Local antibiotic application with calcium sulphate as carrier material to enhance debridement and hardware retention in early fracture-related infection: A promising strategy
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Introduction
The established treatment strategy for early fracture-related infection after internal fixation consists of surgical debridement, the removal or staged exchange of the implants and systemic antibiotics. High local antibiotic concentrations should enhance treatment success. Antibiotic-loaded calcium sulphate beads (CSB), placed around the implant at the site of infection, deliver antibiotics in concentrations approximately 10 times higher than what is achievable with PMMA. Concentrations remain above therapeutic thresholds for more than 8 weeks, without systemic toxicity. Furthermore, the beads dissolve within 2-3 months, making their removal unnecessary. The methodology of this treatment modality is explained and illustrated with three clinical cases.

Methods
In contrast to PMMA, which is a dense acrylic, nonbiodegradable and a potential future nidus, calcium sulfate is a natural bioceramic, biodegradable and nonimmunogenic. Because of its crystalline structure any water-soluble antibiotics can be incorporated. The preparation of the antibiotic-loaded CSBs is performed intraoperatively. The procedure including the hardening of the beads takes about 30 minutes. The different steps are illustrated in Fig. 1A-D.

Case 1: A 19-y old male patient suffered a complex fracture of the pelvic ring in combination with a fracture of the proximal femur. Nine days after internal fixation, infection with S. epidermidis was identified in an aspiration of a fluid collection. Revision was performed, including debridement, irrigation and placement of vancomycin-loaded CSB around the plate (Fig. 2A and B). Treatment was completed with systemic application of antibiotics for 6 weeks. Five months after revision surgery, the patient was free of pain and showed no signs of infection.

Case 2: An 88-y old male patient had an intertrochanteric fracture fixed by cephalomedullary nailing (Fig. 3A-C). Due to persistent wound secretion with detection of coagulase-negative staphylococci, revision with implant retention was performed on day 19. The CSB had been loaded with vancomycin and systemic antibiotic treatment for 6 weeks was initiated. Two years after revision surgery the patient was asymptomatic using a walker without any signs of persistent or recurrent infection.

Case 3: A 59-y old male patient reported increasing pain 3 weeks after internal fixation of a fractured anterior acetabular column. CT investigation revealed a fluid collection along the plate and a hip joint effusion. Aspiration was positive for S. aureus. Revision as described above was performed and vancomycin-loaded CSB were applied (Fig. 4A and B). A 6-week course of systemic antibiotics was given as well. No recurrent infection was observed up to 1 year postoperatively.

Results
Up to now, all patients were followed for at least 12 months. No further surgery was necessary in any patient and fracture healing was evident in all cases without any signs of a persisting or recurrent infection.

Conclusion
Antibiotic-loaded CSB deliver high local antibiotic concentrations over several weeks. This might help to retain internal fixation devices which otherwise would have to be removed, thus reducing morbidity of fracture-related infection.

References:
http://www.wright.com/products-biologics/osteoset