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Current Concepts in the Management of Ankle Osteoarthritis: A Systematic Review

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ABSTRACT

Ankle osteoarthritis is less common than hip or knee osteoarthritis; however, it is a relatively common presentation and is predominantly related to previous trauma. Treatments have traditionally consisted of temporizing measures such as analgesia, physiotherapy, and injections until operative treatment in the form of arthrodesis is required. More recently, interest has been increasing in both nonoperative and alternative operative options, including joint-sparing surgery, minimal access arthrodesis, and new arthroplasty designs. The present systematic instructional review has summarized the current evidence for the treatment options available for ankle osteoarthritis.

Joint sparing surgery, minimal access arthrodesis, ankle arthroplasty, and other advances in both surgical and nonsurgical treatment modalities have added to the already abundant biomedical literature on the subject of ankle osteoarthritis (OA). We review recent publications and provide a comprehensive, systematic review of current treatment options for ankle OA.

Materials and Methods

We conducted a search of the biomedical literature using the search term "ankle arthritis" in the following medical databases: Allied and Complementary Medicine Database (Ovid), British Nursing Index (Ovid), Cumulative Index of Nursing and Allied Health Literature (EBSCO), Embase (Ovid), Health Management Information Consortium: DH-Data and King's Fund (Ovid), Medline (Ovid), the Cochrane Database of Systematic Reviews, and DynaMed. We initially searched for reports published since 2006; however, earlier studies referenced in the reviews were also examined, some of which were included. These papers were included for analysis if there was no relevant recent literature covering the same material, or if the older literature was of better scientific quality. The search revealed >1000 studies. Case reports, small case series, studies not directly related to the treatment of ankle OA, and articles written in languages other than English were excluded. We evaluated the remainder and included 87 studies discussing the treatment options of ankle OA and their potential advantages and disadvantages. The present report provides a summary of the best available evidence in the management of ankle arthritis.

Results

Overview of Epidemiology and Pathophysiology

The ankle is a congruent, generally stable joint that transmits high peak contact stresses across a very thin layer of articular cartilage (1). This cartilage has unique features, including more cross-linking and fewer neutrophil collagenase and interleukin-1 receptors than other types of articular cartilage, that give it high tensile strength (2). Any change to the congruency of the ankle can lead to an increase in the forces across the ankle and accelerated degeneration.

Most ankle OA develops after trauma (78%), with most of the remainder idiopathic (3). The posterior malleolar fragment appears to be important in the development of post-traumatic OA (4). Although appropriate treatment of the original injury will help in the prevention of post-traumatic OA (5), it should be remembered that the outcome of ankle fractures might depend more on the severity of the initial injury than on the quality of the articular reconstruction (6).

Nonoperative Treatment

Glucosamine Sulfate

The use of glucosamine sulfate in the treatment of knee OA has been well established (7), and its use has been expanded to include the treatment of ankle arthritis. It is used as a chondroprotective agent to slow the progression of cartilage wear. One review of glucosamine use in ankle OA has been published (8), which concluded that

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glucosamine sulfate was safe and potentially beneficial but that additional research into its efficacy was required.

Viscosupplementation

Hyaluronic acid (HA) is a type of high-molecular-weight polysaccharide molecule known as a glycosaminoglycan. It attracts water molecules and is the most abundant glycosaminoglycan in synovial fluid. Its perceived mechanism of action includes an anti-inflammatory effect by reducing inflammatory cell migration and the concentration of inflammatory mediators, stimulation of endogenous HA synthesis, chondroprotection, analgesic activity by inhibiting nociceptors, and inhibition of cartilage-degrading enzymes.

Very little high-quality evidence is available about the effectiveness of viscosupplementation. Cohen et al (9), in a double-blind, randomized-controlled trial, reported significant pain relief and improvement of function 3 months after 5 intra-articular injections of 2 mL of HA in osteoarthritic ankles at 1-week intervals compared with a placebo. Karatosun et al (10), in a prospective, randomized-controlled trial of intra-articular HA compared with exercise therapy, did not show any statistically significant differences between the 2 groups at the 12-month follow-up point. Sun et al (11), in their prospective case series of unilateral ankle OA followed up for $\geq$6 months, showed significant American Orthopaedic Foot and Ankle Society (AOFAS) scale score improvements using 3 HA intra-articular injections at 1-week intervals. A systematic review found considerable differences among different studies in terms of the number of injections and follow-up length and that this and the paucity of randomized controlled trials meant that a full meta-analysis was not possible (12).

Operative Treatment

Joint-Preserving Surgery

Debridement, Chondroplasty, and Resection of Osteophytes or Cheilectomy. The indication for joint debridement, chondroplasty, and osteophyte resection or cheilectomy is a well-aligned ankle with some preservation of cartilage space in a patient not prepared to undergo a major reconstructive procedure. This procedure can be used as an adjunct to other procedures, such as distraction arthroplasty and realignment osteotomy (discussed below). Arthroscopic osteophyte resection can be indicated for isolated anterior impingement (13,14). The results were better in ankles with no joint space narrowing compared with those with a narrowed joint space (15,16). The present body of level 4 evidence suggests arthroscopic debridement for mild anterior impingement and early arthritis will be more effective than for advanced diffuse ankle arthritis.

Distraction Arthroplasty. Distraction arthroplasty is indicated for end-stage ankle OA with nearly normal alignment in young patients who would prefer to delay arthrodesis or arthroplasty (17). The patients should be compliant with treatment. It is best performed using a ring external fixator, which will give the advantage of greater weight-bearing stability. Adding a hinged construct will allow intermittent motion for chondroprotective function when unlocked. It can be combined with additional joint debridement and osteophyte resection, tendo Achilles lengthening, or supramalleolar osteotomy. The clinical mechanisms are not well understood, but it is thought that distraction unloads the cartilage and leads to a reduction in bone density, including sclerosis, and areas of low density such as subchondral cysts increased in bone density in one computed tomography-based study (18).

Marijnissen et al (19) reported 75% clinical benefit from their case series and better results with distraction than with debridement at 1 year. Ploegmakers et al (20) showed 73% significant clinical benefit maintained at $\leq$7 years of follow-up in their retrospective study. More recently, Tellisi et al (21) reported improvement in the AOFAS scale and Medical Outcomes Study short-form 36-item questionnaire scores in a retrospective cohort of 23 patients at 30 months using the distraction arthroplasty in conjunction with adjunctive procedures. Saltzman et al (17) reported improvements in the outcome scores with both fixed and motion distraction and that motion improved the outcome scores further compared with fixed distraction; however, adding motion to the ring fixator did not improve the range of movement.

Fig. 1. An osteoarthritic ankle with varus tilt. A previous subtalar fusion had been performed.

Realignment Osteotomy. Supramalleolar realignment osteotomy is indicated for those patients with malalignment, localized arthritis, or malunited ankle or pilon fractures (Figs. 1 and 2). It also has some potential use for those patients with diffuse ankle arthritis who are too young or still have good function and therefore do not wish to consider arthrodesis or arthroplasty. Lee et al (22) reported a series of 16 patients and recommended realignment osteotomy with fibular osteotomy be restricted to those patients with minimal talar tilt and neutral or varus heel alignment. The contraindications include a compromised soft tissue envelope or poor vascularity, diffuse end-