Authors: Milena M. Plöger, Christopher D. Murawski

QUESTION 10: How should postoperative cellulitis be treated in patients with total ankle arthroplasty (TAA) in place?

RECOMMENDATION: In the absence of evidence, we recommend that (1) patients with TAA in place who develop postoperative cellulitis be evaluated thoroughly to rule out periprosthetic joint infection of the ankle, and (2) that isolated cellulitis may be treated with antibiotics, elevation and close monitoring. Aspiration can be considered in certain cases, with the potential risk of introducing deep space infection.

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

Treatment of postoperative cellulitis in patients with TAA is not well-defined. Schipper et al. suggested a compression wrap protocol over a circumferential fiberglass cast significantly reduces the incidence of wound complications [1]. While the authors demonstrated an overall reduction of wound complications, the differing postoperative immobilization protocols did not result in a significant difference in the proportion of wounds in patients with cellulitis requiring antibiotics (oral or intravenous) (22% vs. 16.7%, p = .60).

To our knowledge, there is no other TAA literature reporting on cellulitis. Brook and Frazier reported on 259 patients with culture-positive cellulitis [2]. Based upon their report in which 63 of 259 (24%) cellulitis cases were located on the leg, the authors concluded that the polymicrobial nature of cellulitis warrants the prescription of broad-spectrum antibiotics.

Meanwhile, in the total hip arthroplasty (THA) population, Rodriguez et al. reported on the use of intravenous and oral antibiotics in 16 patients with incisional cellulitis [3]. They assessed the erythematous eruption by hematological investigations, radiography, radionuclide scanning and blood culture, as well as aspiration from the area and skin biopsy. Following assessment, the best antibiotic course was determined. For two to six days until the erythema resolved, the following antibiotics were given to patients: 11 were given cephalexin, one vancomycin, one ampicillin and gentamicin and one cefuroxime. Following this antibiotic course, cephalexin, ciprofloxacin or amoxicillin were administered orally for two to six weeks. One patient received only oral ciprofloxacin, with resolution of the erythema occurring within 24 hours. Rodriquez et al. thus concluded that treatment with antibiotics for a minimum of two weeks led to resolution of symptoms and allowed for nonoperative management of the cellulitis.

In a separate case report on a patient undergoing THA, Perlick et al. argued that most cellulitis is caused by *Streptococcus hemolyticus* or *Staphylococcus aureus* [4]. The authors were successful in treating the surgical site cellulitis with the following protocol: dicloxacillin 2 gm × 3 or clindamycin 600 mg × 3 daily. This finding should also be considered when determining an appropriate treatment regimen for patients with post-arthroplasty cellulitis.

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Authors: Jonathan Kaplan, Steven Raikin

QUESTION 11: Does deep chronic infection after total ankle arthroplasty (TAA) require implant removal?

RECOMMENDATION: Yes. Deep chronic infection after TAA requires implant removal unless otherwise contraindicated.

LEVEL OF EVIDENCE: Strong

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

RATIONALE

While there is substantial evidence in the total hip arthroplasty (THA) and total knee arthroplasty (TKA) literature regarding one- and two-stage revision for infected total joint arthroplasty (TJA), there are very limited studies assessing deep chronic infection in primary TAA and TAA revisions. The majority of recommendations for the evaluation and treatment of the infected ankle arthroplasty in the current literature are based on those recommendations of THA or TKA [1–3]. Hsu et al. reported on the evaluation and management of the painful

TAA. In cases of deep infection in the early period (< 4 weeks), the authors recommended irrigation and drainage (I&D) with polyethylene exchange and intravenous (IV) antibiotics. In infection cases occurring > 4 weeks from the time of initial implantation, a two-stage surgery was required. However, it should be noted that this determination was again based on the THA and TKA literature rather than studies specifically assessing infected TAA [4].

Myerson et al. performed a retrospective review on the management of infection following total ankle replacement [5]. Over a 10-year period, the authors performed 613 total ankle replacements with a deep infection rate of 2.4%. There were 15 late/chronic infections, three early infections and one acute hematogenous infection. In the three early and one acute hematogenous infections, the authors attempted I&D, polyethylene exchange and retention of the components in conjunction with a course of IV antibiotics. Unfortunately, all four patients developed recurrent infection requiring repeat I&D and complete prosthesis removal with antibiotic spacer placement. In the chronic/late infections cohort, they performed a two-stage revision with initial I&D, complete explantation, cement spacer application and IV antibiotics. Of these 15 chronic infections, infection recurrence occurred in three patients, requiring additional interventions. Additionally, from the same institution, Ferrao et al. reported on the definitive treatment of infected total ankle replacements using an antibiotic cement spacer in cases in which revision would not be amenable [6].

In a related study, Patton et al. reported on their experience with infected TAA [3]. Out of 966 patients undergoing TAA, there were a total of 29 infections, accounting for an overall infection rate of 3.2%. They classified these based on acute postoperative complications including cellulitis or wound dehiscence, late chronic infection or remote hematogenous. There were 11 cases of acute postoperative wound dehiscence, three cases of acute postoperative cellulitis, eight cases of remote hematogenous infection and seven cases of late chronic infection. Of the 14 cases in the acute stage (cellulitis and wound dehiscence), one was treated with I&D, polyethylene exchange and antibiotic treatment, three were treated with I&D and antibiotics, four were treated with two-stage exchange revision, one was treated with a one-stage revision, one was treated with permanent antibiotic spacer placement and four were treated with amputation. Of the seven late chronic infections, five were treated with two-stage procedures, one was treated with amputation and one was treated with polyethylene exchange. In the eight cases of remote hematogenous infection, one was treated with amputation, six were treated with two-stage procedures and one was treated with I&D. While the authors report a variety of procedures for each of these presentations based on timing, it should be noted that they defined infection in the early postoperative phase as cellulitis and wound dehiscence rather than an objective diagnosis of deep infection. Additionally, while there were cases of single-stage procedures, these were quite low numbers compared to two-stage procedures or even amputation.

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3.2. TREATMENT: NON-TOTAL ANKLE ARTHROPLASTY-SPECIFIC

Authors: Kent Ellington, Christopher Hirose, Thomas B. Bemenderfer

QUESTION 1: What is the treatment "algorithm" for infection after ankle or hindfoot arthrodesis?

RECOMMENDATION: There is no universal algorithm for addressing the infected ankle or subtalar arthrodesis. A potential algorithm created by consensus is:

LEVEL OF EVIDENCE: Consensus

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

RATIONALE

Infection after ankle or hindfoot arthrodesis always results in a protracted recovery. Recovery from this complication may include multiple surgeries, escalating cost and may result in a painful and poorly-functioning limb. Patients with suspicion of infection following ankle or hindfoot arthrodesis should be evaluated for deep versus superficial infection as well as appropriate host and surgical factors to determine the most appropriate treatment. Superficial infections may be treated with irrigation and debridement (I&D), local wound care and pathogen-specific antibiotics. Deep infections involving the internal hardware should prompt hardware removal. Additional components of treatment may include some combination of placement of antibiotic beads or spacers, stabilization with external fixation to temporarily stabilize or achieve definitive arthrodesis [1] and delayed revision arthrodesis with internal fixa-