

Allergy profile should be updated after uneventful administration of a penicillin or penicillin-related antibiotic to a patient with penicillin allergy



Wesley D. Oliver, PharmD, MS^a, Emily L. Heil, PharmD^{a,b,c},
Kerri A. Thom, MD, MS^c, Joseph P. Martinez, MD^c, and
Bryan D. Hayes, PharmD^{a,b,c}

Clinical Implications

- A patient's allergy profile in the medical record should be updated to indicate tolerance of or reaction to a penicillin or penicillin-related antibiotic.

TO THE EDITOR:

Penicillin allergies are self-reported by approximately 10% of hospitalized patients; however, studies have demonstrated that the true incidence of penicillin allergy is far less than 10% and that most of these patients would tolerate the use of a penicillin.^{1,2} It is impossible to differentiate the patients who are truly allergic from those who are not without appropriate allergy evaluations (such as penicillin skin testing) or accurate documentation of tolerance to previous penicillin or penicillin-related antibiotics. In patients with a documented penicillin allergy, providers appropriately avoid penicillins and penicillin-related antibiotics because there is a risk of great harm to patients if they experience an allergic reaction.

Self-reported penicillin allergies significantly affect antibiotic choices and can lead to unnecessarily prescription of broad or potentially suboptimal antibiotics.^{3,4} Antimicrobial allergies have also been associated with increases in antimicrobial resistance, prevalence of *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus*, and vancomycin-resistant enterococci, hospital length of stay, intensive care unit admission, health care costs, and mortality during hospitalization.⁵⁻⁹ Thus, it is important to correct documentation of an allergy when patients receive and tolerate penicillin or penicillin-related antibiotics (amoxicillin, amoxicillin/clavulanate, ampicillin, ampicillin/sulbactam, and piperacillin/tazobactam).

We performed a medication use evaluation to determine the number of patients who reported a penicillin allergy but who received a penicillin or penicillin-related antibiotic during hospitalization, to quantify the percentage of patients who had a reaction to the antibiotic, and to quantify the percentage of patients whose allergy records were updated to reflect tolerance of or reaction to the antibiotic.

We retrospectively reviewed the charts of patient encounters at our institution between July 1, 2013, and July 1, 2015. Patients were selected for this study if they were aged 18 to 89 years, if penicillin allergy was documented on their chart, and if a penicillin or penicillin-related antibiotic was ordered during their admission. During the study period, approximately 6,200 patients (out of 61,000 total admissions) were admitted to the hospital with a penicillin allergy noted in their charts. Using

pharmacy charge data, we identified 250 patients (4%) from this population for whom a penicillin or penicillin-related antibiotic was ordered. At this stage we did not know whether the antibiotics were administered, discontinued, or part of the penicillin skin testing until we performed a chart review. We randomly chose 100 out of the 250 total patients as a convenience sample for our medication use evaluation.

At our institution, penicillin skin testing and penicillin desensitization are performed by a penicillin allergy testing consultation service managed by infectious diseases physicians. Penicillin skin testing can be requested by the patient's primary care team or by the consultation service if they are following the patient. We identified and accounted for patients (18) in our study group who underwent this testing during hospitalization.

The mean age of our study group was 59 years; 56% were women and 64% were white. Most patients had "penicillin" (96%) documented in their allergy profile, while some patients had specific penicillin-related antibiotics such as piperacillin/tazobactam listed. A specific allergic reaction was not documented for most patients (71%) (Table I).

Sixty of the 100 patients ordered a penicillin or penicillin-related antibiotic actually received it during their hospitalization for therapeutic purposes, most commonly piperacillin/tazobactam (50 of 60 patients [83%]). None of these patients was reported having a reaction after receiving the antibiotic. Patients who received a penicillin or penicillin-related antibiotic were likely to receive more than 1 dose (53 out of 60 patients [88%]), 13 doses per patient on average. A penicillin or penicillin-related antibiotic was ordered for 22 of the 100 patients but was not administered because the order was discontinued or cancelled (in some cases, the reason was not specified). Eighteen of the 100 patients underwent penicillin skin testing; 12 of them tested negative and 6 tested positive or had indeterminate test results. All the 12 patients who tested negative had their allergy profiles updated to reflect the results. In 49 of the 60 (82%) cases in which a patient received a penicillin or penicillin-related antibiotic and did not have a reaction, the allergy profile was not modified with a comment about the patient's tolerance to the drug (Table II).

Our study identified an issue that raises concern. Although a relatively small number of patients (4%) with a documented penicillin allergy were ordered a penicillin or penicillin-related antibiotic, 73% of these patients received a penicillin or penicillin-related antibiotic when ordered. Because of the retrospective nature of this study, we were unable to determine the reason a penicillin or penicillin-related antibiotic was chosen in these patients, the reason alerts were bypassed (2 alerts would have been bypassed, the provider upon ordering and the pharmacist at verification), or the extent of investigation, such as conversations with patients about the severity of their allergies, before the ordering and administration of the antibiotics. Even without being able to determine the reasoning behind the decision, the administration of penicillin or penicillin-related antibiotics to these patients was inappropriate because of an unknown severity of allergy in most patients and the risk of an allergic reaction.

TABLE I. Patients' demographic characteristics (N = 100)

Characteristic	Value
Age (y)	23-89 (mean, 59)
Sex	
Female	56
Male	44
Race	
White	64
Black	30
Other	6
Penicillin allergy listed	
Penicillin	96
Amoxicillin and/or amoxicillin/clavulanate	3
Piperacillin/tazobactam	1
Type of allergic reaction listed	
Not specified	71
Rash	13
Hives	12
Anaphylaxis	3
Rash and hives	1

TABLE II. Results

Variables	No. of patients
Patients with penicillin or penicillin-related antibiotic ordered (n = 100)	
Received penicillin or penicillin-related antibiotic	60
Ordered but not received	22
Received for the purpose of penicillin skin testing	18
Particular penicillin or penicillin-related antibiotic if received (n = 60)	
Piperacillin/tazobactam	50
Ampicillin/sulbactam	5
Penicillin	2
Amoxicillin	1
Amoxicillin/clavulanate	1
Ampicillin	1
If a penicillin or penicillin-related antibiotic was given, was more than 1 dose administered? (n = 60)	
Yes	53
No	7
Doses given if a penicillin or penicillin-related antibiotic was administered	1-46 (mean, 13; median, 7)
Was the allergy profile modified if a penicillin or penicillin-related antibiotic was administered without a reaction? (n = 60)	
No	49
Yes, by pharmacist	6
Yes, by physician	4
Yes, by nurse	1

Fortunately, none of the patients' charts indicated a subsequent allergic reaction, either in the progress notes or as documentation of treatment such as the administration of diphenhydramine. In addition, only 11 of the 60 charts for these patients were updated to reflect tolerance of the penicillin or penicillin-related antibiotic that was administered. It would be

helpful to health care providers who treat these patients in the future to know that an antibiotic in the penicillin family was given without inducing an allergic reaction. Any notation about tolerance (or reaction) to an antibiotic should specify the medication because a patient might be allergic to one medication in the class but not others. A comment in the allergy profile will facilitate antibiotic therapy in the future if the physician is not forced to search past records for information about tolerance or reaction to a penicillin or penicillin-related antibiotic.

In contrast, patients in our study with a documented penicillin allergy who underwent allergy evaluation with penicillin skin testing all had their allergy profiles updated appropriately to reflect the date and result of testing. Patients who tested negative were also subsequently started on a penicillin or penicillin-related antibiotic. A recent study at our institution demonstrated the feasibility and significant impact of a penicillin skin testing program on patients with a documented penicillin allergy.¹⁰

Our discovery of clinicians' failure to update allergy profiles on a majority of patients' charts after penicillin or penicillin-related antibiotics were administered is cause for concern. Patients with a documented penicillin allergy are at risk for harm if administered a penicillin or penicillin-related antibiotic. Although not advocating for the administration of these antibiotics in this group of patients, if it is discovered that they have received these medications, allergy profiles should be updated to reflect the tolerance of the specific antibiotic they received. We urge all clinicians who have chart-updating privileges and responsibilities to monitor and update patients' allergy profiles. If the information on the chart is complete and current, health care providers will be able to make the best decisions for their patients, leading to better outcomes and the cost-effective delivery of care.

Acknowledgment

The manuscript was copyedited by Linda J. Kesselring, MS, ELS, the technical editor/writer in the Department of Emergency Medicine at the University of Maryland School of Medicine.

^aUniversity of Maryland Medical Center, Baltimore, Md

^bUniversity of Maryland School of Pharmacy, Baltimore, Md

^cUniversity of Maryland School of Medicine, Baltimore, Md

Conflicts of interest: E. L. Heil's institution has received a grant from ALK-Abelló (for penicillin allergy skin test supplies for another study unrelated to this study), and E. L. Heil has received support for travel to meetings for the study or for other purposes from ALK-Abelló (attendance to present results of penicillin skin test study at ID Week). The rest of the authors declare that they have no relevant conflicts of interest.

Received for publication July 7, 2016; revised August 4, 2016; accepted for publication August 23, 2016.

Available online October 17, 2016.

Corresponding author: Wesley D. Oliver, PharmD, MS, 29 S Greene St, Rm 400, Baltimore, MD 21201. E-mail: wesleyoliver7@gmail.com.

2213-2198

© 2016 American Academy of Allergy, Asthma & Immunology

<http://dx.doi.org/10.1016/j.jaip.2016.08.011>

REFERENCES

1. Macy E, Ngor EW. Safely diagnosing clinically significant penicillin allergy using only penicilloyl-poly-lysine, penicillin, and oral amoxicillin. *J Allergy Clin Immunol Pract* 2013;1:258-63.
2. Solensky R. Penicillin allergy as a public health measure. *J Allergy Clin Immunol* 2014;133:797-8.
3. Joint Task Force on Practice Parameters; American Academy of Allergy, Asthma and Immunology; American College of Allergy, Asthma, and

- Immunology; Joint Council of Allergy, Asthma and Immunology. Drug allergy: an updated practice parameter. *Ann Allergy Asthma Immunol* 2010;105:259-73.
4. Trubiano JA, Chen C, Cheng AC, Grayson ML, Slavin MA, Thursky KA. Antimicrobial allergy 'labels' drive inappropriate antimicrobial prescribing: lessons for stewardship. *J Antimicrob Chemother* 2016;71:1715-22.
 5. Charneski L, Deshpande G, Smith SW. Impact of an antimicrobial allergy label in the medical record on clinical outcomes in hospitalized patients. *Pharmacotherapy* 2011;31:742-7.
 6. MacLaughlin EJ, Saseen JJ, Malone DC. Costs of beta-lactam allergies: selection and costs of antibiotics for patients with a reported beta-lactam allergy. *Arch Fam Med* 2000;9:722-6.
 7. Macy E, Contreras R. Health care use and serious infection prevalence associated with penicillin "allergy" in hospitalized patients: a cohort study. *J Allergy Clin Immunol* 2014;133:790-6.
 8. Picard M, Begin P, Bouchard H, Cloutier J, Lacombe-Barrios J. Management of patients with a history of penicillin allergy in a large tertiary-care academic hospital. *J Allergy Clin Immunol Pract* 2013;1:252-7.
 9. Sade K, Holtzer I, Levo Y, Kivity S. The economic burden of antibiotic treatment of penicillin-allergic patients in internal medicine wards of a general tertiary care hospital. *Clin Exp Allergy* 2003;33:501-6.
 10. Heil EL, Bork JT, Schmalzle SA, Kleinberg M, Kewalramani A, Gilliam BL, et al. Implementation of an infectious disease fellow-managed penicillin allergy skin testing service. *Open Forum Infect Dis* 2016;3:1-7.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.