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CORR Insights®: One-stage Revision With Catheter Infusion of Intraarticular Antibiotics Successfully Treats Infected THA

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Where Are We Now?

As a greater number of total joint arthroplasties are being performed worldwide, the number of periprosthetic joint infections (PJIs) is also increasing. The treatment of infection, particularly when two-stage exchange arthroplasty

is employed, is invasive and associated with considerable morbidity. Drs. Whiteside and Roy explore an ambitious alternative: Treating PJI with one surgical procedure by augmenting it with catheter infusion of intraarticular antibiotics. This study highlights two important points: (1) The possibility that we can arrive at less-morbid surgical approaches to treat PJI, and (2) the desire to use novel local delivery methods to decrease the risk of infection recurrence.

One-stage exchange arthroplasty for treating PJI was first initiated at the ENDO-Klinik (Hamburg, Germany) in 1976, where it was performed as a radical débridement of soft tissue and exchange of all components in a single

procedure [3, 12]. Patients treated with one-stage exchange arthroplasty demonstrated high functional outcome scores, high success of infection eradication, and cost savings for undergoing only one surgical procedure in specific patient populations [6, 9]. While two-stage exchange arthroplasty for treating PJI has been widely reported, fewer studies report the results of one-stage exchange arthroplasty, and the success rate of surgery is variable [7, 8].

In order to improve the success rate of infection treatment and to decrease the recurrence of infection, novel methods for augmenting surgical débridements were developed to provide local antibiotic delivery. The use of a Hickman catheter to treat infected TKA patients was first described in 2011, and reported a 94% success rate based on infection recurrence [13–15]. The benefit of this delivery method is that antibiotic delivery can be continuously administered. Other methods of antibiotic delivery include polymethylmethacrylate cement, gels, ointments, sponges, fleeces, pastes and beads [4, 5].

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Where Do We Need To Go?

While one-stage exchange arthroplasty has been shown to be an effective method for treating PJI, future studies might focus—as this one did—on continuing to improve the likelihood this approach will result in the eradication of infection. We also need to keep an eye on costs, both to patients and to healthcare systems. The investigators in the current study deserve praise for their efforts towards improving infection eradication within one surgical procedure, which is inherently less costly than two separate surgical procedures, as long as it consistently eradicates infection. However, these treatments may have side effects, such as the development of a sinus tract after using a Hickman catheter. While this was not observed in this study, other studies have noted this as a complication of treatment, which may predispose these patients to reinfection.

While the success rate of infection treatment was high (95%) in the current study, appropriate antibiotic-delivery methods must be investigated to ensure that biofilm can be eradicated from implants and infections prevented over the long-term. The goal is to utilize localized antibiotic-delivery methods to successfully eliminate bacteria while preventing antibiotic

resistance and avoiding systemic toxicity. While most studies use antibiotic concentrations to surpass the minimum inhibitory concentration of bacteria, it may be more effective to consider using antibiotics to surpass the minimum biofilm eradication concentration at the site of infection [2, 10].

While the ultimate goal is to prevent PJIs before they occur, the purpose of infection treatment should be to eradicate the infection and to prevent infection recurrence by performing one procedure. As there are no studies directly comparing the success rate of one- versus two-stage exchange arthroplasty [7], there is a need to conduct randomized controlled trials comparing one- to two-stage exchange arthroplasty in similar patient populations.

How Do We Get There?

Most infection studies focus in some way on the use of antibiotics. Although antibiotics are the mainstay of treatment against bacterial infections, drug resistance and greater systemic toxicity render them undesirable for long-term use. As a result, there is a growing interest towards using antiseptics, such as chlorhexidine gluconate and dilute povidone-iodine, for combating implant-related infections [1, 11].

Conducting further *in vivo* animal studies and human studies using different concentrations and combinations of antiseptics is important to further our knowledge of using antimicrobials in lieu of antibiotics.

The treatment of infection after surgical débridement requires a mechanism of local antimicrobial delivery. Catheters allow for intra-articular irrigation, as reported in this study, but there is the concern for sinus tract formation. Larger studies utilizing Hickman catheters in one-stage exchange arthroplasty should be conducted at different institutions to determine the incidence of how often this treatment is limited by this complication. As an alternative to catheters, other biomaterials such as sponges and gels have the potential to remain within the joint and obviate the need for removal after treatment [5]. In the future, smart implants may be developed to detect planktonic bacteria, as well as those within biofilms, which could trigger the release of antimicrobials to treat early infections without surgical intervention.

By performing one surgical procedure to fully eradicate PJI with a local antibiotic delivery mechanism, patient outcomes may improve after PJI and the consequences of such a devastating complication after total joint arthroplasty may be reduced.

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