Dilute Betadine May Not Effectively Treat Implant Associated Bacteria During Debridement, Antibiotics, and Implant Retention

Scott Nodzo, K. Keely Boyle[1], Stephen A. Tyrpak, Jacob Opalinski, Mary Canty
[1]UBMD Orthopaedics & Sports Med

INTRODUCTION:

Debridement, antibiotics, and implant retention (DAIR) is one strategy for treating periprosthetic joint infection (PJI). Techniques and irrigant solutions used during a DAIR procedure are not standardized and vary from surgeon to surgeon. Dilute betadine is a recognized irrigant solution used during primary total joint arthroplasty for prevention of PJI; however, it's use during an active PJI is not well studied. The purpose of this study was to evaluate the use of dilute betadine during a DAIR procedure in a swine knee PJI model.

METHODS:

Nine Yucatan swine were implanted with a cemented commercially available patellofemoral implant (Figure 1). The animals were separated into three groups. The first group of three (INFECT) were inoculated with an orthopedic methicillin resistant *Staphylococcus aureus* (MRSA) clinical strain (US isolate CA-127) with a starting inoculum of 10^5 CFU/mL. Five mL of the MRSA bacteria were injected into the knee joint after arthrotomy closure. The INFECT animals were sacrificed on PODs 6, 10, and 12. The INFECT-ABX group (n=3) were inoculated and then started on oral rifampin (4mg/kg) and levofloxacin (6mg/kg) twice daily on POD 5 which was continued for 10 days until sacrifice on POD 15. The final group, DAIR-BETADINE (n=3), was inoculated and started on rifampin and levofloxacin twice daily on POD 5 which continued until sacrifice. On POD 15 these animals underwent a DAIR procedure with soft tissue debridement followed by a three-minute soak of the retained implant and soft tissues with dilute betadine (17cc of 10% betadine in 500ml of normal saline). The wound was then irrigated with 1 liter of normal saline. The implant was then immediately removed from the knee joint for processing. At sacrifice, all implants were removed for processing using an osteotome and mallet. The implant was rinsed in PBS to remove loosely adherent bacteria and then placed into fresh PBS with 0.1% saponin, vortexed for 1 minute, sonicated for 10 minutes, and then vortexed an additional 1 minute to remove the bacteria from the surface of the implant. Samples were serially diluted and plated on Mueller Hinton agar plates. After incubation at 37°C for 18-24hrs, colony forming units (CFUs) were enumerated. Peripheral blood and periarticular tissue cultures were collected and plated. CFUs were compared using non-parametric Mann-Whitney statistical analysis.

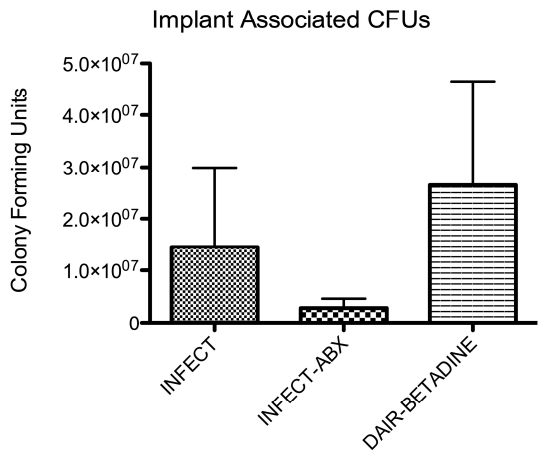
RESULTS:

All nine animals had implant associated bacteria as enumerated from the sonicated patellofemoral implant (Figure 2). In the INFECT group, a mean of $1.5x10^7 \pm 1.5x10^7$ CFU/implant (range $2.8x10^6$ to $3.2x10^7$ CFU/implant) were enumerated from the patellofemoral implant. In the INFECT-ABX group a mean of $2.8x10^6 \pm 1.8x10^6$ CFU/implant (range $1.0x10^6$ to $4.5x10^6$ CFU/implant) were enumerated, and in the DAIR-BETADINE group $2.7x10^7 \pm 2.0x10^7$ CFU/implant (range $3.5x10^6$ to $4.0x10^7$ CFU/implant) were enumerated. There were no statistically significant differences in CFU counts between the three groups. All blood cultures were negative at the time of harvest and all animals had positive monomicrobial tissue cultures.

DISCUSSION AND CONCLUSION:

There is no standard treatment regimen for performing a DAIR procedure. This study suggests a combination of oral antibiotics and a DAIR procedure with dilute betadine did not reduce the bacterial burden on the implant with one three minute soak compared to animals treated with oral antibiotics alone and untreated control animals. Multiple soaks, different concentrations of betadine, and a longer duration of soak may change these observed results; however, betadine at this concentration may not be an effective irrigant solution during a DAIR procedure, and alternate concentrations of betadine or irrigant solutions should be considered.

Figure 2


Implant Associated CFUs
Colony Forming Units
5.0×10^07
4.0×10^07
3.0×10^07
2.0×10^07
1.0×10^07
0
INFECT
INFECT-ABX
DAIR-BETADINE

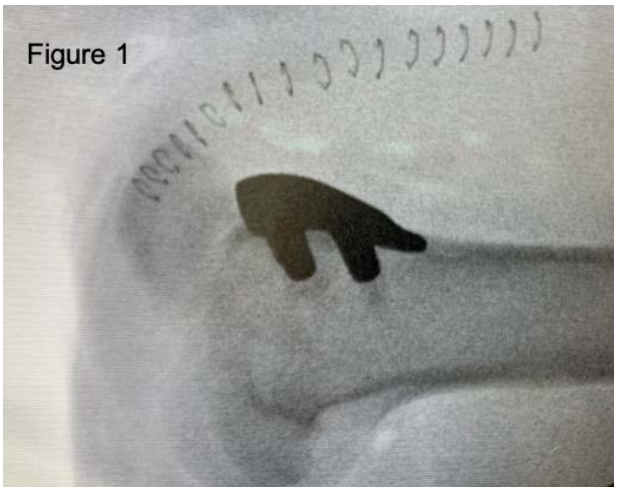


Figure 1