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Author: Daniel Fuchs

QUESTION 9: Should culture samples be taken during all revision total ankle arthroplasty (TAA)?

RECOMMENDATION: We recommend that intraoperative cultures be taken during revision TAA. The result of intraoperative cultures should be interpreted together with clinical suspicion for infection and the results of the laboratory and imaging investigations. We also recommend that multiple tissue specimens be collected. Given a lack of evidence for routine intraoperative cultures for revision TAA literature, this recommendation is based on analogous evidence in the total hip and knee replacement literature.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

There have been no studies in the TAA literature that have evaluated the utility of routine intraoperative cultures for all revision TAA cases. Multiple case series and review articles on revision TAA have been published which do not specifically advocate for or against this practice [1–4]. Jonck et al. do, however, recommend curettage of any encountered cysts at the time of revision and advise that cyst material should be sent for cell count, microbial culture and histopathology [3]. However, no data is included regarding previous results and utility of these samples.

There have been multiple studies in the total hip and knee replacement literature investigating the role of routine cultures taken during revision arthroplasty for presumed aseptic failure. Barrack et al. published on a series of revision total knee replacements with unexpected positive intraoperative cultures [5]. There were 41 cases with positive cultures out of 692 total cases. Twenty-nine of these cases had only one positive culture without additional evidence of infection and were considered false positives. None of the presumed false positives had long-term signs of infection or required additional surgery. The other 12 cases had multiple positive cultures or one positive culture and an abnormal preoperative inflammatory marker or synovial aspirate. These cases were treated with a four to six week course of antibiotics and two of these patients presented with early recurrent infection requiring a two-stage exchange. An additional patient had aseptic loosening requiring revision at six years, at which time there was no sign of infection and negative intraoperative cultures. The authors recommended routinely sending at least five sets of cultures in the setting of abnormal preoperative inflammatory markers, abnormal synovial aspirate or tissue appearing concerning for infection intraoperatively at the time of revision.

Jacobs et al. reported on 679 cases of revision hip or knee arthroplasty for presumed aseptic failure [6]. Infection was defined by the presence of two or more positive intraoperative cultures with the same organism. The incidence of unsuspected infection was 10%. For total knee replacements, patients diagnosed with infection went on to require repeat revision for recurrent infection at a higher rate compared with patients who were not diagnosed with infection at initial revision. For total hip replacements, there was no significant increased rate of recurrent infection requiring revision. The authors emphasized the importance of improved preoperative work-up prior to revision total joint arthroplasty to minimize the number of unsuspected prosthetic joint infections.

Given that there is a small but significant incidence of unsuspected joint infection in hip and knee arthroplasty, there is likely a similar incidence of unsuspected TAA infection amongst presumed aseptic failures. Routine cultures at the time of revision for aseptic failure may help to identify unsuspected infections. However, even the literature for hip and knee replacement does not provide significant evidence to suggest how to intervene once the diagnosis is made and whether long-term outcomes can be improved once intraoperative cultures lead to the diagnosis of periprosthetic joint infection (PJI).

Therefore, we recommend that all patients undergoing revision ankle arthroplasty be investigated for PJI, which includes measuring serum markers, aspiration of the joint, intraoperative evaluation (which may include histology) and any other necessary tests. The

result of intraoperative culture during revision ankle arthroplasty can then be interpreted in light of laboratory and imaging investigations and any clinical suspicion for infection.

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2.2. DIAGNOSIS: NON-TOTAL ANKLE ARTHROPLASTY-SPECIFIC

Authors: Yasuhito Tanaka, Amiethab Aiyer, Eiichiro Iwata, Yusuke Yamamoto, Michael R. Mijares

QUESTION 1: What is the optimal number of samples for culture in patients undergoing surgery for foot and ankle infections?

RECOMMENDATION: The optimal number of samples for culture in patients undergoing surgery for foot and ankle infections is unknown. We recommend that multiple tissue samples be taken.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

Our search of the literature did not reveal any data regarding the optimal number of culture samples that should be taken during foot and ankle surgery. However, there is high-level evidence in the periprosthetic joint infection (PJI) literature regarding this topic. Bémer et al. conducted a prospective multicenter study evaluating the minimum number of samples required to make an accurate diagnosis of PJI [1]. They determined that four samples were sufficient for diagnosing PJI with the highest mean percentage of agreement (98.1% and 99.7%, respectively) in regards to the bacteriological criterion and diagnosis of confirmed PJI.

Atkins et al. performed a prospective study assessing the effect of sample number on the ability to diagnosis PJI [2]. Their study recommended sending five to six specimens and defined a cutoff of three or more positive operative cultures yielding an indistinguishable organism for definite diagnosis. This recommendation achieves an extremely high specificity, but an impractical sensitivity (it would require too many samples). In order to achieve both excellent sensitivity and specificity, five to six specimens with two or more culture-positive samples are recommended to diagnose infection.

The Infectious Diseases Society of America guidelines [3] provide moderate evidence from more than one well-designed clinical trial, without randomization (B-II evidence) recommending at least three (and optimally five or six) intraoperative tissue samples be submitted for aerobic and anaerobic culture to diagnose a PJI.

The majority of studies related to this subject in regards to the foot and ankle relate to the management of patients with diabetic foot ulcer and osteomyelitis. The available studies have revealed that the yield of culture is dependent on how these culture samples are taken (e.g., swab, bone biopsy and so on) and did not evaluate the influence of the number of culture samples taken.

In 144 diabetic foot ulcer patients with suspected osteomyelitis, ulcer swab and bone biopsy specimens were taken. The authors found that there is poor reliability of the ulcer swab culture in identifying the pathogens causing osteomyelitis in this patient population. When used in conjunction with bone biopsy specimen culture, there may be a more reliable isolate for effective management [4]. Another study reported that swab cultures may have utility for guiding the antibiotic selection for management of low-grade infection. In the setting of higher grade infections, deeper tissue culture and biopsy are necessary [5].

Although there is limited literature guiding the number of samples necessary to obtain for foot and ankle infections, this indicates the need for research in this area. Given the extent of studies conducted in other areas of orthopaedic surgery, similar studies should be conducted in the foot and ankle area to better guide appropriate management.

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