Applications and Outcomes of Physician-Directed Antibiotic-Loaded Cement and Calcium Sulfate in Orthopaedic Surgeries: A Retrospective Study

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Purpose: Surgical site infections (SSIs) in patients with orthopaedic trauma can lead to poor outcomes and continue to be a widespread problem in spite of perioperative delivery of systemic antibiotics. As a potential solution, antibiotic-loaded calcium sulfate (CS) or bone cement (BC) can deliver locally high doses of antibiotics as well as osteoconductive materials. This study documents the incidence and nature of these antibiotic delivery strategies and associated outcomes.

Methods: A retrospective review was conducted of patients (≥18 years) presenting with musculoskeletal injuries over an 8-year period (2010-2018) to the orthopaedic trauma services at the Atrium Health Level I trauma center. Patients requiring surgical intervention with implants and increased risk factors for infection resulting in the use of antibiotic-loaded BC and/or CS were included. Demographic data, injury characteristics, treatment, and postoperative outcomes were collected from patient medical records.

Results: Study surgeries (n = 204) used antibiotic-loaded CS and/or BC to treat existing infections (n = 113) or prophylactically (n = 91). There were no differences in demographics/medical history. BC was used most frequently ($P<0.0005$) prophylactically (80%) vs for infection-treatment (53%). The frequency of BC and CS application format (beads, implant coating, formed into nail, space filler) was different ($P<0.0005$). The antibiotics selected were also different ($P<0.0005$) with vancomycin plus gentamicin most commonly mixed into CS and vancomycin, gentamycin, and tobramycin the most common BC combination. For prophylactic cases, subsequent infection occurrence was significantly more common for CS than BC (n = 91, $P<0.05$), and the time between surgery and infection diagnosis was significantly shorter for CS (n = 28, $P<0.05$). There were also more antibiotics complications reported but fewer implant failures in CS cases ($P<0.05$). For cases treating preexisting infections, there were no differences in complications between CS and BC.

Conclusion: With the increasing utilization of antibiotic-loaded CS and BC, it is important to document application methods and track patient outcomes. In this retrospective study, we determined that infection was more likely after prophylactic antibiotic CS use than antibiotic BC use even though there were no differences detected in patient risk factors.