# Guideline

# Brief Resolved Unexplained Events (BRUE): Emergency Management in Children

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| **Document ID** | CHQ-GDL-00746 |  **Standard 8** Recognising and Responding to Acute Deterioration | |
| **Version No.** | 3.0 | | |
| **Risk Rating** | Medium | | |
| **Primary Document** | | | |
| **Custodian** | Director of Paediatric Emergency Department | **Approval date** | 19/03/2025 |
| **Accountable Officer** | Executive Director Clinical Services | **Effective date** | 25/03/2025 |
| **Applicable to** | Medical, Nursing and QAS Staff working in Children's Health Queensland | **Review date** | 19/03/2029 |

## HUMAN RIGHTS

This governance document has been human rights compatibility assessed. No limitations were identified indicating reasonable confidence that, when adhered to, there are no implications arising under the *Human Rights Act 2019.*

## PURPOSE

This guideline has been developed to assist clinicians in the understanding of the definition, approach to patient evaluation, and management of children less than 1 year of age who present with BRUE (Brief Resolved Unexplained Events), formerly known as ALTE (Apparent Life Threatening Event).

## SCOPE

This guideline applies to all staff involved in the care and management of children with BRUE

## GUIDELINE

### INTRODUCTION

The American Academy of Pediatrics (AAP) published a new clinical practice guideline advocating for the replacement of the term Acute Life-Threatening Events (ALTE) with BRUE (brief, resolved, unexplained

event) in May 2016.[1] ALTE was first introduced in 1986 replacing the term "near-miss sudden infant death syndrome". [2] However due to the subjective and imprecise nature of the definition of ALTE[3], the AAP created a more precise definition for this group of clinical events and at the same time removed the more serious implication of the term 'life-threatening'. Subsequent research has shown decreased numbers of admission for BRUE diagnosis without an increase in ED representations or adverse outcomes.[4]

The most important aspect in suspected BRUE is to make the correct diagnosis for the episode following a thorough history and examination. The next step is to risk stratify the patients into low-risk or high-risk categories.

The AAP guideline provides a risk-based approach to diagnosis and evidence-based recommendations to reduce unnecessary investigations in the low-risk infant group. It is important to note however that the guideline does not provide management recommendations for the high-risk infant group due to lack of reliable research evidence at this time.

## DEFINITION

A BRUE is defined as an event occurring in an infant <1 year of age when the observer reports a sudden, brief (<1 minute), and now resolved episode of ≥1 of the following[1,3]:

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

**ALERT**

**Clinicians should only diagnose a patient with BRUE after conducting a thorough history and physical examination and if there is still no explanation for the event.**

See Appendix 1: BRUE Definition and Inclusion/Exclusion Factors for detailed definition of BRUE.

## HISTORY AND EXAMINATION

A thorough and complete history is important in differentiating BRUE from a more concerning event that may require more extensive investigation and monitoring. In addition, this also assists in stratifying what is a Low Risk BRUE' compared with a 'Higher Risk BRUE'.

It is important that the history and examination are performed by a doctor experienced in paediatric assessment, and ideally a Paediatric Emergency Medicine (PEM) or Paediatric Medicine Specialist, Fellow or senior trainee should review the patient and be involved in the decision on final disposition. If sufficiently experienced staff are not available, e.g., overnight, it would be reasonable to keep the patient for observation after discussion with a senior staff member or admit for reassessment by a senior staff member in the morning. If an experienced PEM or Paediatric Specialist or Fellow is unavailable, consultation with closest available paediatric services would be advisable to enable appropriate decision-making regarding diagnosis and disposition. This could be through usual local pathways, or via CATCH if no local advice available.

**ALERT**

**Children who have been the victims of abusive or non-accidental injury (NAI) may prsent with altered episodes which could be mistaken as BRUE. Published rates of abusive head trauma are 10 x the baseline risk, and the diagnosis is frequently (up to 85%) missed on first presentation[5]**

Specific consideration for child abuse should be given to all children with unexplained events including those with multiple or changing versions of the events and episodes that are not consistent with the child's developmental stage.

## History

Key features

- Description of the event
  - Location of the event
  - Who was present
  - Preceding events
  - Relationship to feeding
- Symptoms noted during the event
  - Airway and Breathing
    - Choking or gagging
    - Colour change
    - Breathing effort
  - Circulation
    - Colour- central and peripheral
  - CNS
    - Movement
    - Conscious state
- Circumstances at resolution of the event
  - Total duration
  - How the event stopped
  - CPR performed

In addition to the above description of the event, a full systems review and paediatric history should be obtained including perinatal/birth history, immunisations, growth and development, social and family history as well as clarifying that this is the first similar event and no prior diagnosis of BRUE have been made. Particular attention should be paid to any red flag features for non-accidental injury, including changing description of event, history inconsistent with child's development stage, as well as any history of child safety involvement.

See Appendix 2: History Taking in the Assessment of Potential BRUE for further information on history taking in the assessment of potential BRUE.

## Examination

A full examination of the fully exposed infant is essential. This should aim to identify signs of possible differential diagnoses including consideration of NAI. A full set of vitals and growth parameters must be documented.

See Appendix 3: Physical Examination in the Assessment of Potential BRUE for further information on physical examination in the assessment of potential BRUE.

## Differentials

The diagnosis of BRUE should only be made after a thorough history and examination have failed to make an explanatory diagnosis of the event.

Important differentials to consider are outlined in appendix 5. Particularly frequent and/or serious differentials include: GORD or aspiration, LRTI, Neurological disease, serious bacterial infection, airway obstruction, surgical abdomen, cardiac arrhythmias, metabolic conditions and inflicted injury[6]

Appendix 5: Differential Diagnosis of Low- and High-Risk BRUE Diagnosis of Low- and High-Risk BRUE

## Risk Assessment: Low Risk BRUE versus High Risk BRUE

Once a diagnosis of BRUE is made, risk classification can be undertaken.

The factors that determine a 'Low Risk BRUE' include (must meet all criteria) [1,3]:

- Age > 60 days
- Gestational age ≥32 weeks and postconceptional age ≥45 weeks
- First BRUE (no prior BRUE and not occurring in clusters)
- Duration <1 minute
- No CPR by trained provider
- No Family history or BRUE or sudden unexplained death in a sibling
- No concerning physical findings or historical features

Patients who do not meet ALL the criteria above would be classified into the 'High Risk BRUE' group.

Please refer to Appendix 4: BRUE Diagnosis & Risk Stratification Flowchart for a flow diagram categorising events into low- or high-risk BRUE and to Appendix 5: Differential Diagnosis of Low- and High-Risk BRUE for list of differentials of low- and high-risk BRUE.

**ALERT**

The presence of certain warning signs increases the likelihood that the acute event is medically significant. Infants with the following signs **should be admitted** to the hospital for observation with cardiorespiratory monitoring.

## WARNING SIGNS FOR SIGNIFICANT PATHOLOGY

- Symptoms at the time of evaluation, including toxic appearance, lethargy, unexplained recurrent vomiting or respiratory distress.

- Significant physiological compromise during the event, based on a detailed history, including generalised sustained cyanosis or loss consciousness, and/or need for resuscitation by a trained provider.
- Bruising or any other evidence of trauma
- History of prior events in this patient, especially in the preceding 24 hours or clusters of events.
- History of clinically significant events or unexpected death of a sibling
- Administration or access to medication
- History raising suspicion for child abuse including inconsistent description of event.
- Dysmorphic features, congenital anomalies, including those suggestive of a known syndrome

## MANAGEMENT

### Low Risk BRUE

If the infant is categorised into the low-risk category, it is appropriate to not perform further investigations and dedicate time to educate and engage the parents in a shared decision-making process in terms of further management and follow up.

Depending on the level of clinical suspicion and parental anxiety in an otherwise low-risk category infant, it is appropriate to perform an electrocardiogram (ECG), Pertussis PCR (if exposure likely, unimmunised child, or no maternal antenatal booster), or monitor the infant for a short duration of 1-4 hours with continuous pulse oximetry and serial observations. Appendix 4: BRUE Diagnosis & Risk Stratification Flowchart outlines the American Academy of Pediatrics recommendations regarding management options for infants with low-risk BRUE.

### High Risk BRUE

Infants who are categorised into the high-risk group would require further management to delineate the aetiology of symptoms. The decision on the type of investigation, imaging, and specialist consultation depend on the history and physical examination as well as the social situation of the infant. Even in high-risk patients, investigations rarely contribute to explanatory diagnoses.[7] All infants with a diagnosis of High Risk BRUE should be admitted under the General Paediatric team.

**ALERT**

There is no evidence to inform the management of High Risk BRUE.

These patients require a detailed plan which should be tailored to the individual case.

Paediatric opinion should be sought.

## DISPOSITION

The infant with a low-risk BRUE episode may be discharged home if both the caregiver and senior clinician with paediatric experience (or via CATCH if none are available) are comfortable with the plan. It is also reasonable to observe for a few hours or admit for further observation if the parent or clinician feels this is necessary.

Advocating for CPR training for parents and providing them with course resources is an important component of patient and family-centred care. CPR training enables the parents to have a sense of empowerment and has not been shown to increase parental anxiety[8].

All infants discharged with a diagnosis of low-risk BRUE should be followed up by a General Practitioner (GP) or Paediatrician in 24 hours. The disposition of the infant with high-risk BRUE would depend on the aetiology and/or the diagnosis of the symptoms.

## CONSULTATION

Key stakeholders who reviewed this version:

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|---|---|
| • ED Fellow QCH Emergency Department<br>• ED SMOs QCH Emergency Department | • SMO QCH General Paediatricians |

## DEFINITIONS

| Term | Definition |
|---|---|
| BRUE | An event occurring in an infant < 1 year when the observer reports a sudden, brief, and now resolved but unexplained episode of ≥1 of: (1) cyanosis or pallor; (2) absent, decreased or irregular breathing; (3) marked change in tone (hyper- or hypotonia); and (4) altered level of responsiveness. |
| ALTE | An episode that is frightening to the observer and that is characterized by some combination of apnoea (central or occasionally obstructive), colour change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking, or gagging. |
| AAP | The American Academy of Pediatrics |
| CPR | Cardiopulmonary Resuscitation |

## REFERENCES


| No. | Reference |
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| 4. | Ramagopal S, Noorbaksh KA, Callaway CW, Wilson PA, Pitetti RD. Changes in the Management of Children with Brief Resolved Unexplained Events (BRUEs). Peditrics 2019;144(4)e20190375 |
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| 6. | Perth Children's Hospital. Clinical Practice Guideline: Brief Resolved Unexplained Event. 2021; https://pch.health.wa.gov.au/For-health-professionals/Clinical-Practice-Guidelines/Brief-Resolved-Unexplained-event |
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## GUIDELINE REVISION AND APPROVAL HISTORY

| Version No. | Modified by | Amendments authorised by | Approved by | Comments |
|---|---|---|---|---|
| 1.0 20/02/2017 | Director Paediatric Emergency Department | Divisional Director, Critical Care | Executive Director Hospital Services | |
| 2.0 01/02/2021 | Director Paediatric Emergency Department | A/Division Director, Critical Care | Executive Director Clinical Services | |
| 2.1 01/02/2024 | Governance Officer (Documents) | Paediatric Emergency Physician | Paediatric Emergency Physician | Minor Change |
| 3.0 19/03/2025 | Director Paediatric Emergency Department | A/Division Director, Critical Care | Executive Director Clinical Services | Scheduled review |

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| **Key words** | BRUE, ALTE, life threatening, CPR, choke, 00746 |
| **Accreditation references** | NSQHS Standards (1-8): 1, 5, 8 |

## APPENDIX 1: BRUE DEFINITION AND INCLUSION/EXCLUSION FACTORS[1]

| | Includes | Excludes |
|---|---|---|
| Brief | Duration < 1min; typically 20-30s | Duration ≥1 min |
| Resolved | Patient returned to his or her baseline state of health after the event | At the time of medical evaluation |
| | Normal vital signs | Fever or recent fever |
| | Normal appearance | Tachyopnoea, bradypnea, apnea |
| | | Tachycardia or Bradycardia |
| | | Hypotension, hypertension, or hemodynamic instability |
| | | Mental status changes, somnolence, lethargy |
| | | Hypotonia or hypertonia |
| | | Vomiting |
| | | Bruising, petechiae, or other sins of injury/trauma |
| | | Abnormal weight, growth or head circumference |
| | | Noisy Breathing (stridor, sturgor, wheezing) |
| | | Repeat event(s) |
| Unexplained | Not explained by an identifiable medical condition | Event consistent with gastroesophageal reflux, swallow dysfunction, nasal congestion etc.<br>History or physical examination concerning for child abuse, congenital airway abnormality etc. |
| Event Characterisation | | |

| | Includes | Excludes |
|---|---|---|
| Cyanosis or Pallor | Central Cyanosis: blue or purple colouration colouration of face, gums, trunk | Acrocyanosis or perioral cyanosis |
| | Central Pallor: pale colouration of face or trunk | Rubor |
| Absent, Decreased, or irregular breathing | Central apnoea | Periodic Breathing of the newborn |
| | Obstructive apnoea | |
| | Mixed obstructive apnoea | Breath-holding spells |
| Marked change in tone (hyper- or hypotonia | Hypertonia | Hypertonia associated with crying, choking, or gagging due to gastroesophageal reflux or feeding problems |
| | Hypotonia | Tone changes associated with breath-holding spell<br>Tonic eye deviation or nystagmus<br>Tonic-clonic seizure activity<br>Infantile spasms |
| Altered responsiveness | Loss of consciousness | Loss of consciousness associated with breath-holding spell |
| | Mental status change | |
| | Lethargy | |
| | Somnolence | |
| | Postictal Phase | |

## APPENDIX 2: HISTORY TAKING IN THE ASSESSMENT OF POTENTIAL BRUE[1]

| Features to be considered |
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| Considerations for possible child abuse:<br>• Multiple or changing versions of the history/circumstances<br>• History/circumstances inconsistent with child's developmental stage<br>• History of unexplained bruising<br>• Incongruence between caregiver expectations and child's developmental stage, including assigning negative attributes to the child |
| History of the event<br>• General description<br>• Who reported the event?<br>• Witness of the event? Parent(s), other children, other adults? Reliability of historian(s)?<br>• State immediately before the event<br>  ○ Where did it occur (home/elsewhere, room, crib/floor, etc)?<br>  ○ Awake or asleep?<br>  ○ Position: supine, prone, upright, sitting, moving?<br>  ○ Feeding? Anything in the mouth? Availability of item to choke on? Vomiting or spitting up?<br>  ○ Objects nearby that could smother or choke?<br>• State during the event<br>  ○ Choking or gagging noise?<br>  ○ Active/moving or quiet/flaccid?<br>  ○ Conscious? Able to see you or respond to voice?<br>  ○ Muscle tone increased or decreased?<br>  ○ Repetitive movements?<br>  ○ Appeared distressed or alarmed?<br>  ○ Breathing: yes/no, struggling to breathe?<br>  ○ Skin color: normal, pale, red, or blue?<br>  ○ Bleeding from nose or mouth?<br>  ○ Color of lips: normal, pale, or blue?<br>• End of event<br>  ○ Approximate duration of the event?<br>  ○ How did it stop: with no intervention, picking up, positioning, rubbing or clapping back, mouth-to mouth, chest compressions, etc?<br>  ○ End abruptly or gradually?<br>  ○ Treatment provided by parent/caregiver (eg, glucose-containing drink or food)?<br>  ○ 911 called by caregiver?<br>• State after event<br>  ○ Back to normal immediately/gradually/still not there?<br>  ○ Before back to normal, was quiet, dazed, fussy, irritable, crying? |
| Recent history<br>• Illness in preceding day(s)?<br>  ○ If yes, detail signs/symptoms (fussiness, decreased activity, fever, congestion, rhinorrhea, cough, vomiting, diarrhea, decreased intake, poor sleep)<br>• Injuries, falls, previous unexplained bruising? |

| Features to be considered - continued |
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| Past medical history<br>• Pre-/perinatal history<br>• Gestational age<br>• Newborn screen normal (for IEMs, congenital heart disease)?<br>• Previous episodes/BRUE?<br>• Reflux? If yes, obtain details, including management<br>• Breathing problems? Noisy ever? Snoring?<br>• Growth patterns normal?<br>• Development normal? Assess a few major milestones across categories, any concerns about development or behavior?<br>• Illnesses, injuries, emergencies?<br>• Previous hospitalization, surgery?<br>• Recent immunization?<br>• Use of over-the-counter medications? |
| Family history<br>• Sudden unexplained death (including unexplained car accident or drowning) in first- or second-degree family members before age 35, and particularly as an infant?<br>• Apparent life-threatening event in sibling?<br>• Long QT syndrome?<br>• Arrhythmia?<br>• Inborn error of metabolism or genetic disease?<br>• Developmental delay? |
| Environmental history<br>• Housing: general, water damage, or mold problems?<br>• Exposure to tobacco smoke, toxic substances, drugs? |
| Social history<br>• Family structure, individuals living in home?<br>• Housing: general, mold?<br>• Recent changes, stressors, or strife?<br>• Exposure to smoke, toxic substances, drugs?<br>• Recent exposure to infectious illness, particularly upper respiratory illness, paroxysmal cough, pertussis?<br>• Support system(s)/access to needed resources?<br>• Current level of concern/anxiety; how family manages adverse situations?<br>• Potential impact of event/admission on work/family?<br>• Previous child protective services or law enforcement involvement (eg, domestic violence, animal abuse), alerts/reports for this child or others in the family (when available)?<br>• Exposure of child to adults with history of mental illness or substance abuse? |

## APPENDIX 3: PHYSICAL EXAMINATION IN THE ASSESSMENT OF POTENTIAL BRUE[1]

| Physical Examination |
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| General appearance<br>• Craniofacial abnormalities (mandible, maxilla, nasal)<br>• Age-appropriate responsiveness to environment |
| Growth variables<br>• Length, weight, occipitofrontal circumference |
| Vital signs<br>• Temperature, pulse, respiratory rate, blood pressure, oxygen saturation |
| Skin<br>• Colour, perfusion, evidence of injury (eg, bruising or erythema) |
| Head<br>• Shape, fontanelles, bruising or other injury |
| Eyes<br>• General, extraocular movement, pupillary response<br>• Conjunctival haemorrhage<br>• Retinal examination, if indicated by other findings |
| Ears<br>• Tympanic membranes |
| Nose and mouth<br>• Congestion/coryza<br>• Blood in nares or oropharynx<br>• Evidence of trauma or obstruction<br>• Torn frenulum |
| Neck<br>• Mobility |
| Chest<br>• Auscultation, palpation for rib tenderness, crepitus, irregularities |
| Heart<br>• Rhythm, rate, auscultation |
| Abdomen<br>• Organomegaly, masses, distention<br>• Tenderness |

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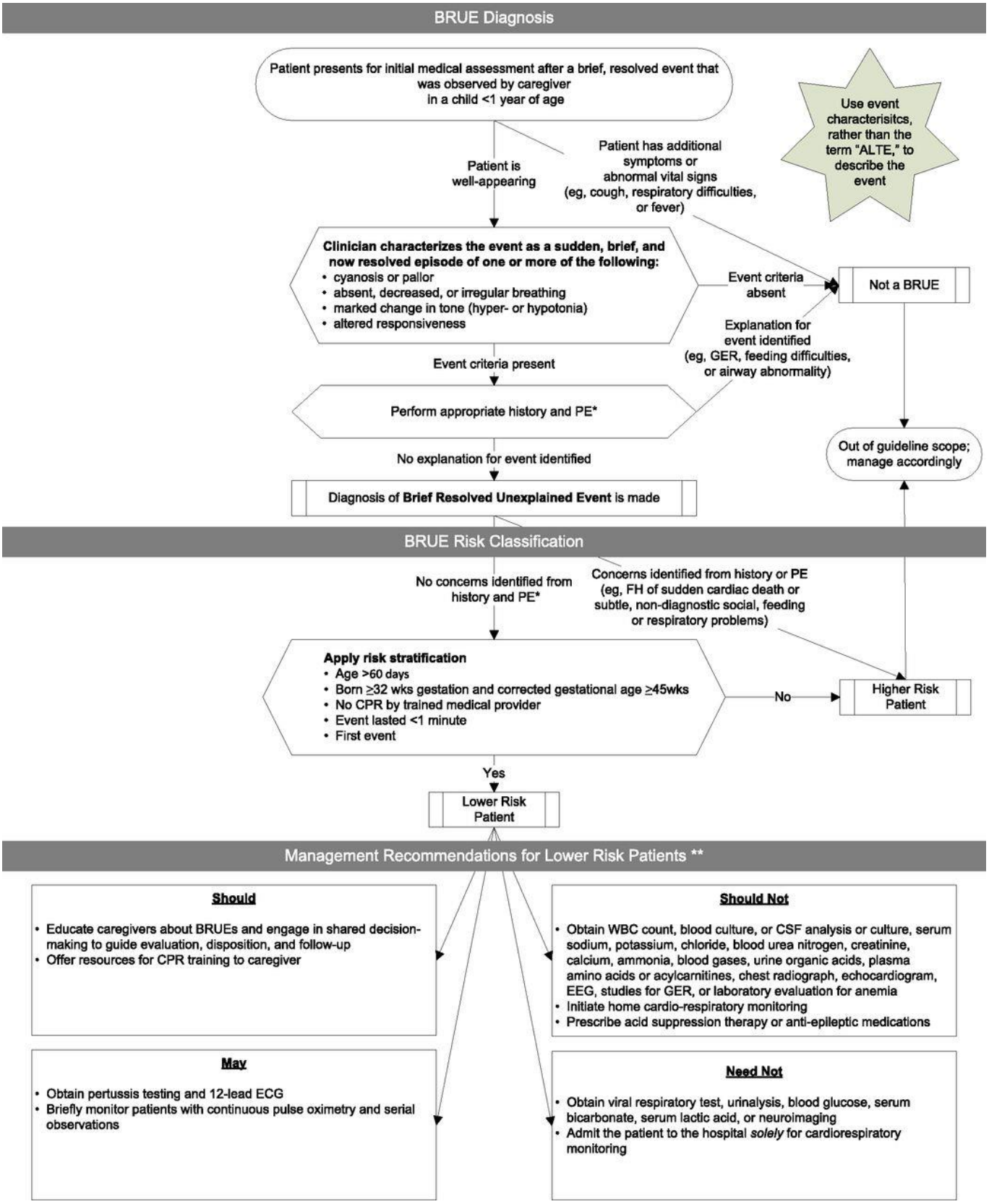
| Genitalia<br>• Any abnormalities |
| Extremities<br>• Muscle tone, injuries, limb deformities consistent with fracture |
| Neurologic<br>• Alertness, responsiveness<br>• Response to sound and visual stimuli<br>• General tone<br>• Pupillary constriction in response to light<br>• Presence of symmetrical reflexes<br>• Symmetry of movement/tone/strength |

# APPENDIX 4: BRUE DIAGNOSIS & RISK STRATIFICATION FLOWCHART[1]



# APPENDIX 5: DIFFERENTIAL DIAGNOSIS OF LOW- AND HIGH-RISK BRUE1

| Differential Diagnosis of Low- and High-Risk BRUE | |
|---|---|
| *Otolaryngologic*<br>• Maxillary hypoplasia<br>• Micrognathia<br>• Macroglossia<br>• Choanal atresia<br>• Pyriform aperture stenosis<br>• Laryngomalacia/anomalies<br>• Subglottic stenosis<br>• Tracheomalacia/anomalies<br>• Adenotonsillar hypertrophy<br>• OSA<br>• Vaso-vagal response<br>• Unintentional suffocation<br>*Gastrointestinal*<br>• GER<br>• Dysphagia/choking<br>• Oesophageal dysmotility<br>• Laryngeal chemoreflex<br>• Bowel obstruction<br>• Gastroenteritis<br>• Tracheoesophageal fistulas<br>• Oesophageal foreign body<br>• Intussusception<br>*Cardiovascular*<br>• Channelopathies (prolonged QT syndromes, Brugada syndrome, short QT syndrome)<br>• Congenital heart disease<br>• Vascular ring/sling/compression<br>• Cardiomyopathy/myocarditis<br>• Ventricular pre-excitation (Wolff-Parkinson-White syndrome)<br>• Arrhythmia | *Pulmonary*<br>• Aspiration<br>• Asthma<br>• Foreign body<br>• Congenital airway anomalies/malacia<br>• Infection Haemorrhage<br>• Upper and lower respiratory tract infection<br>*Infectious*<br>• Bronchiolitis<br>• Pneumonia<br>• Croup<br>• Upper respiratory infection<br>• UTI<br>• Sepsis<br>• Meningitis<br>• Gastroenteritis<br>• Viral syndrome<br>• Specific organisms (pertussis, RSV, and other respiratory viruses)<br>*Genetic/metabolic*<br>• IEMs (fatty acid oxidations disorders, urea cycle disorders)<br>• Mitochondrial disorders<br>• Electrolyte disturbance<br>• Hypocalcaemia<br>• Hypoglycaemia<br>*Child maltreatment*<br>• Abusive head trauma<br>• Caregiver-fabricated illness (also known as Münchausen by proxy and medical child abuse) Intentional suffocation<br>• Poisoning<br>• Medical neglect |

| | |
|---|---|
| • Sepsis<br>• Syncope<br>*Neurologic*<br>• Seizures<br>• Stroke<br>• Intracranial mass lesion<br>• Brain/intracranial structural or vascular abnormality<br>• Intracranial haemorrhage<br>• Hydrocephalus<br>• Neuromuscular disorder<br>• Congenital central hypoventilation syndrome<br>• Apnea of prematurity<br>• Infant botulism<br>• Demyelinating disorder (transverse myelitis, multiple sclerosis, acute disseminated encephalomyelitis) | *Toxin exposure*<br>• Medication adverse effect<br>• Substance exposure via human milk<br>• Environmental exposure<br>• Vaccine reaction<br>*Miscellaneous*<br>• Acrocyanosis<br>• Hypothermia<br>• Breath-holding spell<br>• Idiopathic |