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Intraoperative intra-articular injection of gentamicin: will it decrease the risk of infection in total shoulder arthroplasty?

Jeffrey Lovallo, MD[a,b,c], Jarrett Helming, DO[d], S. Mehdi Jafari, MD[d], Afia Owusu-Forfie, MS[d], Skye Donovan, PT, PhD[d,e,*], Christopher Minnock, MD[d], Farshad Adib, MD[f]

[a]*Anderson Orthopedic Clinic, Alexandria, VA, USA*
[b]*Department of Medicine, Georgetown University, Washington, DC, USA*
[c]*INOVA Hospital, Alexandria, VA, USA*
[d]*Nirschl Orthopedic Center, Arlington, VA, USA*
[e]*Department of Physical Therapy, Marymount University, Arlington, VA, USA*
[f]*University of Maryland, Baltimore, MD, USA*

Background: Deep infection is a debilitating complication after shoulder arthroplasty. Intra-articular injection of antibiotic can give a higher concentration compared with intravenous administration. We hypothesized that a group of patients given an intra-articular, intraoperative injection of gentamicin would report a lower infection rate than a group without local antibiotics.

Methods: Between 2005 and 2011, the senior author performed 507 shoulder arthroplasties. We retrospectively reviewed all of those cases. All patients were administered systemic prophylactic antibiotics. Beginning in June 2007, patients were also injected with 160 mg of gentamicin in the glenohumeral joint at the end of their surgery. Patient records were examined for preexisting medical conditions, type of surgery, and presence of infection. Patients receiving surgery before 2007 were compared with those after to determine the effect of prophylactic gentamicin administration in preventing deep infection associated with surgery. All patients were observed for a minimum of 1 year.

Results: Of the 507 surgeries, 164 were performed before 2007 (without intra-articular injection of gentamicin; group A) and 343 were performed with addition of gentamicin (group B). In group A, 5 patients presented with infection (3.0%) compared with 1 in group B (0.29%). The gender, mean age, mean body mass index, and prevalence of comorbidities were similar between the groups.

Conclusions: The data from this study support the conclusion that intra-articular intraoperative gentamicin administration may reduce postoperative infection.

This study was approved by the Marymount University IRB (study #11-25).

*Reprint requests: Skye Donovan, PT, PhD, Department of Physical Therapy, Marymount University, 2807 N Glebe Rd, Arlington, VA 22207, USA.

E-mail address: Skye.donovan@marymount.edu (S. Donovan).

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The axillary fossa includes numerous sebaceous glands and hair follicles that permit the rich growth of bacterial flora.[13] The proximity of the axilla to surgical sites may predispose the wound to bacterial contamination. A devastating complication after primary or revision total shoulder arthroplasty is a deep infection. The reported incidence of infection after shoulder arthroplasty ranges between 0.4% and 4%.

This area challenges shoulder arthroplasty surgeons and places an enormous financial and psychological burden on patients and society. Inexorably, scientists endeavor to discover efficient ways to fight infection in 3 battlefields; prevention, diagnosis, and treatment. A great challenge is to find newer techniques that could be more effective in reducing the risk of this dreaded complication.

In a study published in 2007, Yarboro et al[18] demonstrated that locally applied antibiotic is the most effective method to kill bacteria present in a wound, more so than systemic administration. Direct intra-articular infusion of antibiotics delivers higher local concentrations compared with intravenous administration. This method has been used in veterinary practice for treatment of pyarthrosis.[5,7,15] There are reports in the literature of the use of this method for treatment of infected total knee and hip arthroplasties and, most recently, in cervical spine surgery.[4,11,14,16]

The purpose of this study was to determine whether the administration of intra-articular antibiotics during surgery is effective to prevent deep postoperative infections. Gentamicin was selected as the antibiotic of choice on the basis of the work of Yarboro.[18] A recent study by Pahys et al[11] described the use of vancomycin powder in wounds after cervical spine surgery. In this study, they reported a greatly diminished infection rate after the application of vancomycin during surgery.[11] Our study focused on a different method of antibiotic administration, intraoperative intra-articular injection of gentamicin, and evaluated whether this method reduces the risk of infection after total shoulder arthroplasty. Our hypothesis was that the addition of gentamicin will reduce the number of infections after total shoulder arthroplasty.

Materials and methods

We retrospectively reviewed our prospectively collected database of all shoulder arthroplasties that the senior author (J.L.) performed between 2005 and 2011. We analyzed the data of 507 consecutive shoulder arthroplasties in 504 patients including 433 (86%) primary arthroplasties and 71 (14%) revisions. These cases were reviewed for the presence of deep postoperative infection that manifested within 180 days of surgery. Infection was defined as increasing pain, elevated erythrocyte sedimentation rate and C-reactive protein level, clinical appearance of infection at the time of surgery, possible positive culture, and more than 10 white blood cells per high-power field.[8]

The system used in both standard and reverse arthroplasties was DePuy (DePuy Orthopaedics Inc, Warsaw, IN, USA). Indications for primary shoulder arthroplasties were osteoarthritis in 281 cases, rotator cuff tear arthropathy in 78 cases, rheumatoid arthritis in 13 cases, post-traumatic arthritis in 49 cases, and avascular necrosis in 12 cases.

The most common indications for revision arthroplasty were loosening of glenoid or humeral components, periprosthetic fracture, component malposition, failed hemiarthroplasty, and rotator cuff tears. All revisions considered for the study were aseptic in nature. There were 292 standard total shoulder arthroplasties, 76 hemiarthroplasties, 4 CAP hemiarthroplasties, 64 reverse arthroplasties, and 71 revision arthroplasties. Fixation of the glenoid component was cemented in total shoulder replacement and cementless in reverse total shoulder arthroplasty. Fixation of the humeral components was cemented in 77 cases and cementless in the remaining cases. DePuy bone cement was used in primary arthroplasties, and gentamicin-impregnated cement was used in revision surgeries. Our inclusion criteria included any patient who underwent an arthroplasty from 2005 to 2011. We excluded patients who had a history of infection in the shoulder being operated on before arthroplasty. After excluding 4 previously infected arthroplasties, we entered 507 of them in the study. Of the cohort, 177 (34.9%) had a history of previous surgery on the shoulder being operated on, including fracture fixation, arthroscopy, rotator cuff repair, acromioplasty, and biceps tenotomy or tenodesis.

The senior author performed all surgeries in a standard surgical theater not equipped with a laminar airflow system. All procedures were performed under general anesthesia in a beach chair position through a deltopectoral approach. Within 1 hour before skin incision, prophylactic intravenous antibiotics (cefazolin) were administered to all patients. Clindamycin or vancomycin was administered in patients with an allergy to cephalosporin. Intravenous antibiotics were subsequently continued for 24 hours postoperatively. The same sterile preparation and drape technique was used for all patients. We routinely used iodine-impregnated incision drapes (Ioban; 3M, St. Paul, MN, USA) to cover the surgical site unless the patient had an allergy to iodine, for whom we used non-iodine drapes. Drains were not used, and the surgical team did not wear body-exhaust suits.

In group B, at the end of the procedure and when all the final components were in place and before closure of the incision, we inserted a spinal needle into the joint through the lateral skin. After closure of the deltopectoral interval, subcutaneous tissue,