The Use of Cephalosporins and Carbapenems in Penicillin-Allergic Patients

Stephanie J. Kuhn, PharmD, BCPS
Infectious Diseases Clinical Pharmacist, Wesley Medical Center, Wichita, Kansas

January 25, 2016
Learning Objectives

Participants will be able to:

• Review the classification of beta-lactam allergies
• Discuss key literature regarding cross-reactivity of penicillins with cephalosporins and penicillins with carbapenems
• Describe the implications of beta-lactam allergies on prescribing practices
Patient Case

- 55-year-old male
- C/C: Rash which developed on his left lower leg four days prior, with increased swelling and erythema
- Vitals on admission: Temp 102.1 F, blood pressure 93/50, pulse 102, respiratory rate 22, O2 saturation 67 percent on 15L
- Emergently intubated and admitted to the ICU with a diagnosis of sepsis secondary to skin source vs. pulmonary source
- On physical review, it is noted that the patient is wearing a bracelet stating a penicillin allergy
- No family present at admission
- Started on vancomycin and aztreonam
Background

• β-lactams are the most commonly prescribed class of antimicrobials
• Initial reports cite a cross-reactivity rate ranging from 0.7 to 10 percent between penicillin and cephalosporin antibiotics
• Penicillins are the most common cause of drug-induced anaphylaxis
  – Risk of anaphylaxis is small: 0.01-0.05 percent

Weiss ME. 7th Ed. Mandell. 2010
Frumin J. Ann Pharmacother 2009
Background

• Fear of cross-reactions among β-lactams leads to:
  – Use of alternative or broader antibiotics
  – Use of possibly inferior antibiotics
  – Increased healthcare costs
  – Development of bacterial resistance

Frumin J. *Ann Pharmacother* 2009
Classification of Allergic Reactions
## Classification of Allergic Reactions

<table>
<thead>
<tr>
<th>Type of Reaction</th>
<th>Description</th>
<th>Antibody</th>
<th>Cells</th>
<th>Clinical Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Anaphylactic</td>
<td>IgE</td>
<td>Basophils, mast cells</td>
<td>Anaphylaxis, urticaria</td>
</tr>
<tr>
<td>II</td>
<td>Cytotoxic or cytolytic</td>
<td>IgG, IgM</td>
<td>Any cell with isoantigen</td>
<td>Hemolytic anemia, cytopenias, nephritis</td>
</tr>
<tr>
<td>III</td>
<td>Immune complex disease</td>
<td>Soluble immune complexes</td>
<td>None directly</td>
<td>Serum sickness, drug fever</td>
</tr>
<tr>
<td>IV</td>
<td>“Delayed” or cell mediated</td>
<td>None known</td>
<td>Sensitized T-lymphocytes</td>
<td>Contact dermatitis</td>
</tr>
</tbody>
</table>

Weiss ME. 7th Ed. Mandell. 2010
Torres MJ. *Med Clin North Am* 2010
Type I: Immediate Hypersensitivity

• β-lactam antigens interact with IgE antibodies bound to mast cells/basophils
• Cross-linking leads to release of mediators
• Clinical symptoms
  – Laryngeal edema
  – Bronchospasm
  – Possible cardiovascular collapse
• Usually occurs within one hour

7th Ed. Mandell. 2010
Torres MJ. Med Clin North Am 2010
Type II: Cytotoxic Antibodies

• β-lactam specific IgG/IgM attaches to blood cells or renal interstitial cells
• Activates complement system
• Clinical symptoms
  – Hemolytic anemia
  – Leukopenia
  – Thrombocytopenia
  – Drug-induced nephritis
Type III: Immune Complexes

- β-lactam specific IgG/IgM forms complexes with β-lactam antigens
- Complexes lodge in tissue sites
- Clinical presentation includes serum sickness or drug fever

Weiss ME. 7th Ed. Mandell. 2010
Torres MJ. Med Clin North Am 2010
Type IV: Cell Mediated Hypersensitivity

• β-lactam antigens bind with T-lymphocytes
• Results in release of cytokines
• Tissue inflammation and injury
• Clinical symptoms:
  – Maculopapular exanthema
  – Urticaria
• Seen within 24-48 hours

ME, 7th Ed. Mandell. 2010
Torres MJ. Med Clin North Am 2010
β-Lactam Structure

- Penicillins
- Cephalosporins
- Carbapenems
- Monobactams

Image from: rxportal.blogspot.com
Effects of β-Lactam Structures

• Formation of a hapten-protein complex:
  – Seen with penicillins due to their low molecular weight
  – Penicilloyl configuration is the most common form

• Advantages of cephalosporins over penicillins:
  – Slower haptenization rates
  – Haptenization occurs less frequently

Weiss ME. 7th Ed. Mandell. 2010
Torres MJ. Med Clin North Am 2010
Review: Pathophysiology

• Four categories of reaction
  – Type I: IgE mediated, most severe
  – Type IV: T-cell mediated, most common
• Due to the structure of penicillins, they are more likely to precipitate and cause adverse reactions compared to the other classes
• Structural differences between the classes lead to a varying degree of cross-reactions

Weiss ME. 7th Ed. Mandell. 2010
Torres MJ. Med Clin North Am 2010
Audience Poll

Which type of allergic reaction is seen most commonly?

A. Anaphylactic
B. Cytotoxic or cytolytic
C. Immune complex disease
D. “Delayed” or cell mediated
Cephalosporins: The Data
Cephalosporin Cross-Reactivity

• Meta-analysis including nine studies
• Over 47,000 patients enrolled
• Compared cross-reactivity of penicillins to cephalosporins in both penicillin-allergic and non-penicillin-allergic patients

Pichichero M. Head Neck Surg. 2007
Cephalosporin Cross-Reactivity

Of the nine studies evaluated:

• Five trials compared allergic reactions caused by cephalosporin in subjects with history of penicillin/amoxicillin allergy with no confirmation of allergy

• Four trials confirmed allergy history with skin testing prior to evaluation

Pichichero M. Head Neck Surg. 2007
## Cephalosporin Cross-Reactivity: Outcomes Between the Generations

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergic reaction to any cephalosporin with penicillin/amoxicillin allergy by history alone</td>
<td>2.63 (2.11-3.28; p &lt; 0.00001)</td>
</tr>
<tr>
<td>Allergic reaction to any first generation cephalosporin with penicillin/amoxicillin allergy by history alone</td>
<td>4.79 (3.71-6.17; p &lt; .000001)</td>
</tr>
<tr>
<td>Risk of cross-reactivity with positive skin tests</td>
<td>1.48 (0.64-3.41; p = 0.36)</td>
</tr>
</tbody>
</table>

Penicillin allergic patients enrolled (n=2,387)  
Non-penicillin allergic patients enrolled (n=44,897)
Cephalosporin Cross-Reactivity: All Generations

<table>
<thead>
<tr>
<th>Study</th>
<th>Hx of Pen Allergy</th>
<th>No Hx of Pen Allergy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
</tr>
<tr>
<td>Griffith Cephalothin</td>
<td>0/7</td>
<td>0/54</td>
</tr>
<tr>
<td>Petz Cefazolin</td>
<td>3/74</td>
<td>8/1369</td>
</tr>
<tr>
<td>Walter Cephalothin</td>
<td>0/15</td>
<td>4/94</td>
</tr>
<tr>
<td>Dash Cephalexin</td>
<td>3/69</td>
<td>73/6573</td>
</tr>
<tr>
<td>Dash Cephaloridine</td>
<td>20/255</td>
<td>92/10967</td>
</tr>
<tr>
<td>Pichichero Cefpodoxime</td>
<td>2/234</td>
<td>20/2025</td>
</tr>
<tr>
<td>Petz Cephalothin</td>
<td>14/109</td>
<td>86/3471</td>
</tr>
<tr>
<td>Petz Cephaloridine</td>
<td>8/138</td>
<td>21/1045</td>
</tr>
<tr>
<td>Pichichero Cefprozil</td>
<td>3/157</td>
<td>23/1340</td>
</tr>
<tr>
<td>Petz Cephalexin</td>
<td>19/291</td>
<td>87/7819</td>
</tr>
<tr>
<td>Petz Cefsmadole</td>
<td>13/89</td>
<td>83/1303</td>
</tr>
<tr>
<td>Pichichero Cefuroxime</td>
<td>8/428</td>
<td>89/5410</td>
</tr>
<tr>
<td>Lin Cettazidime</td>
<td>3/521</td>
<td>57/3427</td>
</tr>
</tbody>
</table>

Total (95% CI) 2387 44897

Total events: 96 (Hx of Pen Allergy), 643 (No Hx of Pen Allergy)

Test for overall effect: P < 0.00001

Pichichero M. Otolaryngology. 2007
Cross-Reactivity: First Generation

<table>
<thead>
<tr>
<th>Study</th>
<th>Hx of Pen Allergy n/N</th>
<th>No Hx of Pen Allergy n/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Griffith Cephalothin</td>
<td>0/7</td>
<td>0/54</td>
</tr>
<tr>
<td>Petz Cefazolin</td>
<td>3/74</td>
<td>8/1369</td>
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<tr>
<td>Walter Cephalothin</td>
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<td>3/69</td>
<td>73/6573</td>
</tr>
<tr>
<td>Dash Cephaloridine</td>
<td>20/255</td>
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<td>Petz Cephalexin</td>
<td>19/291</td>
<td>87/7819</td>
</tr>
<tr>
<td>Petz Cefamandole</td>
<td>13/89</td>
<td>83/1303</td>
</tr>
</tbody>
</table>

Total (95% CI) 1047 32695
Total events: 80 (Hx of Pen Allergy), 454 (No Hx of Pen Allergy)

Test for overall effect: P < 0.00001
Cross-Reactivity: Second Generation

<table>
<thead>
<tr>
<th>Study</th>
<th>Hx of Pen Allergy</th>
<th>No Hx of Pen Allergy</th>
<th>OR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pichichero Cetprozil</td>
<td>8/157</td>
<td>23/1340</td>
<td>1.12 [0.33, 3.76]</td>
</tr>
<tr>
<td>Pichichero Cetuxone</td>
<td>6/428</td>
<td>89/5410</td>
<td>1.14 [0.55, 2.36]</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>565</td>
<td>6750</td>
<td>1.13 [0.61, 2.12]</td>
</tr>
</tbody>
</table>

Total events: 11 (Hx of Pen Allergy), 112 (No Hx of Pen Allergy)

Test for overall effect: P = 0.70

Pichichero M. Otolaryngology. 2007
Cross-Reactivity: Third Generation

<table>
<thead>
<tr>
<th>Study</th>
<th>Hx of Pen Allergy n/N</th>
<th>No Hx of Pen Allergy n/N</th>
<th>OR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pichichero Cefpodoxime</td>
<td>2/234</td>
<td>20/2025</td>
<td>0.86 [0.20, 3.72]</td>
</tr>
<tr>
<td>Pichichero Cefprozil</td>
<td>3/157</td>
<td>23/1340</td>
<td>1.12 [0.33, 3.76]</td>
</tr>
<tr>
<td>Lin Cefazidime</td>
<td>3/521</td>
<td>57/4327</td>
<td>0.43 [0.14, 1.39]</td>
</tr>
<tr>
<td>Pichichero Cefuroxime</td>
<td>9/426</td>
<td>99/5410</td>
<td>1.14 [0.55, 2.36]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>1340</strong></td>
<td><strong>13102</strong></td>
<td><strong>0.85 [0.51, 1.42]</strong></td>
</tr>
</tbody>
</table>

Total events: 16 (Hx of Pen Allergy), 189 (No Hx of Pen Allergy)

Test for overall effect: P = 0.53
Immediate Allergic Reactions

• Prospective study conducted in 2005

• **Primary Objective**: Evaluate frequency of anaphylactic reactions to penicillins and cephalosporins in addition to their cross-reactivity

• **Subjects**: 1,170 children with suspected immediate allergic reactions

Atanaskovic-Markovic M. Pediatr Allergy Immunol. 2005
Study Design

Skin Testing

Skin test positive: Considered allergic

Skin test negative: Challenge

Atanaskovic-Markovic M. Pediatr Allergy Immunol. 2005
Immediate Allergic Reactions

• Skin or challenge test positive: 682 patients (58.3 percent)
  – Overall 644 patients (94.4 percent) reacted to penicillins
  – Overall 241 patients (35.3 percent) reacted to cephalosporins

• In vivo reactions
  – 36.4 - 88.1 percent positive reactions to any penicillin
  – 0.3 - 29.2 percent positive reactions to any cephalosporin

• Cross-reactivity dependent on generation

Atanaskovic-Markovic M. Pediatr Allergy Immunol. 2005
Clinical Reactions in Orthopedic Patients

• Retrospective study

• **Primary objective**: Examine the incidence of reactions to cephalosporins during orthopedic procedures

• **Subjects**: Penicillin-allergic adult patients who received a cephalosporin during their procedure

Goodman E. J Clin Anesthesia. 2001
Clinical Reactions in Orthopedic Patients

• 413 penicillin-allergic patients included

• 300 penicillin-allergic patients received a cephalosporin
  – All but two received cefazolin
  – One received ceftazidime
  – One received cefazolin and gentamicin

• Only one penicillin allergic patient had a reaction
  – Diphenhydramine and hydrocortisone administered

Goodman E. J Clin Anesthesia. 2001
Cephalosporin Cross-Reactivity

- Non-anaphylactic reactions most common
- Cephalosporin and penicillin cross reactivity much lower than originally believed
- Cross-reactivity rate varies depending on generation of cephalosporin
Audience Poll

Which class of cephalosporin is associated with the highest rate of cross reactivity?

A. First  
B. Second  
C. Third  
D. Fourth  
E. All
Carbapenems and Monobactams: The Data
Carbapenems in Penicillin-Allergic Patients

- Prospective study
- **Primary Objective**: Evaluate the possibility of using meropenem in children with history of penicillin allergy
- **Subjects**: 107 subjects ages three to 14 with history of immediate reactions to at least one penicillin
Study Design

Skin Testing

Skin test positive: No further challenge

Skin test negative: Meropenem challenge

Atanaskovic-Markovic M. Allergy. 2008
Carbapenems in Penicillin-Allergic Patients

- Skin testing completed to verify penicillin allergy
- 108 children included
  - 126 reactive episodes
    - One 5-year old boy had positive response to intradermal testing with meropenem
  - 107 children tolerated meropenem challenge
- Cross-reactivity rate determined to be <1 percent
Cross-Reactivity: Monobactams

• Monobactams have a structure which differs from other β-lactams
• Aztreonam is safe to use in patients with any form of penicillin allergy
• Many studies have demonstrated no cross-reactivity between monobactams and the remaining β-lactam classes
• Aztreonam appears to be weakly immunogenic

Frumin J. The Annals. 2009
Torres M. Med Clin N Am. 2010
Cross-Reactivity Among the Classes

• **Objective:** Evaluate the literature of allergic cross-reactivity between penicillins, carbapenems and monobactams

• Evaluated prospective and retrospective studies

Frumin J. The Annals. 2009
### Retrospective Carbapenem Trials

<table>
<thead>
<tr>
<th>Reference</th>
<th>PCN Allergic/Total</th>
<th>PCN Allergy Verification</th>
<th>Documented Reaction (n)</th>
<th>Results of Cross-Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>McConnell (2000)</td>
<td>63/63</td>
<td>Documented versus reported (separated)</td>
<td>Rash (6)</td>
<td>9.5% (6/63) – in documented and reported</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acute renal failure (1)</td>
<td>33% (2/6) – in documented</td>
</tr>
<tr>
<td>Prescott (2004)</td>
<td>100/211</td>
<td>Documented or reported (combined)</td>
<td>Rash (8)</td>
<td>11% (11/100) in penicillin allergic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Drug fever (3)</td>
<td>2.7% (3/111) in non-penicillin allergic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hives (2)</td>
<td>p = 0.024</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Respiratory distress (2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Neutropenia (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anaphylaxis (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arthralgia (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acute renal failure (1)</td>
<td></td>
</tr>
<tr>
<td>Sodhi (2004)</td>
<td>163/266</td>
<td>Reported</td>
<td>Maculopapular rash (11)</td>
<td>9.2% (15/163) in penicillin allergic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Drug fever and rash (1)</td>
<td>3.9 (4/103) in non-penicillin allergic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Maculopapular rash and facial edema (1)</td>
<td>p = 0.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Puritis (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Other (1)</td>
<td></td>
</tr>
</tbody>
</table>

PCN=penicillin

Frumin J. The Annals. 2009
## Prospective Carbapenem Trials

<table>
<thead>
<tr>
<th>Reference</th>
<th>PCN Allergic/Total</th>
<th>PCN Allergy Verification</th>
<th>Cross Reaction to Carbapenem (n)</th>
<th>Results of Cross-Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saxton (1988)</td>
<td>39/59</td>
<td>Skin testing</td>
<td>Imipenem (7) Imipenem metabolites (5)</td>
<td>25.6% (10/39) in penicillin allergic 47.4% (9/19) in penicillin skin-test positive</td>
</tr>
<tr>
<td>Romano (2006)</td>
<td>112/112</td>
<td>Skin testing</td>
<td>Imipenem (1)</td>
<td>0.9% (1/112) in penicillin skin test positive</td>
</tr>
<tr>
<td>Romano (2007)</td>
<td>104/104</td>
<td>Skin testing</td>
<td>Meropenem (1)</td>
<td>1% (1/104) in penicillin skin test positive (95% CI 0.02 – 5.2)</td>
</tr>
<tr>
<td>Atanaskovic-Markovic (2008)</td>
<td>108/128</td>
<td>Skin testing</td>
<td>Meropenem (1)</td>
<td>0.9% (1/108) in penicillin skin test positive</td>
</tr>
</tbody>
</table>

PCN=penicillin

Frumin J. The Annals. 2009
# Prospective Aztreonam Trials

<table>
<thead>
<tr>
<th>Reference</th>
<th>PCN Allergic/Total</th>
<th>PCN Allergy Verification</th>
<th>Skin Test Positive</th>
<th>Aztreonam Reaction</th>
<th>Results of Cross-Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saxton (1984,1985)</td>
<td>49/111</td>
<td>41 verified by skin test</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Jensen (1987, 1991)</td>
<td>15/15</td>
<td>Documentation</td>
<td>None</td>
<td>Drug fever (2), Rash (1)</td>
<td>0% positive skin test 0% hypersensitivity during first course 16.7% (3/18) were sensitized</td>
</tr>
<tr>
<td>Vega (1991)</td>
<td>42/49</td>
<td>Controlled challenge test or skin test</td>
<td>None</td>
<td>None</td>
<td>3.4% (1/29) had positive skin test 0% reacted to IV administration</td>
</tr>
<tr>
<td>Martin (1992)</td>
<td>6/6</td>
<td>Challenge and skin test</td>
<td>None</td>
<td>None</td>
<td>0% amoxicillin-allergic patients reacted to benzylpenicillin, aztreonam or ceftazidime</td>
</tr>
</tbody>
</table>

Frumin J. The Annals. 2009
Carbapenems and Monobactam Cross-Reactivity

• Carbapenem and penicillin cross-reactivity much lower than originally believed
• Cross-reactivity appears to be <1 percent
• Monobactams differ structurally from other β-lactams
• No cross-reactivity with monobactams
Patient Case: A Second Look

Jumping ahead:

• Blood cultures positive for methicillin-sensitive *Staphylococcus aureus*

• Sepsis determined to be due to MSSA bacteremia secondary to cellulitis

• Aztreonam stopped, patient continued on vancomycin

• Patient remains admitted to the ICU on pressors

• Repeat blood cultures remain negative
Audience Poll

Would you narrow this patient to nafcillin or cefazolin based on his presentation/history?

A. Yes
B. No
Tolerability of Cephalosporins and Carbapenems in Patients with Reported Penicillin Allergies: Experience in a Community Hospital
Study Design

• Conducted at a large community hospital

• **Primary Outcome**: To identify rate of cross-reactivity to cephalosporins and carbapenems in patients labeled penicillin-allergic

• **Primary Objective**: To determine the tolerability and cross-sensitivity of cephalosporins and carbapenems in patients with reported penicillin allergies

• **Secondary Objective**: To determine if a difference exists in rate of tolerability between age group and gender

Hansen H. IDWeek 2014.#746
Study Design: Inclusion/Exclusion Criteria

Inclusion
• Penicillin allergy listed in the electronic health record as reported by patient or any healthcare provider
• Must have received a cephalosporin or carbapenem after documentation of a penicillin allergy
• Inpatient status

Exclusion
• Reported allergy to cephalosporins or carbapenems prior to administration of that antibiotic class
• Unspecified β-lactam allergy
• Administration of a rescue medication

Hansen H. IDWeek 2014.#746
Study Design: Methods

• De-identified report containing:
  – Demographics
  – Allergy information
  – Antibiotic and rescue medications received
  – Reaction

• Evaluated for:
  – Allergy
  – Antibiotic received
  – Possible reaction
Subjects

595 Subjects evaluated

95 excluded
61 Pre-existing cephalosporin allergy
18 Unspecified β-lactam allergies
16 Rescue medication two hours prior

500 Subjects included

Hansen H. IDWeek 2014. #746
Results: Patient Population

Type of β-Lactam Received

Percent

1st Generation Cephalosporin
2nd Generation Cephalosporin
3rd Generation Cephalosporin
4th Generation Cephalosporin
Carbapenems

Hansen H. IDWeek 2014.#746
Subjects by Severity of Original Penicillin Allergy

- Unknown
- Mild
- Severe

Percent

Hansen H. IDWeek 2014.#746
## Results: Primary Objective

<table>
<thead>
<tr>
<th>Reaction</th>
<th>Frequency (n)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>480</td>
<td>96</td>
</tr>
<tr>
<td>Yes</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>500</td>
<td>100</td>
</tr>
</tbody>
</table>

Prevalence = 4 percent
Results: Severity of Reported Penicillin Allergy

- **No Reaction**: n=480
- **Reaction**: n=20
- **Mild**: n=4
- **Severe**: n=2
- **Unknown**: n=14

*p = 0.035*
## Results: Primary Objective

<table>
<thead>
<tr>
<th>Parameter (n)</th>
<th>Prevalence of Reaction (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Reaction Rate (n=500)</td>
<td>4.0% (20)</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Generation Cephalosporins (n=170)</td>
<td>3.5% (6)</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Generation Cephalosporins (n=20)</td>
<td>5.0% (1)</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Generation Cephalosporins (n=209)</td>
<td>3.3% (7)</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; Generation Cephalosporins (n=81)</td>
<td>7.4% (6)</td>
</tr>
<tr>
<td>Reported Penicillin Allergy Classification</td>
<td></td>
</tr>
<tr>
<td>Severe Penicillin Allergy (n=67)</td>
<td>6.0% (4)</td>
</tr>
<tr>
<td>Mild Penicillin Allergy (n=249)</td>
<td>5.6% (14)</td>
</tr>
<tr>
<td>Unknown Penicillin Allergy (n=184)</td>
<td>1.1% (2)</td>
</tr>
</tbody>
</table>

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## Results: Secondary Objective

<table>
<thead>
<tr>
<th>Parameter (n)</th>
<th>Prevalence of Reaction (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (p = NS)</td>
<td></td>
</tr>
<tr>
<td>Males (n=199)</td>
<td>5.0% (10)</td>
</tr>
<tr>
<td>Females (n=301)</td>
<td>3.3% (10)</td>
</tr>
<tr>
<td>Age (p = NS)</td>
<td></td>
</tr>
<tr>
<td>Pediatric (n=14)</td>
<td>14% (2)</td>
</tr>
<tr>
<td>Adult (n=486)</td>
<td>3.7% (18)</td>
</tr>
</tbody>
</table>
Study Summary

• Patients with penicillin allergies frequently receive cephalosporins and carbapenems at Wesley Medical Center

• 4 percent of our penicillin-allergic patients had a cross-reaction

• This practice is tolerable for most patients

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Patient Case

• Refresher: 55-year old male on vancomycin for MSSA bacteremia secondary to cellulitis
• Initial penicillin allergy listed as severe, reaction unknown due to patient’s bracelet
• Clarified allergy (one week later) with patient’s wife: “Was told he had an allergy as a kid. Had some type of rash to penicillin.”
• Documentation of allergy changed to reflect clarification
Audience Poll

Based on the new information, would you narrow this patient to nafcillin or cefazolin?

A. Yes
B. No
Patient Case: The End Result

• Patient narrowed to cefazolin to complete his course of antibiotics for MSSA bacteremia
• Patient decided to get rid of the penicillin allergy bracelet and instead carry a note card describing his allergies and reactions
Take Home Points
Take Home Points

• True allergy occurs in 7 to 23 percent of patients

• Four categories of reactions

• Patients with IgE mediated reactions (anaphylaxis):
  – Do not challenge with a cephalosporin or carbapenem
  – Monobactams are safe to use in this patient population

• Patients with non-IgE mediated reactions (e.g. rash) may tolerate other β-lactam antibiotics

Weiss ME. 7th Ed. Mandell. 2010
Torres MJ. Med Clin North Am 2010
Audience Poll

Does your institution currently use cephalosporins or carbapenems in penicillin-allergic patients?

A. Yes
B. No
Audience Poll

If you currently do not use cephalosporins or carbapenems in penicillin-allergic patients, do you think you will change your practice?

A. Yes
B. No
Questions