

Food and drug reactions and anaphylaxis

First aid anaphylaxis management in children who were prescribed an epinephrine autoinjector device (EpiPen)

Michael Steven Gold, MD, and Robyn Sainsbury, MBBs North Adelaide, Australia

Background: Epinephrine for first aid use by parents and other caregivers and in the form of an autoinjector device (EpiPen, Center Laboratories) is often prescribed for children who have had previous anaphylactic reactions. It is not known whether the EpiPen device is used appropriately during subsequent reactions and whether its use is able to prevent the complications of anaphylaxis.

Objective: Our purpose was to determine parental knowledge and practice concerning first aid anaphylaxis management, the frequency of recurrent generalized allergic reactions, the first aid measures taken, and the subsequent outcome of these reactions. **Methods:** A retrospective survey was performed with a telephone questionnaire of all children with a history of anaphylaxis who attended a specialist allergy service and were prescribed an EpiPen autoinjector device.

Results: Recurrent generalized allergic reactions occurred with a frequency of 0.98 episodes per patient per year and were more common in those with food compared with insect venom anaphylaxis. The EpiPen device was only used in 29% of recurrent anaphylactic reactions. Parental knowledge was deficient in recognition of the symptoms of anaphylaxis and use of the EpiPen device, and adequate first aid measures were not in place for the majority of children attending school. Those children in whom the EpiPen device was used were less likely to be given epinephrine in hospital and to require subsequent hospital admission.

Conclusion: The EpiPen autoinjector device is infrequently used in children with recurrent episodes of anaphylaxis; the reasons for this require further research. It is likely that parents and other caregivers will require continuing education and support in first aid anaphylaxis management. When the EpiPen device is used appropriately, it appears to reduce subsequent morbidity from anaphylaxis. (*J Allergy Clin Immunol* 2000;106:171-6.)

Key words: Anaphylaxis, children, EpiPen autoinjector device

Anaphylaxis is thought to have affected between 1% and 2% of the general population.¹ A recent study in Australia has shown that up to 0.6% children attending preschool and school have had at least one anaphylactic

Abbreviations used

ANAR: Anaphylactic reaction

NAR: Nonanaphylactic reaction

reaction and that food is a more common trigger than insect venom.² Mortality from anaphylaxis is uncommon yet well documented and is usually the result of hypoxia resulting from cardiovascular collapse, airway tract obstruction, or pulmonary edema.³ Epinephrine is the drug of choice for the initial treatment of anaphylaxis because the 2 most important effects are to block mediator release and to reverse their end-organ effects.⁴ Individual case studies of fatal food anaphylaxis have documented that epinephrine is not usually given soon after the onset of symptoms or after exposure to an offending trigger.^{5,6} In contrast, with nonfatal cases epinephrine was given early and before the development of life-threatening symptoms.⁶ Therefore it is now recommended that patients who have had previous anaphylactic reactions or the parents or caregivers of such children have epinephrine available for first aid use.⁷⁻⁹

In children there is little information on whether prescribed epinephrine is used appropriately in the first aid management of anaphylaxis. More important, it has not been clearly documented whether these first aid measures are able to prevent the complications of anaphylaxis. This retrospective survey has examined children with a history of anaphylaxis for whom an autoinjector epinephrine device (EpiPen, Center Laboratories) was prescribed. The aims of the study were to determine parental knowledge regarding anaphylaxis management, the frequency of recurrent generalized allergic reactions, the subsequent use of an EpiPen device, and whether use of an EpiPen autoinjector device was associated with a decrease in anaphylaxis morbidity.

METHODS

All children with anaphylaxis who had been supplied with an EpiPen device between January 1996 and June 1998 and who were attending the pediatric allergy service of the Women's and Children's Hospital, Adelaide, South Australia, were eligible for study. Children with anaphylaxis were referred by their primary care physician to the service. Each child was reviewed by one of 2 allergists and an EpiPen autoinjector device was prescribed if the child was weighed more than 15 kg and had anaphylaxis that had result-

From the University Department of Pediatrics, Women's and Children's Hospital, North Adelaide, Australia.

Received for publication Sept 13, 1999; revised Jan 18, 2000; accepted for publication Jan 24, 2000.

Reprint requests: Michael Steven Gold, MD, University Department of Pediatrics, Women's and Children's Hospital, 72 King William Road, North Adelaide, South Australia, Australia 5006.

Copyright © 2000 by Mosby, Inc.

0091-6749/2000 \$12.00 + 0 1/1/106041

doi:10.1067/mai.2000.106041

ed in respiratory tract or cardiovascular involvement. Verbal and written instruction in the use of the EpiPen device and an anaphylaxis action plan was given to the parent(s) and, if appropriate, to the child. This documented that the device should be used when symptoms of respiratory tract obstruction or cardiovascular collapse developed with or without known exposure to the anaphylactic trigger. Parents were asked to provide the written information to other caregivers, including school staff.

Contact details of eligible children were retrieved from the hospital records and at least 4 attempts were made to contact each parent by telephone. Once the parents were contacted, consent was obtained to participate in the study, which was approved by the Research and Ethics Committee of the Women's and Children's Hospital, Adelaide. A telephone questionnaire was then administered by a single researcher (R. S.). The questionnaire documented the age of the child, the time since prescription of the EpiPen autoinjector device, the specific trigger (if known), and the symptoms of all generalized allergic reactions if these recurred. Details on education regarding the use of the EpiPen device, information provided to other caregivers, and measures in place to prevent anaphylaxis were also obtained. Parents were asked to list the symptoms of anaphylaxis and to describe how to administer the EpiPen device. The 4 essential steps against which parents were scored in the use of the device included removal of the gray cap, placing the black end on the thigh, applying pressure until a click was heard, and then holding the autoinjector in place for 10 seconds. Parents were asked details about first aid precautions in place at school including an anaphylaxis action plan, the availability of an EpiPen device, training of school staff, and consent documentation. The number of generalized allergic reactions since prescription of the EpiPen device, the severity of these reactions, use of the device, and details of subsequent outcome (hospitalization or use of epinephrine) was obtained. The Fisher exact test and the Mann-Whitney *U* test were used for statistical analysis.

Generalized allergic reactions were divided into anaphylactic (ANAR) and nonanaphylactic reactions (NAR). An ANAR was defined as a generalized allergic reaction with respiratory and/or cardiovascular symptoms that occurred after exposure (confirmed or suspected) to a trigger (if known). Respiratory symptoms that were elicited included a hoarse voice, persistent cough, and difficult or noisy breathing. Cardiovascular symptoms included dizziness or loss of consciousness. Skin or gastrointestinal symptoms may have been present but were not a prerequisite for inclusion as an ANAR. NAR was defined as a generalized allergic reaction that occurred after exposure (confirmed or suspected) to a trigger that resulted in skin rash and/or gastrointestinal symptoms only. Skin rash included facial or limb swelling or urticaria. Gastrointestinal symptoms included vomiting, nausea, or diarrhea.

RESULTS

During the study period 94 children attended the allergy service and were prescribed an EpiPen autoinjector device. Of these, 86 had anaphylaxis and 8 children had a history of acute severe asthma as the primary reason for EpiPen prescription. Of the children with anaphylaxis, the parents of 68 (80%) were interviewed, 17 (19%) could not be contacted, and 1 parent refused to be interviewed. In comparing the 68 children who were contacted with the 17 who could not be contacted, there was a similar proportion of children with insect venom and food anaphylaxis (62% vs 76% and 24% vs 35%, respectively). There were no differences in the median age at presentation, age at time of study, and time since pre-

scription of the EpiPen device between those children whose parents could and could not be contacted. Of the parents interviewed, only 9 had not received direct education by a specialist, but 6 of these parents had received education from their spouse after specialist review.

When parents were asked to describe the symptoms of anaphylaxis, the majority reported skin rash and shortness of breath but few parents reported specific symptoms that may have indicated upper airway obstruction (noisy breathing, hoarse voice, difficulty swallowing or talking) or hypotension (loss of consciousness or collapse) (Table I). Parents whose children had experienced a greater number of generalized allergic reactions seemed to have a greater knowledge of the symptoms of anaphylaxis (Table II). Specifically, regarding knowledge of anaphylactic symptoms, 26% of parents whose children had 2 or more recurrent allergic reactions scored greater than 9 of 11 compared with 12% of parents whose children had experienced 1 or fewer recurrent reactions.

Only 16 (24%) parents were able to recall all 4 steps required for the correct use of the EpiPen autoinjector device and 4 (5%) parents could not recall any steps. More than 80% of parents could describe the site of administration and to apply pressure, but only 50% remembered that the gray cap had to be removed before use and that the device had to be held in place for 10 seconds. A similar relationship was demonstrated between the frequency of recurrent reactions and knowledge of EpiPen use. Parents whose children had experienced a greater number of generalized allergic reactions seemed to have a greater knowledge of EpiPen use (Table II). Thirty-seven percent of parents whose children had 2 or more recurrent allergic reactions were able to recall all 4 steps of EpiPen use compared with 19% of parents whose children had experienced 1 or fewer recurrent reactions.

The majority of parents (97%) had informed school staff and other caregivers that the child had anaphylaxis and which triggers should be avoided. However, only 27 (40%) children had an EpiPen device at school, an anaphylaxis action plan, documented consent, and a school staff member trained to use the device. There were no differences in parental knowledge or practice between those children with insect, food, or idiopathic anaphylaxis.

The specific allergen, age at presentation, age at the time of study, time since prescription of the EpiPen, number of subsequent generalized allergic reactions, and the location of the child when the reaction occurred is detailed in Table III. Children with insect venom anaphylaxis were significantly older at presentation and at the time of study than children with food anaphylaxis ($P < .05$). For the 68 patients the total period of study since prescription of the EpiPen was 1477 patient-months, with a mean time of 20 months. A total of 121 recurrent generalized reactions occurred in 37 of 68 (54%) of children, or an average of 0.98 allergic reactions per child per year since the prescription of the EpiPen (Table III). Seventy-six of these reactions were NAR and 45 were ANAR. Children with food anaphylaxis were at least 4-fold more likely to have had recurrent generalized aller-

TABLE I. Number and percentage of parents (n = 68) who reported specific anaphylactic symptoms when asked to describe the symptoms of anaphylaxis

Anaphylactic symptoms reported by parents										
Skin symptoms		Respiratory symptoms						Other		
Rash	Swelling	Shortness of breath	Noisy breathing	Cough	Hoarse voice	Hard to swallow	Hard to talk	Faint/dizzy	LOC	Other (eg, vomiting)
58 (85%)	50 (74%)	63 (93%)	17 (25%)	10 (15%)	2 (3%)	1 (1%)	1 (1%)	19 (28%)	11 (16%)	5 (7%)

LOC, Loss of consciousness.

TABLE II. Frequency distribution of parental knowledge of anaphylactic symptoms and EpiPen use according to number of recurrent generalized allergic reactions

	Frequency of recurrent allergic reactions	
	1 or fewer recurrent reactions (n = 49)	2 or more recurrent reactions (n = 19)
Knowledge of anaphylaxis symptoms (score /11)		
1-4	12 (25%)	5 (26%)
5-8	31 (63%)	9 (47%)
9-11	6 (12%)	5 (26%)
Knowledge of EpiPen use (score /4)		
0	4 (9%)	0 (0%)
1	9 (18%)	1 (6%)
2	6 (12%)	2 (11%)
3	21 (43%)	9 (46%)
4	9 (18%)	7 (37%)

TABLE III. Anaphylactic trigger, age at presentation and study, time since prescription of EpiPen, number of reactions, and location of child when reactions occurred in 68 children with anaphylaxis

	Insect	Food	Idiopathic	All
No. of children	42	24	2	68
Anaphylactic trigger	Bee 35 Hopper ant 7	Nut 11 Cow's milk 5 Egg 4 Fish 2 Other food 2		Insect venom 42 Food 24 Idiopathic 2
Age at presentation (y) (median and range)	5 (1.0-13.5)*	1.5 (0.1-15.0)	7.0 (3.0-12.5)	4 (0.1-15)
Age at study (y) (median and range)	9 (3.5-19)*	5 (1.5-18)	10 (6-14)	8 (1.5-19)
Time since prescription of EpiPen (mo)	24 (4-72)	18 (6-48)	24 (12-48)	20 (3-72)
Generalized allergic reactions (No. and reactions per patient per year)				
Nonanaphylactic reactions	24 (0.3)	49 (1.3)	3 (0.75)	76 (0.61)
Anaphylactic reactions	12 (0.14)	22 (0.58)	11 (2.75)	45 (0.37)
Total	36 (0.44)	71 (1.9)	14 (3.5)	121 (0.98)
Location of child when generalized reaction occurred				
Away from home	16/36 (44%)	25/71 (35%)	3/14 (21%)	44/121 (36%)
Away from home and at school	8/36 (22%)	10/71 (14%)	2/14 (14%)	20/121 (17%)
At home	20/36 (56%)	46/71 (65%)	11/14 (79%)	77/121 (64%)
Reactions without parent present	7/36 (19%)	11/71 (15%)	2/14 (14%)	20/121 (17%)

*Children with insect venom anaphylaxis were significantly older at presentation and at the time of study compared with children with food anaphylaxis, $P < 0.05$.

gic reactions (both NAR and ANAR) than were children with insect venom anaphylaxis. However, the 2 children with idiopathic anaphylaxis experienced the highest number of recurrent reactions.

In 37 of 76 (49%) of the NAR, exposure to a known trigger occurred (23 insect venom and 14 food), and on 34 of 76 (45%) occasions exposure to a new trigger was documented. These 34 reactions all occurred in children with food anaphylaxis and consisted of generalized skin rash after contact with an allergen (such as grass pollen or animal dander) or another food trigger. On 5 occasions no trigger was identified. In 32 of 45 (71%) of the ANARs exposure to a known trigger occurred. On 13 occasions the trigger was not identified, but on 11 occasions these reactions occurred in the 2 children with idiopathic anaphylaxis. The remaining 2 reactions occurred in children with food anaphylaxis and exposure to a covert food trigger is likely. Only 5 of 68 children did not attend creche, preschool, or school and had no caregivers other than their parents; 2 were of preschool age and 3 were adolescents employed or attending university. Of the 121 generalized reactions, 44 (36%) occurred away from home and only 20 (17%) occurred at school or without a parent present.

After the 121 generalized reactions no first aid medication was used on 14 (12%) occasions. On 6 occasions these were ANAR. Four of these reactions occurred in one patient who had a hypersensitivity to antihistamines; this patient had medical follow-up and observation on all occasions with epinephrine being given once. Of the 2 other cases, one child was taken to hospital and given epinephrine with good effect but of concern was one teenager who "sat it out" alone in his car until symptoms abated spontaneously. After the 121 generalized reactions an oral antihistamine only was used on 92 (76%) occasions and an EpiPen autoinjector (with or without an antihistamine) was used on 15 (12%) occasions. On 13 of these 15 occasions the EpiPen was administered after the onset of anaphylactic symptoms (respiratory and/or cardiovascular) but on 2 occasions it was used before the onset of these symptoms. An EpiPen was given by a parent (5), the child (4), school staff (3), and a general practitioner (3) on these occasions. In all cases where a child self-administered an EpiPen the child was supervised by an adult.

In 32 of 45 (71%) of the ANAR episodes an EpiPen autoinjector was not used in first aid treatment (Table IV). For the majority, 22 of 32 (69%), of these occasions the EpiPen was available and had not expired. The EpiPen was more likely to be used for insect venom anaphylaxis than for food or idiopathic anaphylaxis. A similar number of anaphylactic reactions, in those with insect venom and food anaphylaxis, occurred away from home (41% vs 54%, respectively). However, in all episodes of insect venom anaphylaxis an EpiPen was administered compared with only 9% of episodes of food anaphylaxis ($P < .001$). Likewise, a similar number of anaphylactic reactions, in those with insect venom and food anaphylaxis, occurred with the parent present (67% vs 64%, respectively). However, the EpiPen was administered in 62% of

episodes of insect venom anaphylaxis compared with only 14% of episodes of food anaphylaxis ($P < .001$).

On the 32 occasions when an EpiPen autoinjector was not administered, epinephrine was subsequently administered in an emergency department or by a medical practitioner on 15 (47%) occasions. In contrast, in only 2 of the 13 (15%) occasions when children received an EpiPen was epinephrine subsequently administered ($P < .05$). On the 32 occasions when the EpiPen was not given, admission to hospital occurred on 15 (47%) occasions compared with 2 of 13 (15%) occasions when the EpiPen was administered ($P < .05$) (Table IV).

DISCUSSION

First aid implies a simple yet life-saving intervention that is usually commenced at the onset of symptoms, in the community by nonmedical or lay personnel, and before the patient receives medical attention. Although conventional cardiopulmonary resuscitation may be required for first aid anaphylaxis management, many authorities would advise the early use of epinephrine as the most important measure.⁷⁻⁹ For this reason it is advocated that parents and other caregivers of children with anaphylaxis are supplied with epinephrine for first aid use. However, this view is not consistently held and the following reasons have been cited against the widespread provision of injectable epinephrine in children with food anaphylaxis¹⁰: that prescription of an injectable device may restrict the child's activity unnecessarily, that it may cause rather than allay anxiety, and that it may stigmatize the child and lead to exclusion from various activities. In addition, the lack of good evidence that epinephrine is life saving when used in the context of first aid and the potential hazard of epinephrine were thought to be important.

The use of injectable epinephrine in the context of first aid to prevent the complications of anaphylaxis has not been comprehensively evaluated in children. In Australia the EpiPen autoinjector is the only autoinjector device that is widely available. It was clinical practice during the study period to only prescribe this device for children whose weight exceeded 15 kg. Although the retail cost of the EpiPen may be prohibitive (\$150), the cost to patients attending the allergy service was subsidized, with families paying between \$3 and \$60 depending on the family income. For no patient did the cost of the EpiPen prevent its being dispensed.

This retrospective survey has documented that recurrent generalized allergic reactions, in a cohort of anaphylactic children attending a tertiary care allergy service, occurs frequently. Reactions are more likely to be experienced by children with food or idiopathic anaphylaxis than by those with insect venom anaphylaxis. This finding has been noted in a similar study and is likely to reflect the risk of continuing food exposure compared with seasonal exposure to insects stings.¹¹ Although one third of the generalized reactions were ANAR, an EpiPen autoinjector was only administered for a minority of these reactions despite the EpiPen being in date and available.

TABLE IV. Comparison of 45 episodes of anaphylaxis in which the EpiPen was and was not given

	Total	EpiPen given	EpiPen not given
No. of episodes of anaphylaxis	45 (100%)	13 (29%)	32 (71%)
Age (y) (median and range)	8.5 (2-18)	7 (5-14)	10 (2-18)
Anaphylactic trigger			
Insect venom	12	9	3*
Food	22	2	20*
Idiopathic	11	2	9
Anaphylactic reactions occurring away from home			
Insect venom	5	5	0*
Food	12	2	10*
Idiopathic	3	1	2
Anaphylactic reactions occurring at school			
Insect venom	4	4	0*
Food	5	0	5*
Idiopathic	1	0	1
Anaphylactic reactions occurring without parent present			
Insect venom	4	4	0
Food	8	0	8
Idiopathic	1	0	1
Outcome			
Epinephrine (excluding EpiPen) subsequently administered	17	2 (14%)	15 (47%)†
Hospital admission	17	2 (14%)	15 (47%)†

*Of the reactions occurring at home, at school, or without a parent present, children with insect venom anaphylaxis were significantly more likely to have an EpiPen administered than those with food anaphylaxis, $P < .001$.

†Children who had an EpiPen administered were significantly less likely to have epinephrine subsequently administered or require hospital admission, $P < .05$.

Parental education at the time of EpiPen prescription clearly does not ensure that the device will be administered with recurrent episodes of anaphylaxis. The reasons for the infrequent use of an EpiPen autoinjector require further study. Both this and a previous study have demonstrated that despite education and training at the time of prescription of an EpiPen, subsequent parental recall of the symptoms of anaphylaxis (other than skin rash and difficulty breathing) and use of the EpiPen is deficient on review.¹² In addition, although parents readily informed other caregivers that the child had a history of anaphylaxis, measures were not in place to ensure the provision of epinephrine in these situations. This is of particular concern in those children attending creche, preschool, and school. Here the majority of children did not have basic first aid measures in place (an anaphylaxis action plan, an EpiPen autoinjector available, and someone willing and able to administer the device). However, lack of knowledge may not be the only factor contributing to the infrequent use of an EpiPen. Interestingly, children with food anaphylaxis, compared with those who had insect venom anaphylaxis, were less likely to have an EpiPen administered. This cannot be explained by the fact that more food reactions were occurring away from home or that the parent of the affected child was not present during a reaction. In addition, there were no apparent differences in parental knowledge or practice between those with food or insect venom anaphylaxis. The reasons for this difference require further investigation, but the following reasons may be possible. First, children with food anaphylaxis were younger than those with insect venom anaphylaxis and there may be a reluctance and difficulty in administering the EpiPen in younger children. Second, because reactions were

occurring more frequently in those children with food anaphylaxis, parents may have been reluctant to use the EpiPen on multiple occasions. Last, some of the children with insect venom anaphylaxis were undergoing immunotherapy and this may have provided an opportunity for continuing education in the use of an EpiPen.

The majority of generalized reactions, including anaphylaxis, occurred at home and with a parent present. This has been noted in other case series of anaphylaxis in children.^{13,14}

Although recent attention has emphasized the need for first aid measures to be in place outside the family home, education of the primary caregiver of the child should not be neglected. Continuing parental education and support regarding the prevention, recognition, and management of anaphylaxis would appear critical. Specifically, children with food and idiopathic anaphylaxis should be targeted. These children may be at greater risk of morbidity from anaphylaxis given that recurrent reactions occur more frequently, immunotherapy is not available, and the EpiPen is less likely to be used.

No deaths occurred in this study but the findings do suggest that the first aid use of epinephrine did prevent subsequent morbidity from recurrent episodes of anaphylaxis. In those children who experienced an ANAR, use of an EpiPen significantly reduced the chances of hospitalization and the subsequent use of epinephrine. The majority of children who were given epinephrine in hospital were subsequently admitted for observation. Clearly, additional studies are required to ascertain whether prescription and use of an EpiPen does prevent morbidity and mortality from anaphylaxis.

The provision of medication within a child care center or school remains problematic given the lack of policy, training, and support provided to staff within these centers.^{15,16} In this study first aid precautions for anaphylaxis were not in place at the majority of school sites. Parents cannot be expected to achieve the cooperation of educational caregivers unless the correct policy, training, and process are in place. As a result of a recent survey of anaphylaxis prevalence and school management in South Australia, a collaborative project has been established among the allergy service, the educational department, and first aid trainers.² Educational authorities now recognize that they have a duty of care that covers the first aid management of anaphylaxis and in certain selected cases this involves the use of epinephrine. The project offers all school staff at sites where a child is enrolled with a history of anaphylaxis and who has an EpiPen autoinjector a 1-hour anaphylaxis training program. The program is implemented by first aid trainers and funded by the education department. More than 1332 school staff at 113 school sites have now received training in the first aid management of anaphylaxis. A similar program has been described in the United Kingdom,¹⁷ and this may provide an alternate model for anaphylaxis education. Consideration should be given to the widespread implementation of such a model given the poor ability of some medical professionals to educate parents on first aid anaphylaxis management.¹⁸ Such programs should also be extended to parents and other caregivers of children with anaphylaxis.

In children with anaphylaxis who are prescribed an EpiPen autoinjector the device is infrequently used with recurrent episodes of anaphylaxis. The reasons for this require further research, as does the effectiveness of educational interventions aimed at improving the first aid response of parents and other caregivers after the recurrence of anaphylaxis in affected children.

REFERENCES

1. Position statement: the use of epinephrine in the treatment of anaphylaxis. *J Allergy Clin Immunol* 1994;94:666-8.
2. Boros C, Kay D, Gold MS. Parent reported allergy and anaphylaxis in 4173 South Australian pre-school and school children. *J Paediatr Child Health* 2000;36:36-40.
3. Delage C, Irey NS. Anaphylactic deaths: a clinopathological study of 43 cases. *J Forensic Sci* 1972;17:525-39.
4. Nicklas RA, Bernstein IL, Li JT, Lee RE, Spector SL, Dykewicz MS, et al. The diagnosis and management of anaphylaxis. *J Allergy Clin Immunol* 1998;101(Suppl):S465-528.
5. Yunginger JW, Sweeney KG, Sturmer WQ, Giannandrea LA, Teigland JD, Bray M, et al. Fatal food-induced anaphylaxis. *JAMA* 1988;260:1450-2.
6. Sampson H, Mendelson L, Rosen J. Fatal and near-fatal anaphylactic reactions to foods in children and adolescents. *N Engl J Med* 1992;327:380-4.
7. American Academy of Pediatrics, Committee on School Health. Guidelines for urgent care in school. *Pediatrics* 1990;86:999-1000.
8. Position Statement of the Canadian Paediatric Society. Fatal anaphylactic reactions to food in children. *Can Med Assoc J* 1994;150:337-9.
9. Position statement: American Academy of Allergy, Asthma and Immunology. Anaphylaxis in schools and other child-care settings. *J Allergy Clin Immunol* 1998;102:173-6.
10. Patel L, Radivan FS, David TJ. Management of anaphylactic reactions to food. *Arch Dis Child* 1994;71:370-5.
11. Grabenstein J, Smith L. Incidence of anaphylactic self-treatment in an outpatient population. *Ann Allergy* 1989;63:184-8.
12. Haug SW. A survey of EpiPen use in patients with a history of anaphylaxis. *J Allergy Clin Immunol* 1998;102:525-6.
13. Dibs SD, Baker MD. Anaphylaxis in children: a 5-year experience. *Pediatrics* 1997;99:117-8.
14. Novembre E, Antonella C, Bernardi R, Mugnaini L, Caffarelli C, Cavagni G, et al. Anaphylaxis in children: clinical and allergologic features. *Pediatrics* 1998;101:693. Available at: <http://www.pediatrics.org/cgi/content/abstract/101/4/e8>.
15. Hay G, Harper T, Courson F. Preparing school personnel to assist students with life-threatening food allergies. *J School Health* 1994;64:119-21.
16. Bannon MJ, Ross EM. Administration of medicines in school: who is responsible? *BMJ* 1998;316:1591-3.
17. Vickers D, Maynard L, Ewan P. Management of children with potential anaphylactic reactions in the community: a training package and proposal for good practice. *Clin Exp Allergy* 1997;27:898-903.
18. Grouhi M, Alsheri M, Hummel D, Roifman C. Anaphylaxis and epinephrine auto-injector training: who will teach teachers? *J Allergy Clin Immunol* 1999;104:190-3.