if apnea)
- Educate family **(See Notes 2, 4)**
- Consider offering CPR/apnea/reflux class **(See Note 2)**

DISCHARGE CRITERIA

- No ongoing episodes
- Feeding well
- Baseline mental status
- Caregiver comfortable with plan
- Education complete **(See Notes 2, 4)**
- Close follow-up planned

BRIEF RESOLVED UNEXPLAINED EVENT (BRUE)

(Infants age < 1 year)

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NOTE 1

A recent study (Tieder et.al. Pediatrics 2021) found that 87% of patients presenting with BRUE had at least 1 AAP higher-risk factor. Revisits occurred in 6.9% of ED and 10.7% of hospital discharges. A serious diagnosis was made in 4.0% (82) of cases; 45% (37) of these diagnoses were identified after the index visit. The most common serious diagnoses included seizures (1.1% [23]) and airway abnormalities (0.64% [13]). Risk is increased for a serious underlying diagnosis for patients discharged from the ED with a history of a similar event, an event duration > 1 minute, an abnormal medical history, and an altered responsiveness ($P < .05$). AAP risk criteria for all outcomes had a negative predictive value of 90% and a positive predictive value of 23%.

A second, similar, study by Bochner et. al. found that among 980 infants hospitalized after an ED visit for a BRUE without an explanatory diagnosis at admission, 363 (37.0%) had an explanatory diagnosis identified during hospitalization. In 805 (82.1%) infants, diagnostic testing, specialty consultations, and observed events did not contribute to an explanatory diagnosis, and, in 175 (17.9%) infants, they contributed to the explanatory diagnosis (7.0%, 10.0%, and 7.0%, respectively). A total of 15 infants had a serious diagnosis (4.1% of explanatory diagnoses; 1.5% of all infants hospitalized with a BRUE), the most common being seizure and infantile spasms, occurring in 4 patients.

NOTE 2

Key points for family education:

- BRUE ≠ Near-miss SIDS
- Approx. 9/10 patients do not have future BRUEs
- Home monitors are **not** recommended
- Children's Minnesota Respiratory Therapy offers weekly CPR classes: please call the CPR hotline at 651-220-5279 for both campuses

St, Paul Apnea Program - 651-220-6267

- **GER/Reflux Class:** 1:1 family education with Apnea Program RN includes management of reflux symptoms (with or without danny sling for upright positioning), CPR and 24/7 RN telephone support.
- **Apnea Home Monitor Class:** 1:1 family education with Apnea Program RN and Medical Equipment company includes overview of normal and abnormal infant breathing patterns, equipment, home apnea monitor alarm response, CPR and 24/7 RN telephone support post discharge.

Minneapolis Apnea Program - 612-813-5831

- **GER/Reflux Class:** 1:1 family education with Apnea Program RN includes management of reflux symptoms (with or without danny sling for upright positioning), CPR and 24/7 RN telephone support.
- **Apnea Home Monitor Class:** 1:1 family education with Apnea Program RN and Medical Equipment company includes overview of normal and abnormal infant breathing patterns, equipment, home apnea monitor alarm response, CPR and 24/7 RN telephone support post discharge.
- **CPR Class:** 1:1 family education with Apnea Program RN for CPR instruction.

NOTE 3

In one study multivariate analysis revealed odds ratio for abusive head trauma were 4.9 with a 911 call ($P = .037$), 5.3 with vomiting ($P = .024$) and 11.9 with irritability ($P = .0197$). Clinicians should have a high index of suspicion for abuse and evaluate for bruising, torn frenulum, inconsistent event description, Munchhausen syndrome by proxy and a family history of abuse.

NOTE 4

GER is suspected in approx. 50% of BRUE cases, but causality is difficulty to prove. No studies have assessed if GER medications are useful. Recommend educating families on side effects of medications and desire to avoid in children.

Reflux precautions may include:

- Assess for overfeeding
- Burp during feeding
- Hold upright after feeding
- Consider elevating HOB
- Consider Danny sling
- Reflux/apnea class: (**See Note 2)**
- Avoid smoke exposure

NOTE 5

Considerations for additional workup if ongoing episodes or concerns on history/exam.

Consider consultation if concern for specific underlying etiology:

- Gastroenterology
- Otolaryngology
- Pulmonary or sleep expert
- Child abuse expert
- Neurology
- Cardiology
- Biochemical genetics

Consider additional testing in combination with specialty consultation:

- Videofluoroscopic swallowing study for "silent" aspiration not seen in bedside evaluation
- Continuous prolonged oximetry to characterize recurring events
- Sleep study to characterize and quantify central versus obstructive apnea
- Prolonged (12–24 hours) EEG
- BMP and ammonia for metabolic disturbance

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TABLE 1: Examples of additional H+P features to assess

(See AAP guideline Tieder et. al. 2016 for more details)

Event	Exam	Past history	Family history	Social history
What happened before/after	Bruising/torn frenulum? Vomiting?	Birth and perinatal history, gestational age, newborn screen	Sudden unexplained death (single-car accident/ drowning)?	Exposure to smoke/ molds/toxins?
Duration + location	Engages with caregiver?	History of bruising?	BRUE/ALTE/SIDS in family member?	Recent stressors?
Is the story consistent and plausible?	Tone and strength?	History of reflux?	Long QT syndrome or other arrhythmia?	Support system and access to resources?
Interventions (back blows, CPR, 911)?	Fontanelle soft?	Previous BRUE or concerning movements?	Genetic/neurologic diseases?	Previous CPS/ law enforcement involvement?
Recent illness or changes? Use of OTC medications?	Cardiac and lung sounds?	Development and growth normal?	Substance abuse or mental illness?	Exposure to infectious diseases (e.g., pertussis)?

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TABLE 2: Potential Causes of BRUE in Higher-Risk Infants

(See AAP Framework Merritt et.al. 2019 for more details)

Child maltreatment	Gastrointestinal	Pulmonary	Other

• Abusive head trauma
• Purposeful suffocation
• Medical child abuse
• Poisoning
	• GERD
	• Oropharyngeal dysphagia
	• Laryngospasm
	• Nasopharyngeal reflux
	• Tracheoesophageal fistula
	• Esophageal stricture
	• Extraesophageal vascular slings
	• Cricopharyngeal achalasia
		• Obstructive apnea
		  - Upper airway structural abnormality
		  - Lower airway structural abnormality (e.g., laryngomalacia and laryngeal cleft)
		  - Respiratory dysrhythmias
		• Central apnea
		  - Meningitis
		  - Head trauma
		  - Congenital central hypoventilation syndrome
		  - Congenital brain abnormality
		• Parenchymal disease
		  - Infection
		  - Pneumonitis from "microaspiration"
			• Anemia
			• Periodic breathing

Neurology	**Cardiology**	**Infectious disease**	**Inborn errors of metabolism**
• Epilepsy and seizures • Structural brain abnormalities • Progressive neurologic disease • Infantile spasms • Neuromuscular disorder • Tuberous sclerosis • Benign neonatal epilepsy syndrome • Maternal myotonic dystrophy	• Cardiac arrhythmias • Congenital heart disease • LQTS • Cardiomyopathy (dilated or hypertrophic)	• Bacterial infections (e.g., sepsis, meningitis, pneumonia and urinary tract infections) • Respiratory viruses, including RSV • Pertussis • Viral meningitis	• Urea cycle disorders • Fatty acid oxidation disorders • Organic acidemias • Lactic acidemias

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