Systematic Review

Analysis of Outcomes for High Tibial Osteotomies Performed With Cartilage Restoration Techniques

Cynthia A. Kahlenberg, M.D., Benedict U. Nwachukwu, M.D., Kamran S. Hamid, M.D., M.P.H., Michael E. Steinhaus, M.D., and Riley J. Williams III, M.D.

Purpose: To evaluate reported medium- to long-term outcomes after high tibial osteotomy (HTO) with associated cartilage restoration procedures. **Methods:** A review of the MEDLINE database was performed. The inclusion criteria were English language, clinical outcome study with HTO as the primary procedure, use of a form of cartilage repair included, and the mean follow-up period of at least 2 years. Each identified study was reviewed for study design, patient demographics, type of procedures performed, clinical outcomes, progression to total knee arthroplasty, and complications. **Results:** Eight hundred and twenty-seven patients (839 knees) were included. The most common cartilage preservation technique used in conjunction with HTO was microfracture (4 studies; 22.2%). The mean Lyscholm scores, reported in 50% of the studies, ranged from 40 to 65.7 preoperatively and improved to a range of 67 to 94.6 postoperatively. Four studies (22.2%) used a visual analog scale for evaluation of pain and all had a mean visual analog scale of less than 3 postoperatively. Among studies evaluating conversion to arthroplasty, the rate of conversion was 6.8% and the range of mean number of years from HTO to conversion was 4.9 to 13.0. The overall reported complication rate was 10.3%. **Conclusions:** HTO with cartilage restoration procedures provides reliable improvement in functional status in the medium- to long-term period after surgery and has potential to delay or avoid the need for knee arthroplasty surgery. **Level of Evidence:** Level IV, systematic review of Level I to IV studies.

Unicompartmental knee osteoarthritis in young and active individuals presents a challenging problem for orthopaedic surgeons. Although total knee replacement and unicompartmental knee replacement provide reliable pain relief and excellent outcomes for older patients, there are greater concerns about performing arthroplasty procedures in younger, active patients who have a higher risk for prosthesis wear and thus may require one or multiple revision operations with increased associated morbidity. High tibial osteotomy (HTO) is a durable alternative to joint arthroplasty in younger, active patients with isolated medial compartment osteoarthritis.[1-3]

HTO has been recommended for individuals less than 65 years old with isolated medial compartment osteoarthritis and intact ligamentous structures.[4] HTO may delay or in some cases prevent the need for patients to undergo knee arthroplasty procedures.[2] As such, HTO has even been described as a cost-effective alternative to total knee replacement and unicompartmental knee replacement for younger, active patients.[5]

Cartilage restoration procedures have further expanded the orthopaedic surgeon's armamentarium for young patients with knee pain and joint surface defects. There is likely a synergistic relation between cartilage restoration and knee realignment, with improved alignment allowing for cartilage status improvement and similarly with improved cartilage status there is likely increased pain relief after HTO.[3,4] The purpose of this systematic review was to evaluate reported medium- to long-term outcomes after HTO with associated cartilage restoration procedures. Our hypothesis was that HTO with cartilage restoration would provide reliable long-term outcomes for selected patients with knee osteoarthritis.

From the Department of Orthopaedic Surgery, Hospital for Special Surgery (C.A.K., B.U.N., M.E.S., R.J.W.), New York, New York; and Midwest Orthopaedics at Rush, Rush University Medical Center (K.S.H.), Chicago, Illinois, U.S.A.

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Address correspondence to Cynthia A. Kahlenberg, M.D., Hospital for Special Surgery, 535 East 70th Street, New York, NY 10021, U.S.A. E-mail: kahlenbergc@hss.edu

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Methods

Search Strategy

A systematic review of the MEDLINE database was performed in March 2016 using the PubMed Interface. A search was performed using a combination of the following primary terms: "high tibia osteotomy," "high tibial osteotomy," "tibia osteotomy," and modifiers such as "cartilage," "microfracture," "chondrocyte," "chondroplasty," and "osteochondral." The Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines with a Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist were used. The initial search yielded 300 results. Each article was evaluated using the inclusion and exclusion criteria (Fig 1). The inclusion criteria were English language, clinical outcome study with HTO as the primary procedure, use of a form of cartilage repair included, and the mean follow-up period of at least 2 years. Studies were excluded if they reported only aggregate outcomes of HTO with and without cartilage repair techniques, but if a portion of the patients in the study underwent both types of procedures and data for those patients were reported separately, they were included in the analysis. Studies reporting outcomes of HTO without any cartilage restoration procedure were excluded. One study was excluded from review because it was found to include a subset of data that overlapped with a larger study from the same institution.

Data Collection

Each identified study was reviewed for the following: study design, period of enrollment, level of evidence, number of patients, country of origin of the study, mean follow-up period, patient demographics, type of osteotomy performed, and type of cartilage preservation technique used. We also recorded number of patients and time frame of progression to knee arthroplasty. Data from second look arthroscopy (if performed) were captured and these included functional outcome measures, complications, and patient satisfaction.

Statistical Methods

Demographic, follow-up, and outcome data were analyzed using pooled analysis. Simple pooling of data can result in spurious relations; thus for these continuous outcomes, a weighting strategy based on the power of the study was selected as a surrogate for accuracy. This methodology was selected as opposed to

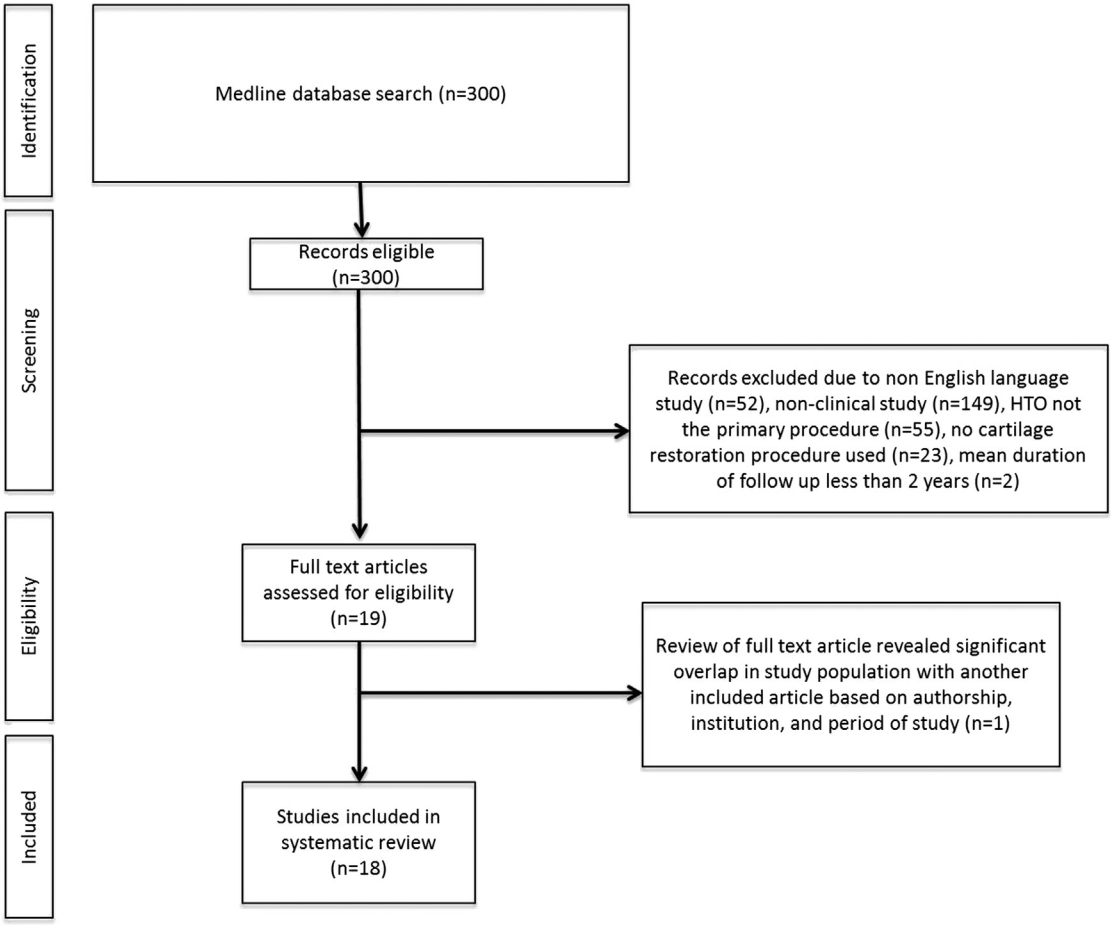

Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart. (HTO, high tibial osteotomy.)