

Whether these findings can be applied to the PED in the United States will need to be further evaluated.

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Food-Induced Anaphylaxis in Infants and Children

Samady W, Trainor J, Smith B, Gupta R. *Ann Allergy Asthma Immunol.* 2018;121(3):360-365

PURPOSE OF THE STUDY. To describe food-induced anaphylaxis in infants and to compare the clinical presentations with those in older children.

STUDY POPULATION. There were 357 cases of food anaphylaxis diagnosed and treated in the emergency department over a 2-year period (from June 2015 to June 2017). These cases included 47 infants, 43 toddlers, 96 young children, and 171 school-aged children.

METHODS. This was a retrospective chart review in which a standardized collection form was used. Anaphylaxis was defined by using the 3 criteria outlined in the second symposium on the definition and management of anaphylaxis. The primary group of interest was infants (<12 months of age); comparison groups were toddlers (12-24 months of age), young children (2-6 years of age), and school-aged children (>6 years of age).

RESULTS. Infants and toddlers presented with skin involvement more frequently than school-aged children (94% and 91% vs 62%; $P < .001$). Hives was the most common skin manifestation, found in 70% of infants compared with 54% of school-aged children ($P = .001$). Infants presented with gastrointestinal involvement more frequently than any other age group (89% of infants versus 63% of toddlers [$P = .003$], 60% of young children [$P = .006$], and 58% of school-aged children [$P < .001$]). Vomiting was present in 83% of infants. Respiratory symptoms were more common in older cohorts (17% of infants versus 54% of young children [$P < .001$] and 49% of school-aged children [$P < .001$]). Wheezing was present in 2% of infants compared with 31% of young children ($P < .001$) and 22% of school-aged children ($P = .001$). Eggs and cow's milk were the most common foods to cause anaphylaxis in infants, significantly more so than in school-aged children. Infants had lower rates of anaphylaxis caused by peanuts and tree nuts compared with older cohorts. Eczema was not significantly more common in infants than in older cohorts. Children who were allergic to eggs and cow's milk had a history of eczema 25% and 28% of the time, respectively. Half of the children with peanut allergies had a history of eczema. Infants were least likely to be discharged from the hospital.

CONCLUSIONS. This was the largest study to date in which the symptomatology of food-induced anaphylaxis in infants was described. The main manifestations were hives and vomiting. Most infants did not have eczema or a history of food allergies.

REVIEWER COMMENTS. The biggest weakness of this study was the lack of confirmation of allergy by skin or in vitro allergy tests. The take-home message is that there are differences in the presentation of food anaphylaxis and in the types of foods associated with food anaphylaxis in infants compared with older children. If hives are not present, the diagnosis of anaphylaxis can be overlooked. On the other hand, hives and vomiting are common symptoms in infants; therefore, a diagnosis of food allergy should be confirmed before advising prolonged food avoidance.

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Improving Anaphylaxis Care: The Impact of a Clinical Pathway

Lee J, Rodio B, Lavelle J, et al. *Pediatrics.* 2018;141(5):e20171616

PURPOSE OF THE STUDY. To evaluate the clinical impact of a revised anaphylaxis clinical pathway with reductions in emergency department (ED) observation time, increased provider education on anaphylaxis, and patient accessibility to epinephrine auto-injectors.

STUDY POPULATION. The study population included pediatric ED patients at an urban, tertiary university-affiliated children's hospital, before and after changes to a clinical anaphylaxis pathway.

METHODS. This was a multidisciplinary quality improvement initiative, performed at an urban, tertiary university-affiliated children's hospital ED to update the anaphylaxis clinical pathway. ED observation time was reduced from 8 to 4 hours, with the goal to reduce anaphylaxis-related admissions. Provider education on anaphylaxis and prompt epinephrine use was improved, and all patients were discharged from the ED with an epinephrine auto-injector. Data were analyzed 18 months before and after the pathway update. Patients with anaphylaxis were identified by using *International Classification of Diseases, Ninth Revision* and *International Classification of Diseases, 10th Revision* codes. Their medical records were reviewed to evaluate ED management and follow-up care. The study authors set a target epinephrine administration time of ≤ 20 minutes after ED arrival and a goal of $\geq 80\%$ of patients being discharged from the hospital with epinephrine. Statistical analysis was performed by using Fisher's exact test for the primary end point and

subject follow-up data. The Mann–Whitney *U* test was used to compare the median time of first epinephrine administration for critical patients before and after implementation of the new clinical pathway. A *P* value $\leq .05$ was considered statistically significant.

RESULTS. A 60% reduction from baseline ($P < .0001$) was noted for anaphylaxis-related admissions; 106 of 182 cases (58.2%) required admission before the pathway revision, compared with 65 of 257 (25.3%) after. No statistically significant difference was noted in the rate of patients returning to the ED within 72 hours for recurrence of anaphylaxis-related symptoms (1.3% baseline versus 2.6% after revision; $P = .99$). The median time to first epinephrine administration for critical patients before the pathway change was 15 minutes. After pathway revision, it decreased to 10 minutes, which met the target goal of <20 minutes. The target goal of $>80\%$ of discharged patients leaving with personal epinephrine auto-injectors was also met; 164 of 192 (85.4%) patients filled or received auto-injectors. In regard to safety, there were no deaths during the study period. There were no ICU admissions. Postrevision, a greater proportion of patients were seen for allergy and/or immunology follow-up (113 of 182 [62.1%] before and 166 of 257 [64.6%] after, respectively).

CONCLUSIONS. The study authors concluded that the revised clinical anaphylaxis pathway improved patient care by reducing the anaphylaxis-related admission rates, ensuring prompt delivery of epinephrine to critical patients, and increasing epinephrine auto-injector carriage rates for discharge patients. Future directions include evaluating sustainability of the updated pathway and improving efficiency of care delivery.

REVIEWER COMMENTS. This quality improvement initiative improved management of anaphylaxis in a pediatric ED. Anaphylaxis is a life-threatening event, and prompt treatment with epinephrine is vital. By reducing the observation period, the study authors demonstrated that the rate of anaphylaxis-related admissions could be reduced. This study was performed at a large tertiary-care pediatric hospital, which is a limitation; however, a similar endeavor could be performed at a smaller community hospital as well. For patient populations living in resource-poor areas, prompt recognition and treatment of anaphylaxis could mitigate prolonged ED observation periods, admissions, and prevent unnecessary transfers to tertiary-care centers. The authors of this study reiterate the importance of good provider education regarding the recognition and prompt treatment of anaphylaxis with epinephrine. It is impressive that $>80\%$ of their subjects were discharged with an epinephrine auto-injector in hand. The price of auto-injectors makes them cost prohibitive for some families despite insurance

coverage. Finding ways, as this study has shown, to improve access to epinephrine is important as well.

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Further Evaluations of Factors That May Predict Biphasic Reactions in Emergency Department Anaphylaxis Patients

Lee S, Peterson A, Lohse CM, Hess EP, Campbell RL.
J Allergy Clin Immunol Pract. 2017;5(5):1295–1301

PURPOSE OF THE STUDY. To evaluate variables to help in the identification of patients who are at an increased risk for biphasic anaphylactic reactions in the emergency department (ED).

STUDY POPULATION. The study included 807 patients in the ED with a total of 872 ED visits for anaphylaxis. The median age was 34 years, with 58% female patients and 26% pediatric subjects <18 years of age. Food was the most common inciting trigger in 35% of patients, followed by drugs in 20% of patients and venom in 12% of patients; 22% of patients had an unknown trigger. At least 1 dose of epinephrine was administered in 54% of visits, and 90% of patients received systemic steroids.

METHODS. This was an observational study of patients presenting to an academic ED from 2008 to 2015. Anaphylaxis cases were identified both retrospectively and prospectively on the basis of diagnostic criteria from the National Institute of Allergy and Infectious Diseases Food Allergy and Anaphylaxis Network. Biphasic reactions were defined as recurrent symptoms and signs of anaphylaxis occurring within 72 hours of the initial reaction without reexposure to the offending trigger.

RESULTS. There were 36 visits (4.1%) that resulted in biphasic anaphylaxis, with a median time from the initial reaction of 3 hours (range: 0.5–44 hours). Of those, 17 visits (47%) required treatment with epinephrine. The use of steroids was not associated with biphasic anaphylaxis. Statistically significant variables included a history of anaphylaxis (odds ratio [OR]: 2.74; 95% confidence interval [CI]: 1.33–5.63), an unknown trigger (OR: 2.4; 95% CI: 1.14–4.99), and delayed administration of the first epinephrine dose 60 minutes after symptom onset (OR: 2.29; 95% CI: 1.09–4.79). The risk of a biphasic reaction was 1.6% in patients with none of these risk factors and 20% in patients with all 3 risk factors.

CONCLUSIONS. The authors of this study report a rate of biphasic anaphylactic reactions of 4.1%, with almost half requiring treatment with epinephrine, indicating clinically

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