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ACFAS Clinical Consensus Statement

Consensus Statement of the American College of Foot and Ankle Surgeons: Diagnosis and Treatment of Ankle Arthritis

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Executive Summary

The American College of Foot and Ankle Surgeons has developed a consensus statement on diagnosis and treatment of ankle arthritis. A modified Delphi method was sed in an attempt to develop consensus on a series of 18 statements using the best available evidence, clinical experience, and educated judgment.

The panel reached consensus that the following statements were "appropriate":

S1: It is clinically relevant to determine causes and types of ankle arthritis.
S2: Assessment of instability and alignment are important in the management of ankle arthritis.
S3: Plain weightbearing x-ray images of the ankle should be examined before the use of advanced imaging.
S4: Advanced imaging such as an magnetic resonance imaging or computerized tomography scans is useful for working up a patient with ankle arthritis.
S5: A multimodal approach is important for pharmacological management of painful ankle arthritis.
S7: Bracing with an ankle/foot orthosis is an effective conservative treatment option for ankle arthritis.
S9: Intra-articular corticosteroid injection is a viable option for treatment of ankle arthritis.
S11: Periarticular ankle realignment osteotomy may relieve the symptoms of ankle arthritis.
S15: Open arthrodesis is a viable option for treatment of ankle arthritis.
S16: Arthroscopic arthrodesis is a viable option for treatment of ankle arthritis.
S17: Total ankle arthroplasty is a viable option for treatment of ankle arthritis.
S18: Amputation may be a viable option for the treatment of complex ankle issues when previous salvage attempts have failed.

The panel did not find any of the statements "inappropriate."

The panel did not find any of the statements "neither appropriate nor inappropriate."

The panel was unable to reach consensus on the following statements:

S6: Physical therapy may be a useful option for treatment of ankle arthritis.
S8: Cast immobilization is a viable option for treatment of ankle arthritis.
S10: Intra-articular nonsteroidal injection is a viable option for treatment of ankle arthritis.
S12: Resurfacing articular surfaces with biologics/scaffolds is a viable option for treatment of ankle arthritis.
S13: Arthroscopic debridement is a viable option for treatment of ankle arthritis.
S14: Arthrodiastasis is a viable option for treatment of early ankle arthritis.

Clinical consensus statements (CCSs) reflect information synthesized by an organized group of experts based on the best available evidence, expert opinions, and to some degree, uncertainties and minority viewpoints. A CCS is not meant to establish clinical practice guidelines, systematic evidence reviews, or recommendations. A CCS should assist in promoting discussion on relevant topics, as opposed to providing definitive answers. Adherence to consensus statements will not ensure

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successful treatment in every clinical situation, and individual clinicians should make decisions based on all available clinical information and circumstances.

This CCS focuses on the general topic of diagnosis and treatment of ankle arthritis, with the aim of addressing controversies in treatment options. Although the statements apply to many types of ankle arthritides, our focus is mostly on noninflammatory arthritis, including primary and posttraumatic arthritis, unless specified in a given section of the CCS.

Methods

A 7-member panel consisting of 6 foot and ankle surgeons and a biostatistician, who are all familiar with the topic of ankle arthritis, participated in 1 face-to-face meeting, several email dialogs, and 3 conference calls. The panel was tasked with developing a series of CCSs on the topic of ankle arthritis that may be controversial or misunderstood. Using our collective clinical experience during a face-to-face open discussion, we developed a preliminary list of 25 specific statements covering the diagnosis and treatment of ankle arthritis. A preliminary literature search using Medline, EMBASE, Cochrane, and CINAHL databases was conducted to assess availability of published research on each statement. Based on the results of these preliminary searches, some of the initial statements were combined. A final list of 18 of the original 25 statement/questions was retained for further discussion.

Consensus

A modified Delphi method was used to attain consensus among the members of the panel, who were asked to review and anonymously rate the appropriateness of each statement. Rating was graded from 1 (extremely inappropriate) to 9 (extremely appropriate) on a Likert scale (1). The results were summarized with basic descriptive statistics, including an average, distribution of the scores, and outliers. The results were kept anonymous, and summary results were distributed back to the panel members. After open discussion of these results, the statements were distributed for a second anonymous review by the same panel members, and the answers were again analyzed using the same method. The new results were grouped from 1 to 3 (inappropriate), 4 to 6 (neither inappropriate nor appropriate), and 7 to 9 (appropriate). Although an attempt was made to reach consensus for all questions, it was not a requirement, and contrary opinions were encouraged. In such cases, when the answers were heterogeneous, we categorized the statement as one where we were “unable to reach consensus” even though the average score might have fallen into one of the above categories indicating appropriateness or lack thereof.

Thereafter, each panel member performed an in-depth review of current literature using Medline, EMBASE, CINAHL, and the Cochrane Database for each assigned statement. Although this was not a formal systematic review, each panel member conducted thorough literature searches. The final draft of the manuscript was submitted to *The Journal of Foot & Ankle Surgery*.

Discussion

1. The panel reached consensus that the statement: “It is clinically relevant to determine causes and types of ankle arthritis,” was appropriate.

It is suggested that 15% of the world’s adult population (or ~100 million people) has joint pain due to osteoarthritis (OA), with ~10% and ~18% of men and women affected, respectively (2). OA is less common in the ankle than in the knee or hip (3). The ankle is less susceptible to primary OA than other joints, owing to its stiffer cartilage (4−6) containing more glycosaminoglycans and less water (7) and it being less responsive to inflammatory cytokines (8−10).

Compared with patients with knee OA, ankle OA patients have lower body mass index (BMI), higher educational attainment, and better physical function (11). Most ankle arthritis (65% to 80%) is posttraumatic in nature (3,9,12), compared with <10% and <2% of knee and hip arthritis, respectively (13). Therefore, those with ankle OA are typically younger than those with knee or hip arthritis (11,14), and this may necessitate surgery earlier in life (15).

Although 37% to 53% of advanced or end-stage ankle OA patients have had malleolar fractures (9,10,16), fracture of any rearfoot bones, as well as sprains and lateral ankle ligament instability (17,18), can lead to OA of the ankle. Deformity of the lower extremity often accompanies posttraumatic ankle OA, and therefore, the biomechanics of the joint can be altered (9,19,20). Thus, being aware of the mechanism of injury and making assessments of surrounding osseous and soft tissue structures other than the ankle itself are also important in clinical management of ankle OA. Additionally, knowing whether the traumatic cause is recent or distant can help in planning the course of treatment. It may also be important to determine what treatment was used previously. If the treatment was conservative, the type and duration of the treatment should be determined. If the past treatment was surgical, then what specifically was done and what, if any, complications occurred should be determined.

A history of open fracture, which has a high risk of infection (21), or an open wound and/or surgical intervention should be reviewed thoroughly with the patient. In addition, identifying whether the patient has any underlying medical issues such as neuropathy, vasculopathy, or a chronic pain syndrome is important to avoid short-term complications, such as infection and wound-healing complications, or ongoing pain, if surgical intervention is indicated.

Nontraumatic underlying deformity itself can cause arthritic changes in the ankle. Underlying causative long-term deformities such as flat and cavus feet, for example, can cause arthritic changes in the ankle and often influence the surgical treatment plan. Observing misalignment of the ankle or surrounding structures in motion and standing not only helps in clinical planning, but may also point to the cause of the ankle arthritis (22).

BMI is associated with OA, and it is also associated with a greater number of complications after total ankle arthroplasty (TAA) and ankle arthrodesis (AA) (23). A higher BMI exacerbates the already higher rates of complications after TAA and AA, more than it does after hip and knee arthroplasty (24−27). Weight loss can be used to help manage the symptoms of ankle arthritis (28). There is a moderately favorable effect of physical activity and fitness on knee OA (29), whereas findings on strenuous physical activity are conflicting (30−32): it has been shown to be detrimental (33), beneficial (34), and to have no effect (35). Ankle arthritis can also be caused or influenced by systemic conditions, such as infections, inflammatory diseases, and diabetes mellitus (36,37). When present, these conditions need special medical attention and appropriate referrals.

2. The panel reached consensus that the statement: “Assessment of instability and alignment are important in the management of ankle arthritis,” was appropriate.

It has been shown that as many as 28% of cases of ankle OA are precipitated by chronic ankle instability or a severe ankle sprain, whereas the incidence of ankle OA is much lower than that of ankle sprains (9). Arthroscopy studies have identified the association between ligament injury, pain, and cartilage damage; however, not all ligamentous injuries result in ankle OA (38−40). In other words, ligament injury can, but does not always, alter joint alignment and kinematics in a manner that results in cartilage degeneration (41). Regarding the surgical treatment of ankle OA, ankle ligament insufficiency is also associated with higher rates of total ankle implant failure (42). Because of the strong relationship between ligament injury and altered ankle alignment and kinematics, it is strongly recommended that the evaluation of ankle arthritis include concomitant evaluation of ankle instability. Treatment of ankle instability should also be considered when managing ankle OA.

3. The panel reached consensus that the statement: "Plain weightbearing x-rays of the ankle should be examined before the use of advanced imaging," was appropriate.

Plain x-ray evaluation should include anterior-posterior, mortise, and lateral views, at a minimum. Often, in addition to a standard lateral view, the weightbearing stress dorsiflexion (i.e., "charger") view may be used to assess for anterior ankle impingement, and plantarflexion views may be used to identify the joint level that is compensating for reduced motion in pedal joints (e.g., talonavicular, naviculocuneiform, or tarsometatarsal). Hordyk et al (43) identified that overall motion does not change, but the location of the motion does change, after total ankle replacement (TAR), when comparing pre- and postoperative stress plantarflexion, neutral lateral, and stress dorsiflexion views, thus advocating for the utility of the charger view. In cases of suspected deformity, a hindfoot alignment view can be helpful to aid in understanding the intrinsic deformity related to the ankle itself, as well as deformity present in adjacent bone and joint segments (44). In addition to deformity, joint space narrowing, osteophytosis, and subchondral cyst formation can be identified using plain X-ray imaging. Various classification systems also exist specifically for staging of ankle arthritis (45–48).

Beyond the preliminary workup, plain-film radiographic imaging is important in surveillance of surgically managed ankle arthritis. Prissel et al (49) identified sufficient intraobserver reliability (superior to interobserver reliability) in 15 TAR patients using standard measurements on plain radiographs. This may demonstrate the effectiveness of single-surgeon annual postoperative plain-film radiographic surveillance.

4. The panel reached consensus that the statement: "Advanced imaging such as magnetic resonance imaging (MRI) or computed tomography (CT) scan is useful for working up a patient with ankle arthritis," was appropriate.

Based on the plain film radiographic findings, further imaging can be considered. Advanced imaging modalities in ankle arthritis can be helpful in determining the proper treatment pathway. The American College of Radiology places certain imaging modalities on a spectrum of appropriateness, based on the level of pathology as well as radiographic findings. In the case of chronic ankle pain with radiographic signs of OA, the ACR finds it appropriate to order advanced imaging such as MRI or CT (50). The ACR does not give a Tc-99m bone scan, an ultrasound image, or an arthrogram a high score for appropriateness in this patient group.

The usefulness of advanced imaging in the diagnosis of ankle arthritis is evident throughout the literature, but more importantly, it is useful in defining a preoperative patient workup for ankle/hindfoot fusions and arthroplasty. Dohn et al (51) compared traditional radiography, CT, and MRI and found that both CT and MRI revealed significantly more erosions than did traditional radiography. Wilkinson et al (52) demonstrated that a long TR (time of repetition between radiofrequency pulse sequences of 2500-4000 ms) with an intermediate TE (time of echo of 30 to 50 ms, which is the duration of time between delivery of the radiofrequency pulse and receipt of the echo) with fat suppression allows differentiation of the cartilage from the long T2 synovial fluid and short T2 deep layer cartilage and underlying bone. This allows for optimal visualization of cartilage thinning in OA.

Generally, MRI is useful for soft tissue pathologies and inflammatory changes about the ankle, whereas CT allows clear identification of osseous abnormalities (53). MRI in ankle OA could demonstrate osteochondral defects, subchondral cysts, disorders of ligaments and tendons, bone marrow edema, avascular necrosis of bone, and/or synovitis (54–58). CT in ankle OA, on the other hand, is useful for evaluation of previous fracture nonunions, joint ankylosis, and bone quality and density, including subchondral cyst formation and tarsal coalition (54,59–61). The indications of these modalities therefore depend on treatment plan and should be individualized.

In addition to traditional CT and MRI scans, newer and more sophisticated modalities such as hybrid imaging and weightbearing CT have garnered interest in the musculoskeletal community. Pagenstert et al (62) evaluated the accuracy of 99mTc-DPD SPECT/CT in localization of active degenerative joint disease of the foot in 20 patients with pain of uncertain origin. They demonstrated intraobserver diagnostic precision for the site of active arthritis with SPECT/CT and concluded that SPECT/CT was a useful imaging tool in localizing active arthritis. Parthipun et al (63) also studied the usefulness of triple-phase (99m) Tc-hydroxymethylene diphosphonate bone scans with SPECT/CT, and found that the site of the degenerated joint determined by the hybrid scan differed from the clinical examination in 37% of the patients. Using SPECT-CT, Knupp et al (64) showed significantly higher radioisotope uptake in the medial joint compartment in varus, and in the lateral compartment in valgus, ankle OA. The results of that study also showed that SPECT-CT allowed assessment of metabolism of degenerative changes of the tibiotalar joint. Whether precise localization of degenerative changes is needed in planning destructive surgical treatment (such as arthrodesis or implant arthroplasty) of the ankle OA is uncertain, but the studies suggest that there is potential usefulness in other joint preservation procedures.

Richter et al (65) evaluated foot and hindfoot alignment in 30 patients using weightbearing CT, CT without loading the foot, and conventional weightbearing x-ray images, and observed significant differences in angles measured using these different imaging methods. Weightbearing CT may provide useful surgical planning information in cases of complex ankle OA with severe underlying deformities.

5. The panel reached consensus that the statement: "A multimodal approach is important for pharmacological management of painful ankle arthritis," was appropriate.

Nonsurgical pain management of chronic arthritis, including the use of nonsteroidal anti-inflammatory drugs (NSAIDS), intra-articular injections, and opioids, has been reported to improve symptoms of arthritis under various conditions (66–71). Although no single modality is known to be superior in treating OA pain, the severity and types of complications and side effects of treatments vary. The potential risks and complications of pharmacologic pain management range from addiction to gastric ulceration, as well as renal and liver damage (69,72). Multimodal pain management strategies, therefore, may reduce the potential risk of adverse events and the side effects of any one therapy by reducing the effective dose required for any given modality (73,74). Multimodal strategies are further advocated by pain management societies and are consistent with the paucity of evidence that any given modality is superior to another in the treatment of ankle arthritis (75,76).

As a part of multimodal pain management, anti-inflammatory medications can be considered, and include steroidal or nonsteroidal options. NSAIDS can be effective for pain management associated with ankle arthritis (76). However, starting a patient on this type of therapy should always be preceded by obtaining a thorough understanding of associated medical comorbidities including, but not limited to, cardiovascular, gastrointestinal, and renal disease (69). Concomitant use of anticoagulants should also be considered. A discussion with the patient's primary care physician is always appropriate to verify and ensure safety of the prescribed (or recommended over-the-counter) medication. Topical NSAIDS may provide relief while limiting the risk of potential side effects, compared with commonly used oral options (76−78).

Alternatively, steroidal anti-inflammatory medications can be used for the management of ankle OA (76). Oral steroids may be considered for short-term management, but long-term management with oral steroids should be weighed against potential complications, again involving consultation with the primary care physician. Steroid injections have also demonstrated both diagnostic and therapeutic benefit for ankle arthritis (see CSS 9).

Regarding ankle OA specifically, there is little evidence related to the use of narcotic analgesics. A study comparing opioid versus non-opioid medication for moderate to severe chronic OA of knee, hip, and back included 240 patients and examined pain over a 12-month observation period. The results revealed no difference in terms of pain management (79). A systematic review in 2007 indicated that the evidence for opioids reducing back pain was mixed (80). The American Pain Society suggested a central role for opioids in treating severe arthritis pain that was unresponsive to NSAIDs (81). Similar recommendations appear in other articles (82,83). However, a large claims database study showed that <4% of patients with rheumatoid arthritis (RA) were receiving chronic opioids (84)

The American College of Rheumatology (70,85) and the European League Against Rheumatism (86,87) have similar recommendations in terms of the pharmacological treatment of OA, although these recommendations are not specific to the ankle. Acetaminophen is recommended as the first-line therapy. When patients do not achieve satisfactory results, which is not uncommon (88), treatment is suggested to move to other NSAIDs or cyclooxygenase-2 selective inhibitors. These must be monitored, as they may result in long-term adverse effects (36,89−92). If these fail, one can then move to carefully designed regimens using narcotics, with or without acetaminophen and NSAIDs. This recommendation is also made for those whose OA is detrimental to their quality of life. It should be noted that the probability of long-term narcotic use increases several days after initiation of the treatment (93).

6. The panel was unable to reach consensus on the statement: “Physical therapy may be useful for treatment of ankle arthritis.”

Physical therapy (PT) is typically a tried-and-true modality for many ailments of the lower extremity, especially for functional rehabilitation after surgical management. It appears, however, that in the case of a chronically arthritic ankle, it may play a marginal role. Most therapeutic modalities rely on joint motion, and when there are limitations in joint motion, treatment becomes difficult. It appears that PT is most beneficial when implemented in patients with early signs of arthritis and with minimal subchondral disruption (94). Most available literature describes the role of PT either in early RA or after a surgical intervention in patients with ankle arthritis (94−96). Although the American College of Rheumatology has set forth diagnostic and therapeutic criteria, including PT as a treatment modality, for the hip, knee, and hand, no such guideline has been created for the ankle (97−99).

It is important to differentiate between inflammatory and noninflammatory arthritis and to assess the stability of the joint when determining a specific PT treatment plan. It has been recommended that PT is to be implemented for arthritic patients to evaluate functional capacity and to aid with exercise programs and identify measurable deficits (100). Most programs should primarily focus on muscle strengthening, anti-inflammatory measures, and joint mobilization to tolerance of both the ankle and hindfoot (95). Maintaining strength and flexibility with joint mobilization via PT or a home exercise program can also be beneficial to the preoperative patient and has not been shown to accelerate the arthritic process (95,101). Physical therapists have multiple treatment modalities (e.g., thermotherapy, ultrasound, and transcutaneous electrical nerve stimulation, to name a few) at their disposal that may be implemented for standard treatment; however, there has been no substantial evidence that shows the efficacy of most of these modalities for the treatment of chronic ankle OA (95). For the treatment of an inflammatory arthropathy, the use of low-level laser therapy has been shown to be efficacious in reducing pain and increasing flexibility in the rheumatoid patient (102).

7. The panel reached consensus that the statement: “Bracing with an ankle foot orthosis (AFO) is a recommended conservative treatment modality for ankle arthritis,” was appropriate.

Bracing of the lower extremity is a widely accepted conservative treatment modality for ankle OA. The goal of bracing management in ankle OA should be to provide reduction of pain by minimizing tibiotalar motion and contact, while maintaining the joint in a neutral position (103,104). It is often difficult to reduce sagittal plane motion and keep the ankle in neutral without controlling the entire rearfoot and ankle complex. The most successful braces will offer triplanar motion control (103,105).

A variety of braces are available in multiple materials, from leather to carbon fiber. Some of the more common bracing options include a hinged ankle-foot orthosis (AFO), carbon fiber AFO, double-upright brace, and patella tendon bearing brace. The AFO gauntlet brace has been shown to be effective for the arthritic ankle, as it controls triplanar motion in the rearfoot and ankle (105).

Although bracing has been a stalwart of the treatment regimen for most arthritides, trials comparing bracing options are quite limited. One of the few studies to compare multiple bracing options for the arthritic ankle was conducted by Huang et al in 2006 (103). They compared a custom-made AFO, a rigid hindfoot orthosis (HFO-R), and an articulated hindfoot orthosis (HFO-A). They tested 13 subjects with unilateral ankle OA using these bracing types and recorded subjects walking on level, ascending, and descending ramps, using an 8-camera motion analysis system. They collected data on the range of motion of the hindfoot/ankle and forefoot. They concluded that the HFO-R was the best option for patients with ankle OA, as it provided selective restriction to ankle-hindfoot motion while allowing sufficient forefoot motion (103).

The greatest challenge to the surgeon in prescribing the brace can be adherence of the patient to the treatment. Education on bracing and expectations should be discussed in detail with patients before prescribing. The future of bracing may involve 3-dimensional printing and fully customizable designs using computer programs.

8. The panel was unable to reach consensus on the statement: “Cast immobilization is a viable option for treatment of ankle arthritis.”

There do not appear to be any controlled clinical studies examining the use of casting in ankle OA (104). Therefore, there is no substantial evidence for the use of immobilization in the treatment of ankle OA. Anecdotally, immobilization can reduce some of the acute inflammatory process that results from ankle OA. Sometimes this is needed to isolate the location, magnitude, and type of pain by differentiating acute and chronic issues surrounding the ankle OA. Therefore, cast immobilization may provide more accurate diagnostic information regarding ankle OA; however, there is no substantial evidence as to the long-term benefit of cast immobilization as a treatment option.

On the other hand, it has been suggested that foot orthoses may be used in OA to control pain and inflammation, as well as to stabilize joints (105,106) and limit motion (105). More specifically, in the foot, orthoses may redistribute loads (107,108) and limit range of motion (109), specifically in the sagittal plane (105).

Various orthotics have been shown to alter the biomechanics of the foot and ankle (103,110). In treating patients with chronic ankle pain due to RA, 1 study examined 2 soft/semirigid orthoses. These foot orthoses reduced pain and functional limitations (111). Other studies have also indicated success in using orthoses for treating pain in patients with foot RA (112,113). A survey examined patient satisfaction with orthotics (114), and although the survey was general in terms of both etiology and orthotic design, patients were satisfied (although women and younger patients were less likely to be satisfied). In spite of the apparent lack of evidence, there is no shortage of recommendations for use of orthotics in ankle OA (94,105,115,116).

9. The panel reached consensus that the statement: “Intra-articular steroidal injection is a viable option for treatment of ankle arthritis,” was appropriate.

Throughout the review, it was appreciated that the use of intra-articular injections was identified in many forms of arthritis including juvenile idiopathic arthritis (JIA), RA, acute gout, and OA. The majority of studies, however, were identified in the management of JIA and RA. Even fewer studies look specifically at foot and ankle injections. Most are retrospective studies, and the only prospective study had a small sample size (117).

The majority of studies used varying strengths of triamcinolone as the drug of choice for performance of these injections. There were several that suggested use of methylprednisolone. The majority of studies confirmed short-term efficacy of intra-articular corticosteroid injection of the ankle, regardless of the etiology of the arthritic disorder. Ward et al (117) performed a prospective, 1-year follow-up on their ankle joint injections and appreciated a statistically significant improvement in ankle symptoms up to and including the month 6 after the injection. They also appreciated that the magnitude of response at 2 months was a predictor for a sustained response at 9 months and 1 year postinjection (117).

Regarding repeat injection, some studies have shown that subsequent injections are not as efficacious as the first (118). One study used imaging to determine the impact of synovial hypertrophy on ankle injections and found that those with milder hypertrophy were found to benefit the most from the injection (119). Other studies investigated relationships between inflammatory markers and efficacy and duration of the response to the injection; those positive for antinuclear antibodies did not have as good a response to the injection therapy (118).

Corticosteroid injections have been found to be a safe treatment with limited complications, particularly when used in the foot and ankle. This has been appreciated in clinical experience and reported in the literature. The safety of these injections is borne out in a report by Anderson et al (120), who looked at 1708 patients over a 16-year period and observed that the most common adverse event was postinjection inflammatory flare, and there were no observed postinjection infections.

The efficacy of injection therapy may be impacted by the technical performance and severity of disease process, both locally and systemically. Regarding the ankle, a study suggested that in most cases the therapeutic benefits of pain relief and reduced swelling did not extend beyond 3 months, with repeat injections having reduced benefit (118).

Corticosteroid injection can also be used as a diagnostic test, and responsiveness may indicate good prognosis for surgery (121).Ward et al (117) found that the magnitude of response to a corticosteroid injection at 2 months predicted a sustained response at 9 and 12 months after the injection. Khoury et al (121) reported in a series of 20 patients with presumed ankle OA that diagnostic injections identified a correct site of pain in 17 patients (85%). They pointed out that diagnostic injections were more effective in identifying painful joints than were imaging studies.

10. The panel was unable to reach consensus on the statement: “Intra-articular nonsteroidal injection is a viable option for treatment of ankle arthritis.”

While corticosteroid is the most commonly used injection for ankle OA, options for injectable biologics have expanded in recent years. Most cited options include, but are not limited to, hyaluronic acid (HA), platelet-rich plasma (PRP), mesenchymal stem cells, and amniotic fluid injections (122). Frequently, these injections are implemented in larger joints such as the knee, but indications have been expanded to smaller joints such as the ankle.

Viscosupplementation is a widely used therapy in the treatment of knee arthritis, and in recent years it has become a highly researched therapy in the ankle, owing to its successes in the knee. There have been several prospective trials and a meta-analyses pertaining to the use of HA in the treatment of OA. Whitteveen et al in 2010 (123) evaluated the safety and dose response of HA in the ankle, and they determined in their prospective trial of 26 patients that the therapy was safe and most effective with 3 weekly doses of 1 ml, rather than a single dose of 1, 2, or 3 ml. In a meta-analysis performed by Chang et al in 2013 (124), the authors concluded that HA injections significantly reduced the pain associated with ankle OA, and also recommended that multiple doses be administered. The 2 most recent prospective trials by Hernandez et al (125) and Murphy et al (126) had similar results and concluded that HA viscosupplementation is a useful, effective, conservative treatment for ankle OA. Many of the studies recommended a 3-injection protocol and the use of fluoroscopy to verify injection into the ankle. In a recent consensus statement on viscosupplementation with HA for the management of OA published in *Seminars in Arthritis and Rheumatism*, experts agreed with the use of HA in the treatment of ankle OA (127). Although they did not reach a consensus owing to the paucity of rigorous randomized controlled trials, their literature review suggested that HA injections may be a safe, effective, and reliable conservative treatment modality for the treatment of ankle OA, when dosed appropriately.

PRP injection is a relatively new option for the treatment of OA. It is thought that injection of growth factors, specifically transforming growth factor beta, from highly concentrated platelets can promote proliferation of chondrocytes, while also downregulating gene expression of type I collagen and upregulating type II collagen (128). The use of PRP for the conservative treatment of osteochondral lesions of the talus was first reported by Mei-Dan et al (129) in a prospective randomized trial comparing PRP to HA. The authors found that HA and PRP were equally effective in reducing pain and increasing function for ≥6 months. Fukawa et al (130) recently presented a case series evaluating the safety and efficacy of PRP injections in the ankle. They found PRP to be safe and that it can significantly reduce pain associated with ankle OA. In the few studies that are available, outcomes have been positive; however, it should be noted that there have been few prospective studies dedicated to the use of PRP as a conservative treatment modality. In a systematic review of PRP use for the treatment of ankle OA, only 5 studies were included. Of the 5, only 2 (40%) used PRP injection as a primary therapy; in the others (60%), PRP injections were used as an adjunct to surgical procedures (131).

The use of other alternative biologic injection therapies, including stem cell therapy and amniotic membrane therapies, are promising; however, they have not been extensively researched. Emadedin et al (132) evaluated the long-term use of mesenchymal stem cells in patients with OA in a variety of joints, including the ankle. Of the 18 patients enrolled, 6 (33.3%) received injections in the ankle. The patients were followed for ≤30 months and found to have a reduction in their pain scores and an increase in walking distance, and the treatment was found to be safe.

Human amnion/chorion membrane as an injection therapy has been suggested to promote soft tissue healing and reduce inflammation. Gellhorn and Han (133) recently presented a 40-patient case series using human amnion/chorion injection for the treatment of tendinopathy and arthritis. Twenty of the 40 patients had joint injections, 2 of which were in the ankle. The authors found the injection therapy to be safe and clinically effective in reducing pain and improving function, and they had a 93% incidence of patient satisfaction.

11. The panel reached consensus that the statement: "Periarticular ankle realignment osteotomy may relieve the symptoms of ankle arthritis," was appropriate.

Periarticular osteotomy is a joint-preserving procedure that may be used for the treatment of ankle arthritis. Many ankle OA cases are secondary and posttraumatic in nature (134), and they commonly accompany underlying deformities that are associated with malunion and/or soft tissue imbalances (10,135) that result in asymmetrical wearing of the joint rather than uniform narrowing, which is often seen in a primary arthritis. Correcting underlying deformities redistributes the pressure points, thereby leading to a decrease in pain (136−142), increased function (46,137,138,140,142−145), improved subchondral bone plate density (146), delayed progression of arthritis (145,147), and even regeneration of joint cartilage (47,136,138,148).

Periarticular osteotomy can be performed at the supra- and/or inframalleolar intraarticular levels (145,149), or within the foot, depending on the apex of deformity. Above (proximal to) the ankle, the osteotomy is often performed with an opening, a closing, or a dome-shaped osteotomy. Below (distal to) the ankle, either medial or lateral translational osteotomy of the calcaneal tuberosity and other osteotomies for correction of underlying foot deformities, such as cavus and planus feet, can be performed (141).

Supramalleolar osteotomy (SMO) use, in varus ankles in particular, has been extensively studied for the treatment of ankle OA and has shown promising results (134,138,144,145,148,150−154). To a lesser degree, correction of valgus deformity via SMO also has provided good results (141,143,146,155). Foot procedures such as calcaneal osteotomy and cavus foot reconstruction have been also investigated in terms of the treatment of early OA of the ankle (136,141,156).

The success of periarticular osteotomy depends on several factors. The degree of arthritis (136,138,141), apex and amount of deformity (144,152), surrounding soft tissue stability (149), surgical technique (157), and underlying foot deformity (156) have all been suggested as predictive factors for the surgical outcomes. Gross et al (158) showed the association of preoperative bipolar activation (both tibial and talar sides) of the ankle in SPECT/CT with poor results after SMO. In general, earlier-stage OA (less joint degeneration) treated with an osteotomy that addresses the apex of the deformity usually responds well to periarticular osteotomy. Also, realignment osteotomies may relieve or minimize the symptoms of ankle arthritis, as stage 1 in the 2-stage approach to TAA.

12. The panel was unable to reach consensus on the statement: "Resurfacing articular surfaces with biologics/scaffolds is a viable option for treatment of ankle arthritis."

Local, isolated arthritic changes, or osteochondral lesions (OCLs), of the talus are more common than global ankle arthritis. Local ankle arthritic changes are secondary to 50% to 73% of acute ankle sprains (159). OCLs are a challenging aspect of ankle arthritic changes that foot and ankle surgeons deal with commonly. Treatments vary depending on the size and location of the OCL, but the basic premise is to enhance the ability of the talus to form hyaline-like fibrocartilage through bone marrow stimulation, with the addition of the surgeon's preference of biologic graft.

Microfracture, or bone marrow stimulation, for the treatment of talar OCLs with an area of <150 mm^2 has been shown to have good results, but larger lesions consistently do poorly (160−162). Therefore, resurfacing talar OCLs with biologic scaffolds may be considered for local ankle arthritic changes. Some studies suggest the efficacy of various techniques for the treatment of large focal OCLs with biologics that are both autologous and allogenic.

Autologous matrix-induced chondrogenesis (AMIC) has been studied recently and is increasing in popularity. AMIC involves a bilayer matrix of collagen I/III used to stabilize the blood clot formed after microfracturing (163). Gottschalk et al (164) studied 21 consecutive patients undergoing AMIC for talar OCLs with a 5-year follow-up. The mean defect size was 1.4 cm^2, and the defects were most commonly found on the medial shoulder (76%). Scores on the German version of the Foot Function Index significantly decreased from before surgery to 1 year after surgery (56 $\pm$ 18 versus 33 $\pm$ 25; $p = .003$) and showed a nonsignificant decrease between the 1- and 5-year follow-up visits (33 $\pm$ 25 versus 24 $\pm$ 21; $p = .457$). The authors were not able to detect any significant effect of lesion size on functional improvement scores at 1 or 5 years.

Kreulen et al (165) evaluated 10 patients with OCLs of the talus treated with matrix-induced autologous chondrocyte implantation (MACI). Unlike AMIC, the MACI procedure uses the patient's harvested cartilage, and these chondrocytes are then cultured and embedded in a collagen membrane bilayer. A second surgery is performed 6 to 12 weeks later to implant the new cartilage. Patients were followed for 7 years, and functional outcome scores were collected for 9 of 10 patients. American Orthopaedic Foot and Ankle Society (AOFAS) scores improved significantly ($p < .05$). Significant improvements in physical functioning ($p < .01$), social functioning ($p < .01$), and lack of bodily pain ($p < .01$) were also seen compared with preoperative values. Other studies have shown similar results and support the utility of MACI for large OCLs (166,167).

Biologics/scaffolds, as applied to talar OCLs, refers to true biologics used to stimulate chondrocyte maturation and hyaline cartilage formation. Therefore, resurfacing techniques with these scaffolds may be a viable option for focal arthritic talar defects.

13. The panel was unable to reach consensus on the statement: "Arthroscopic debridement is a viable option for treatment of ankle arthritis."

Although multiple studies have shown the effectiveness of arthroscopy in the treatment of anterior impingement syndromes, there is insufficient evidence supporting the routine use of isolated ankle arthroscopic debridement for advanced ankle arthritis (168−171). In a 2009 systematic review by Glazebrook et al (172), it was found that arthroscopic debridement was not effective for the treatment of ankle arthritis, with the exception of isolated bony impingement.

In 1 prospective cohort study, van Dijk et al (173) compared outcomes after arthroscopic debridement in patients with isolated anterior impingement versus those with more advanced ankle OA. Pain relief at 2 years after surgery was significantly better in the isolated anterior impingement group than in the OA group. Patients without joint space narrowing had 90% good to excellent results, whereas patients with visible arthrosis on preoperative radiographs reported 50% good to excellent results. Having ankle symptoms for a longer time was associated with both a higher OA grade and lower postoperative satisfaction.

Amendola (174) and colleagues showed that 24 of 29 patients undergoing an arthroscopic procedure for debridement of anterior bony or soft tissue ankle impingement reported benefiting from the procedure at a minimum 2-year follow-up period. In the same study, however, only 2 of 11 patients (18.2%) with ankle OA or chondromalacia reported the same benefit.

Cho et al (175) evaluated 22 patients who underwent arthroscopic debridement of the medial gutter, combined with lateral ankle stabilization. They followed these patients for 3 years and obtained AOFAS, visual analog scale (VAS) pain, and Foot and Ankle Mobility Measures scores. At the time of the procedure, all patients had Takakura stage II medial gutter arthritis. Although only 1 (4.6%) patient developed recurrent ankle instability postoperatively, 6 (27.3%) had a progression of arthritis as measured by the Takakura staging system.

In 2007, Hassouna et al (168) performed a 5-year survival analysis of 80 arthroscopic debridements and found that patients with impingement symptoms without OA performed significantly better than those with OA. In 2013, Parma et al (176) reviewed 80 patients who had arthroscopic debridement over a 10-year period. Those with ankle impingement performed the best, and those with chondral defects, older age, and previous trauma performed poorly. In a series of 63 patients, similar results were found by Choi et al (177), who found that ankle arthroscopic debridement benefited selected patients, and the 2 major risk factors for poor outcomes were intra-articular lesions and high BMI.

14. The panel was unable to reach consensus on the statement: “Arthrodiastasis is a viable option for treatment of early ankle arthritis.”

Ankle arthrodiastasis has been used as a joint sparing procedure in the management of end-stage ankle arthritis. The exact mechanism by which this treatment confers benefit remains uncertain, but it is believed that mechanical offloading of the injured joint with continued weightbearing status promotes an environment that allows for chondrocyte repair within the milieu of decreased synovial fluid pressure, while offering stress shielding of associated subchondral cysts that allows for resorption (178). Development of fibrocartilage occurs during this offloading period, which permits healing of cartilaginous injuries while reducing the risk of synovial fluid−based subchondral cysts. Intema et al (179) used CT to demonstrate normalization of bone density mineralization 3 months after joint distraction in patients with a preoperative presentation of subchondral sclerosis with cystic degeneration. The normalization correlated with decreased pain and functional deficits in 26 patients with posttraumatic arthritis (179). Lamm and Gourdine-Shaw (180) showed joint space widening and fibrocartilage formation evidenced by MRI. Their study looked at 3 patients with preoperative and postoperative T1- and T2-weighted MRI studies, 4 months after hinged distraction, and they demonstrated reduced subchondral thickness of ~0.5 mm and increased cartilage thickness or joint space gap of 0.5 mm after an average of 13 months. They also appreciated a decrease in the number and size of talar and tibial subchondral cysts (180).

Fragomen et al in 2013 (181) attempted to discover the minimum distraction gap needed to produce mechanical offloading of the joint with arthrodiastasis. In their study using 9 cadaveric specimens, they discovered that a 5.8-mm gap measured on a plain x-ray image was necessary to achieve elimination of joint contact in the ankle. This was not consistent with the observations of van Valburg et al who, in 1995, reported that a 5-mm gap achieved by daily 1-mm distraction starting on the first postoperative day demonstrated improved joint mobility and joint space widening in 55% of their patients (182).

The use of circular external fixation frames to achieve diastasis of the ankle has been performed with both static and hinged frames. Ploegmakers et al in 2005 (183) reviewed 25 patients with severe ankle arthritis and appreciated a 73% clinical benefit at 7 years using fixed distraction. Marijnissen et al in 2002 (184) published an open prospective study of 57 patients with a 34-month follow-up period using fixed distraction, and demonstrated good pain control with increased mobility and joint spaces that further improved over time. Use of a hinged frame theoretically adds the potential benefit of joint range of motion during distraction period. In 2014, Marijnissen et al (185) subsequently published the results of a retrospective cohort study of 111 patients using both fixed and hinged frames with an average follow-up of 144 months. This study had less promising results, demonstrating an incidence of failure of 50% and positive outcomes that decreased over time Nguyen et al in 2015 (186) studied 29 patients who had either fixed or hinged distraction, with a minimum follow-up of 5 years. Sixteen patients (55%) at final follow-up preserved their native ankle, and 13 (45%) had undergone AA or TAA. Positive predictors for ankle survival at 2 years included older age and the use of fixed distraction. The authors concluded that ankle function after joint distraction declined over time. Performance of concomitant procedures including SMOs, cartilage reparative techniques such as microfracture, and regeneration with allograft or autograft resurfacing have been studied in only limited case presentations.

15. The panel reached consensus that the statement: “Open arthrodesis is a viable option for treatment of ankle arthritis,” was appropriate.

Until recent years, open arthrodesis has been the gold standard in the surgical treatment of ankle arthritis. Today, alternatives such as total ankle implant arthroplasty and arthroscopic arthrodesis have gained in popularity. However, open arthrodesis is still relevant in the treatment of ankle OA, mostly because of the more definitive nature of the procedure and its good long-term survival (187). Chalayon et al (188) presented a single-institution 11-year review of 215 ankle arthrodeses and found that the incidence of union was 91%, that of reoperation was 19%, and nonunion was the most common reason for reoperation, followed by hardware removal and incision and drainage for suspected infection. On the other hand, Henricson et al (189) reported in 2018 an incidence of reoperation in primary AA of 7.8% in a review of the Swedish Ankle Registry. They showed the risk of reoperation to be 15% when surgery was performed arthroscopically with screw fixation, 8% when performed open with screw fixation, 5% with intramedullary nail fixation, and 3% after stabilization with plate and screw fixation. Yasui et al (190) reviewed 8,474 cases of AA by open and arthroscopic approaches between 2005 and 2011 and tried to identify reoperation rates. Of the cases, 7,322 (86.4%) were performed using an open technique. They identified 635 cases requiring revision arthrodesis, with a resultant incidence of 8.7%. Of interest, Yasui et al looked at the rate of re-operation resulting from adjacent joint arthritis after AA and identified 401 of 7,322 (5.6%) open AA cases that required subsequent adjacent joint arthrodesis (190). Trieb et al in 2005 (191) reported on 34 open arthrodeses that were followed for 5.5 $\pm$ 3.2 years and did not observe the development of significant arthrosis in adjacent joints. In a systematic review, Ling et al (192) identified 24 articles looking at adjacent joint arthritis after AA, 18 (75%) of which were clinical, and only 5 (27.8%) of which had pre-arthrodesis radiographs available. In 2 of the 18 studies, all patients with AA had adjacent joint arthritis. Of the 675 patients included in the 18 studies, only 12 (1.8%) required reoperation for adjacent joint arthrodesis (192).

The following recent systematic reviews show that the open arthrodesis is still comparable in efficacy to the more recently available alternatives. Honnenahalli Chandrappa et al (193) conducted a systematic review and meta-analysis of arthroscopic versus open arthrodesis of the ankle. The study included 1 prospective and 5 retrospective cohort studies. After analyzing the accumulated data, they were not able to detect any difference in overall incidences of complications, infection, and the operative time between open and arthroscopic techniques. However, length of stay, incidence of fusion, and tourniquet time were superior in the arthroscopic group (193). Interestingly, Park et al (194) also conducted a systematic review with similar included studies but reached different conclusions. They suggested that the arthroscopic group had fewer complications and a better incidence of union. Their study, however, did not include a meta-analysis. Yasui et al (190), with a large data set analysis, showed similar revision rates between open and arthroscopic groups; however, the subsequent adjacent joint arthrodesis rate was greater in the open group (5.6%) than in the arthroscopic group (2.6%).

Kim et al (195) compared TAA with AA in their systematic review of comparative studies and an accompanying meta-analysis. The arthrodesis group included both open and arthroscopic approaches, and the results were similar in terms of AOFAS, Medical Outcomes Short Form-36, VAS, and patient satisfaction scores compared with the TAA group. However, complication and reoperation rates were significantly higher in the TAA group. The study did include many older implants (designed and launched before 2009). Lawton et al (196), in their review, on the other hand, included noncomparative cohort studies that used only third-generation implants. Their cumulative data showed a higher incidence of complications with AA, while reoperation remained higher with TAA.

Although there are many comparative and cumulative studies of these data, we still lack randomized clinical trials. Selection bias in these retrospective data can make interpretation of the results difficult. It is conceivable that higher-risk patients may undergo arthroscopic arthrodesis in preference to an open procedure, while patients with severe deformity or those that require structural bone grafts may fall into the open arthrodesis group, in a retrospective study. Similarly, in the case of TAA versus AA, those who did not qualify for TAA for reasons such as high BMI, age, or degree of deformity could have ended up in the AA group.

It should also be noted that some data within these meta-analyses are heterogeneous. This can be due to inconsistency in surgical techniques, experience of surgeons, or regional patient characteristics. Arthroscopic arthrodesis and TAA can be more technically challenging than open AA. Therefore, outcomes could have been affected by the aforementioned factors being unequally distributed between the groups.

Although other alternatives to open AA have shown promising results, the open approach is sometimes unavoidable. When dealing with severe deformities, an arthroscopic approach may not be practical. A large wedge resection or implantation of structural graft cannot be performed with the arthroscopic approach. With open arthrodesis, it is also more feasible to place robust internal fixation for stability. Similarly, TAA may have poorer prognosis in severe deformity (197,198) and obese patients (199,200)

16. The panel reached consensus that the statement: “Arthroscopic arthrodesis is a viable option for treatment of ankle arthritis,” was appropriate.

Arthroscopic ankle arthrodesis (AAA) is rapidly becoming a popular treatment for end-stage ankle arthritis for selected patients (193,194). It has demonstrated faster union rates, decreased complications, reduced postoperative pain, and shorter hospital stays (2,21,193,194,201−212) compared with open arthrodesis. The large amount of cancellous boney contact and preservation of the bony contour afforded by this technique allows for significant stability and enhances the use of rigid internal fixation (204,213). O’Brien et al (202) showed there was greater variability of ankle position in patients that underwent open ankle fusion compared with those who underwent arthroscopy. While there is discussion that AAA has limitations in patients with significant deformity, several studies have shown success in this patient population. Gougoulias et al (208) achieved successful AAA for ankle deformities of 15° to 45° of varus or valgus deformity. Winson et al (205), in a 2005 publication, suggested that it may be possible to fuse ankles with deformities of >25° arthroscopically. It is important to keep in mind that when performing AAA in patients with significant deformity, it may be necessary to perform a mini-arthrotomy, and that careful preoperative planning is essential in these cases (214).

A significant advantage of AAA is the time to union. In a study of 39 arthroscopic arthrodeses, Collman et al (204) reported an average time to fusion of 47 days, whereas Glick et al (215) noted a 9-week average fusion time in 34 ankles. Other studies have noted time to fusion for arthroscopic AA ranging from 8.9 to 12 weeks (201,205,211). One theory to support the decreased time to fusion is that the arthroscopic technique does not disrupt the periarticular blood supply, thus facilitating healing (211,215−217).

Another potential advantage of AAA is the reduced need for pain medication postoperatively (207,210,211). It is now common practice for AAA to be performed in outpatient surgery centers, and generally the decision to admit a patient postoperatively is based on comorbid deformities and not postoperative pain concerns (214).

Other advantages of AAA include decreased blood loss, decreased disruption of the soft tissue structures about the ankle, and diminished risk of venous thromboembolism due to shorter immobilization times. There are also limited limb length changes, as well as fewer anatomic changes to the ankle (207), and this is quite beneficial if patients are ever to be converted to TAA.

Most recently there have been 2 published systematic reviews demonstrating significant advantages of AAA over open AA (193,194). Each has confirmed that AAA leads to better clinical scores, higher fusion rates, shorter tourniquet times, fewer complications, a shorter hospital stay, and less blood loss compared with the open procedure (194).

17. The panel reached consensus that the statement: “Total ankle arthroplasty is a viable option for treatment of ankle arthritis,” was appropriate.

Surgical management of end-stage ankle arthritis with total ankle implant arthroplasty (total ankle replacement [TAR]) has been carried out over the past 50 years. Historically, the complication rate for TAR has exceeded that for AA (218). More recently, long-term survivorship has improved due to improved implant design and surgical techniques. Short-term survivorship has recently been reported to be 95.3% (219). No superiority has been determined between mobile and fixed bearing prostheses (220). Long-term survivorship at 15 years after TAR has been reported to be 73% (221). In a large, mid-term follow-up study of patients at a high-volume TAR institution, there was no demonstrated difference between patients with substantial versus minimal deformity (222).

Bipolar allograft arthroplasty of the ankle has historically been performed and has demonstrated 71% survivorship at 5.3 years; however, longer-term follow-up is uncertain, and long-term TAR survivorship results surpass the intermediate term results of bipolar allograft arthroplasty. Therefore, the latter technique has largely been abandoned (223−225). Custom total talus replacement with ceramic alumina was performed in 55 ankles with good results at short- to intermediate-term follow-up (226). Custom cobalt chrome total talus replacement has been successfully performed, although without a long-term duration of follow-up or data from a large sample of patients (227−230).

Appropriate soft tissue management is important in the effort to achieve a successful outcome after TAR. For the varus deformity, this may include the adjunct use of a deltoid peel and tendon balancing, in addition to lateral ankle ligament reconstruction. In the valgus deformity, deltoid reconstruction and tendon balancing can be equally important. The learning curve for TAR appears to be significant, and reported results during the learning curve are inferior to the results of high-volume, experienced TAR surgeons (231,232).

18. The panel reached consensus that the statement: “Amputation may be a viable option in treatment of complex ankle issues when previous salvage attempts have failed,” was appropriate.

Patients who have undergone multiple revision surgeries for the treatment of ankle arthritis may have resultant intractable pain, loss of function, and decreased quality of life. Deformity that cannot be reconstructed, severe bone loss, recurrent joint infection, or osteomyelitis may also warrant consideration for amputation as a treatment option.

It has been shown that chronic lower extremity pain can improve after below-the-knee amputation (233). However, persistent or newly developed chronic pain frequently manifests after amputation (234−236). Preamputation pain and acute postamputation pain have been shown to be associated with chronic postamputation pain (237). Therefore, many of people with severe preoperative chronic pain after multiple failed limb salvage attempts are at great risk for developing chronic pain even after amputation. The UK’s orthopaedic specialty-specific guidelines on complex regional pain syndrome (CRPS), published by the Royal College of Physicians, recommends against amputation for the treatment of CRPS unless intractable infection is present (238).

Wukich et al (239) showed that, in a diabetic population, both quality of life and function improved after transtibial amputation. All of the patients in that study had diabetes-related foot complications. In patients with Charcot arthropathy, Wukich and Pearson (240) also observed improvement in self-reported quality of life and function after transtibial amputation. In these groups of patients, however, the reason for amputation is rarely due to pain; rather, they suffer from chronic wounds, loss of function, and infection. In terms of long-term function, it has been shown that amputation is a viable alternative to limb salvage in a severe acute trauma setting (241,242).

Infected hardware or prosthesis is another challenging problem that can occur after ankle reconstruction. If explantation is not an option, patients either have to commit to a long-term antibiotic treatment or undergo amputation, as having multiple surgeries to treat this condition can decrease one’s quality of life and promote deconditioning. Nonunions can also lead to multiple surgeries in the ankle. Multiple nonunions can be due to underlying medical conditions (such as diabetes, nutritional deficiency, smoking history, and other comorbidities) (243,244), poor surgical technique, infectious process, noncompliance, and multiple previous surgeries. OConnor et al (245) showed that each revision surgery for nonunion increases the risk of nonunion by almost 3-fold.

A chronic wound that does not respond to local wound care or a healed fragile skin that cannot tolerate any new incision may also prohibit further surgical reconstruction at the ankle level; therefore, the condition may necessitate amputation. If the patient elects to pursue amputation as a definitive treatment option, proper consultations are recommended. Psychology, physical, and occupational therapy and pain medicine should be involved in the care of the patient.

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