Abstract #1789

Inpatient Penicillin Skin Testing: Outcomes from a Propensity-matched Case-control Study

christina.sarubbi@duke.edu
DUMC Box 103259
Room 170 Hanes House
Durham, NC 27710
Phone: (919) 681-3357

aset Duke Antimicrobial Stewardship and Evaluation Team

Sarubbi C[1,2], Wrenn R[1,2], Turner NA[1,2*], Kleris R[3], Seidelman J[2], Lugar P[3], Radojicic C[3], Moehring R[1,2], Anderson DJ[1,2]

1- Duke Antimicrobial Stewardship and Evaluation Team Durham, NC, USA; 2- Division of Infectious Diseases, Duke University Medical Center, Durham, NC, USA; 3- Division Of Allergy and Immunology, Duke University Medical Center, Durham, NC, USA

Duke Center for Antimicrobial Stewardship and Infection Prevention

Abstract

Background: Nearly 10% of patients report an allergy to penicillin, yet fewer than 10% are confirmed to have a true allergy. Reported allergy frequently leads to the use of costlier, broader-spectrum or less effective antibiotics. We launched a penicillin skin testing (PST) service offering real-time skin testing for inpatients. Here we present clinical outcomes for the first 80 consecutively tested cases compared to propensity-matched controls.

Methods: PST was performed on 80 adults with a reported penicillin allergy admitted to Duke University Hospital between 11/2016 and 3/2018. A logistic regression model predicting receipt of PST was developed using a cohort of penicillin-allergic, untested adults. Prediction variables included age, gender, diagnosis, and Charlson co-morbidity index. Using this model, the PST cases were propensity-matched 1:1 with untested, penicillin-allergic controls admitted in the preceding year (10/2015-10/2016). Rates of first-line antibiotic receipt were compared between PST cases and their propensity-matched controls.

Results: Cases and controls had similar demographics, reported allergies, diagnoses and co-morbidities. Cases were more likely to receive a first-line antibiotic (p=0.003, table 2). Rates of clinical cure, 90-day recurrence, *C. difficile* infection and allergic reaction did not significantly differ between skin-tested and untested patients. A single allergic reaction (rash upon receipt of a cephalosporin) occurred in the PST group.

Conclusions: Penicillin skin-testing significantly increased the proportion of patients receiving first-line antibiotics. While rates of recurrence and *C. difficile* infection were lower for skin-tested patients, these differences did not reach statistical significance. As this study was not expressly powered to detect such differences, we plan to reassess these outcomes once we have accrued a sufficiently large cohort of tested patients.

Background

- 10% of patients report an allergy to penicillin, yet fewer than 10% are confirmed to have true allergy on testing.[1]
- As reported penicillin allergy frequently results in use of second-line antibiotics, readily available inpatient skin testing may improve outcomes.

Methods

- Cases consisted of the first 90 consecutive adult inpatients who underwent penicillin skin testing at Duke University Hospital between 11/2016 and 3/2018.
- A logistic regression model was created to predict receipt of penicillin skin testing. Using this model, penicillin skin-tested cases were matched 1:2 with untested, penicillin-allergic controls admitted from 11/2015-10/2016, with a caliper of 0.2.
- All statistical modeling was conducted using R (version 3.3.2).

Results

- **Table 1. Demographic and clinical characteristics for penicillin skin-tested vs propensity-matched controls.**

	Untested n=130 (%)	Penicillin skin tested n=77 (%)
Age [median, IQR]	61 [46-74]	63 [49-74]
Gender (male)	66 (50.8)	40 (51.9)
Race		
African-American	28 (21.5)	18 (23.4)
Caucasian	94 (72.3)	55 (71.4)
Reported Allergy to PCN		
Anaphylaxis	23 (17.7)	9 (11.7)
Angioedema	0 (0)	1 (1.3)
Hives/urticarial	27 (20.8)	20 (25.9)
Rash (non-specific)	35 (26.9)	27 (33.8)
Other	45 (34.6)	20 (25.9)
Co-morbidities		
Cancer	23 (17.7)	8 (10.4)
Diabetes mellitus	26 (20.7)	9 (11.7)
Chronic kidney disease	14 (10.8)	5 (6.5)
mCCMI [median, IQR]	3.0 [1.4-4.8]	2.5 [1.0-4.7]
Diagnosis		
Syphilis	1 (0.8)	3 (3.9)
Meningitis	0 (0)	0 (0)
Pneumonia	20 (15.4)	9 (11.7)
Urinary tract infection	12 (9.2)	11 (14.3)
Endocarditis	3 (2.3)	3 (3.9)
Bacteremia	49 (37.7)	24 (31.2)
Osteomyelitis	10 (7.7)	10 (13.0)
Intra-abdominal	9 (6.9)	4 (5.2)
Skin/soft tissue	26 (20.0)	18 (23.4)
Service		
Medicine	86 (66.2)	38 (49.4)
Surgery	28 (21.5)	36 (46.8)

- A caliper of 0.2 achieved a match for 86% of cases, match ratio 1:1.7.

Results (continued)

Table 2: Outcomes in penicillin skin-tested patients vs propensity-matched controls.

- Patients with a reported penicillin allergy who underwent subsequent penicillin skin testing were more likely to receive first-line therapy (odds ratio 4.2, p=0.00014).
- There was no significant difference in clinical cure rates, allergic reactions, adverse drug events, or 90-day *C. difficile* rates.

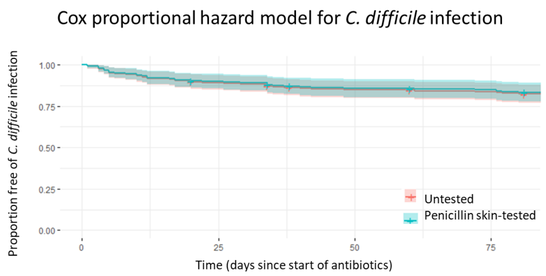
Odds Ratios for Outcomes in Penicillin skin-tested vs untested controls

	Untested n=130 (%)	Penicillin skin tested, n=77 (%)	Odds Ratio (95% CI)	p-value
First-line therapy	55 (53.0)	56 (82.4)	4.2 (2.1-8.9)	0.00014
Clinical cure	98 (87.5)	55 (94.8)	2.6 (0.8-11.7)	0.14
Allergic reaction	1 (0.008)	1 (0.01)	1.7 (0.07-44.4)	0.69
Adverse drug event	10 (7.8)	6 (8.2)	1.1 (0.35-2.9)	0.92
C. difficile occurrence (90d)	5 (4.2)	1 (1.4)	0.32 (0.02-2.0)	0.30

*Odds ratios are reported relative to untested controls. Note that denominators for outcomes may vary due to missing data, either from censoring or lack of a clear adjudication standard.

Figure 1: Cox proportional hazard model for *C. difficile* infection.

- As this study was conducted on an inpatient population, differing rates of follow-up after discharge could result in censoring bias.
- Even after accounting or censoring bias with a Cox proportional hazard model, there was no significant difference in *C. difficile* rates between tested and untested cohorts.



Conclusions

- Penicillin skin testing was associated with significantly increased odds of receiving a first-line antibiotic, without any detected increase in risk of allergy or adverse drug reaction.
- While rates of clinical cure and 90-day *C. difficile* occurrence were not significantly different, this study was not adequately powered to detect such differences.
- Accrual of skin-tested patients is ongoing to better assess outcomes such as *C. difficile* rates, clinical cure rates, and infection recurrence rates in a larger cohort.

DukeHealth

1. Macy E. Penicillin and beta-lactam allergy: epidemiology and diagnosis. *Curr Allergy Asthma Rep*. 14(11): 476. 2014.

*NA Turner received support from the Antibacterial Resistance Leadership Group (ARLG). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.