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The gaps in anaphylaxis diagnosis and management by French physicians.

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To the Editor:

Several studies have assessed the knowledge of health professionals in recognition and treatment of anaphylaxis using case-based surveys with conflicting results [1-3]. The proportion of responders able to recognize anaphylaxis and treat with appropriate adrenaline ranged from 56% to 95% [1, 3]. The causes for this under optimal management are not clearly understood. In this context, EAACI anaphylaxis guidelines were recently updated.

The aim of the current study was to assess physician's knowledge regarding diagnosis and management of anaphylaxis in children and then to identify causes for the deficiencies.

We conducted a survey using a 2 part questionnaire. In the first part, skills on anaphylaxis diagnosis and management were evaluated through a clinical scenario; in the second part, factors associated with correct diagnosis and management were assessed.

In the first part, the questions were based on a clinical scenario involving a 2-year old child with a peanut-induced anaphylaxis. This scenario was inspired by Krugman et al. with significant modifications [3] (Table 1). It was reviewed and approved as an anaphylaxis case by expert allergists from the anaphylaxis working group of the Société Française d'Allergologie in accordance with widely accepted criteria of anaphylaxis [4]. EAACI guidelines on anaphylaxis were used as the reference text to define the correct responses which were also reviewed and approved by the same expert allergists [5]. The questionnaire was completed by physicians during continuing medical education (CME) courses prior to receiving any information on this topic. Physicians were asked to respond to 9 statements regarding diagnosis and management of this food-induced anaphylaxis. Five of them were considered key questions (Table 1): 1. correct diagnosis; 2. immediate intramuscular adrenaline injection; 3. immediate call for medical transport to a pediatric emergency service; 4. prescription of adrenaline auto-injector before discharge; 5. referral to an allergist for further evaluation within 1-2 months.

In the second part, questions were designed to identify factors that could influence diagnosis and treatment of anaphylaxis, mostly regarding the use of adrenaline. Physicians were asked through a multiple choice question if they would inject adrenaline intramuscularly in case of anaphylaxis and the reasons for their refusal if any. We evaluated: location and duration of medical practice, medical specialty, training in food allergy during the last 3 years either during residency or during CME, caring for food allergic patients alone or in collaboration with an allergist, previous experience in injecting adrenaline for allergic symptoms.

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Statistical analysis was performed by the Biostatistics Unit of the Lille University Hospital. Statistical testing was done at the two-tailed α level of 0.05. Data were analyzed using the SAS software package, release 9.3 (SAS Institute, Cary, NC). All categorical variables were described with frequencies and percentages. Association of correct diagnosis of anaphylaxis, 5 correct key responses, use of adrenaline in the scenario with factors were studied using Chi-Square tests or Fisher's exact tests when the expected cell frequency was <5 . The magnitude of the association was assessed by calculating the standardized differences. An absolute standardized differences >0.20 was interpreted as meaningful difference [6].

A total of 318 physicians were enrolled in the present survey; all physicians completed the questionnaire. They were general practitioners ($n=87$, 28%), pediatricians ($n=72$, 23%), allergists ($n=30$, 10%), school doctors and mother and child care doctors ($n=61$, 19%) and pediatric junior doctors ($n=62$, 20%). Their practice was exclusively private practice (29%), exclusively hospital (31%), mixed (7%) or others (33%).

Part 1.

Overall, 70% of participants agreed that the clinical scenario was consistent with anaphylaxis; 24% refused the diagnosis because hemodynamic disorders or respiratory distress were missing. Thirty-one percent of physicians agreed to administer adrenaline intramuscularly first. Only 30% of physicians correctly agreed with both diagnosis and initial treatment with adrenaline; 74% of physicians chose to administer antihistamine and bronchodilators first. Only half of physicians agreed it was necessary to transfer the child to a pediatric emergency unit. Nearly a third of physicians thought that a one-hour observation period after anaphylaxis was enough. These responses are detailed in table 1. A step by step approach of the 5 key questions is shown in table 1. Regarding the 5 key questions determining an optimal management, only 19% of the 318 doctors got all responses in accordance with guidelines.

Part 2. The responses to the question "In case of anaphylaxis in a child would you immediately inject intramuscular adrenaline?" were as follow (several responses were possible, expressed as percentage of the 318 responders): "yes" (59%), "no, only after calling the emergency ward" (22%), "no, only in case of hemodynamic or respiratory disorders" (18%), "no, I have never used it before" (3%), "no, only in the presence of an emergency physician" (3%), "no, because adrenaline has side effects" (2%).

A correct diagnosis was associated with a hospital practice (standardized difference, 56.8%, $p=0.0002$). The use of adrenaline in the scenario was associated with a correct diagnosis ($p<10^{-4}$), pediatric specialty (standardized difference, 89.8%, $p<10^{-4}$), a recent CME on food allergy (standardized difference, 37.8%, $p=0.005$) and experience of adrenaline injection in real practice (standardized difference, 28.2%, $p=0.019$). A correct response to all the 5 key questions was associated with pediatric specialty (standardized difference, 89.4%, $p<10^{-4}$) and a recent CME on food allergy (standardized difference, 30.7%, $p=0.04$). The proportion of correct responses to the clinical scenario according medical specialties are shown in table 2. Being an allergist, location and duration of medical practice, caring for food allergic patients alone or with an allergist were not significantly associated with a correct diagnosis or a better management.

Our findings confirm the gaps in physicians' knowledge of diagnosis and management of pediatric anaphylaxis. Diagnosis of anaphylaxis, evaluation of the severity of the adverse reactions and the use of adrenaline were insufficient for the majority of the physicians. Only 19% of the participants had an optimal management step by step from diagnosis to referral to an allergist; 31% of them completed the correct diagnosis and the appropriate treatment with intramuscular adrenaline. Pediatric specialty and CME on food allergy were associated with a better diagnosis, a more frequent use of adrenaline and a better 5-step management.

Recognizing anaphylaxis is the first step in the management of allergic reaction. In our study, physicians under evaluated the severity of the clinical signs and symptoms so that about half of them thought the child had an oral syndrome. One quarter even refused the diagnosis because hemodynamic disorders or respiratory distress were missing. Physicians were more likely to agree with adrenaline intramuscular injection if they agreed with the diagnosis of anaphylaxis. These findings highlight the need for an easier definition of anaphylaxis especially for non-allergists to improve the diagnosis and consequently the appropriate treatment with adrenaline. However, recognition of the diagnosis of anaphylaxis is rather correct but the indication of intramuscular adrenaline injection in children without cardiovascular or respiratory compromise may not be shared by all the physicians. This could also be explained by the relatively low level evidence of several European recommendations on anaphylaxis management [5]. Our results are worse than those described in other studies [1, 3, 7]. Four hundred and ten questionnaires were filled in by pediatricians during national congresses in Turkey and 87% of them agreed with the diagnosis of anaphylaxis described in clinical cases scenario, 86% would inject adrenaline in mild anaphylaxis scenario [7]. An online international survey embedded in a case discussion of food-induced

anaphylaxis was distributed by internet to different populations of providers and caregivers [1]. Of 7822 responders (physicians 37%), over 80% of them in all groups correctly identified the case of anaphylaxis with prominent skin and respiratory symptoms; however, only 55% correctly recognized the case without skin symptoms. Ninety-five percent selected adrenaline as the most appropriate treatment for anaphylaxis [1]. Krugman et al. performed a survey based on clinical case scenario distributed by mail to a US national random sample of 1130 pediatricians [3]. Of the 468 (41%) responders, 70% agreed that the scenario was consistent with an anaphylaxis and 72% chose to inject adrenaline [3].

Our findings highlight also the failure to identify the need for a prompt phone call to a medical emergency service and a minimal 6-8 hour medical observation after an anaphylaxis in accordance with EAACI guidelines: only 50% of participants would call a medical service immediately and 32% would be satisfied with a 1-hour observation after resolution of the symptoms [4]. For those with cardiovascular symptoms, a close medical 12-24 hour observation is even recommended [5]. Finally, 22% of responders did not prescribe an adrenaline auto-injector after resolution of the symptoms, in contradiction with EAACI and French guidelines that firmly recommend an adrenaline auto-injector prescription before discharge following a food-induced anaphylaxis [5].

We then analyzed factors that could influence diagnosis and management of anaphylaxis. Our findings suggest that food allergy CME may be an important factor associated with correct diagnosis, appropriate adrenaline treatment and finally a 5-step optimal management of anaphylaxis. Results from previous research on CME effectiveness, not only in the field of allergy, have been reviewed and are conflicting [8]. Krugman et al. reported that food allergy CME did not predict a correct diagnosis and treatment with adrenaline by health care providers [3]. They found that health care providers who are used to caring for food allergic patients provide better acute management in case of anaphylaxis. In our study, caring for allergic patients was not associated with a better anaphylaxis management. Arroabarren et al. reported that the application of an anaphylaxis protocol improved physicians' skills to manage anaphylaxis in a pediatric emergency unit [9].

The strong point of our study is that the physicians were given the questionnaire during CME courses prior to receiving any information; all doctors agreed to complete the questionnaire even if they were less informed and implicated in food allergy care. In other electronic surveys the relatively high rate of correct responses may be due to the fact that responders are more likely to be interested and informed by this topic [1, 3]. There were also several limitations to this study. Only one clinical case was proposed to the physicians to avoid a time-consuming survey. We targeted various medical specialties to determine if the anaphylaxis management differed among them. As a consequence,

due the relatively small sample size of this survey, multivariate analysis for determining the factors associated with an optimal management was not statistically possible.

In conclusion, food allergy is a major public health concern in many countries and anaphylaxis is increasing. It is first crucial to increase awareness of anaphylaxis of all the physicians involved in this field. Promoting studies to increase the level of evidence for anaphylaxis diagnosis and treatment is a challenge that remains to be addressed.

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Table 1. Correct responses to the clinical scenario of a 2-year-old child experiencing anaphylaxis.

Questions	Correct responses	Correct responses n (%)	Correct responses for the 5 key questions step by step n=318 (%)
He is probably experiencing an oral allergy syndrome (Q1)	disagree	49	219 (70)
He is probably experiencing anaphylaxis. (Q2)	agree	219 (70)	
This is not an anaphylaxis as there is not any respiratory distress nor hemodynamic disorder. (Q3)	disagree	76	
I would administer inhaled bronchodilators and oral antihistamine first. (Q4)	disagree	26	95 (31)
I would administer intramuscular injection of adrenaline first. (Q5)	agree	31	
I would immediately call for medical ambulance to transfer him to the pediatric emergency ward. (Q6)	agree	50	70 (24)
After the symptoms resolved and a 1-hour observation, I would discharge him home. (Q7)	disagree	68	
I would not prescribe adrenaline auto-injector because his symptoms were mild without respiratory distress. (Q8)	disagree	78	63 (20)
I would recommend referral to an allergist for evaluation within 1-2 months. (Q9)	agree	87	61 (19)

Scenario. A 2-year-old boy is brought by his mother soon after an allergic reaction. He is known to be allergic to peanut but unfortunately he ate a small amount of peanut at home. Ten minutes after he started crying and pulling at his mouth. Now he has swollen lips, cough and wheezing without any hives or respiratory distress; his vital signs are normal.

The 5 key questions determining the correct management of anaphylaxis are in bold.

Table 2. Correct responses to the 5 key questions of the clinical scenario according to medical specialties.

	General practitioner N=87 (28%)	Pediatrician N=72 (23%)	Allergist N=30 (10%)	School /mother and child care doctors N=61 (19%)	Junior doctor N=62 (20%)	Total N=318* (100%)
Correct diagnosis (Q2)	50 (59%)	58 (82%)	25 (83%)	30 (51%)	53 (86%)	219 (70)
Intramuscular adrenaline injection (Q5)	15 (17%)	42 (58%)	10 (33%)	6 (10%)	23 (37%)	99 (31)
Immediate call for medical and transfer to emergency service (Q6)	32 (20%)	47 (30%)	14 (47%)	18 (40%)	43 (69%)	159 (50)
Prescription of an adrenaline auto-injector (Q8)	59 (68%)	58 (81%)	22 (73%)	40 (66%)	52 (84%)	248 (78)
Referral to an allergist (Q9)	67 (77%)	61 (85%)	27 (90%)	52 (85%)	55 (89%)	277 (87)
All the 5 key questions correct	9 (15)	28 (46)	4 (6)	3 (5)	17 (28)	61 (19)

*6 missing data regarding to the type of medical specialties.