

Intrawound Vancomycin Powder Reduces *Staphylococcus aureus* Surgical Site Infections in a Rabbit Model

James Paul Hovis, MD¹; Robert V. O'Toole, MD; Theodore T. Manson, MD;
Mark E. Shirliff, PhD; Manjari Joshi, MD; Roman Natoli, MD

¹University of Maryland Medical Center, Baltimore, Maryland, USA

Purpose: A technique that is gaining popularity to reduce the risk of surgical site infection and hardware colonization after fracture fixation surgery is the application of local vancomycin powder intraoperatively. However, there has been little basic science evidence to validate its efficacy in orthopaedic trauma patients. We hypothesize that application of vancomycin powder to the surgical sites in a rabbit model of plate fixation contaminated with methicillin-resistant *Staphylococcus aureus* (MRSA) will demonstrate a decrease in the risk of surgical site infection.

Methods: All of the surgical sites were then seeded with 1×10^8 CFU of MRSA. 125 mg (estimated to be equivalent to a 1000-mg dose for a human) of vancomycin powder was applied to 9 of the rabbits (treatment group) and the other 9 did not have vancomycin powder (control group). Serum vancomycin levels were measured at scheduled time points over 24 hours. Tibias and implants were harvested at 2 weeks from implantation to determine bone infection and implant biofilm formation based on the number of bacterial colony-forming units. Radiography, histology, and electron microscopy aided in evaluation. Outcomes were compared using a Fisher exact test with $P < 0.05$ set as significant.

Results: No bone infection or implant colonization occurred in the vancomycin powder group. Six bone infections and 6 implant biofilm formations (67%; 95% confidence interval, 45%-88%) occurred in the group that did not receive vancomycin powder ($P = 0.009$). Serum vancomycin levels were detectable at minimal levels at 1 and 6 hours only. Pathological changes occurred in the specimens that were positive for infection.

Conclusion: This study demonstrates that the application of vancomycin powder at the time of hardware implantation to a surgical site seeded with MRSA decreases risk for infection of the bone and colonization of implants in a rabbit model, with minimal increase in serum vancomycin levels. The results are encouraging and support the rationale for a clinical trial investigating the use of local intraoperative vancomycin powder to reduce the rate of surgical site infections.