***CORR* Insights®: Sonication of Antibiotic Spacers Predicts Failure during Two-stage Revision for Prosthetic Knee and Hip Infections**

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Received: 7 April 2014 / Accepted: 10 April 2014 / Published online: 29 April 2014
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Where Are We Now?

Infection recurrence remains an important problem following two-stage exchange arthroplasty for the treatment of periprosthetic joint infection. Mortazavi and colleagues [6] reported reinfection in 28% of patients treated with this protocol for infected knee arthroplasty. Reinfection may be attributed to either infection with new microorganisms or failure to eradicate the initial infection despite the first-stage procedure and antibiotic administration [11]. Undiagnosed persistence of infection is of major concern because reimplantation in this setting will likely lead to failure. Therefore, the key question is whether infection has been controlled following the first stage and, as a corollary, whether we can proceed with the second stage.

This CORR Insights® is a commentary on the article “Sonication of Antibiotic Spacers Predicts Failure during Two-stage Revision for Prosthetic Knee and Hip Infections” by Nelson and colleagues available at: DOI: 10.1007/s11999-014-3571-4.

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This *CORR Insights®* comment refers to the article available at DOI: 10.1007/s11999-014-3571-4.

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Diagnosis of ongoing infection is a challenging task and none of the currently available diagnostic modalities can accurately assess eradication of infection. Microorganisms may survive following the first stage without generating a clinical, laboratory, or histopathologic picture suggestive of infection. Inflammatory markers cannot differentiate between resolution and persistence of infection in that setting [2, 3]. Aspiration preceding the second stage has low sensitivity [2–4], as does intraoperative histopathology during the second stage [1].

Microorganisms may attach on the surface of foreign material forming a biofilm [10] and may not be identified by traditional microbiological techniques leading to false negative cultures. Sonication of implants removed during the first stage dislodges biofilm bacteria and cultures of sonicate fluid are more sensitive than periprosthetic tissue cultures, especially if antibiotics have been used within the previous two weeks [9]. Limited information exists regarding sonication of antibiotic spacers removed at the second stage [5, 8] and its role remains unclear.

Where Do We Need To Go?

Nelson and colleagues convincingly demonstrated that antibiotic spacer sonication improved sensitivity of intraoperative cultures (note that a number of the sensitivity and specificity values in this study were corrected in a published erratum DOI: 10.1007/s11999-014-3626-6). They also showed that positive sonication cultures were associated with reinfection. Sonication cultures are only available postoperatively and so cannot guide the decision to proceed with reimplantation, but they do offer important prognostic information.

Even so, some issues still require clarification. First, the optimal colony-forming unit (CFU/mL) threshold for considering positive sonication cultures was unclear. When only growth ≥ 20 CFU/10 mL was considered as positive sonication culture, sensitivity was 64% and specificity was 92%. This was a strong improvement over standard cultures that had sensitivity of 45% and specificity of 88%. Inclusion of subtle growth (< 20 CFU/10 mL) as a criterion for positive cultures increased sensitivity to 82%, but also decreased specificity to 64% with only two of nine patients with subtle growth developing reinfection. Second, the adverse prognosis associated with positive intraoperative cultures should be evaluated in the context of other prognostic factors, such as patient comorbidities, soft tissue status, surgical factors, and microorganism resistance [6]. Finally, the best management approach for patients with positive intraoperative cultures still needs to be determined. It appears intuitive that antibiotics may help prevent reinfection. However, it could be argued that antibiotics may not change the clinical course of these patients for several reasons: (1) The spacer harboring the biofilm is removed and further débridement takes place during the second stage (nine of 18 patients with positive sonication cultures did not develop reinfection at a minimum 19-month followup). (2) Reinfection may be due to persisting microorganisms that have attached not only on the spacer but also on surrounding bone and soft tissues and have formed biofilms that will not be eradicated with antibiotics. (3) Reinfection may be due to a new infection instead of persistence of the initially treated infection, especially in patients with comorbidities [11].

How Do We Get There?

Innovative diagnostic modalities that can accurately assess persistence of infection in a timely manner either before or during the second stage are necessary to guide the replantation decision and to reduce reinfections. Until such modalities become available, we need well-designed multicenter studies to clarify the prognostic role of positive intraoperative cultures and allow risk stratification based on the degree of microorganism growth but also on patient comorbidities, microorganism resistance, and other factors. It is important that such studies use well-established criteria for the definition of infection [7] and have adequate followup.

Assessment of reinfection risk based on prognostic models from these studies could help guide management of

patients with positive intraoperative cultures. Close observation, repeat courses of systemic antibiotics, and antibiotic suppression are potential management options and randomized controlled trials will help establish the optimal management strategy based on reinfection risk.

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