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Review of Brief Resolved Unexplained Events (Brues) in a Pediatric Emergency Department of a Large Tertiary Care Center

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Abstract

Background: The American Academy of Pediatrics (AAP) published a clinical practice guideline in 2016 recommending replacement of the term "Apparent Life-Threatening Event" (ALTE) with a new term named "brief resolved unexplained event" (BRUE), which can be high or low-risk. The AAP does not offer any specific guidance for infants with high-risk BRUEs except to perform relevant investigations, based on specific areas of concern, identified in the history or physical exam.

Patients and Methods: To find the proportion of BRUEs and understand the applicability of AAP BRUE guidelines within our pediatric emergency department (PED) infant population of a large tertiary care center. Retrospective review of relevant data from January 2017- December 2019 was carried out.

Results: 22 patients satisfied the BRUE criteria during the study period, with an incidence of 4.8 cases/1000 infant-year. 14 (63.6%) were classified as high-risk BRUEs, while 8 (36.3%) were low-risk. In the high-risk group, 11 (78.5%) were admitted, and 3 (21.4%) got discharged against medical advice. Six (75%) infants from the low risk group were admitted, and 2 (25%) were discharged from PED. Two (18.1%) of the admitted high risk BRUE patients died during admission. From the hospital discharged patients, 17 (77.2) stayed healthy and 3 were lost to follow-up.

Conclusion: Application of AAP guidelines can help streaming BRUE patients appropriate. Implementation of these guidelines within the PED can help avoid over-diagnosis and consequent unnecessary hospital admissions in this category of patients.

Introduction

The AAP published clinical practice guidelines in 2016, recommending replacing ALTE with a new term BRUE [1,2]. An apparent life-threatening event was defined as any event that was frightening to the observer and consisted of a combination of apnea, color change, muscle tone variation, choking or gagging. ALTE replaced the term Sudden Infant Death Syndrome (SIDS) back in 1986 [3,4].

The definition of a BRUE is an observed event occurring in an infant younger than one year of age, where the observer reports a sudden, brief yet resolved episode of one or more of the following; cyanosis or pallor, absent/decreased/irregular breathing, marked change in tone (hyper- or hypotonia), altered level of responsiveness [5]. The diagnosis can only be made when there is no explanation for a qualifying event after an appropriate history and physical examination [5].

High-risk infants are younger than two months of age, with history of prematurity (especially < 32 weeks gestation), and with more than one event [5]. Low-risk infants are older than 60 days, gestational age 32 weeks or more, post-conceptional age greater than or equal to 45 weeks, first brief resolved unexplained event, event lasting < one minute, no Cardio-Pulmonary Resuscitation (CPR) required by a trained medical provider, no concerning historical features or physical examination findings [5]. Patients who do not meet the criteria as low risk are also considered high risk [5].

Infants with a low-risk brief resolved unexplained event do not require any investigations. A brief period of observation (1-4 hours) with continuous pulse oximetry is usually adequate. The AAP does not offer any specific guidance for infants with high-risk events; the common sense approach is to perform relevant tests based on specific areas of concern identified in the history or physical exam e.g performing a 12-lead ECG can be beneficial in identifying channel opathies that lead to sudden death [6]. Testing for pertussis may be useful in at-risk populations (suggestive symptoms, un-immunised patients). Other blood investigations, cultures, urine analysis, imaging, electroencephalogram (EEG), pH probe, and poly somnography are not routinely recommended [6-12].

A study conducted within the pediatric intensive care unit (PICU) of a large tertiary care center reviewed the BRUEs over a 3 years period.

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They reported a total of 30 infants, who all required PICU admission, but survived to hospital discharge [13,14].

Another study followed the BRUE children for 5 years. A significant proportion of those cases ended up diagnosed as global developmental and speech delay, although no deaths were reported [9].

Methods

Our study was approved by the Research Advisory Committee at KFSH&RC (RAC no: 2191298). This retrospective study was conducted at our tertiary care center from January 2017 to December 2019. The records of 2265 infants were reviewed retrospectively. Infants aged 1 year or younger, admitted to PED for an episode defined as a BRUE, were included in this study. Data was collected from the patient's electronic medical records. We recorded the demographic details, clinical symptom atology, and duration of stay and disposition of these patients. Continuous data were expressed as mean ± standard deviation and categorical data were reported as counts and percentages.

Results

Medical records of 2265 infants presenting to the emergency department over 2 years from January 2017 till December 2019 were reviewed.

22 patients satisfied the eligibility criteria. The estimated incidence rate of the BRUE was 4.8 /1000 infant-years. The mean age (in months) was 1.13 (SD 2.18) [Figure 1]. 15 (68.1%) were full-term infants while the remaining 7 (31.8%) were preterm [Figure 2].

14 (63.6%) were diagnosed as high-risk BRUE, while 8 (36.3%) were low-risk.

In the high-risk group, 11 (78.5%) were admitted, and 3 (21.4%) got discharged against medical advice.

6 (75%) of the low risk BRUE patients were also admitted, and 2 (25%) were discharged home from PED.

In the admitted patients of both groups 3 (17.6%) were diagnosed with congenital heart disease, 5 (29.4%) gastrointestinal disease, 3 (17.6%) Inborn error of metabolism/genetic disorders, 1(5.8%) with sepsis and 2 (11.7%) had pulmonary disorder. Three (17.6%) of the admitted patients did not have a definite diagnosis. Two (18.1%) of our high risk patients died during admission.

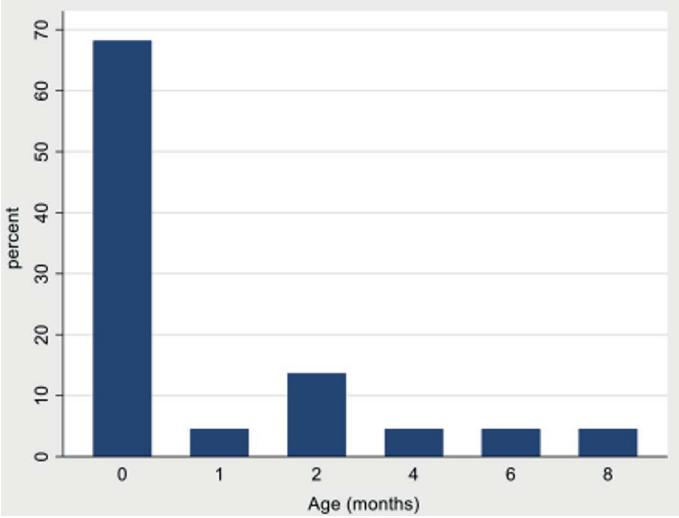

Figure 1: Infants hospitalized for BRUE, per age (In months)

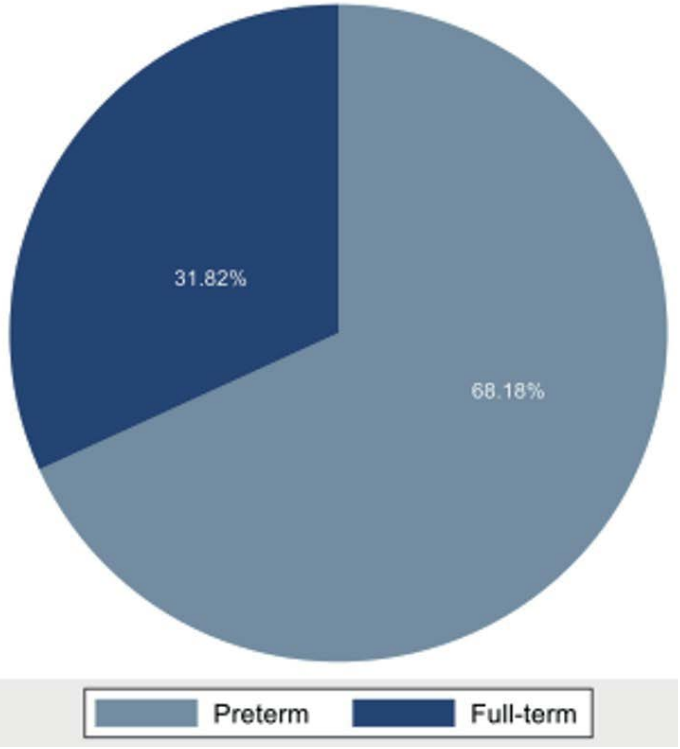

Figure 2: Percentage of full-term and preterm delivery

17 (77.2) patients were discharged and stayed alive with no repeat BRUE at 3 months follow up. Three patients were lost in follow-up.

Discussion

The assessment of BRUE patients can be challenging and requires a thorough history and examination. Our study is the first one in the institution to show the incidence of BRUEs within the PED of KFSH&RC and effect of application of AAP guidelines on these patients.

Our incidence rate of the BRUE in this study was around 4.8 cases/1000 infant-year. This is higher than the reported incidence of 0.6%-0.8% within all emergency department visits for infants, although the true incidence remains unknown [13]. Our institution is a tertiary center with complex cohort of patients including mothers with genetic and metabolic diseases, which could explain this increased incidence. A recent observational study done in a single center in France between 2017 and 2019 found 54 patients diagnosed with BRUE, including 40 high-risk cases [15].

The majority of our study population were diagnosed as high-risk BRUE with a high admission rate of 72%. This is higher than reported in other tertiary care institutions [6,7]. This could be due to our sicker patient population or higher index of clinical suspicion for an underlying condition. 29.4% of our admitted patients were diagnosed with an underlying condition (cardiac disease, GI, metabolic disorders, infectious, or pulmonary disease), although the remaining majority did not have clear diagnosis at the time of discharge. Two of our admitted patients from the high risk BRUE group died during hospital admission. The first one was diagnosed with Spinal Muscular Atrophy (SMA) and ended up having a "Do No Attempt Resuscitation order" (DNAR), due to poor prognosis. The second deceased patient was diagnosed with

tetralogy of Fallot, who later developed post-cardiac catheterization complications including multi-drug-resistant bacteremia and sepsis.

It is noticeable that only 3 (33.3%) of our infants categorised in the low-risk BRUE were managed in the ED, the remaining 5 (66.6%) were admitted after additional investigative work-up and consultation with other specialities.

This approach to the lower risk group is not compliant with the recommendation laid out in AAP guidelines. This approach led to increased burden on healthcare resources and unnecessary hospital admissions.

17 (77.2%) of the patients were discharged in stable and healthy condition, and their follow-up did not yield any further clinical problems. Three patients were lost on follow-up.

A recently study carried out in multiple hospitals in Illinois, between 2013 and 2019, reviewed 4639 infants with diagnosis of BRUE in ED, before and after the release of AAP guidelines. They found the number of BRUE patients admitted/transferred decreased significantly by 0.3% per quarter, after the guidelines were implemented, mainly in the academic centers [14].

Conclusion

Implementation of AAP BRUE guidelines within the ED, can avoid over-diagnosis and unnecessary admissions in this group of patients.

Limitations

This is a single center study done in a large tertiary care in Middle East and the findings may not be generalisable to other centers.

Recommendations

Multicenter study analyzing a larger sample before & after the implementation of guidelines will be more helpful and can help highlight the real impact of the guidelines in management of BRUE patients.

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