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## **Management of acute allergic reactions by dispatching physicians in a Medical Emergency Dispatch Centre**

Hélène Godet-Mardirossian MD (1), Nathalie-Sybille Goddet MD (1), François Dolveck MD (1), Michel Baer MD (1), Dominique Fletcher MD PhD (1), Alexis Descatha MD PhD (1,2,3).

- (1) Assistance Publique Hôpitaux de Paris - SAMU 92-SMUR, Raymond Poincaré Teaching Hospital, Garches, France
- (2) Université de Versailles St-Quentin, UMRS 1018, Occupational health Unit, Poincaré Teaching Hospital, Garches, France
- (3) Inserm, U1018, Centre for research in Epidemiology and Population Health, Epidemiology of occupational and social determinants of health, F-94807, Villejuif, France

Correspondence :

Dr Alexis DESCATHA

SAMU92-Unité de pathologie professionnelle, CHU Poincaré, 104 bd Poincaré, 92380 Garches, France

+ 33 1 47 10 70 10

Fax + 33 1 47 10 70 07

[alexis.descatha@rpc.aphp.fr](mailto:alexis.descatha@rpc.aphp.fr)

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## **ABSTRACT (243 words)**

### **Background:**

Acute allergic reactions often occur in out-of-hospital settings, and some of these reactions may cause death in the short term. However, initial diagnosis, management and processing of acute allergic reactions by Medical Emergency Dispatch Centres are not documented. We sought to describe acute allergic reactions and their management by a Medical Emergency Dispatch Centre.

### **Methods:**

A prospective study was conducted from 20th August 2006 to 5th November 2006 on incoming calls for acute allergic reactions to the Medical Emergency Dispatch Centre for the *Hauts de Seine* (Paris West suburb, France). The agreement between initial diagnosis (made by dispatching physician) and final diagnosis (made by the physician who later examined the patient), and between initial and final severity, were evaluated using Cohen's weighted Kappa coefficient.

### **Results:**

210 calls were included. The diagnoses made by the dispatching physician were: in 58.1% of cases urticaria, in 23.8% angioedema, in 13.3% laryngeal edema, and in 1.9% anaphylactic shock. The agreement between initial and final diagnoses was evaluated by a kappa coefficient at 0.44 (CI 95%: 0.26-0.61) and the agreement between initial and final severity was evaluated using a kappa coefficient at 0.37 (CI 95%: 0.24-0.50).

### **Conclusion:**

We have highlighted only moderate agreement between the initial severity assessed by the dispatching physician and the final severity assessed by the physician later examining the patient. This demonstrates the need to develop a tool for assessing severity of acute allergic reactions for dispatching physicians in Medical Emergency Dispatch Centres.

## INTRODUCTION

The Epidemiology of Anaphylaxis Working group of the American College of Allergy, Asthma and Immunology, summarised the findings from major international epidemiological studies and concluded that the overall frequency of episodes of anaphylaxis lies between 30 and 950 cases per 100,000 persons per year.<sup>1</sup> In France in 2005-2006, acute allergic diseases represented 0.9% to 2% of Emergency Medical System (EMS) visits with an emergency service physician on board.<sup>2,3</sup>

Acute allergic reactions can take on very different clinical presentations and potentially involve numerous organs, including the skin and the respiratory, cardiovascular, gastrointestinal, and neurological systems. Even though acute allergic reactions can be easily distinguished by emergency physicians, many definitions of what constitutes a case exist, and no consensus can be observed. For instance, there is no universally agreed definition of anaphylaxis and there is no universally agreed criteria for diagnosis.<sup>4</sup> As there is no consensus regarding the definition of anaphylaxis, the criteria for inclusion of patients into studies may differ from one country to another and this increases the difficulty in estimating incidence rates.

One of the main features of the French pre-hospital EMS (*SAMU, Service d'Aide Médicale d'Urgence*) is the participation of a physician at each stage in the organization. Actually, in the French Medical Emergency Dispatch Centres, all calls received are processed by a dispatching physician.<sup>5</sup> All calls for medical problem are received on the French pre-hospital EMS ("15", the national free medical emergency phone number) and are medically dispatched. There is no alternate EMS or screening system. The "SAMU" is a hospital department whose function is to centralise all emergency medical calls and organise an appropriate response. If a patient, a primary care physician, or everybody else face to an emergency problem and need an evaluation, triage, prehospital treatment or evacuation, he

referrers to the centralized pre-hospital French EMS. Effective management of allergic emergencies by pre-hospital French EMS is dependent on the diagnosis and assessment of severity made by dispatching physicians in the Medical Emergency Dispatch Centre.

The aim of the study was to describe acute allergic events leading to prehospital EMS decisions in a circumscribed French district.

We aim to describe the characteristics of acute allergic reactions, key elements in the initial processing, and the agreement on the one hand between the initial and final diagnose and on the other hand between the initial and final severity.

## **METHODS**

### Study design

A prospective study was conducted from 20th August 2006 to 5th November 2006 on incoming calls to the Medical Emergencies Dispatch Centre for Hauts de Seine district, Paris West suburb. Cases of acute allergic reactions were included by dispatching physicians regardless of the patient's age, the caller and the place of call. Cases were included if the dispatching physician recorded a diagnosis of acute allergic reaction with the clinical presentation included any generalized skin, gastrointestinal, respiratory, cardiovascular, or neurological manifestations. Calls for asthma features alone were excluded from the study because the assessment of severity and criteria for emergency dispatch are established.

The study comprised two data collection stages. First, the dispatching physician filled in the "dispatch questionnaire" during the patient's call. Second, each patient included in the study was contacted on the phone by the investigating physician who filled in the "follow-up questionnaire". These questionnaires were both specifically instituted for this study.

### Data collection

The following details were obtained from each patient during completion of the “dispatch questionnaire”: age, gender, regular allergy medications (antihistamines, corticosteroids), symptoms (clinical features), and probable cause of allergic reaction (presumed aetiology). The following items were also recorded in this questionnaire: initial severity evaluated by the dispatching physician using the French medical classification of emergency patients, clinical diagnosis (urticaria, angioedema, laryngeal edema, and anaphylactic shock) and response finally chosen by the dispatching physician (advice over the phone, medical consultation with a general practitioner (GP), ambulance with first-aid personnel on board and ambulance with an emergency service physician on board).

The patient was contacted for the “follow-up questionnaire” which provided information about evolution, hospitalization and diagnosis made by the physician who later examined the patient.

The "initial severity" was studied using the CCMU severity score (the French medical classification of emergency patients, *CCMU, Classification Clinique des Malades des Urgences, Table 1*) evaluated by the dispatching physician in two classes: "not severe" with a stable prognosis (CCMU 1 and CCMU 2) and "severe" with unstable condition, likely to worsen (CCMU 3 to 5).<sup>6</sup>

The "final severity" was considered in two classes, “severe” and “not severe” according to whether or not hospitalization occurred, whatever the unit.

### Data analysis

Bivariate statistical analyses were used to describe acute allergic reactions. Relationships between qualitative variables were studied using Pearson's  $\chi^2$  test and Fisher's exact test when the conditions for applying the  $\chi^2$  test were not met. Comparisons of averages were

performed using Student's T-test. The agreement between initial and final diagnosis on one hand, and between initial and final severity on the other hand, were evaluated using Cohen's weighted Kappa coefficient. The statistical analyses were conducted using the SAS software, Institute Inc. Cary, NC, USA (version 9.1). A *P*-value less than 0.05 was considered statistically significant.

#### Treatment of missing data

The reason for missing data regarding final diagnosis was that not all patient calls were followed by a medical consultation. All other variables had very little missing data (less than 1%).

#### Ethics

The protocol was approved by the French Commission on Individual Freedom and Data Storage (*CNIL, Commission Nationale Informatique et Liberté*).

## **RESULTS**

Two hundred and ten patients participated in the study.

Table 2 displays the characteristics of calls and patients, and the clinical features of the patients included. In more than 90% of cases, calls for acute allergic reactions came from the patient's home and the caller was the patient him/herself or a person close to him. The female-male ratio of patients was 0.63. Ages ranged from 0.4 to 95 years with a mean age of 30.2, lower among men than among women, respectively 25.8 and 32.9 years ( $P < 0.05$ ). More than a half the patients had a history of allergy, and 19.5% had a regular allergy medications (H1-antihistamines: 14.8%, corticosteroids: 3.3%, H2-antihistamines: 0.5%, desensitization: 1%).

The clinical symptoms the most frequently reported at the time of the call were pruritus (52.4%), facial edema (29.2%), localized erythema (24.8%), localized urticaria (superficial swelling of the skin resulting to a red raised itchy lesion) (23.3%), generalized urticaria (22.4%), generalized erythema (14.8%), paresthesia (14.8%). No significant difference was evidenced between men and women apart for conjunctive erythema and watering eyes (more frequent among men than women,  $P<0.05$ ).

### **Diagnosis made by dispatching physician and response**

The diagnoses made by the dispatching physician were: in 58.1% of cases urticaria, in 23.8% angioedema, in 13.3% laryngeal edema, and in 1.9% anaphylactic shock (table 2). No statistical significant difference in the distribution of diagnoses was observed between men and women. For the initial severity, 11.1% of allergic reactions were assessed as severe by the dispatching physician and 88.9% as not severe (table 3), without significant differences between men and women, among age groups, or among presumed allergens ( $P>0.05$ ).

There was no statistical association between the response chosen by the dispatching physician and the patient's gender, but the response differed significantly with age ( $P<0.001$ ). In the extreme age groups (0-2 years and 75-95 years), the response was in most cases a medical consultation with a GP. The response varied significantly with the diagnosis. The more "severe" the physician's diagnosis (laryngeal edema and anaphylactic shock), the more likely was the response to involve intervention ( $P<0.0001$ ). The response also varied according to the degree of severity assessed by the dispatching physician ( $P<0.0001$ ). The reactions assessed as "severe" led to sending an ambulance with emergency physicians on board in more than 75% of cases.



In the majority of cases of urticaria and angioedema, the patient stayed at home (82.6%). More than a half of patients with laryngeal edema were hospitalized (58.3%). The reactions described by the dispatching physician as anaphylactic shock were all hospitalized (table 4).

### **Agreement.**

The agreement between initial and final diagnoses was evaluated by a weighted kappa coefficient at 0.44 (CI 95%: 0.26-0.61). The diagnosis made by the dispatching physician was the same as the diagnosis by the physician later examining the patient in 53.98% of cases (table 5). The agreement between final and initial severity was evaluated using a kappa coefficient at 0.37 (CI 95%: 0.24-0.50). There is a significant difference between initial severity assessed by the dispatching physician and final severity assessed according to the hospitalization criterion ( $P<0.0001$ ). Dispatching physicians estimated that 11.1% allergic reactions were severe. The physicians later examining patients assessed the proportion of severe allergic reactions to be 31.7%. Thus, 24.2% of the reactions classified initially as "not severe" in dispatch centre were finally classified as "severe". The severity of allergic reactions was, in almost a quarter of the cases, underestimated by dispatching physicians.

## **DISCUSSION**

Acute allergic reactions often occur in out-of-hospital setting, their incidence is growing, and some of these reactions can cause death. However, allergic reactions leading to management by pre-hospital emergency services and their management by dispatch physicians have not been focused on previously. There is no consensus regarding management of allergic reactions, but, in order to homogenize our practices we implemented procedures about allergic reaction (with increase of consistency between physicians). There is no randomised

controlled clinical trial in humans providing unequivocal evidence for their triage and treatment. Indeed, prompt medication with epinephrine is important for survival, and trying other medication would be unethical in some cases.<sup>7-9</sup> Only a few studies have been conducted in prehospital setting.<sup>10-11</sup> In USA in 2002, a study described the management of anaphylaxis in out-of-hospital setting and reported that 2.8 million runs (visit by EMS personnel) comprised between 0.34% and 0.82% runs for allergy.<sup>11</sup> In 1996 Maio et al showed that allergic reactions in prehospital setting accounted for 0.4% of adult cases and 0.5% of paediatric cases.<sup>12</sup> The authors concluded that there was no standardization of case definitions, and management varied considerably. In France, allergic reactions leading to management by the Medical Emergency Dispatch Centres have not been described before. Therefore the comparison between initial and final severity has never been made. Most studies in dispatch centres were only interested in calls that resulted in sending an ambulance with a physician on board.<sup>13,14</sup> We considered all calls, regardless of the response. These elements have to our knowledge never been studied before.

Even if it is doubtful that the true etiology of an allergic reaction could be clearly designated by a dispatch physician, the presumed etiology in our study was consistent with the results of a study in the United Kingdom which found that the etiology was medication in 30% of cases, a food in 30%, and an insect bite or sting in 32% of cases.<sup>15</sup>

Our study showed low correlation between the initial severity assessed by the dispatching physician and the final severity. A similar finding was observed for the initial diagnosis and final diagnosis. The diagnosis relevance and the estimation of severity in dispatch centre were studied by Besnier et al.<sup>16</sup> For all medical conditions combined, it was shown that the diagnosis made by the dispatching physician was the same as the diagnosis made thereafter by the physician examining the patient in 51.9% of cases. Severity was underestimated by the

dispatching physician in 14.4% of cases. The same analysis performed on our study shows results of the same order. However the severity of a larger proportion of acute allergic reactions was underestimated (21.67%). This low level of agreement between the initial and the final evaluation demonstrates the difficulty in assessing the severity of these reactions in dispatch centres. The disparity between initial and final assessment could also be due to a worsening of the reaction over time or to the opposite an improvement over time, since both are possible with or without triage. We need to study the management of acute allergic reactions by dispatching physicians, because effective management is crucial for pathologies liable to lead to death in the short term.

We chose to study the initial severity as assessed by the dispatching physician using the French clinical classification of emergency patients. This classification is widely known, reproducible and adaptable to a dispatch centre. Its reliability, assessed by a measure of reproducibility, is good, with a kappa coefficient at 0.72.<sup>6</sup> Other severity scores exist but they are complex and require physiological and biological measures, making their use impossible in a dispatch centre where physicians only have the phone interview.

For our analysis of final severity, we chose to describe as "severe" those reactions that required hospitalization. In emergency departments, Brown chose hypotension and hypoxia as severity indicators.<sup>17</sup> In a dispatch centre, it is not possible to obtain physiological data or even accurate clinical information for all patients. We therefore chose the variable "hospitalization or not" as a proxy to assess the final severity, since this information was available for all patients. The known major factor for hospitalization in emergency room is severity. However the terminology for severity based on the criteria for hospitalization is not necessarily accurate. Furthermore, hospitalization criteria are likely variable, and many patients are hospitalized for reactions that are not severe while other patients with anaphylaxis

are not necessarily hospitalized. However, we assume that prehospital physicians will decide to hospitalize patients with severe reactions or with reactions that can worsen.

In our study, the dispatching physicians included cases of acute allergic reactions. Even though the definition is clinically defined, there is no universally agreed definition and there are no criteria for diagnosis of anaphylaxis.<sup>4,5</sup> Furthermore, the second data set was acquired via information from the patient, which involves recall bias and lack of medical knowledge. One can question the fact that patients can provide reliable information regarding the diagnosis made by the examining physician and even about the evolution. However, they could certainly indicate whether they were hospitalized.

Each urticaria assessed by the dispatching physician as a potential allergic urticaria had been included in the study. Urticaria is not a specific allergic reaction pattern, it mostly occurs in situations such as mainly viral infections, non-steroidal anti-inflammatory drugs use, and other unspecific triggers of histamine liberation without involvement of the adaptive immune system. However we had to consider each diagnosis of allergic urticaria made by dispatching physicians.

We encountered only few serious reactions. However this described the “real life” of acute allergic reactions seen by emergency physicians. Some clinical symptoms did not appear at all during our study and others were very sporadic. As many studies of acute allergic reactions our study was affected by the small size of samples of patients selected and studied.<sup>18</sup> Nevertheless, despite this relative lack of cases, our study highlights the difficulty of assessing the severity of acute allergic reactions for the dispatching physician.

The lack of demonstrated consistency between the range of dispatch physicians could represent a limitation. However, in order to homogenize our practices, we implemented a procedure seven years ago for allergic reaction for management of allergic disorders.<sup>3</sup> We decided to contact the patient few days after the call for outcome rather than his physician, because we felt more confident about simple questions for patients than contacting a very large number of physician of our district (n>500, whereas one physician is not assigned to one patient in France).

## **CONCLUSION**

Issues relating to allergic reactions managed by prehospital emergency dispatch centres had not previously been explored. In a relatively short time, the dispatching physician has to make a diagnosis and chose the best response for the patient, with the only information from the phone interview. Acute allergy can take the forms of a range of clinical signs and the evolution can be very fast and the outcome potentially fatal. These characteristics make it difficult to assess the severity of allergic reactions in dispatch centre. We have highlighted only moderate agreement between the initial severity assessed by the dispatching physician and the final severity assessed by the physician later examining the patient. This demonstrates the need to develop a tool for assessing severity of acute allergic reactions for dispatching physicians in medical emergency dispatch centres.

**Table 1 - The French medical classification of emergency patients (Classification Clinique des Malades des Urgences CCMU)**

CCMU I: Condition injury or functional prognosis considered stable failure to act with additional diagnostic or therapeutic conduct in the emergency department.
CCMU II: Condition injury or functional prognosis considered stable and necessity of complementary diagnostic or therapeutic
CCMU III: Condition injury or functional prognosis may worsen but not involving life
CCMU IV: Pathological situation involving life and not involving the practice of immediate resuscitation manoeuvre.
CCMU V: Pathological situation involving life and necessity of immediate resuscitation manoeuvres.

**Table 2- Characteristics of calls and patients and individual clinical reaction features (n=210)**

<b>Time of the day (24 hour format)</b>	<b>n</b>	<b>%</b>	<b>Regular allergy medications</b>	
0h 8h	31	14.8%	Antihistamines H1	31 14.8%
8h 18h	84	40.0%	Corticosteroids	7 3.30%
18h 24h	95	45.2%	Desensitization	2 1.0%
<b>Place of call</b>			Antihistamines H2	1 0.5%
Home	180	85.7%	No regular medications	167 79.5%
School	8	3.8%	<b>Clinical features (Symptoms)</b>	
Workplace	9	4.3%	Pruritus	110 52.4%
Public place	5	2.4%	Facial edema	61 29.2%
Medical office	6	2.9%	Localized erythema	52 24.8%
Unknown	2	1.0%	Localized urticaria	49 23.3%
<b>Who called?</b>			Generalized urticaria	47 22.4%
Patient or a person close to him	192	91.4%	Generalized erythema	31 14.8%
Rescuer	1	0.5%	Paresthesia	31 14.8%
Nurse	10	4.8%	Conjunctival erythema and watering eyes	16 7.6%
Physician	7	3.3%	Mucosa oedema	14 6.7%
<b>Gender</b>			Sense of choking	14 6.7%
Men	81	38.6%	Other edema	12 5.7%
Women	129	61.4%	Difficulty speaking	12 5.7%
<b>Age</b>			Rhinitis	12 5.7%
0-2 years	21	10.0%	Respiratory distress	11 5.2%
3-15 years	52	24.8%	Nausea, vomiting, diarrhea	9 4.3%
16-44 years	85	40.5%	Dysphagia	9 4.3%
45-64 years	35	16.7%	Cough	8 3.8%
65-74 years	3	1.4%	Dizziness	8 3.8%
75-95 years	14	6.7%	Collapse. with or without unconsciousness	8 3.8%
<b>Personal allergic history</b>			Laryngeal dyspnoea	7 3.3%
Yes	115	54.8%	Abdominal pain	5 2.4%
No	83	39.5%	Chest pain	3 1.4%
Unknown	12	5.7%	Wheezing	0 0.0%
<b>Familial allergic history</b>			Cardiac arrest	0 0.0%
Yes	43	20.5%	Coma	0 0.0%
No	75	35.7%	Sneezing	0 0.0%
Unknown	92	43.8%		
<b>Presumed etiology (Allergen)</b>				
Drug	72	34.3%		
Food	51	24.3%		
Other (mostly insect bites)	68	32.4%		
Unknown	19	9.0%		

**Table 3-Initial diagnosis and initial severity**

<b>Initial Diagnosis*</b>	<b>n</b>	<b>%</b>
Urticaria	122	58.1%
Angioedema	50	23.8%
Laryngeal edema	28	13.3%
Anaphylactic shock	4	1.9%
Other (collapse, conjunctivitis...)	6	2.9%
<b>Total</b>	<b>210</b>	<b>100.0%</b>
<b>Initial severity*</b>		
CCMU 1	137	65.9%
CCMU 2	48	23.1%
CCMU 3	15	7.2%
CCMU 4	7	3.4%
CCMU 5	1	0.5%
<b>Total</b>	<b>208**</b>	<b>100.0%</b>

\*initial diagnosis: diagnosis made by dispatching physician, CCMU=French medical classification of emergency patients.

\*\* variable "initial severity": two missing data (where emergency physician unable to classify severity)



**Table 4- Orientation of patients depending on initial diagnosis**

Initial diagnosis* (n=210)	Orientation** (n=207)				n (total)
	Home		Hospitalization		
	n	%	n	%	
Urticaria	99	82.6%	21	17.4%	120
Angioedema	28	57.1%	21	42.9%	49
Laryngeal edema	11	41.7%	17	58.3%	16
Anaphylactic shock	0	0.0%	4	100.0%	4
Other	3	50.0%	3	50.0%	6
n (total)	140		67		207

\*initial diagnosis: diagnosis made by dispatching physician

\*\*variable "orientation": three missing data (1%)

**Table 5- Initial and final diagnosis**

	Initial diagnosis*		Final diagnosis**	
	n	%	n	%
Urticaria	122	58,1%	53	46.9%
Angioedema	50	23,8%	31	27.4%
Laryngeal edema	28	13.3%	7	6.2%
Anaphylactic shock	4	1.9%	3	2.7%
Other	6	2.9%	19	16.8%
n (total)	210	100.0%	113	100.0%

\*initial diagnosis: diagnosis made by dispatching physician

\*\*final diagnosis: diagnosis made by the physician who later examined the patient.

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