Kentucky Antimicrobial Stewardship Innovation Consortium

Educational Pearl

Know Your Antibiotic: Aztreonam the Monobactam

Aztreonam is a monobactam antibiotic with a unique spectrum of activity. Monobactams are a β-lactam antibiotic subclass with a differing core structure. Aztreonam has historically been regarded as a "go-to" option for patients with severe penicillin and/or cephalosporin allergies.[1, 2] Now knowing that side chains are the primary driver of allergic cross-reactivity and not the core structure, what is the role of aztreonam in patient care?

Spectrum of Activity

Aztreonam has exclusively gram-negative activity, including *Pseudomonas aeruginosa*. It has NO activity against gram-positive bacteria or anaerobic bacteria. Therefore, many empiric antibiotic regimens require multiple antibiotics if aztreonam is chosen. For example, aztreonam cannot commonly be substituted for ceftriaxone for empiric community-acquired pneumonia treatment due to lack of activity against *Streptococcus pneumoniae*.[2]

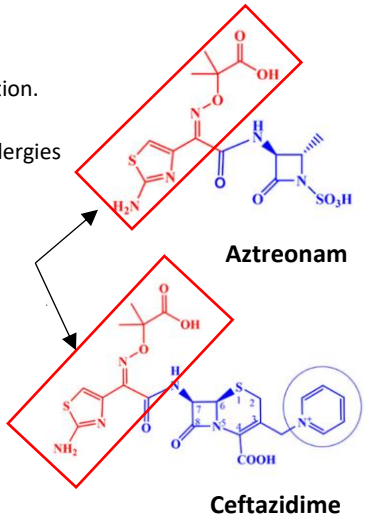
Role in Multi-drug Resistant Infections

Aztreonam is inactivated by many β-lactamases including ESBL, AmpC, and KPC. However, aztreonam is stable against rare, but nasty metallo-β-lactamases (MBL) such as NDM, VIM, and IMP.[2] Gram-negative bacteria often express multiple mechanisms of resistance, therefore aztreonam is often used in combination therapy for extremely drug resistant bacteria. In one study, the combination of ceftazidime-avibactam + aztreonam was associated with lower 30-day mortality, lower clinical failure, and shorter length of stay as compared to other antibiotic regimens in the treatment of bloodstream infections due to MBL producing gram-negative bacteria.[3] Ceftazidime-avibactam + aztreonam is a preferred option for infections due MBL producing gram-negative bacteria in the Infectious Diseases Society of America Gram-negative Resistance Guidelines.[4]

β-lactam Allergies

For β-lactam allergies, cross-allergies are largely mediated by similarity of structures at the R-1 side chain position. Interestingly, aztreonam and ceftazidime have *identical side chains.* The 2022 Drug Allergy Practice Parameter guidelines make the following statements regarding agent selection in patients with Ig-E mediated β-lactam allergies (e.g. hives, anaphylaxis).[1]

- Penicillin allergic patients may safely take the following:
  - Aztreonam
  - Cephalosporin with a dissimilar R-1 side chain (e.g. cefazolin, ceftriaxone, cefepime)
  - Carbapenem
- Ceftazidime allergic patients should NOT receive aztreonam due to identical R-1 side chains (Figure)
  - Other cephalosporin allergic patients may receive aztreonam



Key take-aways: Aztreonam is only active against gram-negative bacteria, so monotherapy may not be sufficient for empiric treatment of some infections. Aztreonam in combination with ceftazidime-avibactam is an option for infections due to metallo-β-lactamase producing gram-negative bacteria. Do not use aztreonam in patients with an allergy to ceftazidime.

References

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3. Falcone M, Daikos GL, Tiseo G, et al. Efficacy of Ceftazidime-avibactam Plus Aztreonam in Patients With Bloodstream Infections Caused by Metallo-β-lactamase-Producing Enterobacterales. *Clin Infect Dis*. 2021;72(11):1871-1878. doi:10.1093/cid/ciaa586
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