

Pre-treating PJI with systemic antibiotics decreases tissue and implant bacterial counts: results from an in vivo model

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INTRODUCTION: Periprosthetic joint infection (PJI) is a complication of total joint arthroplasty that typically requires revision surgery for treatment. Systemic antibiotics are usually held prior to surgery to improve yield of intraoperative cultures. However, recent studies suggest that preoperative aspirations have a high concordance with intraoperative cultures, which may allow surgeons to initiate antibiotic treatment earlier. The purpose of the study was to investigate the effect of Pre-surgical systemic antibiotic therapy on the bacterial burden within the periprosthetic space and systemic immune reaction.

METHODS: MSSA (Xen36) *S. aureus* PJI was induced in the right rear legs of twenty-four mice using a previously validated in vivo murine model of PJI. Mice were randomized to a control group or to receive two weeks of systemic vancomycin (subcutaneous delivery) or vancomycin plus rifampin (subcutaneous delivery and intravenous, respectively). Bacterial burden was quantified in the periprosthetic soft tissue, on the tibia, and on the implant via ex vivo counting of colony forming units (CFUs). Following completion of antibiotic treatment, mice were euthanized and periprosthetic tissue and the implant were harvested. Tissues were homogenized and serially plated to quantify bacterial burden in CFUs. The implant was sonicated and then plated for CFUs. Local and systemic inflammation were assessed via weighing of bilateral inguinal and iliac lymph nodes as well as through serum amyloid A analysis (SAA). Non-parametric pairwise group comparisons were performed using a Mann-Whitney U test.

RESULTS SECTION: Vancomycin plus rifampin (VancRif) treatment significantly reduced bacterial burden in the periprosthetic soft tissue, bone, and implant compared to control ($p<0.001$) and vancomycin (Vanc) alone ($p<0.001$) (Figure1). Both antibiotic treatment groups reduced the weight of the right iliac lymph nodes, with the comparison groups of control-Vanc, control-VanRif, and Vanc-VanRif, showing significance of $p<0.001$ when run using a Mann-Whitney U test. Neither antibiotic treatment significantly reduced SAA compared to controls. Upon surgical harvesting, both antibiotic treatment groups displayed minimal amounts of purulence on visible inspection, compared to controls.

DISCUSSION: The combination of vancomycin plus rifampin reduced bacterial burden in the soft tissue, on the bone, and on the implant, and was more effective than vancomycin monotherapy. These findings are in line with clinical results that show improved clinical treatment outcomes in the setting of prosthesis retention when rifampin therapy is added.

SIGNIFICANCE/CLINICAL RELEVANCE: Administration of antibiotics in PJI cases prior to surgery reduces joint infection burden and could lead to more effective surgical resection. Additional in vivo studies are underway to further clarify this possibility.

IMAGES AND TABLES:

Figure 1

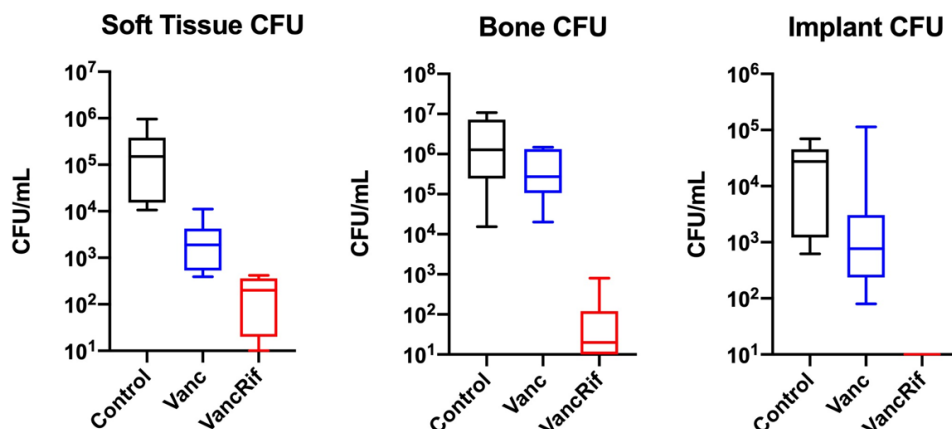


Figure 1. CFU counts on processed soft tissue, bone, and implants. Non-parametric pairwise group comparisons were performed using a Mann-Whitney U test showing significance comparing control-Vanc, ($p < 0.001$); control-VanRif, ($p < 0.001$); and Vanc-VanRif, ($p < 0.001$).