

Appropriateness of Beta-Lactam Allergy Record Updates After an Allergy Service Consult

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Abstract

Background: Many patients with a self-reported penicillin allergy go on to tolerate beta-lactam antibiotics. Allergy specialists may be consulted to determine the nature and extent of the allergy. However, electronic allergy records must be appropriately updated such that recommendations are carried forward. **Objective:** To determine the percentage of patients who have their electronic allergy record updated after an allergy service consult (ASC). **Methods:** This was a retrospective study of patients with at least 1 documented beta-lactam allergy and had an ASC during (inpatient) or prior to (outpatient) hospital admission at Northwestern Memorial Hospital and Prentice Women's Hospital in Chicago, Illinois. **Results:** Within the study period, a total of 26 526 patients were identified as having a documented antibiotic allergy, with 21 657 patients (81.6% of patients with allergies) having a listed beta-lactam allergy. Of these patients, 1689 (7.8%) patients were identified as having an ASC during or prior to admission, with 598 patients meeting inclusion criteria. Changes in the allergy record were recommended by the ASC for 62% (n = 371) of patients; however, the allergy record was updated after the ASC in 74.9% (n = 278) of patients. **Conclusion:** ASC recommendations to delabel a patient as beta-lactam allergic must result in updating the allergy record in order to optimize future treatment. Given the low proportion of allergy-labeled patients tested, programs outside formal ASCs should be considered.

Keywords

allergy, antimicrobial stewardship, beta-lactam, antibiotics, allergy service consult

Introduction

It has been well documented that the majority of patients with self-reported penicillin allergy go on to tolerate the use of beta-lactam antibiotics.¹ Numerous studies have established that a beta-lactam allergy label is associated with increased hospital lengths of stay, admission to the intensive care unit (ICU), and increased mortality.²⁻⁴ Nonpreferred beta-lactam antibiotics, which carry the risk of increased adverse events, may be used. Additionally, economic implications related to second-line antibiotic acquisition in patients with these allergy labels are documented.⁵ Allergy labels may also increase the use of broad-spectrum agents such as carbapenems.⁶

Allergy specialists may be consulted for beta-lactam allergy confirmation and possible allergy delabeling.⁷ However, after consultation, electronic allergy records must be updated, if necessary, such that the information from the consult is carried forward for patient care. The objective of this study was to determine the percentage of patients who have their electronic allergy record updated after an allergy service consult (ASC).

Methods

This was a retrospective study conducted at Northwestern Memorial Hospital and Prentice Women's Hospital in Chicago,

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Illinois. Patients were identified through a centralized data warehouse and were eligible for screening if they were admitted between January 2009 and December 2014, aged ≥ 18 years, had at least 1 documented beta-lactam allergy in the medical record, and had an ASC during (inpatient) or prior to (outpatient) hospital admission. Patients were excluded if they were pregnant during admission, had an ASC post hospital admission, or had an ASC unrelated to a beta-lactam allergy. Only the first admission after or the admission during which the ASC occurred per patient was considered for inclusion. Patient demographics and data variables were collected using inpatient and outpatient electronic medical records.

ASCs are requested by the primary medical team when needed for appropriate clinical care. The consult team consists of physicians and is part of the allergy service department. After the consult, the allergy service will determine whether the allergy record requires updates based upon their findings. This may include adding or removing an allergy. The team recommends allergy testing and graded challenges or sensitizations as appropriate for patient care.

The outcome of interest was the percentage of patients with an updated electronic allergy record after an ASC recommended changes to the patient's allergy record. Descriptive statistics were compiled using Intercooled Stata, version 13 (Statacorp, College Station, Texas). This study was approved by the institutional review boards of Northwestern University and Midwestern University.

Results

Within the study period, there were 242 475 inpatients with 360 527 admissions. A total of 26 526 patients were identified as having a documented antibiotic allergy, with 21 657 patients having a listed beta-lactam allergy (81.6% of patients with allergies). Among these patients, 1689 (7.8%) patients were identified as having an ASC during or prior to admission, with 598 patients meeting the inclusion criteria. Patients were predominantly female ($n = 347$, 58%), caucasian ($n = 384$, 64.2%), with median age 59 years (interquartile range [IQR]: 47-71), and a median length of hospital stay of 14 days (IQR: 7-26; Table 1). Approximately 37.9% ($n = 226$) of patients were transferred to the ICU with a median ICU length of stay of 7 days (IQR: 3-14).

There were 88.8% of patients ($n = 531$) with a reported penicillin allergy, 25.1% ($n = 150$) with a reported cephalosporin allergy, and 5.2% ($n = 31$) with a reported carbapenem allergy. Patients may have had more than 1 beta-lactam allergy documented. Additional antibiotic allergies other than beta-lactams were reported in 47.1% ($n = 282$) of patients. A reaction was documented in 64% ($n = 382$) of reported allergies with the most common reaction being rash/itching (54.9%, $n = 210$). The most common indication for antibiotic treatment was wound infection (25.5%, $n = 152$).

The median time to ASC from admission was 5 days (IQR: 2-10), with the majority of patients having an inpatient ASC (Table 1). The most common reason for an ASC was to evaluate penicillin allergies (59.7%, $n = 357$) followed by

Table 1. Patient Demographics and Study Outcomes.

	N = 598
Age, years, median (IQR)	59 (47-71)
Gender, female, n (%)	347 (58%)
Race, n (%)	
Caucasian	384 (64.2)
African American	108 (18.1)
Asian	20 (3.3)
Other	86 (14.4)
Length of stay (LOS), days, median (IQR)	14 (7-26)
Transferred to intensive care unit (ICU), n (%)	226 (37.9)
ICU LOS, median (IQR)	7 (3-14)
Allergies listed, n (%)	
Other nonantibiotic allergies	329 (55.0)
Non-beta-lactam antibiotic allergies	282 (47.1)
Penicillin	531 (88.8)
Cephalosporin	150 (25.1)
Carbapenem	31 (5.2)
Documentation of allergy reaction, n (%)	382 (64.0)
Anaphylaxis	49 (12.8)
Hives	89 (23.4)
Rash/itching	210 (54.9)
Adverse drug reaction	22 (5.8)
Other/unknown	28 (7.3)
Antibiotic indication, n (%)	
Surgical prophylaxis	27 (4.5)
Bloodstream infection	95 (15.9)
Pneumonia	47 (7.9)
Abdominal infection	17 (2.8)
Wound infection	152 (25.5)
Osteomyelitis	14 (2.3)
Urinary tract infection	63 (10.5)
Neutropenic fever	64 (10.7)
Multiple indications	46 (7.7)
Unknown	72 (12.1)
Presence of an infectious diseases service consult, n (%)	435 (72.9)
Recommendations of infectious diseases service consult were followed, n (%)	432 (99.3)
Total length of antibiotic therapy, days, median (IQR)	18 (10-30)
Source of consult, n (%)	
Inpatient	544 (91.0)
Outpatient	54 (9.0)
Days to ASC from admission, median (IQR)	5 (2-10)
ASC reason, n (%)	
Penicillin allergy	357 (59.7)
Antibiotic resistance	91 (15.2)
Adverse reaction to antibiotic—rash	136 (22.7)
Adverse reaction to antibiotic—nonrash	10 (1.7)
Drug shortage	3 (0.5)
Other	1 (0.2)
Allergy determination method, n (%) ^a	
Patient history	173 (28.9)
Skin testing	425 (71.1)
Graded challenge performed, n (%)	405 (67.7)
Passed	402 (99.3)
Desensitization performed, n (%)	17 (2.8)
Passed	17 (100)
Antibiotic selection changed after ASC, n (%)	511 (85.4)
Post-ASC antibiotic spectrum compared to pre-ASC antibiotic, n (%)	
Equivalent/same	24 (4.7)

(continued)

Table 1. (continued)

	N = 598
Narrowed	210 (41.1)
Broadened	277 (54.2)
ASC recommended changes in allergy record, n (%)	371 (62)
ASC recommendations followed by primary team, n (%)	561 (94.3)
Patient allergy list updated after ASC recommendation, n (%)	278 (74.9)

Abbreviations: ASC, allergy service consult; IQR, interquartile range.

^a Defined as how the allergy service determined whether a true allergy existed based off of patient history or by allergy skin testing

evaluation of a reported rash to an antibiotic (22.7%, *n* = 136). There were 15.2% of ASCs due to the need for use of a beta-lactam secondary to antibiotic resistance. Allergy determination methods included patient history (28.9%, *n* = 173) and skin testing (71.1%, *n* = 425). Graded challenges were performed in 405 (67.7%) patients, and 402 (99.3%) patients tolerated these challenges. Among patients in which a graded challenge was performed, 384 (94.8%) had a reported penicillin allergy, 61 (15.1%) had a reported cephalosporin allergy, and 11 (2.7%) had a reported carbapenem allergy.

The antibiotic selection was changed in 85.4% (*n* = 511) of patients after the ASC with therapy adjusted to narrow the spectrum of coverage in 41.1% (*n* = 210) of cases. Approximately three-quarters of patients had an infectious diseases consult in addition to an ASC. Recommendations from the ASC were followed in 561 (94.3%) patients. Changes in the allergy record were recommended by the ASC for 62% (*n* = 371/598) of patients. The patient's allergy list was updated based on ASC recommendations in 74.9% (*n* = 278/371) of patients. Among patients in which the allergy list was updated, 236 (84.9%) had a reported penicillin allergy, 95 (34.2%) had a reported cephalosporin allergy, and 23 (8.3%) had a reported carbapenem allergy.

Discussion

This study found that 74.9% of antibiotic allergy records were updated after an ASC leaving approximately a quarter of patients with allergy records that did not contain appropriate updates. Whether allergy records were not updated because of reluctance to removing or editing a patient's antibiotic allergy record or whether it was due to other reasons was not able to be assessed. Of concern, 92.2% of patients labeled penicillin allergic did not have an evaluation of their allergy. Both of these important findings represent missed opportunities to update or verify drug allergies.

A penicillin allergy label is associated with increased antibiotic use, use of nonpreferred antibiotics, and more general practitioner contacts.⁸ A recent study reported that avoiding the use of beta-lactam therapy in patients with a reported allergy to beta-lactam antibiotics was associated with an increased risk of adverse events.³ In this study, more than half of the patients reported a nonsevere allergy, indicating that increasing beta-lactam use in this patient population is likely possible and may improve patient outcomes.

Based on the low percentage of patients with a reported beta-lactam allergy and an ASC in this study, implementation of allergy testing outside a formal ASC and outpatient allergy testing programs should be explored. These programs must include pathways that designate responsibility for any appropriate allergy record updates and ensure that they occur. It is also recommended that allergy testing services are implemented in conjunction with antimicrobial stewardship programs. In addition, documentation of the time elapsed, since a possible penicillin reaction is often overlooked and should be included in the allergy record.⁹

Penicillin skin testing during the hospital stay has successfully seen its role increase by various health-care professionals. Patients with a history of penicillin allergy and a negative penicillin skin test have a low risk of developing an immediate-type hypersensitivity reaction to a beta-lactam antibiotic.¹ A systematic review and meta-analysis concluded that inpatient penicillin skin testing is a safe and reproducible test to rule out immunoglobulin E-mediated penicillin allergy.¹⁰ There was also a substantial change noted in the prescribing of narrower spectrum antibiotics after penicillin skin testing.¹⁰ These results of the ability to narrow antibiotic spectrum after allergy testing are similar to the current study and should encourage the implementation of penicillin allergy testing outside a formal ASC. In this study, skin testing was performed in only 71% of patients during an ASC. There were 21 059 patients identified in this study who had a beta-lactam allergy listed and did not have an ASC related to antibiotic allergies. This number highlights that implementation of allergy testing outside formal services is important in institutions that both have and do not have a robust Allergy Service available to capture more patients. As a small percentage of patients in this study received testing as an outpatient (9%), the use of outpatient allergy testing postdischarge should be encouraged if allergy testing is deemed inappropriate during the hospital stay (eg, patient is critically ill).

The integration of penicillin allergy management into antibiotic stewardship programs is supported in the literature and represents an opportunity to improve appropriate antibiotic utilization.^{1,11} Programs that incorporate both antibiotic stewardship and antibiotic allergy testing have been shown to be successful in both delabeling patients and have noted that narrower spectrum antibiotics are prescribed post allergy testing.¹² As it is not possible for allergists alone to provide all needed penicillin skin testing services, it has been suggested that partnerships are made with appropriate providers such as pharmacists.¹³ Pharmacist-provided penicillin allergy testing has been shown to optimize antibiotic use.¹⁴ Penicillin allergy testing may also be implemented by pharmacists as part of antimicrobial stewardship.¹⁵

With the addition of technology, clinical guidelines, and education, increased penicillin testing can facilitate appropriate use of beta-lactam antibiotics.¹⁶ As the current study notes 25% of patients had missed allergy record updates, programs should include a method to capture updating of allergy records. Further, the majority of patients with penicillin allergy did not

have additional testing done, despite 575 (96.2%) patients in the study receiving antibiotics.

Limitations of this study must be considered. Our study was limited to adult patients only. As this was a retrospective study, it is difficult to determine whether the allergy record was updated immediately after the consult or at a later time. However, this would have resulted in a larger number of allergy recording being updated, and at best we report that approximately a quarter of updates were missed. As with any study regarding allergy history, the data collected were based upon patient recall and history. We were unable to document if the allergy list was updated by a member of the ASC or the patient's primary team due to the inability to ascertain whether the provider updating the allergy record was a member of the ASC at the time of the consult.

Conclusion

An ASC may lead to recommendations to delabel a patient as beta-lactam allergic; however, this information must be updated in the electronic allergy record to be useful for future patient care. Implemented protocols must ensure that allergy record updates are appropriately documented. Programs outside formal ASCs should be considered, potentially in collaboration with antimicrobial stewardship programs. Future studies should focus on the documentation of the time elapsed since a possible penicillin reaction has occurred. Together, programs to verify beta-lactam allergies and update records when allergy is not documented are needed and may lead to improved management of infections.

Authors' Note

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Declaration of Conflicting Interests

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References

1. Rimawi RH, Cook PP, Gooch M, et al. The impact of penicillin skin testing on clinical practice and antimicrobial stewardship. *J Hosp Med*. 2013;8(6):341-345.
2. 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(8):742-747.
3. MacFadden DR, LaDelfa A, Leen J, et al. Impact of reported beta-lactam allergy on inpatient outcomes: a multicenter prospective cohort study. *Clin Infect Dis*. 2016;63(7):904-910.
4. 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(3):790-796.
5. Li M, Krishna MT, Razaq S, et al. A real-time prospective evaluation of clinical pharmaco-economic impact of diagnostic label of 'penicillin allergy' in a UK teaching hospital. *J Clin Pathol*. 2014;67(12):1088-1092.
6. Al-Hasan MN, Acker EC, Kohn JE, et al. Impact of penicillin allergy on empirical carbapenem use in gram-negative bloodstream infections: an antimicrobial stewardship opportunity. *Pharmacotherapy*. 2018;38(1):42-50.
7. Kim SJ, Sheikh J, Kaplan MS, et al. Trends in allergy/immunology inpatient consultations, 1991-2013. *Ann Allergy Asthma Immunol*. 2014;113(5):577-578.
8. Su T, Broekhuizen BDL, Verheij TJM, et al. The impact of penicillin allergy labels on antibiotic and health care use in primary care: a retrospective cohort study. *Clin Transl Allergy*. 2017;7:18.
9. Staicu ML, Plakosh M, Ramsey A. Prospective evaluation of electronic medical record penicillin allergy documentation at a tertiary community teaching hospital. *Ann Allergy Asthma Immunol*. 2017;119(1):94-95.
10. Sacco KA, Bates A, Brigham TJ, et al. Clinical outcomes following inpatient penicillin allergy testing: a systematic review and meta-analysis. *Allergy*. 2017;72(9):1288-1296.
11. Trubiano J, Phillips E. Antimicrobial stewardship's new weapon? A review of antibiotic allergy and pathways to 'de-labeling'. *Curr Opin Infect Dis*. 2013;26(6):526-537.
12. Trubiano JA, Thursky KA, Stewardson AJ, et al. Impact of an integrated antibiotic allergy testing program on antimicrobial stewardship: a multicenter evaluation. *Clin Infect Dis*. 2017;65(1):166-174.
13. Traynor K. Iowa pharmacists fill allergy testing niche. *Am J Health Syst Pharm*. 2014;71(11):893-894, 896.
14. Gugkaeva Z, Crago JS, Yasnogorodsky M. Next step in antibiotic stewardship: pharmacist-provided penicillin allergy testing. *J Clin Pharm Ther*. 2017;42(4):509-512.
15. Unger NR, Gauthier TP, Cheung LW. Penicillin skin testing: potential implications for antimicrobial stewardship. *Pharmacotherapy*. 2013;33(8):856-867.
16. Chen JR, Khan DA. Evaluation of penicillin allergy in the hospitalized patient: opportunities for antimicrobial stewardship. *Curr Allergy Asthma Rep*. 2017;17(6):40.