CDSS

Antimicrobial Computer Decision Support System

Beta-Lactam Reactions

Assessment of beta-lactam reactions and selection of alternative beta-lactams

This guide is intended to aid clinicians in assessment of beta (β)-lactam reactions and selection of appropriate alternative therapy. It is not a substitute for clinical judgment and should not be used as a sole resource when selecting antimicrobial therapy.

Important β-lactam Allergy Facts

1. 10% of patients report an allergy to penicillin.
2. Less than 1% of patients are truly allergic to penicillin.
3. 80% of patients who had an immediate allergic reaction (Type I, Immunoglobulin E (IgE)-mediated) to penicillin lose sensitivity after 10 years.
4. Cross-reactivity between penicillin and cephalosporins occurs in only 2% of patients and most patients do not have clinically significant reactions.

Obtaining a Detailed Reaction History

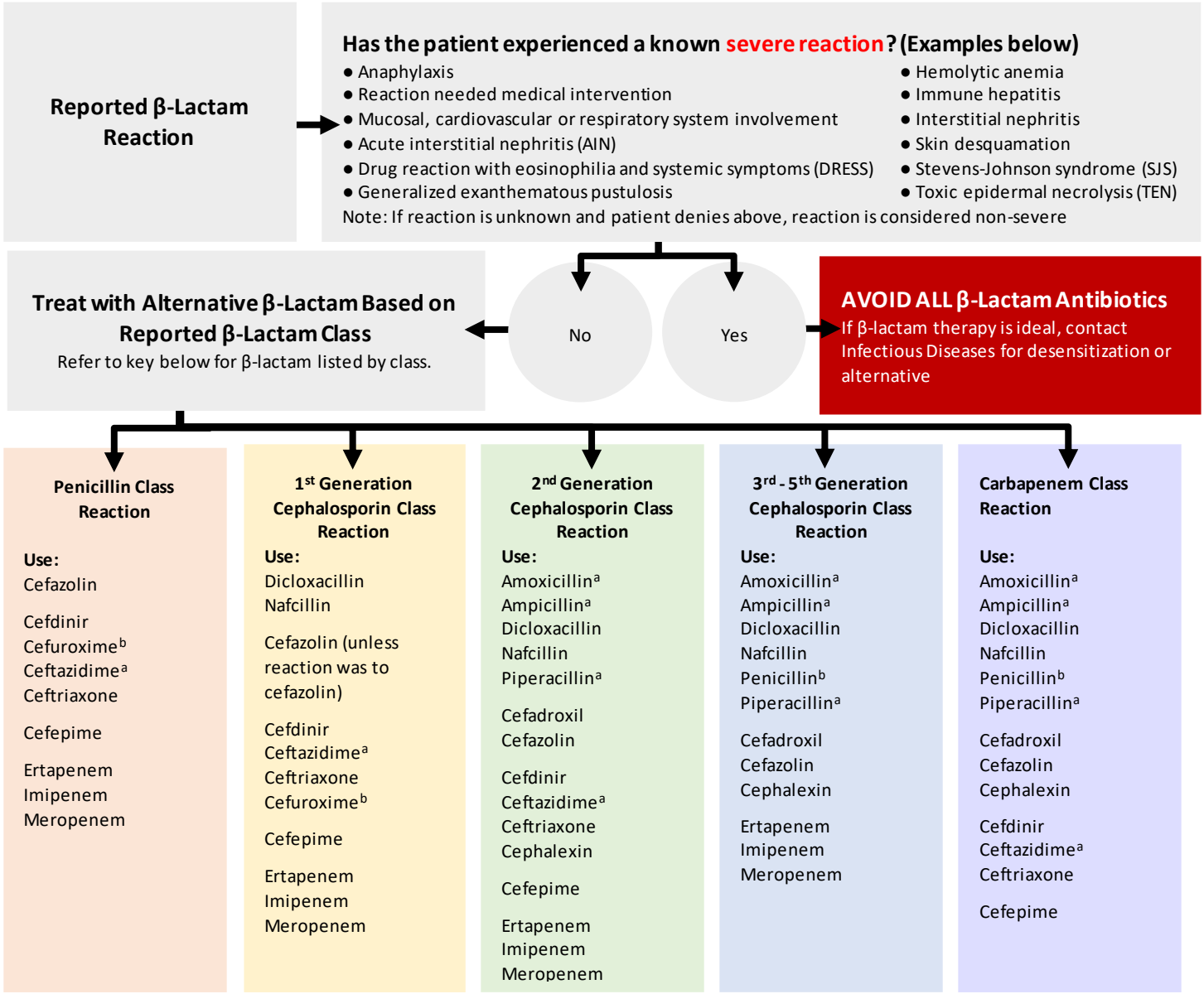
- Locate documented reaction information within the Computerized Patient Record System (CPRS)
    - Reported reactions can be found in the Cover Sheet under Allergies/Adverse Reactions. Double click on the specific reaction for more information, including signs/symptoms and date of reaction.
    - A reaction report can also be found here: Reports tab → Clinical Reports → Allergies.
- Determine β-lactam medication history. A list of all locally prescribed medications can be found here: Reports tab → Clinical Reports → Pharmacy → All Medications.
- Interview the patient or family for details about the reaction. Questions to ask during the interview:
    - What medication were you taking when the reaction occurred? DO NOT accept "Penicillin" or "Cephalosporin" as an allergy, ensure specific offending medication is identified.
    - How long after taking the medication did the reaction occur? Immediate reactions typically occur within 1 hour and up to 72 hours after administration. Delayed reactions occur after 72 hours.
    - How long ago did the reaction occur? Did it occur over 10 years ago?
    - What kind of reaction occurred? Did the reaction require medical attention?

Reaction Assessment and Selection of an Alternative β-lactam

Refer to Figure 1 for assessment of reported β-lactam and selection of alternative β-lactam treatment. See Figure 2 for detailed β-lactam cross-reactivity information. If patient is in a suitable care setting, observation during the first 15 minutes to 1 hour after first dose of therapy may be performed to monitor for signs/symptoms of an allergic reaction.

Figure 1. Assessment of Beta(β)-lactam Reaction and Alternative Treatment

- If the same or a different β-lactam was subsequently tolerated without reaction, that β-lactam may be used.
- If reaction was intolerance (e.g. headache, GI symptoms), family history of reaction, or if the patient denies allergy, any β-lactam may be used.
- May observe patient after administration of first dose.



Contact Infectious Diseases for Specific Recommendations

β-lactam Class	β-lactam Antibiotics
Penicillin	Amoxicillin[a], ampicillin[a], cloxacillin, dicloxacillin, nafcillin, oxacillin, penicillin, piperacillin[a], ticarcillin
1st Generation Cephalosporins	Cefadroxil, cefatrizine, cefazolin, ceftezole, cephalexin, cephalothin, cephapirin
2nd Generation Cephalosporins	Cefaclor, cefamandole, cefonicid, cefotetan, cefoxitin, cefprozil, cefuroxime
3rd-5th Generation Cephalosporins	Cefdinir, cefditoren, cefepime, cefiderocol ,cefixime, cefpirome, cefoperazone, cefotaxime, cefpodoxime, ceftaroline[a], ceftazidime, ceftibuten, ceftizoxime, ceftolozanea, ceftriaxone
Carbapenems	Ertapenem, imipenem and meropenem

a - Also applies to β-lactamase inhibitor combinations (amoxicillin/clavulanate, ampicillin/sulbactam, ceftazidime-avibactam, ceftolozane-tazobactam, piperacillin/tazobactam). **b** - Applies to intravenous and oral formulations.

Figure 2. Beta-lactam Cross-reactivity Chart

AVOID ALL beta-lactam antibiotics or if beta-lactam therapy is ideal, contact Infectious Diseases for desensitization or alternative, if reaction Included any of the following:
Anaphylaxis, respiratory or cardiovascular system involvement, required immediate medical attention, acute interstitial nephritis, generalized exanthematous pustulosis, drug reaction with eosinophilia and systemic symptoms, hemolytic anemia, immune hepatitis, interstitial nephritis, Stevens-Johnson syndrome, toxic epidermal necrolysis

Beta-Lactam	amoxicillin*	ampicillin*	dicloxacillin	nafcillin	penicillin	piperacillin*	cefadroxil	ceFAZolin	cephalexin	cefoTEtan	cefOXitin	cefuroxime	cefdinir	cefixime	cefotaxime	cefpodoxime	cefTAZidime	cefTRIAXone	cefepime	carbapenems^
amoxicillin*		X	X	X	X	X	X	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ampicillin*	X		X	X	X	X	X	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
dicloxacillin	X	X		X	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
nafcillin	X	X	X		X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
penicillin	X	X	X	X		X	X	✓	X	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓
piperacillin*	X	X	X	X	X		X	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
cefadroxil	X	X	✓	✓	X	X		✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ceFAZolin	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
cephalexin	X	X	✓	✓	X	X	X	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
cefoTEtan	✓	✓	✓	✓	✓	✓	✓	✓	✓		X	X	✓	✓	✓	✓	✓	✓	✓	✓
cefOXitin	✓	✓	✓	✓	X	✓	✓	✓	✓	X		X	✓	✓	X	✓	✓	✓	✓	✓
cefuroxime	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X		✓	X	X	X	X	X	X	✓
cefdinir	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		X	X	X	X	X	X	✓
cefixime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X		X	X	X	X	X	✓
cefotaxime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X		X	X	X	X	✓
cefpodoxime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X		X	X	X	✓
cefTAZidime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X		X	X	✓
cefTRIAXone	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	X		X	✓
cefepime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	X	X	X	X	X		✓
carbapenems^	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Key

Beta-lactam color scheme
Penicillin
1st Generation Cephalosporin
2nd Generation Cephalosporin
3rd Generation Cephalosporin
4th Generation Cephalosporin
Carbapenems

Symbols
X - **Not a safe alternative** due to same/similar side chains or clinical evidence/theoretical risk of cross-reactivity.
✓ - Considered a safe alternative due to different molecular structure and no documented cross-reactivity.
* - Cross-reactivity also applies to beta-lactamase inhibitor combinations.
^ - Includes ertapenem, imipenem and meropenem. Carbapenems are theoretically cross-reactive with each other.

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