

Paediatric allergic reactions in the emergency department: a review

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Accepted 12 March 2008

ABSTRACT

Background: Allergic diseases are increasing in incidence worldwide and large numbers of children are now affected by allergy. Few studies have examined allergic reactions in children, particularly in the emergency department (ED) setting.

Outcome Measures: Primary—to describe the epidemiology of acute paediatric allergic reactions. Secondary—to describe the treatment and outcome of allergic reactions presenting to a paediatric ED.

Setting: The ED of a paediatric tertiary referral hospital with approximately 29 000 ED attendances annually.

Methods: A retrospective review of allergic reactions presenting to a paediatric ED over a 2-year period.

Main Results: 237 patients (61% male, median age 46 months) had reactions. 137/100 000 children attend the ED annually. The main identified causative agents were nuts (23%), dairy products (16.5%) and medication (10%). Oral contact was associated with 58.6% of reactions and dermatological symptoms were the most frequent presentation. Only 11(5%) received adrenaline (epinephrine). 46 (19%) were admitted. 55% of all patients received no formal follow-up.

Conclusions: Acute allergic reactions affect boys more than girls and frequently occur at a young age. Food allergies, in particular to nuts, are a major cause of reactions. Allergy represents a frequent presentation to the paediatric ED. There remains a concern about the adequacy of follow-up.

Allergic diseases are increasing in the western world,¹ with growing numbers of individuals affected by severe systemic allergic manifestations such as anaphylaxis, angio-oedema and food allergy.²⁻³ This increasing disease burden has resulted in efforts to characterise the national and international epidemiology of allergic disorders.⁴ Despite this, information about acute allergic reactions, particularly in paediatric populations, is limited.

Although the emergency department (ED) plays a major role in the care of allergic disease,⁵ most studies to date have examined paediatric allergic reactions on an inpatient or outpatient basis or have focussed primarily on anaphylaxis.⁶⁻⁹ A recent study in Australia reviewed paediatric allergic reactions in the ED.¹⁰ This is the first attempt in the United Kingdom to examine the presentation of children with acute allergic reactions within the ED setting. The aims of the study were to describe the epidemiology, aetiology, clinical features, management and outcome of allergic reactions presenting to a UK paediatric ED.

METHODS

A retrospective case-based review was carried out of all children aged under 13 years presenting with allergic reactions to a paediatric ED over a 2-year period from 1 May 2002 to 30 April 2004. The Royal Hospital for Sick Children, Edinburgh, is a tertiary referral hospital that serves as the regional referral centre for south-east Scotland, which has a population of 110 000 children aged 13 years or under.¹¹ It is the only paediatric hospital for children in the city of Edinburgh. The hospital had 29 000 ED attendances annually at the time of the study.

The hospital has a computerised database on which all ED attendances are entered. All attendances to the ED are coded using this database to describe the reason for their visit. Allergic reactions were identified from a search of this database using the keywords “urticaria”, “allergy”, “allergic reaction” and “anaphylaxis”.

We defined patients as having either a generalised allergic reaction or anaphylaxis based on their symptoms and signs as shown in table 1.

Demographic and clinical data were collated from patient records and entered into a Microsoft Access database. Each patient has a single case record, which contains all information on hospital attendances. Simple frequencies were calculated using Microsoft Excel and statistical comparisons made using Graphpad Prism.

RESULTS

Study population

A total of 302 patients were identified as presenting with allergic reaction over the 2-year period from the initial search of the hospital database. Of these, 65 were excluded from analysis as they had either not had allergic reactions, lived outwith the hospital catchment area or were aged over 13 years. A total of 237 patients were therefore included in the study (see fig 1).

Demography and incidence

The median patient age was 46 months (range 2–155 months, with an interquartile range of 17–94 months). A total of 145 patients were male (61%) and 92 female (39%) giving a male : female sex ratio of approximately 3 : 2.

Of all the ED attendances in this study, 83% (197 patients) were first visits and 17% (40 patients) were a repeat attendance with allergy for that child. During the 2-year study period, 14 patients had multiple attendances with allergic reactions.

Based on attendance figures at the time of the study, allergic reactions of all types and severity

Table 1 Definitions of allergic reactions and anaphylaxis

| Definition | Clinical features |
|-------------------------------|---|
| 1. Mild allergic reaction | Dermatological symptoms only—urticaria, other rash, erythema, pruritis, conjunctivitis, rhinitis |
| 2. Moderate allergic reaction | Respiratory symptoms—mild wheeze, dyspnoea, cough Gastrointestinal symptoms—nausea, vomiting, abdominal pain, or facial or limb swelling |
| 3. Severe allergic reaction | Additional respiratory compromise—stridor, moderate–severe wheeze Intra-oral swelling—tongue or throat swelling |
| 4. Anaphylaxis | Systemic symptoms present—altered consciousness, collapse, bradycardia, hypotension |

accounted for four out of 1000 ED attendances. The incidence of allergic reactions was calculated to be 137 per 100 000 population based on population figures obtained from the General Registrar's mid-2002 estimates for the under 13 population in Edinburgh, Midlothian and East Lothian.¹¹

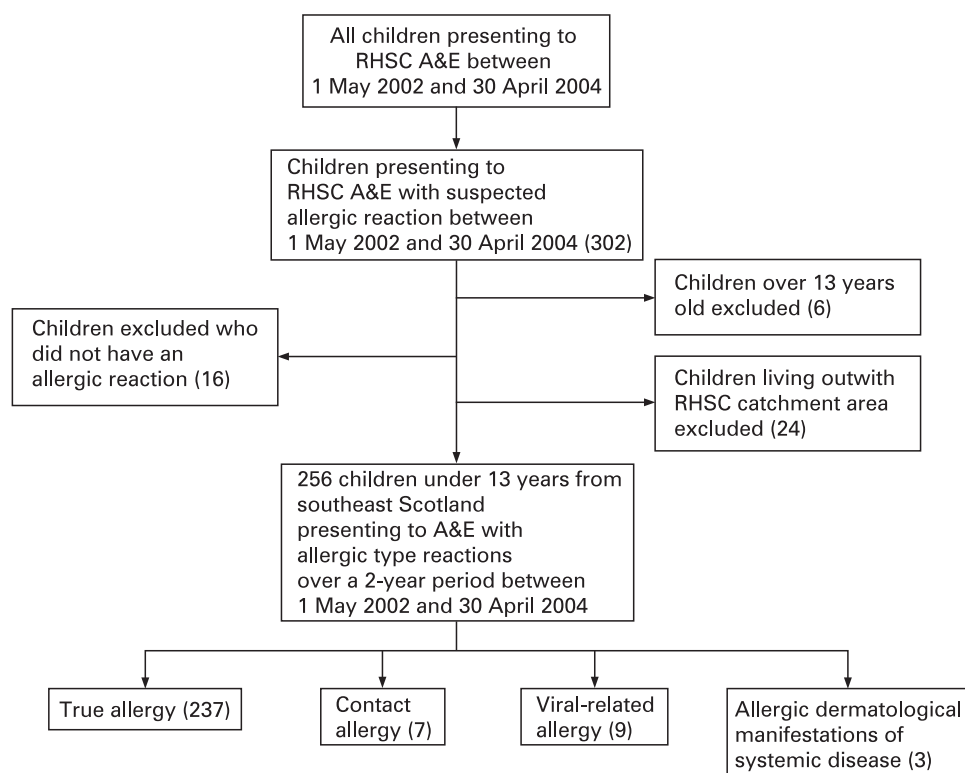
There were 108 presentations during the first year of the study between 4 May 2002 and 16 April 2003. In the second year of the study between 3 May 2003 and 26 April 2004 there were 129 presentations, higher than the previous year.

The study population was representative of the distribution of deprivation in Edinburgh using the Carstairs and Morris deprivation scores ($\chi^2 = 5.58$, $df = 6$ and $p = 0.47$; see table 2).

In particular no relationship was found to exist between social class and allergy.¹²

Causative agents

A wide variety of suspected causative agents were identified. The three most common suspected causes were nuts and seeds (55 patients, 23%), dairy (39 patients, 16%) and medication (24 patients, 10%). In 76 patients (32%) no suspected cause was identified (table 3).

Figure 1 Study population. RHSC, Royal Hospital for Sick Children.**Table 2** Comparison of DEPCAT between study population and Lothian

| DEPCAT | % for study* | % for Lothian |
|--------|--------------|---------------|
| 1 | 16 | 12 |
| 2 | 20 | 16 |
| 3 | 23 | 15 |
| 4 | 27 | 35 |
| 5 | 10 | 12 |
| 6 | 3 | 6 |
| 7 | 2 | 4 |

*Total sample size 235, two patients had no deprivation category available for their postcode. DEPCAT, deprivation category.

Exposure route

Oral contact was overwhelmingly the most common route of exposure. In a significant number of cases (57, 24%) the route of exposure was not known (see table 4). In nine cases (3.8%) the route of exposure was intramuscular; these were all thought to be due to vaccination. There were three patients (1.3%) in whom the route of exposure was subcutaneous, one was due to vaccination, two were thought to be due to insect venom stings.

Clinical presentation

Dermatological symptoms were by far the most common. For example, 109 (46%) of all the patients who attended had urticaria. However, the range of clinical symptoms experienced by the children was wide. Many children had multiple symptoms and had involvement of more than one organ system (see table 5).

Management and disposal

A total of 144 patients (60%) were treated with chlorphenamine; 57 (25%) were treated with prednisolone and 23 (10%)

Table 3 Causative agents

| Suspected cause | No of patients (n = 237) | % |
|---------------------|-----------------------------|------|
| Animal related | 9 | 3.8 |
| Cat/animal fur | 5 | 2.1 |
| Insect venom—wasp | 2 | 0.8 |
| Dog saliva | 2 | 0.8 |
| Foodstuffs | 116 | 48.9 |
| Nuts and seeds | 55 | 23.2 |
| Egg | 22 | 9.3 |
| Other dairy | 17 | 7.2 |
| Fruit | 7 | 3 |
| Fish and shellfish | 5 | 2.1 |
| Lentils | 3 | 1.3 |
| Paprika | 1 | 0.4 |
| Rusk | 3 | 1.3 |
| Pasta | 1 | 0.4 |
| Rice | 1 | 0.4 |
| Peas | 1 | 0.4 |
| Medication | 24 | 10.1 |
| Miscellaneous | 12 | 5 |
| Grass/pollen | 5 | 2.1 |
| Sun cream | 1 | 0.4 |
| Face paint | 1 | 0.4 |
| Medical dressing | 2 | 0.8 |
| Head lice treatment | 1 | 0.4 |
| Other plants | 2 | 0.8 |
| Not known | 76 | 32.1 |
| Total | 237 | 100 |

with hydrocortisone; 11 patients (5%) received adrenaline. The majority of patients (>50%) were discharged home directly from the ED. Only 40% (94) patients received formal follow-up; 55% of all patients (132) were not followed up and for 5% (11 patients), follow-up data were not available. Of the patients with severe and life-threatening reactions, 60% received further follow-up and 40% did not.

DISCUSSION

This is the first study in the UK to examine comprehensively the incidence, epidemiology, treatment and outcome of allergic reactions in the setting of the paediatric ED.

Although there are no national data on the incidence of allergic conditions,¹³ several studies have highlighted the fact that allergic diseases are increasing in incidence.^{14 15} A recent study in Australia found an annual incidence of 9.3 per 1000 ED presentations for generalised allergic reactions.¹⁰ In comparison, our study found the number of ED attendances per year resulting from allergic reactions to be four per 1000. This is therefore approximately half the number of ED attendances per year with allergy than was seen in the Australian study. This difference may be due to different denominators. This equates to approximately one patient every 3 days presenting with an allergic reaction. It is likely that this represents a conservative measurement of the incidence of allergic reactions in children. Although the numbers of ED presentations in the United Kingdom are increasing, this only represents a small and variable proportion of patients with acute allergy, as many children will present to general practice, hospital outpatient departments or will not present to medical services at all.¹⁵

Furthermore, this study is limited by its retrospective nature and although we are confident that we obtained all cases of allergic reactions in the study period, there may inevitably have been some “missed” data.

Table 4 Route of exposure

| Route of exposure | No of patients | % |
|-------------------|----------------|------|
| Oral | 139 | 58.6 |
| Dermal | 19 | 8 |
| Inhalation | 10 | 4.2 |
| Intramuscular | 9 | 3.8 |
| Subcutaneous | 3 | 1.3 |
| Not known | 57 | 24 |

At the time of this study there was a lack of consistent and concordant definitions of allergic reactions and anaphylaxis. Our definitions were therefore developed using the best information available to us. However, a paper by Brown¹⁶ has since published definitions of anaphylaxis using a clinical grading system very similar to ours, which supports the value of our definitions.

The finding of a male predominance and younger median age is in agreement with the literature¹⁷ as is the fact that dermatological manifestations were the most frequent symptoms of allergy.⁸ Several children had gastrointestinal features to their allergic reaction particularly vomiting (41, 17.3%). Nausea, vomiting, cramping abdominal pain and diarrhoea are well recognised features of allergy. This finding is supported by studies by Braganza *et al*¹⁰ and Brown.¹⁶

Previous studies have found an inverse relationship between socioeconomic status and the risk of sensitisation to food and airborne allergens.¹⁸ No social class gradient was found to exist in this study. Perhaps this is because of the affluent nature of the study population in Edinburgh, which may not be representative of social class distributions across the UK.

Table 5 Clinical features

| Symptom | Yes | No | % |
|--|-----|-----|------|
| Dermatological | | | |
| Urticaria | 109 | 128 | 46 |
| Erythema | 146 | 91 | 61.6 |
| Pruritis | 106 | 131 | 44.7 |
| Other rash | 37 | 200 | 15.6 |
| Rhinitis | 9 | 228 | 3.8 |
| Conjunctivitis | 25 | 212 | 10.5 |
| Facial swelling | 104 | 133 | 43.9 |
| Lip swelling | 54 | 183 | 22.8 |
| Tongue swelling | 7 | 230 | 3 |
| Respiratory | | | |
| Dyspnoea | 21 | 216 | 8.9 |
| Wheeze | 38 | 199 | 16 |
| Cough | 17 | 220 | 7.2 |
| Throat swelling | 27 | 210 | 11.4 |
| Stridor | 9 | 228 | 3.8 |
| Hoarseness | 4 | 233 | 1.7 |
| Gastrointestinal | | | |
| Nausea | 7 | 230 | 3 |
| Vomiting | 41 | 196 | 17.3 |
| Abdominal pain | 13 | 224 | 5.5 |
| Dysphagia | 2 | 235 | 0.8 |
| Abdominal bloating | 1 | 236 | 0.4 |
| Loss of appetite | 1 | 236 | 0.4 |
| Diarrhoea | 2 | 235 | 0.8 |
| Cardiovascular and neurological | | | |
| Lightheadedness | 0 | 237 | 0 |
| LOC/collapse | 3 | 234 | 1.3 |

LOC, loss of consciousness.

Table 6 Disposal

| Disposal | Number | % |
|--------------------------|--------|------|
| Admit ITU/HDU | 6 | 2.5 |
| Admit ward | 40 | 16.9 |
| Discharge allergy clinic | 31 | 13.1 |
| Discharge GP | 26 | 11 |
| Discharge home | 134 | 56.5 |

GP, general practitioner; HDU, high dependency unit; ITU, intensive therapy unit.

It is important to note that many children had reactions involving multiple organ systems. As shown by our definitions in table 1, allergic reactions vary across a broad spectrum in their manner of presentation, from mild self-limiting reactions to anaphylaxis, which can be life-threatening. Our findings reinforce the message that allergic reactions in children can present in a multitude of ways. Medical practitioners need to be aware of this and the serious potential for misdiagnosis.¹⁹

Foodstuffs, particularly nuts and seeds, were found to be the most common cause of allergic reactions in children. Previous studies have shown that food allergies, particularly to nuts, are becoming increasingly widespread and are now responsible for most cases of anaphylaxis.^{17 20–22}

It is of concern that in approximately a third of patients no cause for the allergic reaction could be identified. Identifying the causative agent is important as it allows education on avoidance and ideally prevents repeat occurrences. The majority of the patients studied were presenting for the first time. However, 17% (41) of visits were repeat attendances. For one patient, it was their ninth visit with allergy. Although it is inevitable that some children will attend more than once with allergic reactions, efforts need to be made to keep these numbers to a minimum. Not only do repeat attendances further increase the department's workload but multiple allergic reactions are dangerous for patients.

Effective education on allergen avoidance and self-management of allergic reactions is unquestionably important. In this study, 60% of all patients were not followed up and 40% of patients with severe or life-threatening reactions received no follow-up, a finding that has been identified in previous studies.^{5 10} This low rate of follow-up by specialist allergy services, particularly for those children with severe and life-threatening reactions, is clearly of concern. It reflects the paucity of allergy specialists both locally and in the United Kingdom.^{2 23}

The majority of children in this study were discharged to the routine care of general practitioners. A recent study highlighted general practitioners' feelings of inadequacy with managing allergic disorders alone, citing lack of training, difficulties in accessing allergy testing and lack of allergy specialists as the major problems.²⁴ An independent observation in the department since this study was carried out has noted increasing numbers of children re-presenting from the community after an initial mild allergic reaction with self-administered adrenaline without adequate knowledge of when and how to use it.

Does long-term care of allergic disorders require the specialist input of allergy services or can this be managed in the community? This study has shown that the ED is able to manage allergic reactions well acutely, but is it the best place to

provide long-term follow-up and advice? Currently, ED are not carrying out diagnostic investigations for allergy, but if the allergy service remains inadequate, perhaps this will become necessary.²⁵

CONCLUSION

Acute allergic reactions are a common presentation in the paediatric accident and emergency department and numbers seem to be rising. Acute allergic reactions are managed well in the paediatric ED but long-term follow-up remains suboptimal.

Competing interests: None.

Ethics approval: Ethics approval was obtained.

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Emerg Med J 2008 25: 655-658
doi: 10.1136/emj.2007.054296

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