

# 24 Hour In Vivo Intra-Articular Antibiotic Concentrations Fall Below the Minimum Inhibitory Concentration for Most Bacteria following Primary Total Knee Arthroplasty: A Prospective, Randomized Study of Commercially Available Bone Cement

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## INTRODUCTION:

The prophylactic use of antibiotic-loaded bone cement (ALBC) in primary total knee arthroplasty (TKA) is controversial. There is a paucity of in vivo data on the elution characteristics of ALBC. The purpose of this study was to determine if the antibiotic concentration of two commercially available ALBCs exceeded the minimum inhibitory concentration (MIC) and minimum biofilm eradication concentration (MBEC) of common infecting organisms.

## METHODS:

Forty-five patients undergoing TKA were randomized to receive bone cement without antibiotics (n=5) or a commercially available formulation containing 1g of tobramycin (n=20) or 0.5g of gentamicin per 40g (n=20). Patients receiving a spacer using high-dose ALBC for infection (n=5) were recruited as positive controls. Intraarticular drain fluid was collected at 4 and 24 hours. An automated immunoassay measuring antibiotic concentration was performed and compared against MIC and MBEC thresholds. Descriptive statistics and correlation analysis were performed.

## RESULTS:

The mean antibiotic concentration at 4 and 24 hours was 59.3 [0-156] µg/mL and 18.5 [0-43] µg/mL for tobramycin and 40.6 [0-87] µg/mL and 18.5 [0-70] µg/mL for gentamicin, respectively. Time and antibiotic concentration exhibited a negative linear correlation coefficient (r=-0.512). Most reference MIC levels were reached at 4 hours. However, a considerable percentage of patients were below the MIC at 24 hours for many common pathogens, including *Staphylococcus epidermidis* (gentamycin: 67-100%, tobramycin: 85%), *methicillin-sensitive Staphylococcus aureus* (gentamycin: 8-92%), *Streptococcus species* (gentamycin: 8-100%), and *Cutibacterium acnes* (gentamycin: 8-67%, tobramycin:100%). Ranges reflect MIC of different strains of each organism. MBEC threshold values were reached at 4 hours for only the least virulent strains of *Staphylococcus aureus* and *Escherichia coli*.

## DISCUSSION AND CONCLUSION:

Elution of antibiotics from commercially available ALBC decreases rapidly following TKA and mean antibiotic concentration exceeds MIC only at 4 hours for many pathogens. Use of commercially available ALBC may not provide substantial antimicrobial prophylaxis following TKA.

