

## Clinical paper

Prevalence, outcome and pre-hospital management of anaphylaxis by first aiders and paramedical ambulance staff in Manchester, UK<sup>☆</sup>Jennifer A. Capps<sup>a</sup>, Vibha Sharma<sup>b</sup>, Peter D. Arkwright<sup>c,\*</sup><sup>a</sup> University of Manchester, United Kingdom<sup>b</sup> Wrightington, Wigan and Leigh NHS Trust, United Kingdom<sup>c</sup> University of Manchester, Royal Manchester Children's Hospital, Oxford Rd., Manchester M13 9WL, United Kingdom

## ARTICLE INFO

## Article history:

Received 2 October 2009

Received in revised form

20 December 2009

Accepted 18 January 2010

## Keywords:

Anaphylaxis

Adrenaline

Ambulance

Pre-hospital

## ABSTRACT

**Background:** Anaphylaxis is of increasing prevalence and concern in Western communities. Ambulance services are often called to deal with these emergencies. There are few published studies that examine the demand and management of allergic reactions by emergency services. The aim of this study was to investigate the frequency, severity and outcome of calls, as well as whether intramuscular adrenaline was required for successful management of allergic reactions by paramedics and first aiders.

**Method:** A retrospective study of all emergency calls for allergic reactions within Greater Manchester in a 12-month period by the North West Ambulance Service of the United Kingdom.

**Results:** 816 (0.2%) of 401,152 incidents were due to allergic reactions (32/100,000/year). No patients died. In 457 (56%) patients this was the first allergic reaction. Intramuscular adrenaline was administered to 116 (14%) patients. Patients with respiratory/circulatory compromise were significantly more likely to be given intramuscular adrenaline by paramedics (14 (4.4–45)), but not by first aiders (1.9 (0.98–3.6)). Administration of adrenaline by first aiders was more likely in patients with a past history of allergic reactions (4.3 (2.3–8.1)) and where reactions occurred at non-residential addresses (4.6 (2.6–8.2)).

**Conclusions:** Emergency call-outs for allergic reactions made up <1% of total ambulance workload. Most cases were successfully managed without intramuscular adrenaline. Adrenaline appeared to be used appropriately by paramedics. The lack of correlation between clinical severity and adrenaline use by first aiders suggests that they may often not understand the correct clinical indications for this drug.

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## 1. Introduction

Anaphylaxis (classically defined as an allergic reaction associated with respiratory and/or circulatory compromise) is a health problem of growing concern in United Kingdom and other Western communities.<sup>1,2</sup> Previous studies have examined the prevalence of anaphylaxis based on data derived from national computerised GP<sup>2,3</sup> or allergy clinic records<sup>4</sup> and local or regional Emergency Department admissions.<sup>5–12</sup> The incidence of anaphylaxis in the United Kingdom is estimated to be 7–8/100,000/year. Major allergens are medication, insect venom and foods, with the proportion attributable to each of these triggers varying depending on demographics of the cohort studied. Less than half of patients presenting to Emergency Departments with allergic reactions had clinical features of respiratory or circulatory compromise (anaphylaxis).

Intramuscular adrenaline was administered to 5 and 40% of patients with severe reactions.<sup>5,10</sup>

Because of the unexpected nature of anaphylaxis and the rapidity of its onset, patients with allergic reactions perceived as severe will often request pre-hospital emergency care from ambulance services. There is a dearth of published data on the frequency and nature of responses to these calls for assistance. Published evidence amounts to a few case series: 8 survivors treated in a Californian national park<sup>13</sup>; 22 patients treated in King County,<sup>14</sup> 27 patients treated by two anaesthetist-staffed ambulance helicopters in Norway<sup>15</sup> and one American observational study solicited by e-mail, mail and telephone.<sup>16</sup> The latter study found that between 0.34 and 0.82% of total calls were for allergy/anaphylaxis and intramuscular adrenaline was used in 0.16–14.1% of patients in the USA, compared to 31% in Toronto, Canada where adrenaline devices are heavily promoted. Death rates were 0–0.94%. No studies have been conducted in the United Kingdom or investigated other aspects of anaphylaxis or its management in the pre-hospital setting. We therefore conducted a retrospective study of all calls to the Greater Manchester branch of the North West Ambulance Service over a 12-month period by patients suffering from allergies. The aim

<sup>☆</sup> A Spanish translated version of the abstract of this article appears as Appendix in the final online version at doi:10.1016/j.resuscitation.2010.01.021.

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was to collate evidence on the frequency, severity and outcome of these calls, as well as treatments given by both first aiders and paramedics, in order to establish the size of the problem and current management practices. The hypotheses to be tested were that (1) deaths from anaphylactic reactions referred to emergency services are rare; (2) most anaphylactic reactions are successfully treated without the use of intramuscular adrenaline; and (3) paramedics are more likely to use of intramuscular adrenaline than first aiders for allergic reactions involving respiratory/circulatory compromise.

## 2. Methods

### 2.1. Data collection

Data were collected from the North West Ambulance Service's (NWAS) Incident Search system. This system records incident details for an ambulance trust that serves a population of 7 million people over 5400 square miles, and attends 401,152 incidents each year. Incident numbers are used to link the incidents to Sequence of Events and scanned Patient Report Forms. The Sequence of Events documents the time of the call, the response time of the ambulance, and the outcome of the response. The Patient Report Forms contain clinical details and treatments as recorded by the ambulance crew. As this retrospective survey did not involve direct contact with either patients or health care professionals and the NWAS allowed the research team to only collate anonymous data, formal ethics application and approval were not required. Information was collected regarding the date and time of the call, the priority level based on the patient's symptoms at the time of the call (green: non-urgent, amber: urgent but non-life-threatening, red or purple: life-threatening). Patient demographics (age group, gender, general location at time of call) and whether or not the patient was transferred to hospital, known allergies and the likely allergen triggering the reaction were recorded, as were clinical observations made by the crew at the time of their arrival. The clinical observations available were blood pressure, pulse rate, respiratory rate, oxygen saturations, capillary refill time and Glasgow Coma Score (GCS). Details of treatment given (antihistamines, corticosteroids, bronchodilators, oxygen, fluids, and intramuscular adrenaline) before arrival of the paramedic ambulance crew or by the crew once they had arrived were also collected.

### 2.2. Inclusion and exclusion criteria

This survey focused on patients requesting ambulance assistance for allergies (reactions)/envenomations (Code 2) within the Greater Manchester County of the North West of England between the 1st June 2007 and 31st May 2008. Patients with Code 2, which includes calls requesting assistance for allergy (reactions) as well as spider and snake bites and bee and wasp stings were collected. Cases were excluded if the form was blank (e.g. because another ambulance had already arrived on the scene). Cases in which allergy was unlikely to have been the cause were identified after reviewing case records and were also excluded from the analysis. These were identified either on the Patient Report Form by the ambulance crew themselves, or inferred by the history recorded, such as in patients suffering from only local reactions to insect stings. For the purposes of this study all patients suffering from an allergic reaction severe enough to call an ambulance were included, even if there were no signs of respiratory or circulatory compromise when paramedics arrived. All primary data were reviewed by JAC and where there was any uncertainty about the nature of the allergic reaction, cases were discussed with VS.

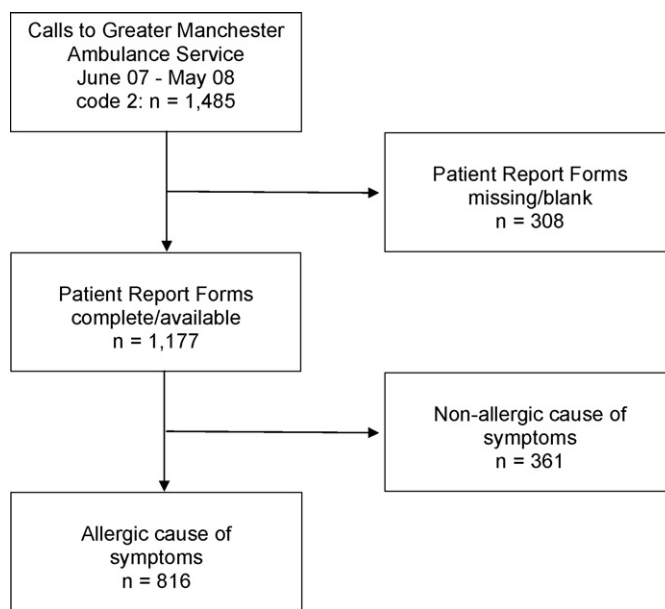


Fig. 1. Patient selection from North West Ambulance Service database.

### 2.3. Outcome measures

Primary outcome measures related to (1) the size of the problem (i.e. the number of patients requiring emergency assistance for allergic reactions compared to the total number of calls to the emergency service), (2) the efficiency of the emergency service in reaching the patient (time delay from receipt of the call to arrival of the ambulance) and (3) the clinical severity of the allergic reactions (triage code given by the emergency call centre (green, amber, red/purple), objective clinical parameters, the outcome up to the point of time of arriving at the hospital). Secondary outcome measures included the use of intramuscular adrenaline by both first aiders and paramedics.

### 2.4. Analysis of data

Data analysis was carried out using Statistical Package for the Social Sciences (SPSS Inc, Chicago, USA). Descriptive statistics were used to summarise the study population and extract information regarding case presentation and management. Chi-square analysis was used to determine differences between discrete variables, with a two-tailed  $P$  value of  $<0.05$  considered significant. Binary regression was used for multivariate analysis, where Relative Risk (RR) and 95% confidence intervals (95% CI) were calculated.

## 3. Results

### 3.1. Demographics of patients requesting an ambulance for allergic reactions

A total of 401,152 incidents were dealt with by the Greater Manchester branch of NWAS in the 12-month period. 1485 (0.4%) were coded as 2 ("allergies (reactions)/envenomations"). Of these, 308 (21%) were excluded because clinical data sheets were not available. 816 of the remaining 1177 (0.2%) related to allergic reactions (Fig. 1). This is compared to 30,737 calls (8%) for chest pain and 472 (0.1%) for carbon monoxide poisoning.

178 (22%) were children  $\leq 16$  years old, of whom 46% (83/178) were female, compared with 64% (410/638) of adults ( $P < 0.001$ ). 659 (81%) incidents occurred at residential addresses, 23 (3%) at schools/colleges, 77 (9%) at healthcare establishments and 57 (7%)

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