

Brief resolved unexpected event: prevalence, etiology and epidemiologic characteristics in Lebanon. a retrospective study of hospitalizations in a tertiary-care center

Abstract

Objective: A Brief Resolved Unexplained Event (BRUE) is a common condition in infancy. However, no epidemiological study has been undergone in Lebanon. This study aims to establish the prevalence and the characteristics of the population hospitalized after a BRUE.

Material and methods: A single-center retrospective study performed from 1998 to 2018 included 156 hospitalized infants, aged less than one year old, in a tertiary medical center. Data were collected from hospital archives.

Results: Most infants (92.9%) hospitalized after a BRUE were aged less than 6 months old, with a slight masculine predominance (52.6%). No pathognomonic symptom was identified. In terms of recurrence of the initial episode, it occurred in 55.1% of the cases. A transfer to a reanimation unit took place in 35.9% of patients, with an average stay of 6.3 days. Two infants were deceased and six were readmitted for the same chief complaint. Final confirmed diagnosis was a Gastro-Esophageal Reflux (GER) in 60.9%. Consequently, a milk change occurred in 17.9% and a GER treatment in 65.4%.

Conclusion: Infants younger than one year and hospitalized for a BRUE present a majority of confirmed GER diagnosis, and seem to have an excellent prognosis.

Keywords: brief resolved unexplained event (brue), infant, gastro-esophageal reflux (ger), epidemiology, reanimation

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Abbreviations: AAP, american academy of pediatrics; BRUE, brief resolved unexplained event; ALTE, apparent life threatening event; MENA, middle east and north africa; GER, gastro-esophageal reflux; CI, confidence interval; PICU, pediatric intensive care unit; RSV, respiratory syncytial virus; ECG, electrocardiogram; PSG, polysomnography; EEG, electroencephalogram; SUPC, sudden unexpected postnatal collapse; WGA, weeks of gestational age; NICU, neonatal intensive care unit

Introduction

The American Academy of Pediatrics (AAP) has implemented in 2016 new guidelines concerning Brief Resolved Unexpected Event (BRUE), hence replacing the previously used term of Apparent Life Threatening Event (ALTE).¹⁻³ It is defined as a short, sudden and self-resolved episode, implicating one or more of what follows:

- Cyanosis or pallor
- Absent, decreased or irregular breathing
- Change in tone
- Altered levels of responsiveness

Infants are less than one year old,^{2,4,5} and episodes last less than one minute, usually 20-30 seconds.⁶ This novel nomenclature restricted the previously heterogeneous clinical presentation.²⁻⁴ While precise prevalence of BRUE remains inconsistent throughout the different undergone studies, it varies around 0.58 to 2.46‰ in recent data.^{7,8} French and Italian recommendations find an age predilection of 2 to

6 months, with a mild masculine predominance and a recrudescence during autumn and winter.⁹⁻¹¹ Many risk factors have been identified by Monti et al.,¹² though no direct correlation has been proven so far.¹² However, finding the underlying cause remains controversial, with no cause identified in 15 to 65%.^{1,10} Gastrointestinal pathologies are mostly incriminated, followed by infections, as well as neurologic, cardiologic, and metabolic disorders.^{8,13-16}

Up until now, very few studies have described the epidemiologic characteristics in the Middle East and North Africa (MENA) countries. Five studies were conducted in Israel, by Ari, Tirosh, Weiss, Tirosh and Goldhammer concluding to excellent prognosis among BRUE and ALTE patients and a low-yield of performed tests, with a raised possibility of an abnormality in the autonomic function related to apnea and Gastro-Esophageal Reflux (GER).^{11,17-20} Similarly, two studies underwent in Iran by Aminiahidashti and Kadivar found, respectively, a predominance of gastric etiologies and an increased incidence of 11‰ with 18 patients admitted for ALTE.^{21,22} The goal of this study was to retrieve the epidemiologic characteristics of infants admitted for BRUE in Lebanon, as well as the final diagnosis and the therapeutic management.

Materials and methods

This is a retrospective observational single-centered study conducted in 2018 at Hôtel-Dieu de France, a tertiary-care center and university medical center affiliated to the Saint Joseph University and located in Beirut, Lebanon. Patients were identified by searching hospital discharge records for infants aged less than one year old with

a chief complaint of a BRUE, over a period extending from January 1998 to June 2018. Included infants were those who complied to the AAP criteria for the definition of a BRUE (2). Infants with congenital or chronic conditions susceptible of causing syncopes were excluded. Other exclusion criteria were unlimited in duration or non-spontaneously resolved events. Ethical approval was obtained from Saint Joseph University's Medical Ethics Committee. Data obtained were anonymized before statistical analysis, and included demographic as well as medical details of the infant's hospitalization. Clinical characteristics were described by mean values, percentages and standard deviations. The Pearson Chi-two test and Fisher Exact test were used for categorical variables. Results are considered significant when P value is inferior to 0.05, with a confidence interval (CI) of 95%.

Results

Final count of infants included in the study over the 20-year period between 1998 and 2018 was 156, with 52.6% males and 47.4% females. Age distribution is shown in Table 1 and age categories were based on developmental stages according to the twentieth edition of Nelson's Textbook of Pediatrics.²³ Mean age upon admission was 62.11 days (standard deviation 71.81), with a minimal age of 8 hours. Prevalence of admissions was variable over the years and is shown in Figure 1. Elements of past personal and family medical history are grouped in Table 1. Symptoms reported by parents were quite variable

(Figure 2). Hospitalization occurred within 24 hours of BRUE in 79.5% of cases (n=124). In addition, a recurrence of the initial episode was found in 55.1% of cases (n=86). The length of hospital stay varies between 1 and 25 days, with an average of 4.96 days (standard deviation 4.143). A transfer to the Pediatric Intensive Care Unit (PICU) was necessary in 35.9% (n=56) of the cases, with an average duration of 6.3 days (minimum 1 day; maximum 25 days; standard deviation 5.369). Specialist referrals were distributed among the various pediatric subspecialties, with a predominance for intensivists (55.8%, n=87), gastroenterology (63.5%, n=99), cardiology (60.9%, n=95) and neurology (59.6%, n=93).

Upon admission, initial clinical examination was unremarkable. Hospital stay was uncomplicated in 72.4% (n=113). Readmission occurred in 3.8% (n=6) and two infants death were recorded during their stay (1.3%). The final diagnosis retained corresponded in 60.9% to GER (n=95); in 13.6% of cases (n=21), no etiology was incriminated. The rest of the final diagnoses fall into several categories (Table 2). The cultures were positive in 16.7% of patients (n=26), all locations combined. The germs most frequently found were the group of staphylococci (5.6%; n=9), as well as *Escherichia coli* (2.5%; n=4). The other germs were mainly bacteria: *Pseudomonas aeruginosa* (1.9%; n=3), the streptococcus group (1.9% n=3), *Enterobacter* (1.3%; n=2), *Klebsiella pneumoniae* (1.3% n=2). Respiratory Syncytial Virus was present in two occurrences (1.3%), and *Candida* in only one (0.6%).

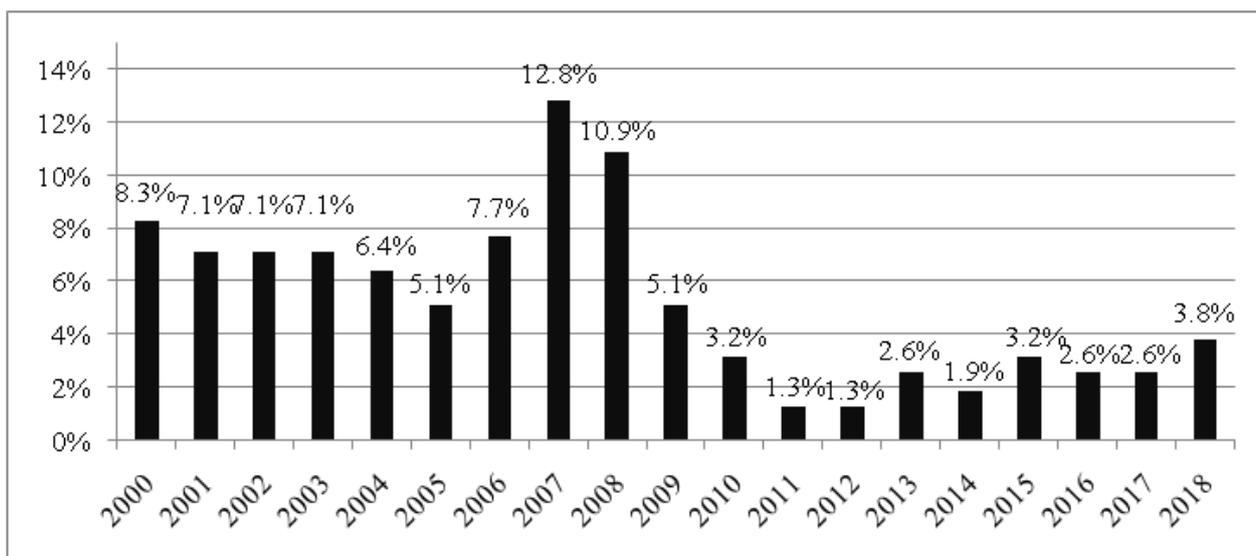


Figure 1 Prevalence of hospitalizations over the years.

Complementary tests carried out are distributed as follows: complete blood count in 94.9% (n=148), hemostasis assessment in 17.3% (n=27), blood electrolytes in 86.5% (n=135), renal function in 40.4% (n=63), hepatic function in 26.9% (n=42), infectious assessment in 67.3% (n=105), lumbar puncture in 30.8% (n=48), chest radiography in 64.7% (n=101), electrocardiogram (ECG) in 49.3% (n=77), rhythmic Holter in 23.1% (n=36), cardiac ultrasound in 33.3% (n=52), Upper Gastro-Intestinal Series in 32% (n=50), barium swallow in 5.1% (n=8), esophageal pH manometry in 44.9% (n=70), polysomnography (PSG) in 9.6% (n=15), digestive endoscopy in 11.5% (n=18), brain imaging in 17.3% (n=27), electroencephalogram (EEG) in 50.6% (n=79).

An abnormal test result that confirmed a diagnosis was found as follows: cardiac ultrasound in 0.9% (n=17), ECG in 3.2% (n=5), Upper Gastro-Intestinal Series in 24.4% (n=38), barium swallow in 2.6% (n=4), esophageal pH manometry in 34% (n=53), PSG in 8.3% (n=13), EEG in 4.5% (n=7).

During hospital stay, medications are often prescribed with antibiotics in 30.1% (n=47), anti-epileptics in 11.5% (n=18), caffeine in 1.9% (n=3), and beta-blockers in 0.6% (n=1). Monitoring of vital parameters is prescribed in 67.9% of cases (n=106), as well as a head-elevated position in 12.2% of cases (n=19). At discharge, a change of milk occurred in 17.9% (n=28) as follows: protein hydrolysates in

2.6% (n=4), starch thickened milk in 8.3% (n=13), carob thickened milk in 3.8% (n=6), double thickened milk in 1.9% (n=3), unspecified anti-reflux milk in 0.6 % (n=1), and hypoallergenic milk in 0.6% (n=1). Added to this, thickeners were also prescribed in 1.9% (n=3), divided into Gelopectosis in 1.3% (n=2) and Biogaia in 0.6% (n=1). Anti-reflux drug treatment was started in 65.4% of infants (n=102),

with different molecules: Domperidone (28.2%, n=44), Omeprazole (19.2%, n=30), Ranitidine (19.9%, n=31), Eesomeprazole (16%, n=25), Metoclopramide (14.7%, n=23), Cisapride (13.5%, n=21). Bitherapy was enhanced in 41% of cases (n=64) and tritherapy in 2.6% of cases (n=4).

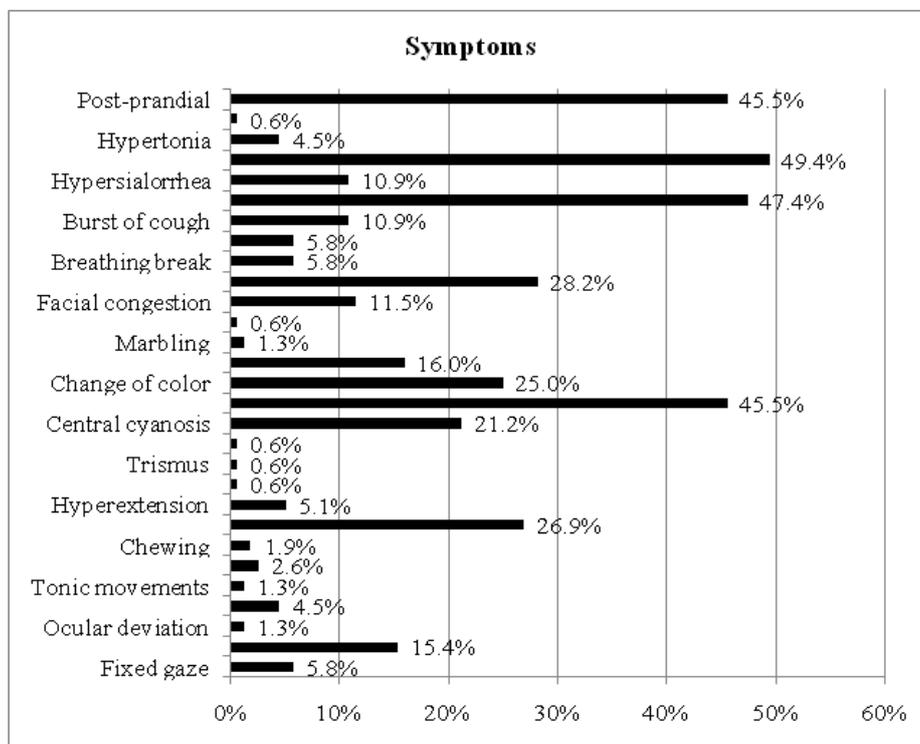


Figure 2 Symptoms described by parents.

Table 1 Past personal and family medical history

	Prevalence (%)	
Age on admission	<24 hours	6.4% (n = 10)
	1-28 days	14.1% (n = 22)
	1-6 months	51.9% (n = 81)
	6-12 months	7.1% (n = 11)
Gestational age (WGA)	< 28	3.2 (n = 5)
	28-32	1.9 (n = 3)
	32-37	23.7 (n = 37)
	>37	71.2 (n = 111)
Birth weight (g)	<1500	5.1 (n = 8)
	1500-2500	19.2 (n = 30)
	>2500	46.2 (n = 7)
	Missing values	29.5 (n = 46)
Maternal age at birth (years)	<18	0
	18-35	25.6 (n = 40)
	>35	5.1 (n = 8)
	Missing values	69.2 (n = 108)

Table Continued

		Prevalence (%)
NICU stay	Yes	23.1 (n = 36)
	No	75.6 (n = 118)
	Missing values	1.3 (n = 2)
Multiple pregnancy	Yes	12.2 (n = 19)
	No	86.5 (n = 135)
	Missing values	1.3 (n = 2)
Delivery mode	Vaginal	48.1 (n = 75)
	C-section	50.6 (n = 79)
	Missing values	1.3 (n = 2)
Immunization	Regular	40.4 (n = 63)
	Delayed	53.8 (n = 84)
	Missing values	5.8 (n = 9)
Prior episode of BRUE	Yes	6.4 (n = 10)
	No	93.6 (n = 146)
Milk	Exclusive Breastfeeding	34 (n = 53)
	Exclusive infant formula	17.3 (n = 27)
	Combined feeding	46.2 (n = 72)
	Missing values	2.6 (n = 4)
Anti-reflux milk	Yes	9 (n = 14)
	No	55.8 (n = 87)
	Starch-thickened	6.4 (n = 10)
	Carob-thickened	1.9 (n = 3)
Milk thickening	Double thickened	0.6 (n = 1)
	Doesn't apply	35.3 (n = 55)
	Yes	2.6 (n = 4)
	No	97.4 (n = 153)
Anti-reflux treatment	Yes	19.9 (n = 31)
	No	80.1 (n = 125)
Family history of BRUE	Yes	0.6 (n = 1)
	No	99.3 (n = 146)

WGA, weeks of gestational age; NICU, neonatal intensive care Unit; BRUE, brief resolved unexplained event

Table 2 Final diagnosis and BRUE characteristics

Final diagnosis	Prevalence (%)	Symptoms onset (%)		Complications (%)		Surgical intervention (%)	
		< 24h	> 24h	Yes	No	Yes	No
GER	60.9 (n = 95)	46.8 (n = 73)	14.1 (n = 22)	16 (n = 25)	44.9 (n = 70)	5.1 (n = 8)	55.8 (n = 87)
Hypertrophic pyloric stenosis	0.6 (n = 1)	0	0.6 (n = 1)	0	0.6 (n = 1)	0.6 (n = 1)	0
Cow's milk allergy	1.3 (n = 2)	1.3 (n = 2)	0	0	1.3 (n = 2)	0	1.3 (n = 2)
Esophagitis	1.9 (n = 3)	0.6 (n = 1)	1.3 (n = 2)	0	1.9 (n = 3)	0	1.9 (n = 3)
Hiatal hernia	0.6 (n = 1)	0.6 (n = 1)	0	0	0.6 (n = 1)	0	0.6 (n = 1)
Esophageal stenosis	0.6 (n = 1)	0.6 (n = 1)	0	0.6 (n = 1)	0	0.6 (n = 1)	0
Erosive gastritis	0.6 (n = 1)	0.6 (n = 1)	0	0	0.6 (n = 1)	0	0.6 (n = 1)

Table Continued

Final diagnosis	Prevalence (%)	Symptoms onset (%)		Complications (%)		Surgical intervention (%)	
		< 24h	> 24h	Yes	No	Yes	No
Benign epilepsy	3.2 (n = 5)	3.2 (n = 5)	0	1.3 (n = 2)	1.9 (n = 3)	0	3.2 (n = 5)
Sandifer syndrome	1.3 (n = 2)	0.6 (n = 1)	0.6 (n = 1)	0	1.3 (n = 2)	0	1.3 (n = 2)
Breath-holding spells	1.3 (n = 2)	1.3 (n = 2)	0	0.6 (n = 1)	0.6 (n = 1)	0	1.3 (n = 2)
Neurologic syncope	0.6 (n = 1)	0	0.6 (n = 1)	0.6 (n = 1)	0	0	0.6 (n = 1)
Intracerebral hemorrhage	0.6 (n = 1)	0.6 (n = 1)	0	0	0.6 (n = 1)	0	0.6 (n = 1)
Meningeal hemorrhage	0.6 (n = 1)	0.6 (n = 1)	0	0.6 (n = 1)	0	0	0.6 (n = 1)
Neonatal meningitis	0.6 (n = 1)	0.6 (n = 1)	0	0.6 (n = 1)	0	0	0.6 (n = 1)
Sylvian artery ischemia	0.6 (n = 1)	0.6 (n = 1)	0	0.6 (n = 1)	0	0	0.6 (n = 1)
Reflex syncope	1.9 (n = 3)	1.3 (n = 2)	0.6 (n = 1)	0	1.9 (n = 3)	0	1.9 (n = 3)
Long QT interval	0.6 (n = 1)	0.6 (n = 1)	0	0.6 (n = 1)	0	0	0.6 (n = 1)
Vagal hyperactivity	0.6 (n = 1)	0.6 (n = 1)	0	0	0.6 (n = 1)	0	0.6 (n = 1)
Infectious risk	1.9 (n = 3)	1.9 (n = 3)	0	0.6 (n = 1)	1.3 (n = 2)	0	1.9 (n = 3)
Pertussis	1.9 (n = 3)	1.3 (n = 2)	0.6 (n = 1)	1.9 (n = 3)	0	0	1.9 (n = 3)
Sepsis	0.6 (n = 1)	0.6 (n = 1)	0	0.6 (n = 1)	0	0	0.6 (n = 1)
RSV pulmonary infection	0.6 (n = 1)	0.6 (n = 1)	0	0.6 (n = 1)	0	0	0.6 (n = 1)
RSV bronchiolitis	1.9 (n = 3)	1.9 (n = 3)	0	0.6 (n = 1)	1.3 (n = 2)	0	1.9 (n = 3)
Tachyaerophagia	0.6 (n = 1)	0	0.6 (n = 1)	0	0.6 (n = 1)	0	0.6 (n = 1)
Non specified diagnosis	13.5 (n = 21)	12.2 (n = 19)	1.3 (n = 2)	1.3 (n = 2)	12.2 (n = 19)	0	13.5 (n = 21)

GER, gastro-esophageal reflux; RSV, respiratory syncytial virus

The results of Pearson test, giving an account of the relationship between the final diagnosis and the characteristics of the BRUE are shown in Table 2. The correlation with the onset of the BRUE finds a p-value of 0.287; for GER, p-value is 0.347. The correlation with the presence of complications finds a p-value of 0.018; for GER, this value is 0.865. The correlation with a surgical intervention finds a p-value of 0.135; for GER, this value is 0.072. We note that out of the 5 Hemi-Nissen surgical procedures, a diagnosis of GER was confirmed; consequently, 5.3% of GER required surgical treatment.

Furthermore, the relationship between BRUE recurrence and the duration separating the BRUE from hospital admission was evaluated by Fisher Exact Test, finding a recurrence in 36.5% (n=57) when BRUE occurred within 24 hours before admission, and in 18.6% (n=29) when it occurred previously, with a total of 55.1% (n=86) of recurrence. The p-value observed for this hypothesis comes back to 0.0001.

Discussion

Previous studies on infant BRUE have highlighted the importance of clinical detection and diagnostic evaluation of this entity, most often benign, but which in some cases could include life-threatening pathologies. Concomitantly, there is currently no cohort nor an epidemiological assessment of this pathology in Lebanon. The population studied is one of the largest in Lebanon. In fact, not only does Hôtel-Dieu de France form one of the benchmark tertiary-care centers in Lebanese territory, but it is also one of the oldest University Medical Centers in the country, hence the number of patients gathered over the years. In addition, data collected over the twenty years all came from the same archiving system, including as well complementary test results. Age distribution of the population shows

a clear predominance in the 1-6 months range; this is consistent with the data in the literature with a peak found between 3 and 4 months of life.⁹⁻¹¹ However, only 6.4% of infants were admitted at less than 24 hours of life. Suggested in 2011 by the British Association of Perinatal Medicine (BAPM), the *Sudden Unexpected Postnatal Collapse* (SUPC) is a subcategory of the previously defined ALTE, specific to neonates.¹⁰ In our study, this low share of representativeness of SUPC could be due to the preponderance of exclusion criteria in a level III maternity, with an increased importance given to prenatal diagnoses, in particular congenital heart diseases.²⁴ Furthermore, with a sex ratio of 1.1:1, our results concur with the slight male predominance mentioned in previous studies.⁹

However, the prevalence of admissions was quite variable over the years (Figure 1), with a cumulative percentage of 72.4% of total admissions before the year 2009. Subsequently, the number of hospitalized cases was in a constant decrease, to no longer exceed 6 admissions per year. This could be due to several factors. On one hand, with the national decentralization policy, University Medical Centers are multiplying on the Lebanese territory and multidisciplinary teams are gaining expertise; henceforth, it is no longer necessary to refer to a single center. On the other hand, improved prenatal screening allowed better management of the underlying vulnerability factors, thereby reducing the occurrence of BRUEs.

In our study, pregnancy and past medical history characteristics were unremarkable (Table 1). In addition, the variability of symptoms described by the parents (Figure 2) corresponds to the clinical heterogeneity described in the literature.²⁻⁴ However, some remain preponderant, namely hypotonia (49.4%), peripheral cyanosis (45.5%) and regurgitation (47.4%). Apnea (28.2%) and loss of contact (26.9%)

were less common. With an added normal initial physical examination found in most admissions, criteria defined by the AAP in 2016 were met.^{1,2,6} Although a briefness of the episode was found in 17.3% of cases, Hauk specified that BRUEs last less than 20 to 30 seconds.⁶ In our study, hospital stay lasted an average of 4.96 days [± 4.413], with a transfer to PICU in 35.9% of the cases and a stay duration of 6.3 days [± 5.369] in the latter. Our results remain consistent with previous data, the average of which varied between 4.4 and 10 days.¹⁶

Given that the population was recruited from a tertiary-care center, access to specialist consultations was easily granted, and occurred in 55 to 63%. Opposed to this, previous recommendations have mentioned resorting to specialists only in severe hospitalized cases.¹⁰ The fact remains that the specialties most requested in this context remain cardiology, gastroenterology and neurology;^{10,25} this was noted by our study as well. Moreover, an intensivist consultation was undertaken in 55.8%, while there was no request for a metabolician's opinion, unlike recommended by Italian guidelines.¹⁰ Due to the divergence of recommendations for first-line complementary explorations,^{1,25} those undertaken in our center fall within a fairly broad spectrum, with however a predominance for complete blood count (94.9%) and blood electrolytes (86.5%). Infectious assessment (67.3%), chest radiography (64.7%), EEG (50.6%), esophageal pH monitoring (44.9%) and ECG (49.3%) follow. In other words, in more than half of the cases, complementary tests included an infectious assessment, as well as gastroenterological, respiratory, cardiological and neurological. Consequently, this approach took place in accordance with the majority of recommendations, hence corresponding to the etiologies most frequently incriminated in BRUEs.²⁶⁻²⁹ Furthermore, Piumelli et al.,¹⁰ found similar data for cardiological and neurological examinations. In their study, infants underwent a cardiac ultrasound in 50%, an ECG in 50% and an EEG in 60%. Henceforth, the importance attached to cardiac and neurological examinations could reflect clinicians' concern regarding the patients' vital prognosis.¹⁰

However, the etiological value of a complementary test was variable, with higher prevalence for digestive explorations (Upper Gastro-Intestinal Series 24.4%; esophageal pH monitoring 34%), and lower for cardiac explorations (cardiac ultrasound 0.9%; ECG 3, 2%) or neurological (EEG 4.5%). This contrasts with the results reported by Brand et al, finding a prevalence of 5.9% (30). As for the infectious agents found, our results remain less conclusive than those objectified in the literature, insofar as staphylococci were predominant (5.6%); this bacteria, being commensal of the human skin, cannot be at the origin of a causal link inducing BRUEs.^{10,31-33}

Our study found a large etiological predominance attributed to confirmed GER (60.9%), all complementary tests combined. In spite of the lack of an exact prevalence for the implication of GER in BRUEs, particularly due to the bias caused by intercurrent apnea, previous studies converge to attribute a significant part for gastroenterological pathologies in triggering BRUEs, ranging from 20 to 54%.^{10,34-40} However, in 13.6% of admissions, and despite all workup, no etiology was incriminated in BRUEs; this contrasts with the figures, although variable, found in previous studies, ranging from 15 to 65%.^{1,10} Admittedly, it is customary to correlate a BRUE that occurred post-meal to a causal GER.²⁵ Our results show a postprandial occurrence in 45.5% of the cases and an association with regurgitation in 47.4%, thus ensuring that the rest of the GER identified do not exhibit these signs, therefore becoming non-pathognomonic. This is in line with the recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN)

and the European Society for Pediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) that do not endorse specific therapeutic management in the event of a combination of a BRUE with regurgitation.^{41,42}

Regarding the onset of BRUEs, there is no statistically significant correlation between the delay separating the latter and hospital admission, and the final diagnosis retained (p-value: 0.287) (Table 2); this hypothesis has not been evoked previously. On the other hand, recurrence of the episodes was found in 55.1% of the cases, similar to previous data, which describes a range between 30 and 60%.^{10,43-45} Nonetheless, when hospitalization occurs more than 24 hours after the onset of a BRUE, reiteration of the episode takes place in 18.6% of cases, with a high statistical significance in our study (p-value: 0.0001). Even if the majority of studies agree on a reduction in the risk of a new occurrence with time,⁴³⁻⁴⁵ our results go against them, and confirm in this way the necessity of cardiorespiratory monitoring.¹⁰

The other complications listed, however, remain inconclusive. In particular, mortality rate was 1.3% following an admission for BRUE, slightly exceeding that previously described.⁴⁶⁻⁴⁸ The fact remains that the correlation between the occurrence of a complication and the final diagnosis remains significant (p-value: 0.018). On the one hand, this is linked to the clinical and etiological heterogeneity of BRUEs.²⁻⁴ However, on the other hand, Piumelli had also shown that complications could increase with the length of hospital stay.¹⁰ Their results were similar to those found by Gatto et al in a 4-year retrospective study conducted in 2018.⁵ Several anti-reflux molecules were suggested and prescribed, namely proton pump inhibitors (Esomeprazole, Omeprazole), dopamine receptor antagonists (Domperidone, Metoclopramide), serotonin receptor agonists (Cisapride) and antihistamines (Ranitidine). However, we find a relative tendency to single out Domperidone; this goes against what has been described in the literature, in particular by Duncan, favoring the use of acid suppressants.⁴⁸ Nevertheless, milk changing or thickening was prescribed in 17.9% of cases, all forms combined. The meta-analysis undertaken by the National Institute for Health and Care Excellence (NICE) in 2015 confirms a reduction in regurgitation and exposure to reflux acidity; however, there is no established causal relationship with the impact on BRUEs, and therefore no recommendations have been issued on this subject.⁴⁹ Although carried out on a large and fairly representative sample of the Lebanese population, the results of our study could not be extrapolated nationwide. In fact, over the years, the development of tertiary-care centers at the national level favors the distribution of specialized medicine and consequently reduces the number of cases referred from peripheral regions. In spite of this, there are no currently published studies concerning the epidemiology of BRUEs in Lebanon; this may be the subject of further multicenter study. Another limitation to our study could also be due to its retrospective nature, making it difficult to collect certain data, in particular concerning semiology and physical examination. Cohort follow-up would be interesting, especially for the evaluation of the long-term consequences of hospitalized patients.

Conclusion

BRUE is considered, par excellence, an entity with clinical and etiological heterogeneity, without a well-defined etiopathogenesis. However, there is no consensus in the literature concerning the prevalence of this pathology, nor its characteristics and adequate management. This study, identifying patients hospitalized for BRUE from January 2008 to June 2018, confirmed the preponderance of

GER as the main underlying etiology, a statement comparable to the data in the literature. It remains the only cohort described in Lebanon and MENA region over a period of twenty years. However, the results obtained remain only descriptive, hampered by the retrospective nature of the study, in the absence of a comparative control group. An assessment of the long-term consequences, as well as the predisposing factors, could be the subject of a later study, in order to develop good practice recommendations adapted to the local population.

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Conflicts of interest

The authors declare there are no conflicts of interest.

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