

## Original Article

# Anaphylaxis in the Pediatric Emergency Department: Analysis of 133 Cases After an Allergy Workup

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**What is already known about this topic?** Studies on pediatric anaphylaxis are scarce, and most are from the United States and Canada. Anaphylaxis is underdiagnosed, underreported, and undertreated. The characteristics of pediatric anaphylaxis differ from those of adults and according to age range.

**What does this article add to our knowledge?** The incidence of pediatric anaphylaxis in a tertiary hospital in Madrid, Spain, was higher than has been reported in adults. Infants were the most frequently exposed group. There was a considerable discrepancy between the etiology of anaphylaxis suspected in the pediatric emergency department and the final diagnosis.

**How does this study impact current management guidelines?** Anaphylaxis workups in children should target food allergy. Guidelines must be implemented to prevent recurrences. Children should be offered an allergy workup. The etiology of anaphylaxis should be confirmed on the basis of allergological data.

**BACKGROUND:** Data on the incidence and characteristics of pediatric anaphylaxis are scarce. Reported causes of anaphylaxis are mostly those suspected by the physician in the emergency department (ED), which may not coincide with the real triggers. **OBJECTIVES:** To investigate the incidence, management, and etiology of pediatric anaphylaxis in the ED of a Spanish tertiary hospital and to determine the concordance between the suspected etiology in the ED and diagnosis after the allergy workup.

**METHODS:** We performed an observational, descriptive study of all patients with anaphylaxis attended in the pediatric ED from 2012 to 2014. Cases were considered anaphylaxis based on National Institute of Allergy and Infectious Diseases/Food Allergy and Anaphylaxis Network criteria. We recorded data on clinical characteristics, management, etiology suspected by the ED physician and patient (or relatives), and the workup performed in the allergy department.

**RESULTS:** We recorded 133 cases of anaphylaxis (incidence, 0.12%), with 20 cases (15%) recorded in children younger than 12 months. Anaphylaxis was correctly diagnosed in the ED in 70 cases (53%). Food allergy was the cause of anaphylaxis in 106 out of 118 studied in the allergy department (AD) (90%). The final etiology differed from the etiology initially suspected in the ED in 42 cases (39%). After the study, the frequency of patients with unidentified triggers decreased by 75%.

**CONCLUSIONS:** The incidence of anaphylaxis is higher in children than previously reported in adults from the same center, and food is the trigger in most cases. To prevent erroneous diagnoses, the etiology of anaphylaxis should be established after an appropriate workup. © 2017 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2017;■:■-■)

**Key words:** Anaphylaxis; Pediatric; Emergency department; Epidemiology; Food allergy; Diagnosis; Etiology; Epinephrine

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One of the most generally accepted definitions of anaphylaxis states that it is a severe, potentially life-threatening systemic hypersensitivity reaction.<sup>1</sup> Several clinical criteria for anaphylaxis have been formulated. The most widely used clinical criteria are those of the National Institute of Allergy and Infectious Diseases (NIAID)/Food Allergy and Anaphylaxis Network (FAAN) consensus,<sup>2</sup> which was based on the opinion of representatives of a number of international allergy organizations. However, this definition is not universally accepted.

Many factors make epidemiologic studies complex and challenging. No consensus has been reached on diagnostic and inclusion criteria, onset of symptoms is rapid and severe, and many of them are common to other diseases, which probably results in

**Abbreviations used**

AD- Allergy department

ED- Emergency department

FAAN- Food Allergy and Anaphylaxis Network

NIAID- National Institute of Allergy and Infectious Diseases

PED- Pediatric emergency department

the fact that the diagnosis of anaphylaxis in the emergency department (ED) has been consistently reported to be low.<sup>3</sup>

Data on the incidence of anaphylaxis are scarce, and even fewer data are available on pediatric anaphylaxis. The few studies published on specific aspects of pediatric anaphylaxis in recent years were all performed in the United States and Canada and revealed incidence rates ranging from 0.11% to 0.41%.<sup>4-8</sup> The incidence of pediatric anaphylaxis has been increasing in the last decade.<sup>4,8</sup> These marked differences between studies may be due in part to methodological aspects, although they may also result from the specific characteristics of the populations analyzed and geographic peculiarities.

Pediatric anaphylaxis differs from adult anaphylaxis in factors such as comorbid diseases, risk factors, and etiological agents. It may also vary with the child's age.<sup>9</sup> Consequently, an in-depth study of anaphylaxis in pediatric patients is fully warranted.

The difficulties inherent to the diagnosis of anaphylaxis are increased in the ED, where the etiology can only be suspected. The objective of the ED should be treating the acute anaphylaxis episode, rather than studying its etiology. However, many epidemiological data on the causes of anaphylaxis are based on ED reports. The suspicion of the attending physician should subsequently be confirmed by a full allergy workup. Important differences between the etiological diagnosis made in the ED and the definitive cause of anaphylaxis have been reported in previous studies.<sup>10,11</sup>

The objectives of this study were to investigate the incidence, management, and etiology of pediatric anaphylaxis in a tertiary hospital in Spain, and to determine the concordance between the diagnosis made in the pediatric emergency department (PED) and that confirmed after the allergy workup.

**METHODS****Design**

We performed an observational, descriptive study of patients attended at the PED of Hospital Materno Infantil Gregorio Marañón, Madrid, Spain, with clinical symptoms of anaphylaxis between March 2012 and March 2014. Our hospital is a referral center for a catchment population of 650,000 people in the city of Madrid, Spain. The PED attends patients aged up to 15 years; older patients are referred to the general ED. The PED is attended by pediatricians with a special training in Emergency Medicine. They are assisted by pediatric residents, who are always overlooked by a senior physician.

This study was approved by the Ethics Committee for Medical Research of our institution.

**Selection of participants**

The electronic medical records of the PED were searched for patients with a diagnosis related to anaphylaxis. For this purpose, we used a list of alphanumeric chains that has been validated in Spain. The terms included were *alerg* (allergy), *anafila* (anaphylaxis), *urtica* (urticaria), *hipersensibili* (hypersensitivity), *eritema* (erythema),

*picadu* (bite), *advers* (adverse), *edem* (edema), *medica* (drug), *reacc* (reaction), *alimen* (food), *abeja* (honey bee), and *avispa* (wasp).<sup>12</sup> All the resulting records were thoroughly reviewed by 2 independent allergy specialists, randomly chosen from a group of 5. In cases in which it was unclear whether the clinical criteria had been fulfilled, a third reviewer was consulted, and the majority criteria were applied.

Anaphylaxis was defined as fulfillment of the clinical criteria established by the NIAID/FAAN, regardless of the initial diagnosis that had been assigned to them in the emergency report.

NIAID/FAAN guidelines consider the diagnosis of anaphylaxis to be highly likely when any of the following criteria are fulfilled: (1) acute onset, with involvement of skin-mucosal tissue and symptoms of respiratory involvement or signs of cardiovascular dysfunction or hypotension; (2) involvement of 2 or more systems (skin-mucosa, respiratory, cardiovascular, gastrointestinal) after recent exposure to a likely allergen; or (3) signs of cardiovascular dysfunction after exposure to a known allergen.<sup>2</sup>

Patients who had been admitted for other reasons and presented anaphylactic symptoms during their stay in hospital were not included.

As part of the clinical routine, patients received written instructions to ask for a date in the allergy department (AD), where they underwent an allergy workup to determine the etiology of the episode.

**Outcomes**

Anaphylactic reactions were classified according to severity. An episode was defined as severe if the patient presented arterial oxygen saturation of 92% or less, hypotension (systolic blood pressure <70 mm Hg for children younger than 1 year, <[70 mm Hg + 2 × age] for children aged 1-10 years, and <90 mm Hg for older children), and/or loss of consciousness.<sup>13</sup> Within this group, anaphylactic shock was established in cases with hypotension or loss of consciousness.

We recorded demographic data, clinical characteristics of the signs and symptoms (urticaria, angioedema, pruritus, flushing, dyspnea, signs of laryngeal edema, wheezing, arterial oxygen saturation, cyanosis, abdominal pain, nausea, vomiting, diarrhea, heart rate, blood pressure, instability, dizziness, loss of consciousness), treatment, etiological factors suspected by the patient and the PED physician, and the number of patients attended daily in the PED. Suspected triggers were extracted from the clinical history. The PED anaphylaxis/allergic reaction protocol requires the physician to ask the patient about possible triggers. If there was not a clear suspicion, it was recorded as an unidentified trigger.

The data collected in the AD were skin test and challenge test results, total and specific IgE values, complete blood cell count values, biochemistry values, urine catecholamines levels, and baseline serum tryptase levels, when indicated.

Patients who were attended in the PED more than once during the period of the study were counted as different cases because triggers and clinical presentation were not necessarily identical in every episode.

**Analysis**

The statistical analysis was performed with IBM SPSS Statistics 16.0 for Windows. Qualitative variables are expressed as frequency and percentage, and quantitative variables are expressed as median and interquartile range.

Categorical variables were compared using the chi-square test, the Fisher exact test, and Cochran Q test; quantitative variables were

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