Original Article

Outcomes of Allergy/Immunology Follow-up After an Emergency Department Evaluation for Anaphylaxis

Ronna L. Campbell, MD, PhD[a], Miguel A. Park, MD[b], Michael A. Kueber, Jr., MD[a], Sangil Lee, MD[a], and John B. Hagan, MD[b] *Rochester, Minn*

What is already known about this topic? Anaphylaxis guidelines currently recommend follow-up with an allergist after an emergency department (ED) visit for anaphylaxis. Low rates of documented allergy/immunology referrals after an ED evaluation for anaphylaxis have been demonstrated in multiple studies.

What does this article add to our knowledge? Our study systematically evaluated outcomes of allergy/immunology follow-up after an ED visit for anaphylaxis and demonstrated that overall, 35% of patients had an alteration in the diagnosis of anaphylaxis or trigger after allergy/immunology evaluation.

How does this study impact current management guidelines? Our study supports current guidelines that recommend a follow-up with an allergist after an ED evaluation for anaphylaxis.

BACKGROUND: Anaphylaxis guidelines currently recommend referring patients with anaphylaxis seen in the emergency department (ED) to an allergist for follow up.
OBJECTIVE: The objective of our study was to evaluate outcomes of allergy/immunology follow-up after an ED visit for anaphylaxis.
METHODS: A retrospective health records review was conducted from April 2008 to August 2012. Charts were reviewed independently by 2 allergists to determine outcomes. Descriptive statistics with corresponding 95% CIs were calculated.
RESULTS: Among 573 patients seen in the ED who met anaphylaxis diagnostic criteria, 217 (38%) had a documented allergy/immunology follow-up. After allergy/immunology evaluation, 16 patients (7% [95% CI, 5%-12%]) had anaphylaxis ruled out. Among those with an unknown ED trigger (n = 74), 24 (32% [95% CI, 23%-44%]) had a trigger identified; and, among those who had a specific suspected ED trigger (n = 143), 9 (6% [95% CI, 3%-12%]) had a trigger identified in a category other than the one suspected in the ED, and 28 (20% [95% CI, 14%-27%]) had an unknown trigger. Thus, there were a total of 77 patients (35% [95% CI, 29%-42%]) who had an alteration in the diagnosis of anaphylaxis or trigger after allergy/immunology evaluation. Four patients (2% [95% CI, 0.7%-4.6%]) were diagnosed with a mast cell activation disorder, and 13 patients (6% [95% CI, 4%-10%]) underwent immunotherapy or desensitization.
CONCLUSION: Overall, 35% of the patients with suspected anaphylaxis in the ED had an alteration in the diagnosis or suspected trigger after allergy/immunology evaluation. These results underscore the importance of allergy/immunology follow-up after an ED visit for anaphylaxis. © **2014 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2014;■:■-■)**

Key words: *Anaphylaxis; Emergency medicine; Follow-up studies; Immunologic desensitization; Mast cell disease*

Anaphylaxis is a sudden systemic allergic reaction that may result in death and is most commonly managed in the emergency department (ED).[1-3] Although anaphylaxis guidelines currently recommend a follow-up with an allergist/immunologist after an ED visit for anaphylaxis, low rates of documented allergy/immunology referrals have been demonstrated in multiple studies and actual follow-up rates are largely unknown but were found to be 14% among patients who were treated for stinging insect anaphylaxis.[3-8]

The reasons for the low rates of allergy/immunology referral and follow-up are unclear. It is possible that ED providers or patients may not clearly understand the rationale for an allergy/immunology follow-up because specific outcomes of follow-up have not undergone rigorous evaluation. According to the 2010 diagnosis and management of anaphylaxis practice parameter, the allergist has the "expertise to obtain a detailed allergy history; coordinate laboratory and allergy testing; evaluate the benefits and risks of therapeutic options; and counsel the patient on avoidance measures."[4] However, because the outcomes of allergy

[a]Department of Emergency Medicine, Mayo Clinic, Rochester, Minn
[b]Division of Allergic Diseases, Mayo Clinic, Rochester, Minn
This study was supported by the Small Grants Program of the Department of Emergency Medicine, Mayo Clinic, Rochester, Minn.
Conflicts of interest: M. A. Park has received consultancy fees from Baxter for a virtual advisory board. J. B. Hagan has received research support from the National Heart, Lung, and Blood Institute, National Institute of Allergy and Infectious Diseases, GlaxoSmithKline, AstraZeneca, and Small Grants Program; and has received travel support from MedImmune. The rest of the authors declare that they have no relevant conflicts of interest.
Received for publication May 9, 2014; revised July 17, 2014; accepted for publication July 21, 2014.
Corresponding author: Ronna L. Campbell, MD, PhD, Department of Emergency Medicine, Mayo Clinic, 200 First Street SW, Rochester, MN 55905. E-mail: campbell.ronna@mayo.edu.
2213-2198

http://dx.doi.org/10.1016/j.jaip.2014.07.011

Abbreviations used
COPD- Chronic obstructive pulmonary disease
ED- Emergency department
EDOU- Emergency department observations unit
FAAN- Food Allergy and Anaphylaxis Network
ICU- Intensive care unit
IQR- Interquartile range
LT- Leukotriene
MCAS- Mast cell activation syndrome
NIAID- National Institute of Allergy and Infectious Disease
NSAID- Nonsteroidal anti-inflammatory drug
PFT- Pulmonary function test
PGF_2-α- Prostaglandin F_2 α

follow-up after an ED visit for anaphylaxis have not previously been systematically studied, formal "evidence" to support referral may be difficult to provide to patients when the trigger is thought to be known and initial management and education have already been provided in the ED. The objective of our study was to systematically evaluate outcomes of allergy/immunology follow-up after an ED visit for anaphylaxis specifically with regard to the presence or absence of confirmation of the diagnosis of anaphylaxis and suspected trigger. We also evaluated the diagnosis of mast cell disorders and the number of patients who underwent immunotherapy or desensitization.

METHODS

Study design and setting

A retrospective health records review was conducted of patients evaluated at Saint Marys Hospital ED, a tertiary care academic ED with 72,000 annual patient visits. The Mayo Clinic Institutional Review Board approved the study protocol.

Selection of participants

Patients included in the ED anaphylaxis database from April 2008 to August 2012 were included. Patients in the database were identified both retrospectively and prospectively. Most patients were identified retrospectively by querying electronic health records of patients in the ED who received a diagnosis that contained text with "allerg," "anaphy," or "sting." Patient records were reviewed and included in the ED anaphylaxis database if (1) the patient provided consent per Minnesota law to have his or her medical records reviewed, and (2) presenting signs and symptoms met the National Institute of Allergy and Infectious Disease (NIAID) Food Allergy and Anaphylaxis Network (FAAN) diagnostic criteria.[1] Overall, 7% of retrospectively identified patients declined consent to have their medical records reviewed during the study period.

A subset of patients were prospectively identified at the time of their ED visit based on a chief concern that included the text: "allergic," "reaction," "angio," "sting," "hives," and "rash." If a patient presented with 1 of the eligible chief concerns, then the ED provider was queried to determine if the patient was suspected of having an allergic reaction or anaphylaxis. If the patient was suspected of having an allergic reaction or anaphylaxis, then the patient was eligible for enrollment and consent was obtained. Data obtained during the ED visit included the suspected trigger, timing of onset, signs and symptoms, and prehospital interventions. The patient was included in this study only if NIAID-FAAN criteria were met. Among the prospectively identified patients, 6% declined consent.

TABLE I. Demographics, patient characteristics, and ED disposition among 217 patients in the ED

Variable	Finding (n = 217)
Girls and women, no. (%)	129 (59)
Age (y), median (IQR)	34 (15-52)
Age range, no. (%)	
0-5 y	39 (18)
6-17 y	22 (10)
18+ y	156 (72)
Race, no. (%)	
White	189 (87)
Asian	7 (3)
Black	6 (3)
American Indian	1 (0)
Other	14 (6)
History of asthma, no. (%)	69 (32)
Disposition from ED, no. (%)	
Home	97 (45)
EDOU	91 (42)
General floor	7 (3.2)
ICU	**22 (10)**

EDOU, Emergency department observations unit; *ICU*, intensive care unit.

TABLE II. Referral source and allergy testing performed at allergy/immunology follow-up among patients in the ED who met NIAID-FAAN criteria

Variable	No. (n = 217)	% Patients (95% CI)
Referral source		
ED provider	139	64 (57-70)
Inpatient evaluator	37	17 (13-23)
Primary care	24	11 (8-16)
Other	17	8 (5-12)
Allergy testing performed	146	67 (61-73)
Skin testing	134	38 (32-45)
IgE enzyme immunoassay	105	48 (42-55)
Other tests	103	47 (41-54)
PFT	13	6 (4-10)
Oral challenge	8	4 (2-7)
Serum tryptase	65	30 (24-37)
N-methylhistamine	24	11 (8-16)
PGF_2-α	24	11 (8-16)
Other	**73**	**34 (28-40)**

PFT, Pulmonary function test; *PGF_2-α*, prostaglandin F_2 α.

Data collection and outcome measurements

Data in the anaphylaxis database, including patient demographics, presenting signs and symptoms, ED disposition, and date of allergy follow-up were collected by using a standardized data abstraction form as previously described.[9] When allergy/immunology follow-up occurred, electronic health records were retrospectively reviewed independently by 2 American Board of Allergy and Immunology certified allergists (M.P. and J.H.) to determine the outcomes of the follow-up visit, including