

Management of anaphylaxis in Spain: pediatric emergency care providers' knowledge

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Background Acute care providers must diagnose and treat patients with anaphylaxis. The objective was to analyze Spanish pediatric emergency departments' (ED) providers' knowledge of the international recommendations for the management of anaphylaxis.

Methods A web-based survey including providers (both attending and residents) from seven Spanish pediatric EDs was conducted. To analyze the knowledge of the identification of anaphylaxis, we used the diagnostic criteria given by the National Institute of Allergy and Infectious Disease and Food Allergy and the Food Allergy and Anaphylaxis Network (2005). To analyze the management, we used the practical recommendations on the management of anaphylaxis published by the Joint Task Force on Practice Parameters (2014).

Results A total of 425 physicians received the link and 337 (79.2%) completed the survey (138 attending, 76.6%; 199 residents, 81.2%, $P < 0.05$). More than 90% of the providers correctly identified the anaphylaxis, except for not diagnosing it when reduced blood pressure is detected after exposure to a known allergen (69.7%) and misdiagnosis of anaphylaxis in patients with progressive urticaria with significant angioedema (65.9%). Nearly 100% identified epinephrine as the first-line treatment. Main failures of treatment were related to the position of the patient, the

effect of medications in preventing a biphasic reaction, the recommended time to observe patients, and those related to the follow-up. No significant differences were found between attendings and residents.

Conclusion Even though the Spanish pediatric ED providers' knowledge of the management of anaphylaxis is good, certain improvement areas are identified in both the identification and the management of these patients. *European Journal of Emergency Medicine* 00:000–000 Copyright © 2018 Wolters Kluwer Health, Inc. All rights reserved.

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Introduction

Anaphylaxis is a severe allergic reaction with rapid onset that can affect young healthy individuals and death can occur within minutes [1]. Therefore, it is imperative that every acute care provider is able to diagnose and treat these patients promptly to minimize morbidity and mortality rates.

In July 2005, the National Institute of Allergy and Infectious Disease and Food Allergy and the Food Allergy and Anaphylaxis Network (NIAID/FAAN) established the currently most recommended diagnostic criteria (Table 1) [1]. On the basis of these criteria and motivated by the increase in cases of anaphylaxis in

emergency departments (EDs) [2], in recent years, many clinical guidelines have been designed to unify the management of these patients [3,4]. In 2014, the Joint Task Force on Practice Parameters (representing the American Academy of Allergy, Asthma and Immunology, American College of Allergy, Asthma and Immunology and the Joint Council of Allergy, Asthma and Immunology) published an update of practical recommendations on the management of anaphylaxis [5]. Despite this, there are problems in the correct identification and management of anaphylaxis [6–8].

Despite the importance of an adequate management of these children, no study has analyzed the anaphylaxis knowledge of European Pediatric Emergency Care providers. In 2015, the Spanish Society of Pediatric Emergencies endorsed the development of a multicenter

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Table 1 National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network criteria for the diagnosis of anaphylaxis

Acute onset of illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (e.g. generalized hives, pruritus or flushing, swollen lips, tongue, or uvula) and at least one of the following: Respiratory compromise (e.g. dyspnea, wheeze or bronchospasm, stridor, reduced peak expiratory flow, hypoxemia) Reduced blood pressure or associated symptoms of end-organ dysfunction [e.g. hypotonia (collapse), syncope, incontinence]
Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours): Involvement of the skin or mucosal tissue (e.g. generalized hives, itch or flush, swollen lips, tongue, or uvula) Respiratory compromise (e.g. dyspnea, wheeze or bronchospasm, stridor, reduced peak expiratory flow, hypoxemia) Reduced blood pressure or associated symptoms [e.g. hypotonia (collapse), syncope, incontinence] Persistent gastrointestinal tract symptoms (e.g. crampy abdominal pain, vomiting)
Reduced blood pressure after exposure to known allergen for that patient (minutes to several hours): Infants and children: low systolic blood pressure (age specific) or >30% decrease in systolic blood pressure. Adults: systolic blood pressure < 90 mmHg or > 30% decrease from that patient's baseline.

study in two phases. First, we should analyze pediatric ED's providers' knowledge of the recommendations for the management of anaphylaxis. Afterwards, we should assess the management of children with anaphylaxis admitted to the Spanish pediatric EDs. In this study, we present the results of the first phase.

Objective

The aim of this study was to analyze the Spanish pediatric ED providers' knowledge of the international recommendations for the management of anaphylaxis.

Methods

We designed a web-based survey completed through Google Drive (Supplementary Table 1, Supplemental digital content 1, <http://links.lww.com/EJEM/A186>) of physicians who attend children in EDs.

Design of the survey

We used the diagnostic criteria given by the NIAID/FAAN to analyze the knowledge of the diagnostic criteria of anaphylaxis [1]. To analyze the knowledge of the recommendations for the management of children with anaphylaxis, we used the update of practical recommendations on the management of anaphylaxis published by the Joint Task Force on Practice Parameters [5].

Setting and participants

We contacted providers from seven Spanish pediatric EDs, both attending physicians and residents, irrespective of their level of training or experience. Questionnaires were elaborated with the site investigators (directors of the seven pediatric ED) before the initiation of the study to confirm understanding of text. Afterwards, the main investigator (M.O.) sent a link for the web-based survey to site

investigators, and these sent the link to the providers of their ED.

Ethics

We obtained overall approval from the Clinical Research Ethics Committee of the Basque Country. No informed consent was required.

Statistical analysis

We used SPSS, version 22 (SPSS Inc., Chicago, Illinois, USA). The descriptive statistics were reported as absolute frequencies or percentages in the case of qualitative variables and as medians and interquartile range for the quantitative variables. Statistical significance was calculated using the χ^2 -test or Fisher's test in categorical variables. A *P*-value of less than 0.05 was considered statistically significant.

Results

A total of 425 physicians from seven EDs received the link to the survey, 180 (42%) attendings and 245 (58%) residents. Of these, 337 (79.2%) completed it (138 attending, 76.6%; 199 residents, 81.2%; NS) (Supplementary Table 2, Supplemental digital content 2, <http://links.lww.com/EJEM/A187>).

The median age of the respondents was 28 years (range: 25–64 years). Excluding the residency training program, the median duration of experience was 5 years (range: 1–36 years).

Globally, we received 5729 responses to the different items, 4418 being correct (77.1%; 83% about diagnosis and 74.6% about treatment), without differences between attendings (78.1%, 95% confidence interval: 71.2–85) and residents (76.4%, 95% confidence interval: 70.5–82.3).

Both attending and residents tended to correctly identify the anaphylaxis (Table 2), except for recognizing anaphylaxis when a reduced blood pressure is noted after minutes/hours of the exposure to a known allergen and misdiagnosing anaphylaxis in patients with progressive urticaria and significant angioedema.

Nearly all the respondents identified the epinephrine as the first-line treatment (Table 3). Main failures related to the treatment were associated with the position of the patient, the value of different medications to prevent the biphasic reaction, the recommended time to observe these patients in the ED, and those related to the follow-up. It is noteworthy that less than 90% of providers identified the correct dose and place to administer the epinephrine, this proportion being lower among the attendings. Less than 30% recommended referral to an allergist and prescription of two devices.

Discussion

The Spanish pediatric emergency care providers' knowledge of the management of anaphylaxis is good,

Table 2 Pediatric emergency care providers' knowledge of the identification of patients with anaphylaxis

Anaphylaxis diagnostic skills	Attendings (<i>n</i> = 138)	Residents (<i>n</i> = 199)	Global (<i>n</i> = 337)
Which of the following cases fulfill the diagnostic criteria for anaphylaxis?			
Reduced blood pressure in minutes or hours after exposure to known allergen?	106 (76.8); 69.8–83.8	129 (64.8); 58.2–71.4	235 (69.7); 64.8–74.6
Yes			
Acute onset of cutaneous symptoms (urticaria, erythema, pruritus) and respiratory compromise. Yes	137 (99.3); 97.9–100	193 (97); 94.6–99.4	330 (97.9); 96.4–99.4
Progressive urticaria with significant angioedema. No	87 (63); 55–71.1	135 (67.8); 61.3–74.3	222 (65.9); 60.8–70.9
Rapid onset of hypotension and gastrointestinal symptoms (vomiting, colicky pain, diarrhea). Yes	121 (87.7); 82.2–93.2	169 (84.9); 79.5–90.3	290 (86); 82.3–89.7
Acute onset of cutaneous symptoms and hypotension. Yes	135 (97.8); 95.3–100	188 (94.5); 91.3–97.6	323 (95.8); 93.7–98

Values are represented as *n* (%); 95% confidence interval.

Table 3 Pediatric emergency care providers' knowledge of the management of patients with anaphylaxis

Anaphylaxis treatment skills	Attendings (<i>n</i> = 138)	Residents (<i>n</i> = 199)	Global (<i>n</i> = 337)
Actions to be performed in all patients with suspected anaphylaxis:			
Continuous monitoring with repeated blood pressure measurement. Yes	137 (99.3); 97.9–100	197 (99); 97.6–100	334 (99.1); 98.1–100
Oxygen administration. Yes	123 (89.1); 83.9–94.3	162 (81.4); 76–86.8	285 (84.6); 80.7–88.4
Venous access. Yes	117 (84.8); 78.8–90.8	170 (85.4); 80.5–90.3	287 (85.2); 81.4–89
Position the patient in supine. Yes	86 (62.3); 54.2–70.4	112 (56.3); 49.4–63.2	198 (58.8); 53.5–64
Position the patient in Trendelenburg. No	99 (71.7); 64.2–79.2	137 (68.8); 62.4–75.2	236 (70); 65.1–74.9
The first line of treatment for patients experiencing anaphylaxis is: epinephrine	138 (100); –	198 (99.5); 98.5–100	336 (99.7); 99.1–100
The preferred route for epinephrine administration is: intramuscular	123 (89.1); 83.9–94.3	189 (95); 92–98	312 (92.6); 89.8–95.4
The recommended dose of epinephrine is 0.01 ml/kg (1 : 1000)	121 (87.7); 82.2–93.2	154 (77.4); 71.6–83.2	275 (81.6); 77.5–85.7
The recommended site for epinephrine injection: anterolateral thigh	110 (79.7); 73–86.4	180 (90.5); 86.4–94.6	290 (86.1); 82.4–89.8
Prevention of biphasic reaction (antihistamines +/- corticosteroids): none	74 (53.6); 45.3–61.9	102 (51.3); 44.4–58.2	176 (52.2); 46.9–57.5
Recommended time of observation in the emergency department: 4–8 h	80 (58); 49.8–66.2	112 (56.3); 49.4–63.2	192 (57); 51.7–62.3
Which of the following recommendations should be made to all patients discharged from an emergency department?			
Education on the use of self-injectable epinephrine and prescribe two devices and referral to allergy. Yes	38 (27.5); 20–34.9	59 (29.6); 17.4–41.8	97 (28.8); 19.8–37.8
Education on the use of self-injectable epinephrine and prescribe two devices. Yes	54 (39.1); 31–47.2	81 (40.7); 33.9–47.5	135 (40.1); 34.9–45.3
Referral to allergist. Yes	96 (69.6); 62–77.3	138 (69.3); 62.9–75.7	234 (69.4); 64.5–74.3

Values are represented as *n* (%); 95% confidence interval.

although it may be improved in both the identification and the management of these patients.

Rapid diagnosis and early initiation of therapy are essential in anaphylaxis [5,9]. Globally, providers identify correctly children with anaphylaxis. Nevertheless, confusion may appear in two situations. The criterion of detection of reduced blood pressure in minutes/hours after exposure to a known allergen was provided largely to accommodate anaphylaxis occurring in an intraoperative setting, hypotension without any other finding in the ED being quite uncommon [10]. On the other hand, misdiagnosis with anaphylaxis in children with progressive urticaria and significant angioedema has been reported previously [11] and may be acceptable. Underdiagnoses of anaphylaxis can be detrimental if treatment is delayed.

After addressing the airway, breathing, and circulation, the next step is to administer epinephrine [9]. In our study, nearly all the physicians correctly identified epinephrine for treating these children, these results being even better than those reported previously [11–12]. We did not find significant differences between residents and attendings. The training of residents has been noted to be an impetus for attending physicians to stay abreast of the most current literature [13]. Furthermore, the

Advanced Pediatric Life Support course in the training of professionals who care for pediatric emergencies, where the management of anaphylaxis in children is addressed in a separated chapter, was introduced in Spain in 2005. Most providers who have received it, mainly those working in the hospital setting, consider that it has a major impact on clinical practice [14]. In addition, the vast majority identified correctly the intramuscular route as the preferred for the epinephrine, in contrast with other series [11, 13]. One in 10 physicians did not choose the correct dose, site, or route for epinephrine, the most common mistakes being choosing the cardiopulmonary resuscitation dose for epinephrine (0.1 ml/kg of 1 : 10 000), the deltoid region, and the subcutaneous route. We should emphasize the importance of algorithms and 'medication cards', which provides essential information including descriptions, dosing, and route of administration of medications to avoid failures.

This adherence to the guidelines contrasts to what is reported in practice [6,7,15,16], second-line medications being used more commonly than the epinephrine [7,15,16]. Certain doubts about the safety of intramuscular epinephrine [8], the fact that anaphylaxis can be self-limited and patients may appear asymptomatic when reaching the ED [5] may explain this discordance.

The recommended position for the patients with anaphylaxis remains controversial [17]. The Trendelenburg position is not recommended by American Academy of Allergy, Asthma and Immunology and American College of Allergy, Asthma and Immunology [5]. Considering that respiratory compromise is more frequent than cardiovascular compromise [15], we considered that supine, or even a more upright position, is the most adequate position for patients with anaphylaxis. Our study reflects these controversies. This aspect should be better clarified when designing guidelines.

After treatment of anaphylaxis, observation in the ED is recommended because a biphasic reaction may occur [9]. The occurrence of a biphasic reaction is unpredictable and the time elapsed between initial presentation and onset of the biphasic reaction is variable. Thus, there is no universally ideal duration of observation after an anaphylactic reaction [9]. Most biphasic reactions occur within 4–8 h of initial presentation; therefore, a minimum observation period of 4–8 h after anaphylaxis is the most commonly recommended [1,3,4,9]. There is no evidence supporting the use of glucocorticoids and antihistamines to prevent biphasic reactions [18–19]. Despite this, both medications are widely recommended [4,9].

Finally, education about the prevention and prehospital management of anaphylaxis is critical and the provider must give explicit instructions to the patient and family on when and how to administer epinephrine [9]. These children may develop new episodes and the prompt administration of epinephrine is essential, sometimes requiring multiple doses [20]. In our study, only 40% of providers educate the families on the use of self-injectable epinephrine and prescribe two devices as recommended [5]. It is noteworthy that some respondents would not prescribe even one device. Only 70% of the providers of our study considered referral to an allergist as recommended for all children with anaphylaxis.

This study has certain limitations. We included providers from seven pediatric EDs included in the Spanish Society of Pediatric Emergencies. Therefore, generalization of these results to other EDs has to be done with caution. Nevertheless, we chose EDs from different regions and the response rate was excellent, reflecting correctly the knowledge of different providers who manage these patients in a pediatric ED. On the other hand, the survey was not validated previously. However, it was based on the diagnostic criteria given by the NIAID/FAAN and the recommendations on the management published by the Joint Task Force on Practice Parameters in 2015. There was no time limit to complete the survey (this option is not offered by Google Drive), and the participants could have had time enough to look for the correct answers in any medical resource, as in the vast majority of the survey-based studies. Nevertheless,

considering that it was an anonymous questionnaire, we do not believe that this was relevant. We did not include exposure to a likely allergen when asking about rapid onset of hypotension and gastrointestinal symptoms as the NIAID/FAAN established. Even if we know this would mean more correct from an academic point of view, we wanted to include anaphylaxis in the differential diagnoses of a patient presenting with gastrointestinal symptoms and hypotension as exposure to a likely allergen can hardly be identified during an emergency situation. Finally, this study may not reflect the real management of the children with anaphylaxis. Yet, this was not the objective of the study and it will be addressed in the second phase of the endorsement received from the Spanish Society of Pediatric Emergencies.

Conclusion

The anaphylaxis knowledge of Spanish pediatric emergency care providers is good. Nevertheless, certain improvement areas are detected both in the identification and in the management of these patients, mainly related to the recommendations and education provided when discharging from the ED. This study addresses the importance of the ongoing continuous education of pediatric emergency physicians.

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Conflicts of interest

There are no conflicts of interest.

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