Treatment of OA of the Knee in the Middle-aged Athlete: The Role of Arthroscopy

Aaron J. Krych, MD,* Jack M. Bert, MD,† and Bruce A. Levy, MD*

Abstract: Knee arthroscopy for patients with osteoarthritis remains controversial. The outcome of arthroscopic debridement in a patient with symptomatic arthritis, and in the absence of mechanical symptoms, is inconsistent and short lived. However, in carefully selected patients with mild or moderate arthritis on standing radiographs, with the acute onset of symptoms, well-localized joint line pain, and painful mechanical symptoms, improved knee function can be expected. Regardless, the natural history of the disease process is unaltered. Patients, especially higher demand middle-aged athletes, must be counseled about the prognosis of degenerative arthritis, the limited positive effects of the arthroscopic procedure, the potential for complications, and the probable need for reconstructive surgery in the future.

Key Words: osteoarthritis, meniscus tear, arthroscopic debridement, chondroplasty, malalignment


Symptomatic knee arthritis has become increasingly common in middle-aged active people, mainly due to increased activity levels. The pathology of disease is a spectrum from isolated unicompartmental degenerative changes to end-stage tricompartmental arthritis. Associated with the arthritic changes are meniscus tears and cartilage degeneration with possible limb malalignment, and ligamentous instability. Comprehensive nonoperative management to reduce the pain associated with arthritis includes weight loss, activity modification, analgesic or anti-inflammatory medications, intra-articular injections of viscosupplements or steroids, muscle strengthening, and off-loading of an isolated affected compartment with a brace or heel wedge. However, activity modification is often unsatisfactory for the middle-aged athlete, and when nonoperative measures fail, surgical intervention may be considered.

The role of arthroscopic debridement for patients with knee osteoarthritis (OA) remains highly debated. Patients with advanced OA of the knee do not seem to benefit from arthroscopy. However, patients with mild to moderate OA and symptomatic meniscus pathology, impinging osteophytes, or loose bodies may benefit greatly from arthroscopic treatment. The goal of arthroscopy in this setting is to reduce mechanical irritation, thereby reducing synovitis. Removal of loose bodies and debridement of unstable cartilage can be performed.

Conflicting opinions based on the orthopedic literature are explained by the wide range of inclusion criteria, surgical procedures, and outcome measures used in different retrospective and even prospective studies. Some series include patients with chronic knee pain due to severe arthritis, whereas others address acute symptoms resulting from degenerative meniscal tears. In addition, arthroscopic “debridement” comprises a variety of procedures combined into a single operation. Lavage removes the mechanical, irritating products of joint degeneration and evacuates degradative enzymes. Partial meniscectomy, articular cartilage shaving and loose body removal are also commonly performed. On occasion, surgeons also carry out a limited synovectomy or osteophyte excision. Success of the operation has been measured by diverse outcomes including patient satisfaction, improved knee scores, or avoidance of knee arthroplasty. Because of the varying inclusion criteria, outcomes assessed, small numbers of patients, and variable follow-up, the literature has become somewhat confusing and discordant. This controversy has been highlighted in several prospective studies.

FAVORABLE EVIDENCE FOR ARTHROSCOPIC DEBRIDEMENT

In a prospective review of 254 patients treated by arthroscopic knee debridement for OA by Aichroth and colleagues, 75% of patients had minimal discomfort after surgery and improved function. Further, almost 85% were satisfied with the treatment at an average follow-up of 44 months. The authors found that patients had more worthwhile improvement with less extensive radiographic arthritis, less severe articular cartilage involvement, and a younger age at the time of the operation. In one of the early prospective randomized trials in 1992, Gibson and colleagues randomized patients to arthroscopic lavage versus arthroscopic debridement with the removal of osteophytes. At 6- and 12-week follow-up, neither procedure led to a marked decrease in symptoms. However, quadriceps strength was improved in the lavage group. In 1993, Merchan and colleagues were one of the first authors to prospectively compare arthroscopic debridement with partial meniscectomy and chondroplasty of loose flaps to nonoperative treatment. They found that in limited degenerative OA with normal limb alignment, the operative group did much better at short-term follow-up. They concluded that the main benefit of the arthroscopy was the treatment of concomitant problems that coexist with the OA, mainly symptomatic meniscus tears.

EVIDENCE AGAINST ARTHROSCOPIC DEBRIDEMENT

In a modern prospective randomized trial for degenerative meniscus tears by Herrlin and colleagues, both
patients treated with arthroscopic partial meniscectomy and those treated with exercise alone had decreased pain, improved knee function, and a high rate of satisfaction with the treatment. The results between the 2 groups were similar for all outcomes including Knee Injury and Osteoarthritis Outcome Score, the Lysholm Knee Scoring Scale, the Tegner Activity Scale, and a Visual Analogue Scale for knee pain at 6-month follow-up. In a recently published 5-year follow-up on this patient cohort, Herrlin et al. maintained comparable results with no significant differences between the patients treated with arthroscopy and those treated with exercise. However, one third of the patients treated with exercise alone did not have satisfactory pain relief and eventually received arthroscopic partial meniscectomy. After arthroscopic partial meniscectomy, this group that had initially failed nonoperative treatment noted significant improvement, similar to the other patients in the study.

In a study comparing arthroscopic debridement, arthroscopic lavage, and a placebo group who had skin incisions only, Moseley and colleagues showed no difference at 2-year follow-up between the 3 treatment groups. The authors concluded that the outcomes after lavage or debridement were not better than those after a placebo procedure. Despite the randomized study design, the results need to be cautiously interpreted as there were several limitations of this study. The first is that it included male veterans only, and almost half (44%) declined participation in the study. Second, the results may not be generalizable as it included only a single surgeon performing the surgeries (performance bias). Third, patients in the lavage group who had “mechanically important, unstable” meniscal tears, the torn portion was removed and the remaining meniscus was smoothed to a firm, stable rim. Furthermore, there may be detection bias as the outcomes were self-reported, and a nonvalidated knee score was utilized. Finally, none of the patients with positive magnetic resonance imaging (MRIs) for internal derangement were included in this study. Regardless, since the Moseley et al. study was published, the arthroscopic code for debridement in patients on Medicare has been disallowed.

In a more recent study by Kirkley et al. in 2008, patients were randomized into 2 groups: surgical lavage and arthroscopic debridement with physical and medical therapy versus nonoperative treatment, including physical and medical therapy only. At 3 months, the arthroscopic group had slightly better outcomes, but at 2 years, no statistically significant clinical difference was noted between the groups. This study used the Western Ontario and McMaster Universities Osteoarthritis Index score, which is a recognized and validated outcome scoring system. The patients in this randomized clinical trial had moderate to severe OA, but patients with large symptomatic meniscal tears were excluded. The definition of “large symptomatic meniscal tear” was based on the surgeon’s subjective assessment, either diagnosed by clinical exam or by an MRI. This inclusion bias is the largest flaw in the study, as often these are the patients who tend to benefit from arthroscopic debridement in association with knee OA.

**SYSTEMATIC REVIEWS**

There are several systematic reviews noted in the literature. In a Cochrane review including 567 patients comprised of randomized studies comparing joint lavage to a control intervention, the authors concluded that joint lavage does not have any benefit in patients with knee OA with respect to pain relief or improvement in function. However, this study did not include any results on arthroscopic debridement. Petty and Lubowitz in 2011 hypothesized that in the long-term follow-up, arthroscopic partial meniscectomy would lead to further deterioration of knee OA. After reviewing 5 studies with 8- to 16-year follow-up, these authors did find that radiographic signs of OA were more likely in the operative knee compared with the contralateral side. However, there was no control group in this study. More importantly is that the clinical symptoms of OA were not observed in the knees with progression of OA, and clinical outcomes did not correlate with the radiographic findings.

Recently, a systematic review of the literature performed by the American Academy of Orthopaedic Surgeons clinical practice guidelines committee for the treatment of OA of the knee was published. The authors graded the available literature based on levels of evidence and then offered recommendations based on these grades. For example, if a large number of studies were graded as level I evidence [well-designed randomized controlled trials (RCTs) with significant differences found], the committee’s recommendation, based on these conclusions, was a “grade A.” Of the 22 recommendations regarding treatment of knee OA, 2 of the recommendations involved arthroscopic management. The authors concluded that arthroscopy with debridement or lavage should not be performed in patients with a primary diagnosis of symptomatic OA of the knee. However, they did recommend that arthroscopic partial meniscectomy or loose body removal is an effective alternative in patients with symptomatic OA of the knee that present with primary signs and symptoms of a torn meniscus or loose body.

**FUTURE STUDY**

There have been significant limitations in previous clinical retrospective and prospective studies which make it difficult to draw significant conclusions. Previous RCTs have included patients with advanced or severe OA, excluded patients with large meniscal tears, or had limited follow-up of 6 months on small numbers of patients. Currently, a multicenter study of MEniscus TEars in Osteoarthritis Research (METEOR trial) has been ongoing at 7 academic institutions. The advantage of this trial is that this RCT excludes patients with severe OA, and includes patients with large symptomatic meniscus tears. In this trial, patients were randomized into operative and nonoperative groups. Inclusion criteria are patients with mild to moderate OA and symptomatic meniscal tears. The results of the “METEOR” trial may help answer the question of which middle-aged athletes can benefit from arthroscopic management of knee OA with associated symptoms of internal derangement. Another future area of study includes the precise technique of arthroscopic debridement. Recently, attention has been given to radiofrequency chondroplasty compared with traditional chondroplasty performed with a mechanical shaving device. An ex vivo comparison study of mechanical versus thermal chondroplasty demonstrated that chondroplasty using a radiofrequency probe resulted in an overall improved cell viability, and decreased tissue effect, than with treatment with a motorized shaver blade. In addition, the cartilage surface was smoother postablation.
as assessed by 3 independent surgeons and in fewer treatment passes with the probe. A 4-year follow-up of a RCT comparing the 2 techniques concluded that both techniques resulted in clinical improvement in the patients treated. However, there were fewer conversions to further surgery such as osteotomy or knee replacement in the group treated with radiofrequency chondroplasty. Clearly, further clinical study needs to be carried out to establish the safety and efficacy of this technique; however, the preliminary results are encouraging.

CLINICAL EVALUATION

A surgeon should treat the patient’s symptoms and not perform surgery based upon the results of the MRI study. A carefully taken history, physical examination, and standing radiographs still remain the most important diagnostic tools. It is important to remember that the prevalence of meniscus tears increases with age, but most are asymptomatic. In addition, up to 75% of the patients with knee OA have meniscal tears on MRI and the pain is no greater, on average, than among patients with OA without evidence of meniscal tears. Despite this, there are >500,000 arthroscopic partial meniscectomies performed in the United States each year in patients with OA.

The primary indication for arthroscopic surgery includes distinct presenting symptoms of well-localized joint line pain with acute onset and mechanical symptoms such as catching or locking that have failed comprehensive nonoperative management. The clinical variables associated with greater improvement after arthroscopic debridement are preoperative joint line tenderness and a positive Steinman test indicative of a torn, unstable meniscus. This has correlated well with the finding of unstable meniscal tissue at the time of surgery. Similarly, the reported predictors of improved outcomes from arthroscopic debridement are mechanical symptoms resulting from loose bodies, displaced articular chondral lesions, and meniscal tears.

Rosenberg et al were the first to compare posteroanterior weight-bearing radiographs, made with the knee in 45 degrees of flexion, to conventional radiographs and found that the posteroanterior weight-bearing radiographs that were made with the knee in 45 degrees of flexion were more accurate, more specific, and more sensitive for assessing joint-space narrowing in the setting of knee OA. Further studies have refined the radiographic techniques, and currently, the “schuss view” (posteroanterior film of both knees flexed at 30 degrees) is suggested as the most accurate method for the evaluation of joint-space narrowing in knee OA. We recommend the routine use of the schuss view to appropriately assess the degree of OA, as a standard anteroposterior view may underestimate the amount of OA present (Figs. 1, 2).

CURRENT INDICATIONS

Despite the confusion in the scientific literature and recent unfavorable press, arthroscopic surgery remains a very reliable and effective procedure in select middle-aged athletes with knee OA. The indications for arthroscopic debridement, partial meniscectomy, and/or loose body removal include a discrete chief complaint: the acute onset of well-localized joint line pain, or mechanical symptoms such as catching or locking. In addition, the radiographs will demonstrate normal or nearly normal alignment, and mild to moderate degenerate changes, and the MRI will confirm the presence of a large meniscus tear.

Despite these important considerations, the occasional athlete with advanced arthritis may be a candidate for...
arthroscopy to relieve acute pain and mechanical symptoms. These patients present with the abrupt onset of a severe, sharp pain in the involved compartment along with catching or locking. The arthroscopic surgery may be very effective, but has limited goals and will not relieve the arthritis pain. Only the unstable portion of a degenerative meniscus is resected with preservation of a balanced, contoured rim. Mobile loose bodies are removed, loose chondral flaps are excised, and deeply fibrillated articular cartilage is lightly débrided (Fig. 3). Osteophytes are removed with a small osteotome or a burr only if they appear to cause painful impingement or block knee motion. In addition, some patients with severe arthritis may present with symptoms in the less involved contralateral compartment. An unstable meniscus tear, especially in the setting of chondrocalcinosis, may occur in the opposite compartment where only mild arthritic changes are present. In our experience, the success of arthroscopic treatment in this setting is very reliable.

CASE EXAMPLES

A 53-year-old male active tennis player presented with radiographic severe OA of the medial compartment, but his only presenting symptom was the acute onset of painful locking in the knee (Fig. 4). At the time of arthroscopy, the advanced OA of the medial compartment was confirmed (Fig. 5), but the removal of the osteochondral loose body from the suprapatellar pouch (Fig. 6) completely relieved his symptoms, and he was able to return to his full activities.

A 47-year-old female active cyclist presented with known symptomatic medial compartment OA, but had the new onset of mechanical catching in the lateral aspect of the knee after a twisting injury. Her radiographs demonstrated significant OA of the medial compartment, but only mild to moderate changes in the opposite lateral compartment (Fig. 7). An MRI demonstrated an unstable flap tear of the posterior horn of the lateral meniscus (Fig. 8). Arthroscopy confirmed the symptomatic lateral tear, which was resected (Fig. 9). She was able to return to her previous activity level.
The concept of drilling through eburnated bone to stimulate reparative cartilage formation was first proposed by Pridie in the 1950s. Abrasion arthroplasty of grade 4 eburnated chondral lesions using motorized instrumentation for first introduced by Johnson in the early 1980s. In this procedure, a superficial layer of 1 to 3 mm of subchondral bone is removed to theoretically allow for formation of a fibrous repair tissue over the defect. However, only one of 8 biopsy specimens in Johnson’s series demonstrated any hyaline-like cartilage. One of the senior authors (J.M.B.) published a comparative series of patients

**FIGURE 4.** Standing radiograph demonstrating severe medial compartment osteoarthritis with osteochondral loose body in suprapatellar pouch (arrow).

**FIGURE 5.** Arthroscopic view of the same medial compartment confirming severe osteoarthritis changes.

**FIGURE 6.** Arthroscopic view of osteochondral loose body.

**FIGURE 7.** Radiographs demonstrating advanced osteoarthritis (OA) of the medial compartment, but only mild OA changes in the symptomatic lateral compartment.
with grade IV Outerbridge changes at the time of arthroscopy comparing treatment with abrasion arthroplasty and debridement versus debridement only. The debridement group did better with 66% good to excellent results compared with only 51% good to excellent results in the abrasion arthroplasty group. In addition, the abrasion arthroplasty group had 33% poor results after the surgery.24 At 5-year follow-up, 15 patients had been converted to total knee arthroplasty (TKA). On the basis of the results in the literature, we cannot recommend abrasion arthroplasty as a reliable, predictable treatment for knee OA.

Microfracture is the most common cartilage repair technique performed in the United States.25 The goal of this procedure is to penetrate the subchondral bone and promote growth factors, stem cells, and platelets to flow from the marrow, and create a fibrin clot that will eventually remodel into fibrocartilage to fill the defect. Because of its limited invasiveness, single-stage technical simplicity, and low cost, microfracture has become a common treatment option for articular cartilage defects, with 90% success of pain relief at short-term follow-up.26 However, the main limitation of microfracture treatment is that healing with mature fibrocartilage is predominantly type I collagen, with only small amounts of type II collagen,27 which lacks the durability of articular cartilage.28 Recent animal data suggest that drilling, rather than microfracture, to a deeper level may improve the amount of fill and percentage of type II collagen.29,30 Although Steadman et al31 have reviewed their long-term results and demonstrated good outcomes, other studies have shown deterioration of results over time.32–37 Currently, microfracture is only indicated for unipolar, contained lesions with good surrounding cartilage and the results are worse in bipolar lesions, uncontained lesions, or where there is diffuse OA present.25 Therefore, we do not feel there is a role for microfracture in the setting of diffuse knee OA.

**POTENTIAL CONTRAINDICATIONS: MALALIGNMENT OR SEVERE RADIOGRAPHIC OA**

It is important to emphasize the importance of axial alignment. If the mechanical axis passes through the lesion, then arthroscopy has been shown to be less successful.38 In a review of 204 arthroscopic knee debridements for OA, the most important predictive factor for patient satisfaction was malalignment with angular deformity.39 In 52 patients who were treated by arthroscopic debridement for severe degenerative joint disease, Salisbury et al40 concluded that patients with varus angular deformity in the degenerative knee had a poor result and should be excluded from consideration for arthroscopic debridement. In a review of 551 arthroscopic procedures for degenerative arthritis of the knee, Ogilvie-Harris and Fitsialos found that the results were much better in the normally aligned knee. However, in the malaligned knee, especially the valgus knee, patients did the worst.35 Kirkley et al3 excluded patients with >5 degrees varus or valgus malalignment in their RCT, and based upon the literature, normally aligned knees seem to do better than those that have >5 degrees of varus or valgus alignment.

There appears to be a high correlation between severity of radiographic arthritis and the risk of conversion to TKA. In a retrospective follow-up of 183 patients treated with arthroscopic debridement, 41 patients underwent TKA at an average follow-up of only 14 months. In this study, the authors found that the higher the grade of cartilage lesion, the more likely patients were to undergo TKA during the time period of the study, with almost half of patients with Kellgren-Lawrence grade 4 lesions undergoing TKA.42

**COMPLICATIONS**

Arthroscopic treatment of OA is attractive because of the associated low morbidity and relative quick recovery. Although the complications of arthroscopy are infrequent, their prevalence appears to be increasing, or at least there is improved recognition and reporting of complications.43–45

![FIGURE 8. Magnetic resonance imaging demonstrating a displaced posterior horn lateral meniscus tear with mild to moderate chondromalacia of the lateral compartment.](image1.jpg)

![FIGURE 9. Arthroscopic view demonstrating the displaced posterior horn lateral meniscus tear.](image2.jpg)
Intraoperative complications include further articular cartilage damage, instrument breakage, neurological, and vascular injury. A not uncommon complication includes creation of a capsular herniation when a portion of the capsule is excised near the portal entry. This manifests as a cosmetically displeasing fluid collection within the subcutaneous tissues, and sometimes is associated with pain. This can also compromise the result of future procedures such as TKA, as the joint communicates freely with the subcutaneous tissues. We recommend that care be taken not to excise any portion of the capsule during the arthroscopic debridement. Postoperative complications include worsening pain, thromboembolism, hemarthrosis, infection, effusion and synovitis, complex regional pain syndrome, and infrapatellar contracture.

The overall complication rates have ranged from 0.8% to 1.8%. It is important to undergo diligence in all phases of the surgical process, including thorough preoperative assessment, the arthroscopic procedure itself, and the postoperative management.

CONCLUSIONS

The decision to perform arthroscopic debridement in patients with knee OA can be challenging. However, if the treating surgeon bears in mind the following principles, there should be a high likelihood of successful outcomes. First, it is important that the orthopedic surgeon treats the patient’s symptoms, not solely the MRI findings. An MRI of an arthritic knee will usually detect meniscal degeneration and tearing, but it does not always identify the etiology of the patient’s symptoms. A thorough history, a detailed physical examination, and standing radiographs remain the most important diagnostic tools. Second, axial alignment is critical. The most appropriate patients for arthroscopic debridement will have normal or near-normal limb alignment. If the mechanical axis passes through the affected compartment, the arthroscopy will likely be unsuccessful. Third, the severity of the arthritis directly affects outcomes. Successful results of arthroscopic surgery are more predictable in patients with only mild to moderate radiographic degenerative changes.

In summary, carefully selected patients with mild to moderate unicompartmental degenerative disease and normal to nearly normal alignment can be considered for arthroscopy, after failure of a comprehensive nonoperative management program. Arthroscopic debridement of unstable, torn, degenerative meniscal fragments that are causing mechanical symptoms, joint line pain, and recurrent effusion is an effective procedure, but has limited goals. Middle-aged athletes should be counseled about the underlying disease process, the limited effects of the arthroscopic procedure, the potential complications, and the possible need for future reconstructive surgery.

REFERENCES


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