

BRUE (Brief Resolved Unexplained Event)

An Evidence-Based, Feeding Focused Clinical Pathway

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Goals

- Provide historical perspective on medical terms used to describe the sudden unexpected death of an otherwise healthy infant: SIDS, Near-Miss SIDS, Aborted Crib Death, ALTE and BRUE.
- Present the 2012 AAP guidelines recommending a shift in language replacing the term ALTE with the term BRUE.
- Review current research focusing attention on the contribution of dysphagia, silent aspiration/laryngeal penetration in symptoms of BRUE in healthy infants.
- Present a clinical pathway with added focus on the evaluation and management of dysphagia as a contributor to symptoms of BRUE.

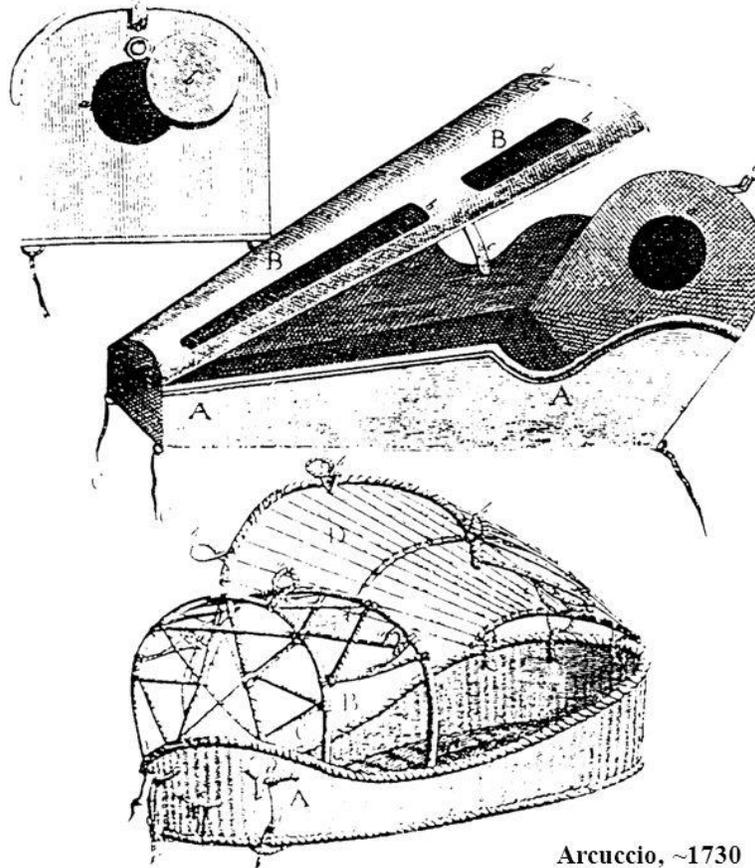
Historical Perspective



- “And this woman’s child died in the night: because she overlaid it”. From 1st Kings, Chapter 3; verse 19. Possibly one of the first examples of SIDS in antiquity.
- Multiple examples of SIDS references in texts from Egypt, Babylon, Greece and Rome thought to be due to overlying and accidental smothering during sleep.
- Accidental smothering became a church issue during the medieval and Renaissance periods. In Florence Italy, an arched device called The Arcuccio was placed over sleeping infants preventing mothers from rolling over onto the babies accidentally.

The Arcuccio

- In 18th century France, a wood and metal cage --- *arcuccio* --- was placed over a bedsharing infant to prevent overlying.
- Charles Dickens, “Of all things in life, there should be nothing so preventable, as there is nothing on the face of it so unnatural, as the death of a little child.”

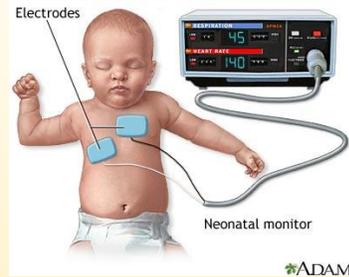


Arcuccio, ~1730

- SIDS – In 1969 the term entered common medical terminology to describe a sudden unexpected death in infancy unexplained after careful postmortem examination. In 1989, the definition was modified to include the death of infants < 12 months that remained unexplained after complete autopsy, examination of the death scene and review of clinical history.
 - Early investigators believed that most deaths represented a distinct syndrome with common mechanisms of death
 - Early studies associated SIDS with an event that occurred during sleep, peaking between 2-4 months of age and declining rapidly thereafter.



- Following an aggressive “Back to Sleep” campaign implemented in 1994, cases of “classic” SIDS decreased 41%. Sub-classifications for SIDS were proposed in 2004 in order to account for remaining cases of sudden infant death.
- Researchers believed these remaining cases represented a heterogeneous population with a variety of underlying mechanisms of death.
- Near-Miss SIDS – (aborted crib death) was a term that emerged in the early 70’s to describe healthy infants who experienced sudden changes in condition believed to be a pre-cursor to SIDS but interrupted by parents or caregivers. The idea that SIDS could be prevented inspired the era of home apnea monitoring.



- By the mid 80's research showed that nearly all infants with a “near-miss” had survived and there was no evidence that monitoring prevented SIDS. The term was retired and replaced by the term ALTE.
- ALTE – (Acute Life Threatening Event) was defined as “an episode frightening to the observer and characterized by some combination of apnea, color change, change in muscle tone, choking or gagging. Event resolution required vigorous stimulation.
 - 50% of ALTE's occurred while infants were awake
 - Events could occur as late as 12 months of age but peaked at < 60 days.
 - While SIDS declined after “Back to Sleep”, the **incidence of ALTE did not.**

- **BRUE** – (Brief Resolved Unexplained Event) was a term proposed by the AAP in 2012 to replace the term ALTE in an attempt to remove the “life threatening” label and highlight the transient nature of events that lacked a clear cause.
 - BRUE describes a sudden, brief, and quickly resolved episode in healthy infants under 12 months. A BRUE **must** be unexplained by history and include one or more of the following:
 - Cyanosis or Pallor
 - Absent, decreased or irregular breathing
 - Change in tone (hypo or hypertonia)
 - Altered level of responsiveness

- Infants with BRUE were divided into high risk and low risk categories.
- Low Risk:
 - Infants older than 60 days (>32 weeks gestation or greater than 45 weeks post-conceptual age).
 - No previous episodes of BRUE
 - Episode lasting < 1 minute
 - No intervention (CPR) required by medical provider
 - Nothing concerning in medical history
 - No positive findings on physical exam (arrhythmia, fever, URI, bruising)

- High Risk:

- Infants < 60 days (< 32 weeks gestation or 45 weeks corrected age)
- Family history of sudden death
- Family history of infant death
- Concerning social history

- High and low risk categories were developed based on best evidence in order to reduce unnecessary testing and admission for low risk infants.

- In the **high risk** category a tiered approach to testing was recommended:
 - Tier 1 – pulse ox monitoring for 4 hours, EKG, RVP, HCT, BG, Head CT, MRI, skeletal survey, social work consult.
 - Tier 2 – Subspecialty consults (GI, ENT, Pulmonology, CARES, Neuro, Cardiology, Genetics). Testing including Video swallow, EEG, Sleep study, UGI.
- In 2016 a retrospective study at Boston Children’s Hospital strongly correlated oropharyngeal dysphagia with admissions after a BRUE.
 - 188 charts were reviewed. While testing included EKG, CXR, EEG and Video swallow, the only clinically significant findings were from the Video swallow studies that found silent aspiration or laryngeal penetration in 72% of infants.

- The Boston study concluded that dysphagia and aspiration were major contributors to BRUE that often goes undiagnosed unless studied.
- While GERD had been frequently cited as a likely cause of ALTE, studies failed to show any correlation.
- Since the Boston study in 2016, multiple studies have focused attention on oropharyngeal dysphagia in neurologically intact/developmentally normal children.
 - The process of swallowing begins with suckling movements in utero and continues to mature through infancy. While fetuses suck and swallow, the need to breathe is not added to the cycle until after birth. Early in life, feeding efforts may lack coordination and result in micro (silent) aspiration.



- One study found that 25-45% of developmentally normal infant oral feeding difficulties.
- A feeding history may uncover symptoms including a weak suck, frequent gagging or choking, the sound of “wet breathing” or “rattling”
- Speech therapists are important consultants to involve in feeding evaluations and can guide parents in ways to improve feeding safety, however, clinical feeding evaluation may not be sensitive enough to capture silent aspiration.
- Simple changes in positioning, nipple flow and pacing can reduce symptoms.
- Over feeding and inappropriate frequency of feedings more often seen in infants older than 2 months who have better mastery over breathing and swallowing coordination.
- Feeding questions should be included in evaluation of both high risk and low risk BRUE.

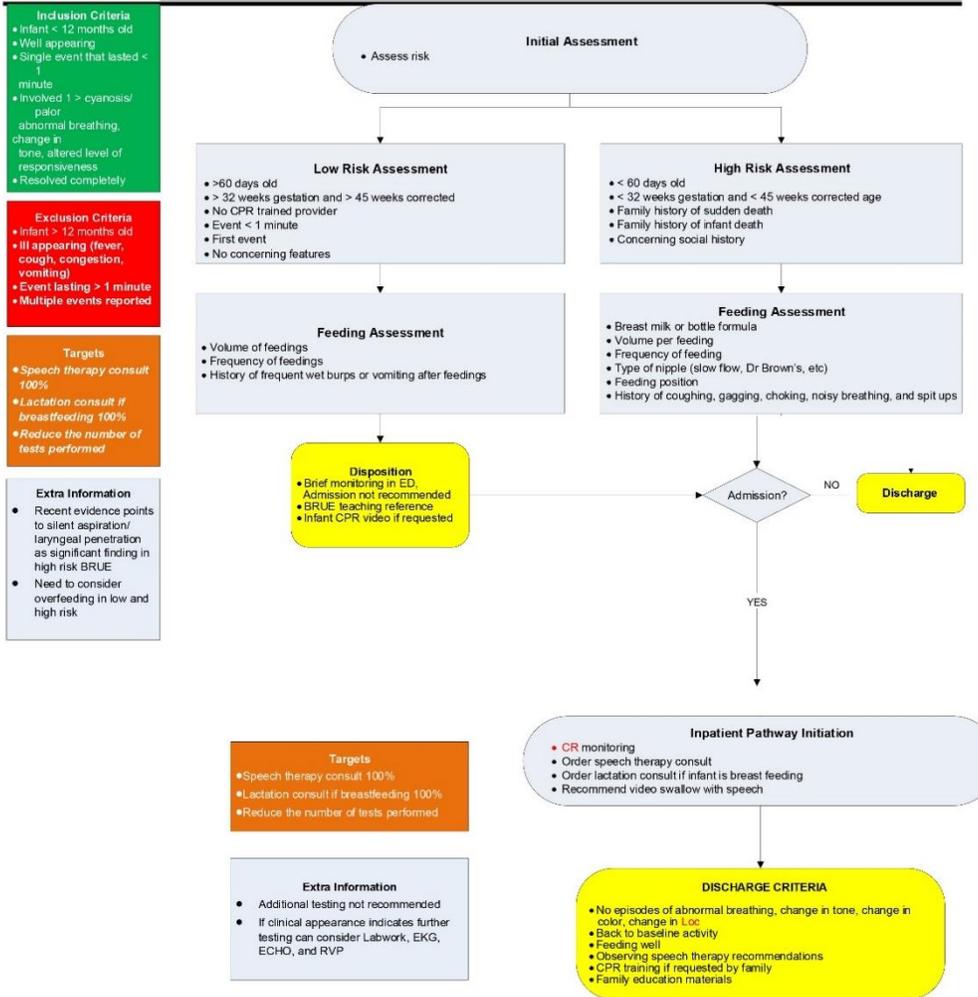
- Videofluoroscopic Swallow Study – radiographic procedure that provides a dynamic view of swallowing. Allows visualization of oral, pharyngeal and esophageal stages of swallowing and can assess the adequacy of the infant's ability to protect his/her airway.
 - Speech therapist can modify feeding strategies and test the effectiveness of their interventions during the study.



BRUE clinical pathway/ from concept to clinical practice

- In 2019 the APN team in General Pediatrics embarked on an IRB approved retrospective chart audit to determine whether the 2012 AAP guidelines for the management of BRUE were being followed.
 - Out of 141 charts audited, 44 of them fit the guidelines for a true BRUE.
 - The remaining 97 infants were found to have identifiable reasons for the episode (fever, RSV, GERD, URI, PFO, laryngomalacia) and were excluded.
 - Of the 44 infants with true BRUE, 37 were high risk, 7 were low risk. Only 2 of the high risk infants received speech consults and none had a video swallow.
- From these results it was determined that a BRUE clinical pathway with an added focus on feeding would reduce the potential for a missed diagnosis of dysphagia.

Brief Resolved Unexplained Event (BRUE)



Since infants considered “**low risk**” are generally older (>60 days), feeding questions are more geared to frequency and volume of feeds since research points to overfeeding as a common issue in this age group.

Questions in assessing “**high risk**” infants (<60 days) focus on

- Is baby breast or bottle fed? (research has not looked directly at this question).
- Volume and frequency of feeds (infants often fed too much and too often)
- Type of nipple (slow flow, premi, Dr. Brown)
- Feeding position
- Parental reports of coughing, gagging, choking, noisy/wet breathing and frequent spit-ups during and after feeds.

- Despite years of research surrounding these sudden, frightening events in otherwise healthy infants, the exact cause/causes remain unclear.
- While research has not answered the question “What **IS** it?”, long term follow-up following BRUE has brought some clarity to “What it is **NOT**”.
 - Infants following a BRUE are no more likely to die than any other infant of the same age who has NOT had a BRUE.
 - An infant who has had a BRUE is not likely to have another
 - The value of hospital admission and testing of “low risk” infants is not supported by research.
 - Oropharyngeal dysphagia in “high risk” infants may be missed without a focused speech evaluation and consideration of a modified barium swallow.

- Opportunity for future research:
 - Studies focused on incidence of BRUE in breast vs. bottle fed infants
 - Studies focused on parental concerns and readiness to leave the hospital after their infant has had a BRUE.
 - Studies of infants presenting with BRUE who undergo clinical speech evaluation AND VFSS (video fluoroscopic swallow study) to determine the significance of silent aspiration and laryngopenetration in healthy infants experiencing a BRUE.
 - Studies focused on the impact of feeding modifications by speech therapy on healthy infants diagnosed with dysphagia associated with a BRUE event.

References

- Brand, D. A., & Fazzari, M. J. (2018). Risk of death in infants who have experienced a brief resolved unexplained event: A meta-analysis. *The Journal of Pediatrics*, *197*, 63-67. doi:S0022-3476(17)31722-5 [pii]
- Duncan, D. R., Amirault, J., Mitchell, P. D., Larson, K., & Rosen, R. L. (2017). Oropharyngeal dysphagia is strongly correlated with apparent life-threatening events. *Journal of Pediatric Gastroenterology and Nutrition*, *65*(2), 168-172. doi:10.1097/MPG.0000000000001439 [doi]
- Duncan, D. R., Growdon, A. S., Liu, E., Larson, K., Gonzalez, M., Norris, K., & Rosen, R. L. (2019). The impact of the american academy of pediatrics brief resolved unexplained event guidelines on gastrointestinal testing and prescribing practices. *The Journal of Pediatrics*, *211*, 112-119.e4. doi:S0022-3476(19)30427-5 [pii]
- Duncan, D. R., Larson, K., Davidson, K., May, K., Rahbar, R., & Rosen, R. L. (2019). Feeding interventions are associated with improved outcomes in children with laryngeal penetration. *Journal of Pediatric Gastroenterology and Nutrition*, *68*(2), 218-224. doi:10.1097/MPG.0000000000002167 [doi]
- Jilani, N. Z., Hussain, A., Al Ansari, K., & Powell, C. V. E. (2019). Gastro-oesophageal reflux is not a major cause of brief resolved unexplained events in infants. *Breathe (Sheffield, England)*, *15*(2), e32-e39. doi:10.1183/20734735.0174-2019 [doi]
- Merritt, J. L., Quinonez, R. A., Bonkowsky, J. L., Franklin, W. H., Gremse, D. A., Herman, B. E., . . . Tieder, J. S. (2019). A framework for evaluation of the higher-risk infant after a brief resolved unexplained event. *Pediatrics*, *144*(2), 10.1542/peds.2018-4101. doi:e20184101 [pii]
- Tieder JS, bonkowsky JL, etzel RA, et al. clinical practice guideline: Brief resolved unexplained events (formerly apparent life-threatening events) and evaluation of lower-risk infants: Executive summary. *pediatrics*. 2016;137(5):e20160591. (2016). *Pediatrics*, *138*(2), 10.1542/peds.2016-1488. doi:10.1542/peds.2016-1488 [doi]

Thank You

