

CORR Insights®: Antibiotic Stewardship Interventions Improve Choice of Antibiotic Prophylaxis in Total Joint Arthroplasty in Patients with Reported Penicillin Allergies

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Where Are We Now?

Early in the history of modern THA, its developer, Sir John Charnley, experienced a 9% incidence of deep infection following THA. He managed to reduce that percentage to 1.3% with the routine use of prophylactic antibiotics, air cleanliness, and body-exhaust attire [1]. Unfortunately, the proportion of patients who develop infections after

THA has barely budged since then and currently sits at about 1% at most large joint centers [2]. But not all infections are equal. Periprosthetic joint infections (PJIs), for example, remain among the most severe complications in present day total joint arthroplasty. Resistant organisms, poor immune status, and failure to properly risk stratify all are problems that contribute to its severity; as someone with a trauma background, I've also cared for devastating chronic infections in patients with severe open fractures treated with open reduction internal fixation.

Early in my career, orthopaedic surgeons did not always correctly dose antibiotics they gave, and they sometimes failed to complete administration prior to surgical incision. We had no idea about how to modify our antibiotic choices in response to nasal swab cultures that can identify methicillin-resistant *Staphylococcus* bacteria. It even was common to give clindamycin or vancomycin to patients who reported a penicillin allergy. It saddens me that this last error remains a common practice.

Today, we know more thanks to studies like the one by Jones and

colleagues [3] in this month's *Clinical Orthopaedics and Related Research*®. In their study, the authors note the importance of choosing the right antibiotic, selecting the proper dose based on the weight of the patient, and of the timing of the dose. But most importantly, they found that cephalosporins can be given in almost all patients with penicillin allergies and that no complications occurred in their series of patients with reported penicillin allergies. Why is this important? Infection risk increases with use of noncephalosporin antibiotic prophylaxis [4, 5]. The current study shows us that a patient's allergy to penicillin does not mean that we have to use a noncephalosporin antibiotic. This is important because cephalosporins are much safer and more effective than either vancomycin or clindamycin.

Where Do We Need To Go?

We must realize that the bacteria we are fighting against are advanced organisms. If COVID-19 has taught us anything, it's that we need to be vigilant in the way we fight infections and diseases. As of this writing in mid-March 2021, I hope that we are at the tail end of the worldwide pandemic. The resilience and innovation shown by our scientists amazes me. We need to show some of that resilience and innovation in the fight against PJIs; to do that, we

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will need greater levels of NIH and other funding to support research in this area. Because it's only a short matter of time before the next super-bacterium emerges, we also have to be vigilant in terms of risk mitigation before elective arthroplasty.

As practicing surgeons, we need to teach our residents, adult reconstruction fellowship programs, and AAOS fellowship members to better understand appropriate perioperative prophylaxis in patients with penicillin allergies. Furthermore, we need to make sure everyone on the healthcare team is on the same page. This includes preoperative nursing staff, anesthesia, and the treating orthopaedic surgeon. Future prospective studies should address ongoing questions of appropriate antibiotic timing and infection rates. Since the current study was slightly underpowered and encountered possible loss of antibiotic stewardship protocols during the study period, standardized protocols in the electronic medical record should become routine protocol. Future prospective multicenter studies could overcome some of the present study's shortcomings. Focus should center on implementing correct antibiotic choice, dosage, and timing, as failure to do so results in a higher infection rate. Careful documentation of cephalosporin allergy seems critical to the success of future studies. Incorporation of standardized preoperative orders that override cephalosporin allergy is a noble goal. Antibiotic stewardship interventions can be implemented across institutions to expand cephalosporin use in patients with a reported penicillin allergy within patients who undergo total joint arthroplasty. Further data about the safety of cefazolin in patients with severe penicillin allergies would be helpful in guiding practice because no patient experienced a severe penicillin allergy with cephalosporin administration in the

current study. Eliminating any possibility of improper antibiotic administration based on documented penicillin allergy should be carefully vetted.

How Do We Get There?

Careful screening of all patients' allergies preoperatively is extremely important. Wyles et al. [5], in their 2019 John Charnley Award-winning paper, showed that PJI increased if surgeons used alternatives to cephalosporins. In their study, the authors stressed the importance of allergy testing to prevent selecting the incorrect antibiotic [5].

In the current study, the authors' center actually changed the electronic medical record to override the cross reactivity of a penicillin allergy with a cephalosporin. How has this manuscript changed my practice? Several instances have come up where the preoperative nursing team has asked whether we need to change the antibiotic because of a penicillin allergy. Our anesthesia and orthopaedic teams have collaborated on proper antibiotic coverage, dosage timing, and antibiotic selection based on nasal swab cultures. This has developed over a period of years, but we have not been as particular about recognizing that a cephalosporin allergy needs to be more carefully scrutinized. The results of this study helped our team reinforce the importance of antibiotic stewardship interventions, which include updating institution guidelines, appropriately classifying allergy reactions, and standardizing antibiotic ordering.

Future study designs could include multicentered studies with standardized antibiotic stewardship programs. These studies should include prospective studies with appropriate cohort size to guarantee statistical significance. These

protocols should include electronic medical record override of penicillin allergy, dosing, and timing of administration. Documentation of adverse antibiotic reactions would be key as nausea and vomiting should not be considered true allergies. Better preoperative allergy testing would be an important study design. Risk stratification and long-term follow up would be very important in future studies to determine the true rate of proton pump inhibitors as well as pathogen identification. Appropriate selection could be tied to preoperative nasal swab results to avoid the consequences of inappropriate or ineffective antibiotic administration. Long-term follow-up would help us determine whether we are improving the proton pump inhibitors infection rate with newer prospective antibiotic stewardship protocols and multicentered studies.

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