RATIONALE

We performed a systematic review of the literature regarding the research question found above as recommended: A PubMed Search for the MeSH Terms ("arthrocentesis"[MeSH Terms] OR "arthrocentesis"[All Fields] OR ("joint"[All Fields] AND "aspiration"[All Fields]) OR "joint aspiration"[All Fields]) AND ("arthroplasty, replacement, ankle"[MeSH Terms] OR ("arthroplasty"[All Fields] AND "replacement"[All Fields] AND "ankle"[All Fields]) OR "ankle replacement arthroplasty"[All Fields] OR ("total"[All Fields] AND "ankle"[All Fields] AND "arthroplasty"[All Fields]) OR "total ankle arthroplasty"[All Fields]) was performed on February 16, 2018. A total of n = 10 results were found.

Additionally a PubMed Search for the MeSH Terms ("infection"[MeSH Terms] OR "infection"[All Fields]) AND ("arthroplasty, replacement, ankle"[MeSH Terms] OR ("arthroplasty"[All Fields] AND "replacement"[All Fields] AND "ankle"[All Fields]) OR "ankle replacement arthroplasty"[All Fields] OR ("total"[All Fields] AND "ankle"[All Fields] AND "arthroplasty"[All Fields]) OR "total ankle arthroplasty"[All Fields]) was performed on February 17th, 2018. A total of n = 200 results were found. After exclusion of irrelevant manuscripts or duplicates, only four publications remained that can be considered a "match" regarding a specific answer to the research question.

Investigation of a prosthetic joint for possible infection, including the ankle, commences with detailed history-taking, physical examination and ordering a series of laboratory tests. There is no gold standard for diagnosis of PJI and because of this, we must rely on a combination of diagnostic techniques to reach or refute the diagnosis of PJI. The serum laboratory tests that should be ordered include ESR, CRP and potentially other tests, such as D-dimer levels. If these laboratory tests are elevated or with normal serological tests and high clinical suspicion for infection, the next line of investigation is believed to be joint aspiration.

The synovial fluid obtained, if any, should be sent for analyses that include total white blood cell count, neutrophil count and the percentage of neutrophils, as well as analyses for biomarkers, such as leukocyte esterase and alpha-defensin. The joint aspirate is also cultured to identify the potential infecting pathogen.

Although the algorithm for investigation of PJI in hip and knee arthroplasty has been well studied and the optimal threshold for parameters, such as cell count and neutrophil differential, determined, there is little data related to PJI of TAA. In the absence of such data, we believe that TAA should also be investigated in a similar fashion to hip and knee arthroplasty. In fact, our search determined that most studies related to TAA use the MusculoSkeletal Infection Society criteria and extrapolate data published in total hip and knee arthroplasty literature to TAA [1]. In one study, Alrashidi et al. recommended that aspiration for synovial fluid analysis should be considered if the ESR and CRP are elevated [2]. This has been corroborated by other studies in recent years, confirming the utility of aspiration to help gauge the presence of inflammation or infection around a TAA [3–5].

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QUESTION 5: What is the best technique for performing aspiration of patients with total ankle arthroplasty (TAA)?

RECOMMENDATION: In the absence of evidence, we recommend that ankle joint aspiration to evaluate for periprosthetic joint infection (PJI) be performed under sterile conditions via the anteromedial approach. Ultrasound guidance may be used if available but is not necessary to obtain an acceptable synovial fluid sample.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

In the setting of suspected ankle PJI based on preoperative history, physical, laboratory values and imaging modalities, preoperative aspiration can be useful and may reveal an organism in 50 to 60% of cases [1]. Landmark-based aspiration using a sterile technique via an anteromedial approach performed in the office is most commonly performed in order to obtain ankle synovial fluid for analysis. Imaging guidance via computed tomography or ultrasound is not usually necessary since the ankle joint is relatively simple to aspirate [2]. Ultrasound guidance may provide higher accuracy if available based on cadaver studies evaluating injections, which suggested 85% accuracy without ultrasound and 100% accuracy with ultrasound [3,4]. However, another study demonstrated 100% accuracy in ankle joint needle insertion in a cadaver study using palpation technique only [5]. In the setting of infection, there is typically excess fluid resulting in simpler access to the ankle joint for aspiration. Thus, aspiration can be performed without necessarily using ultrasound guidance.

The ankle can be accessed via several approaches. The most common approach is the anteromedial approach, which is just medial to the tibialis anterior tendon at the level of the ankle joint.

No difference was seen between anteromedial or anterolateral approaches in a cadaver study when performed by orthopaedic trainees, and there was an 80% success rate of being intra-articular with both approaches [6].

The risk of bacterial contamination of the joint after aspiration has not been studied. There is some literature discussing septic arthritis after corticosteroid injection. One report indicated an incidence of 0.5% in a population of patients with rheumatoid arthritis on immunosuppressant medication [7]. In the general population, infection after cortisone injection is reported to range between 1 in 3,000 to 1 in 16,000 [8,9]. It is generally thought to be very rare when a basic sterile technique is used.

We recommend that the site of ankle aspiration is wiped with alcohol and then prepared with the use of another antiseptic agent, such as povidone-iodine or chlorhexidine. Although not absolutely necessary, the site of aspiration may be isolated with the use of sterile towels. The aspiration may be performed in the office setting or the operating room suite, depending on the infrastructure in each facility.

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QUESTION 6: Should aspiration of the ankle with an antibiotic spacer be performed prior to reimplantation?

RECOMMENDATION: We recommend that aspiration of the ankle with an antibiotic spacer prior to a second-stage reimplantation should be strongly considered. Available studies indicate that a positive culture of the aspirate in this setting is predictive of residual infection, while a negative aspirate culture does not rule out infection and should be interpreted in light of other clinical indicators and laboratory values.

LEVEL OF EVIDENCE: Consensus

DELEGATE VOTE: Agree: 92%, Disagree: 8%, Abstain: 0% (Super Majority, Strong Consensus)

RATIONALE

There have been no studies in the total ankle arthroplasty (TAA) literature that have evaluated the utility of aspiration of an antibiotic spacer as part of a two-stage revision for infected total ankle arthroplasty. In a review article, Alrashidi et al. stated that reimplantation should only be undertaken once the infection is eradicated as indicated by clinical history and examination, serological testing and synovial fluid aspiration [1]. However, no references or evidence is cited to support this assertion. Two large series on the treatment of infected TAA each included two-stage revision with use of an antibiotic spacer as a treatment strategy [2,3]. However, neither study included preoperative aspiration of the antibiotic spacer in the methodology. Of note, Myerson et al. did routinely perform intraoperative examination of tissue and fluid by microscopy during definitive reconstruction surgery in order to evaluate for the presence of polymorphonuclear (PMN) leukocyte count > 5 per high power field or the presence of organisms on Gram stain [2]. If either criterion was met, repeat debridement with antibiotic cement spacer exchange was performed and the definitive reconstruction was deferred.

There have been numerous studies in the total hip and knee replacement literature investigating the utility of aspiration of antibiotic spacers. While these have provided valuable data, it should be noted that these studies were largely retrospective and non-uniform. The definition of the presence of infection was also not clear in some of these studies, and positive culture was considered by many studies as the gold standard. Some studies also correlated the results of the aspiration and intraoperative findings with the ultimate success or failure following reimplantation. The studies also have significant variability in the duration of antibiotic treatment as well as variability in the presence/absence and duration of an antibiotic holiday.

Studies regarding aspirate cultures of antibiotic spacers for infected total knee arthroplasty reported generally better specificity than sensitivity. Specificity ranged from 61 to 100% while sensitivity ranged from 0 to 83% [4–8]. Positive predictive value ranged from 0 to 100% while negative predictive value ranged from 74 to 97% [4–8]. Aside from cultures, additional aspiration tests have been evaluated for accuracy. There is significant variability across reported cut-off values and sensitivity and specificity rates for white blood cell count and PMN% of preoperative aspirates [9–12].

One argument for routine aspiration of an antibiotic spacer of the hip or knee prior to reimplantation revolves around the relatively low cost, simplicity and low risk of the procedure. However, in the setting of a temporary antibiotic spacer of the ankle, there is no evidence regarding the success rate of attempted aspirations.

One challenge that exists is the interpretation of a dry aspiration. In the hip, consideration has been given to performing a saline