Tissue Concentrations of Vancomycin Achieved With Bier Block Administration Versus Intravenous Prophylaxis in Upper Extremity Surgery: A Randomized Controlled Trial

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INTRODUCTION: Prior studies of intraosseous administration of vancomycin have demonstrated significantly higher tissue concentrations of antibiotic using lower doses compared to systemic intravenous (IV) administration. Our purpose was to quantify and compare vancomycin concentrations in bone and soft tissue of the hand and wrist: (1) after regional IV perfusion, (2) after systemic IV administration, (3) and to determine if there is any difference in complication rates between the two modes of medication delivery.

METHODS: Twenty patients undergoing an upper extremity reconstructive procedure requiring removal of bone were randomized to regional IV perfusion of vancomycin (125 mg in 50 ml normal saline) or systemic IV administration of vancomycin (1 g). Samples of subcutaneous fat and bone were collected 5-10 minutes after skin incision, 20-25 minutes after skin incision, and fat was collected at closure. The primary outcome was the difference in bone and fat tissue concentrations between groups. The secondary outcome was complications related to the method of delivery of vancomycin in each group.

RESULTS: Mean tissue concentrations in fat for the regional IV perfusion group were 114.9 ug/g, 117.2 ug/g, and 150.1 ug/g at each timepoint compared to 3.9 ug/g, 5.2 ug/g, and 4.5 ug/g in the systemic IV group, respectively. In bone, mean concentrations were 107.0 ug/g and 117.4 ug/g in the regional IV perfusion group, and 13.0 ug/g and 14.9 ug/g in the intravenous systemic IV group, respectively. A fitted linear mixed model showed the average tissue concentration was 109 ug/g higher in the bier block group compared to intravenous administration ($p<0.001$). There were no systemic or immediate local complications in either group.

DISCUSSION AND CONCLUSION: Regional IV perfusion of vancomycin in the upper extremity below a tourniquet achieves levels of antibiotic concentration up to 33 times greater than systemic IV administration of a much greater dose (8 times). Bier block delivery appears safe and may lower the required dose of vancomycin necessary to treat infections, augment systemic administration in severe infections, and may limit systemic toxicity. These preliminary results warrant further evaluation of this method for the prevention and treatment of infections in the upper extremity.