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QUESTION 5: Is there a role for pre-reimplantation open or arthroscopic tissue biopsy in the evaluation during two-stage exchange of shoulder periprosthetic joint infection (PJI)?

RECOMMENDATION: Unknown. There is one level IV study suggesting that open biopsy prior to second-stage revision for shoulder PJI can identify patients with persistent infection who may benefit from subsequent repeat irrigation and debridement (I&D) prior to second stage reimplantation.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

PubMed and Embase were searched from 1980 to January 2018 to identify studies evaluating preoperative open or arthroscopic tissue biopsy prior to second stage revision shoulder arthroplasty after treatment of shoulder PJI. A secondary search of the references of included studies was also conducted. One article was selected for inclusion. Articles regarding hip and knee arthroplasty were excluded.

Zhang et al. reported a level IV case series in which they performed open biopsy prior to second stage revision for treatment of shoulder PJI [1]. Eighteen patients with shoulder PJI between 2005 and 2012 were included. Patients were treated with a standard protocol involving I&D, removal of implants, antibiotic spacer placement and antibiotic therapy based on culture results for six weeks based on infectious disease service recommendations. At a minimum four weeks after completion of antibiotics, patients were re-evaluated to ensure no clinical symptoms of infection were present and erythrocyte sedimentation rate/ C-reactive protein (ESR/CRP) had normalized. At this point, all patients underwent open biopsy via deltopectoral incision to obtain at least three soft tissue and bone cultures from tissue adjacent to the bone-antibiotic spacer interface. If cultures were negative for 7 to 14 days, patients underwent reimplantation. If cultures were positive, patients instead underwent repeat I&D with antibiotic spacer exchange and the protocol was repeated.

Zhang et al. found that 4 of 18 patients (22%) had positive cultures from the open biopsy indicative of persistent infection with a 38% persistent infection rate for individuals infected with *C. acnes*. One patient had positive cultures again on second open biopsy and

underwent a second spacer exchange prior to finally obtaining a negative third biopsy and undergoing reimplantation. *C. acnes* was the most common pathogen, present in 44% of index shoulder PJIs. Among persistent infections, 3 of 4 patients (75%) had *C. acnes*, and the patient requiring two spacer exchanges had *C. acnes* on each occasion. At a mean of 24 month follow-up (range 12 to 36 months), all 18 patients were reimplanted (2 hemiarthroplasty, 1 total shoulder arthroplasty (TSA), 15 reverse total shoulder arthroplasty (RTSA)) and noted to be clinically infection-free with an average American Shoulder and Elbow Surgeons (ASES) score of 71.

This study is limited in its level IV design and small sample size. Furthermore, patients undergoing two-stage revision had variable index procedures from which they developed shoulder PJI, including one open reduction internal fixation (ORIF) proximal humerus fracture, three hemiarthroplasties, six rotator cuff repairs, five TSAs and three RTSAs. There is no comparison group of patients who did not undergo open biopsy, and no comparison to alternative methods such as shoulder aspiration or arthroscopic biopsy.

The role of open or arthroscopic biopsy prior to reimplantation during a two-stage exchange arthroplasty remains unclear.

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