Parent-Reported Penicillin Allergy Symptoms in the Pediatric Emergency Department

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ABSTRACT

OBJECTIVE: Children often present to the pediatric emergency department (ED) with a reported penicillin allergy. The true incidence of pediatric penicillin allergy is low, and patients may be inappropriately denied first-line antibiotics. We hypothesized that more than 70% of reported penicillin allergies in the pediatric ED are low risk for true allergy.

METHODS: Parents of children presenting to the pediatric ED with parent-reported penicillin allergy completed an allergy questionnaire. The questionnaire included age at allergy diagnosis, symptoms of allergy, and time to allergic reaction from first dose. The allergy symptoms were dichotomized into high and low risk in consultation with a pediatric allergist before questionnaire implementation.

RESULTS: A total of 605 parents were approached; 500 (82.6%) completed the survey. The median (interquartile range) age of the children at diagnosis was 1 year (7 months, 2 years); 75% were diagnosed before their third birthday. Overall, 380 (76%) (95% confidence interval 72.3, 79.7) children had exclusively low-risk symptoms. The most commonly reported symptoms were rash (466, 92.8%) and itching (203, 40.6%). Of the 120 children with one or more high-risk symptom, facial swelling (50, 10%) was the most common. Overall, 354 children (71%) were diagnosed after their first exposure to penicillin. Symptom onset within 24 hours of medication administration occurred in 274 children (54.8%).

CONCLUSIONS: Seventy-six percent of patients with parent-reported penicillin allergy have symptoms unlikely to be consistent with true allergy. Determination of true penicillin allergy in patients with low-risk symptoms may permit the increased use of first-line penicillin antibiotics.

KEYWORDS: pediatric emergency department; penicillin allergy

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WHAT'S NEW

Seventy-six percent of children in the emergency department with a reported penicillin allergy have low-risk symptoms that may not reflect true penicillin allergy. The majority of these allergies were diagnosed before the child was 3 years old while receiving antibiotics for an ear infection.

CHILDREN OFTEN PRESENT to the pediatric emergency department (ED) with a parent-reported allergy to various medications. Penicillin allergy is the most commonly reported medication allergy, reported in 5% to 20% of patients.[1–6] Because physicians rely on these patient- or parent-reported allergies when making treatment decisions, many people are denied first-line antibiotic therapy resulting from misunderstood or misdiagnosed penicillin allergy.[7] As a consequence, these patients are prescribed second- or third-line medications that are more expensive and not the antibiotic of choice for their bacterial infection. Specific to penicillin allergy, more than 95% of patients may actually tolerate a penicillin, either because they were never allergic or because they had an earlier allergy that subsequently resolved.[8]

Drug-related hypersensitivity reactions are an important health problem, but epidemiologic data on drug allergy are scarce. A study of 10,059 6th to 8th grade children found parent-reported allergy in 792 children (7.9%).[9] However, parent surveys revealed a clinical history suggestive of drug allergy in only 117 children (1.2%) and a true frequency of immediate-type drug hypersensitivity in 0.11%. Other studies also support the notion that a large number of adverse drug reactions are not consistent with an allergic reaction.[10–12] Examples of adverse drug reactions classified as allergies include rash, an episode of emesis with medication administration, or the development of antibiotic-associated diarrhea. Several studies have shown that rash associated with amoxicillin is rarely reproducible with allergy testing and that it is a common adverse reaction that results in no patient harm with continuation of the medication.[13,14]

The ascertainment of medication allergy information is commonly performed during triage in the ED setting. Provider reliance on parental report of allergy greatly affects

the care of their children.[9] In addition, there is typically no standardized question format used when ascertaining a true medication allergy, resulting in varying responses from patients and their caregivers. A study of adult surgical patients found that approximately 50% of reactions labeled by surgical interns as allergic were deemed not allergic when assisted by a structured allergy questionnaire.[15] That study and others support the need for a structured questionnaire to help differentiate true allergic reactions from adverse reactions.[16-18]

This study utilized a self-reported penicillin allergy questionnaire to identify and classify patients with reported penicillin allergy into high- and low-risk groups. We know of no previous study that has assessed the percentage of children presenting to a pediatric ED with parent-reported allergies who have exclusively low-risk symptoms. We hypothesized that more than 70% of penicillin allergy as reported by families in a pediatric ED are low risk for a true penicillin allergy.

METHODS

STUDY DESIGN

We conducted a cross-sectional study of children birth to 18 years old inclusive with a history of parent- or guardian (hereafter termed parent)-reported allergy to penicillin who presented to an urban pediatric ED between April 1, 2015, and March 31, 2016. Children were excluded if the family did not speak English or if the child was a ward of the state, currently in foster care, or in police or detention custody. The study was approved by the hospital's institutional review board.

Trained research staff, available in the ED from 8 AM to 11 PM on weekdays and 11:30 AM to 10 PM on weekends, identified a convenience sample of eligible children by chart review for penicillin allergy and approached parents for consent, and children for assent when applicable, in the ED. Consented parents completed an allergy questionnaire administered via an electronic tablet, and the results were uploaded to a secure online database. If two parents were present in the ED, only one parent completed the survey; thus, one survey was completed per child. Research staff abstracted age, recorded in years, and sex from the medical record (Table 1).

Table 1. Characteristics of Child Questionnaire Participants

Characteristic	Overall	High Risk	Low Risk	P*
Age, y, median (IQR)				
Survey completion	6 (3, 11)	7 (3,11)	6 (3,11)	.378
Allergy diagnosis	1 (7 mo, 2yr)	1 (8 mo, 2yr)	1 (7 mo, 2yr)	.205
Race, n (%)				<.05
White	260 (52.0)	49 (40.8)	211 (55.5)	
African American	109 (21.8)	40 (33.3)	69 (18.2)	
Hispanic	67 (13.4)	17 (14.2)	50 (13.2)	
Asian	7 (1.4)	3 (2.5)	4 (1.1)	
American Indian	3 (0.6)	1 (0.8)	2 (0.5)	
Other	54 (10.8)	10 (8.3)	44 (11.6)	
Female, n (%)	222 (44.4)	58 (48.3)	165 (43.4)	.345

*Comparison between high- and low-risk groups.

PENICILLIN ALLERGY QUESTIONNAIRE

The allergy questionnaire included 17 items assessing allergy history and parent report of their child's race (using National Institutes of Health classifications). Allergy-related questions included: age of child when allergy was diagnosed (reported in years, or months if under 1 year old), name of the antibiotic the child was taking when the allergy was diagnosed (eg, penicillin, amoxicillin, amoxicillin/clavulanate [Augmentin, GlaxoSmithKline, Research Triangle Park, NC]), indication of antibiotic prescription for the child (eg, ear infection, throat infection, chest infection), symptoms of allergic reaction, time to allergic reaction from first dose, and whether a parent, physician, or both diagnosed the allergy. There was no limit to the number of allergy symptoms a parent could report. An initial list provided 17 allergy symptoms and parents were allowed to select "other" and add additional symptoms if needed.

Questionnaire symptom responses were dichotomized into high or low risk in consultation with a pediatric allergist before questionnaire implementation (Table 2). This designation was based on the reported organ system involved and the potential for severe immunoglobulin E (IgE)-mediated or a T-cell-driven reaction. The term "high risk" was used to refer to reported reactions, either IgE-mediated or T-cell driven, that bore high clinical risk for readministration of penicillin by any route. The term "low risk" referred to reactions that were not likely to represent a severe IgE-mediated or T-cell-driven process.

For potentially IgE-mediated symptoms, respiratory or cardiovascular involvement was deemed to be high risk (ie, wheezing, difficulty breathing, airway swelling,

Table 2. Symptoms at Time of Allergy Diagnosis, as Reported by Parents

Symptom	n (%)*
Low-risk symptoms	
Nonhive rash	304 (65.2)
Itching	203 (40.6)
Hive rash	135 (29.0)
Diarrhea	57 (11.4)
Vomiting	33 (6.6)
Runny nose	26 (5.2)
Nonspecified rash	25 (5.0)
Nausea	25 (5.0)
Cough	19 (3.8)
No symptoms but family history of penicillin allergy	11 (2.2)
Headache	11 (2.2)
Dizziness	8 (1.6)
High-risk symptoms	
Facial swelling	50 (10.0)
Difficulty breathing	37 (7.4)
Lip swelling	29 (5.8)
Wheezing	27 (5.4)
Throat swelling	24 (4.8)
Skin peeling	15 (3.0)
Mouth blisters	7 (1.4)
Drop in blood pressure	1 (0.2)

*More than 1 symptom could be selected, so the items are not mutually exclusive.