

Orthopedic implant-related infection prophylaxis using a vancomycin-loaded, resorbable hydrogel coating. An in vivo animal study.

Willemijn Boot, Debby Gawlitta, Wouter J.A. Dhert, Henri Ch. Vogely

Department of Orthopaedics, University Medical Center Utrecht, Heidelberglaan 100, Utrecht, the Netherlands

Aim: To investigate the efficacy of a fast resorbable, vancomycin-loaded hydrogel coating (DAC, Novagenit Srl, Mezzolombardo, Italy) to prevent early postoperative infections in an animal model of implant-related infection.

Methods: 18 New Zealand White rabbits received a titanium intra-medullary rod in the proximal left tibia after local contamination with *S. aureus*, without systemic antibiotic prophylaxis. In the experimental group rods were coated with vancomycin-loaded hydrogel (hydrogel-vancomycin group, N=6). Two control groups were used: no-hydrogel (N=6) and hydrogel-only (N=6). Erythrocyte sedimentation rate (ESR), blood neutrophil count and body weights were measured at fixed intervals during the experimental period of 28 days. Following explantation, the anterior part of the proximal tibia was processed for detection of viable bacteria. The posterior part containing the rod was used for histological purposes: bone-implant contact, grading severity of infection and fluorochrome incorporation to follow bone formation. Chi-square or univariate ANOVA with post-hoc Bonferroni test were used for statistical analysis, as required.

Results: No viable bacteria were found in the tibiae in the vancomycin-hydrogel group, indicating absence of local infection, whereas 5/5 tibiae were found infected in the hydrogel-only group (one rabbit died, cause unknown) ($P=0.002$), and 5/6 tibiae in the no-hydrogel group contained bacteria ($P=0.01$). At 28 days follow-up, neutrophil count was significantly lower in the vancomycin-loaded hydrogel group compared to the gel-only group ($P=0.0001$), while no significant difference was found comparing ESR, that returned to normal baseline levels in all groups; ESR levels in the vancomycin-loaded hydrogel group did not show any significant elevation whenever at follow-up, at variance with both control groups. Neutrophil count and ESR did not significantly differ, at final follow-up, between hydrogel only and no-hydrogel groups. Weights over time were significantly higher in both the vancomycin-hydrogel and no-hydrogel groups compared to the hydrogel-only group. The infection grading showed that the hydrogel-vancomycin group had a significantly less severe infection compared to the hydrogel-only group, but not when compared with the no-hydrogel group. Currently, histological slides are evaluated for bone-implant contact and fluorochrome incorporation.

Conclusions: A vancomycin-loaded, fast resorbable, hydrogel coating prevented implant-related infection in an animal model, even in the absence of systemic prophylaxis. Study performed under the multicenter Collaborative Project "I.D.A.C.", funded by the European Commission, within the 7th Framework Programme on Research Technological Development and Demonstration, grant no. 277988.