Advancements in the surgical and alternative treatment of arthritis

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Purpose of review

Surgical and nonsurgical treatment of arthritis is a rapidly developing and evolving field. It is vital for clinicians to keep up on the latest advances. This review focuses on clinical trials or large prospective studies over the past year that evaluated orthopedic surgical techniques for the treatment of arthritis and new nonsurgical therapies that may prevent the need for surgical intervention. Increasing attention has also been focused on the relation between surgeon or hospital case load and the quality of outcomes after surgery.

Recent findings

No fewer than 10 studies have been published over the past year evaluating the use of hyaluronic acid (a visco-supplement) or corticosteroid injections as alternative treatments to knee arthroscopy for osteoarthritis of the knee. Joint replacement research has explored minimally invasive and computer-guided or robot-guided joint replacement surgery, the best operative choice for advanced shoulder arthritis (hemiarthroplasty compared with total shoulder replacement), the role of patellar resurfacing during total joint replacement, and the use of bisphosphonates for retention of bone density after joint replacement.

Summary

The increasing attention on high-quality surgical trials should continue to improve surgical options based on sound research for patients with arthritis. Future research should continue to improve the available high-quality research for treatment choices.

Keywords

arthritis, arthroscopy, joint replacement, orthopedics

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Abbreviations

THR total hip replacement
TKR total knee replacement
TSR total shoulder replacement

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Introduction

Orthopedic surgical techniques have often been introduced without sound, unbiased research demonstrating the effectiveness of the technique over previous procedures or nonsurgical options. As at least one orthopedic surgeon is fond of saying, 'Nothing improves your outcome like the lack of a control group.' Today's orthopedic surgical outcome research, however, has rapidly evolved into high-quality randomized controlled trials and well-designed and executed prospective cohort studies. These studies provide the best evidence of the effectiveness of a new treatment, be it a surgical intervention or nonsurgical alternative or modification to an existing technique. The purpose of this review is to evaluate the studies that have come out in the past year that may alter surgical options for patients with painful and debilitating arthritis of the extremities.

Alternative treatment of knee osteoarthritis

Several promising alternatives to knee surgery are being promoted for the treatment of knee osteoarthritis. Both hyaluronic acid and corticosteroid injections show some promise for non-surgical treatment of the arthritic knee.

Hyaluronic acid

A common treatment for osteoarthritis of the knee has been knee arthroscopy. A recent randomized, placebo-controlled trial provided evidence that arthroscopic debridement may be no more beneficial than a placebo sham surgery [1], suggesting that knee arthroscopy may be an unnecessary procedure for some patients with knee osteoarthritis. Several studies published over the past year have critically evaluated the role of a visco-supplement, hyaluronic acid, to reduce the pain and disability associated with knee osteoarthritis.

Day *et al.* [2••] conducted a large, double-blind, randomized, multicenter study of the effectiveness and tolerance of hyaluronic acid injection for knee osteoarthritis. The comparison group was given a saline injection. Hyaluronic acid injection (five injections over 5 weeks) demonstrated a significant decrease in pain and stiffness compared with the placebo group for weeks 6–18 after injection. This well-designed study strongly supports the clinical effectiveness of hyaluronic acid injection compared with placebo. Jubb *et al.* [3], however, found in a randomized controlled trial comparing hyaluronic acid injection with placebo that there was no difference in the degree of joint

space narrowing between baseline and 1-year follow-up except among patients with mild knee osteoarthritis. Those mild osteoarthritis patients injected with hyaluronic acid had significantly less joint space narrowing than the mild osteoarthritis patients injected with placebo.

Caborn *et al.* [4••] found that hyaluronic acid injection (three injections over 3 weeks) provided favorable 12-week and 26-week improvements in pain and function compared with a similarly tolerable dose of triamcinolone hexacetonide (one injection). Significant differences between the two groups were found for a visual analogue pain scale, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) overall score, and WOMAC functional domain score. Leopold *et al.* [5•] compared hyaluronic acid injection (three injections over 3 weeks) with a single corticosteroid injection for knee osteoarthritis. Significant improvements were seen for both treatment groups at 6 months using the WOMAC. Neither group improved significantly using a modified Knee Society score, and only the hyaluronic acid group significantly improved on the basis of the visual analogue pain scale. Neither group was significantly improved over the other in any of the outcomes measures, however. Tasciotaoglu and Oner [6•] also found that hyaluronic acid injection (three injections over 3 weeks) was not significantly better than corticosteroid injection (three injections over 3 weeks) at 6 months after enrollment, although there was a significant difference between the treatment groups at 3 months, with hyaluronic acid-injected patients having significantly less pain and improved function. This disparity had disappeared at 6 months in this small study of only female patients, however. Overall, it appears that hyaluronic acid injection may offer a modest improvement over corticosteroid injections in the nonsurgical treatment of knee osteoarthritis.

Forster and Straw [7] found in a randomized trial comparing hyaluronic acid injection (five injections over 5 weeks) with arthroscopic lavage that the treatments had similar outcomes at up to 1 year after operation, suggesting that hyaluronic acid injection may be an alternative to knee lavage in patients with knee osteoarthritis. Bayramoglu *et al.* [8] found no association between weekly hyaluronic acid injections with physical therapy over a 3-week period and physical therapy alone in reducing the severity of knee osteoarthritis. This small pilot study of just 37 patients may have been underpowered to find a significant association.

Lo *et al.* [9••] conducted a meta-analysis of hyaluronic acid injection for the treatment of knee osteoarthritis. They concluded that hyaluronic acid injection has a small effect compared with a placebo, and publication bias may explain at least part of this effect. Higher-molecular-weight hyaluronic acid injections may be more effective than lower-molecular-weight hyaluronic acid in treating knee osteoarthritis, but the heterogeneity of these studies limits definitive conclusions. Wang *et al.* [10••] also conducted a meta-analysis and reached similar conclusions. Older patients with advanced knee osteoarthritis did not respond well to hyaluronic acid injection, the use of acetaminophen as an escape analgesic reduced hyaluronic acid effectiveness, and lower-quality studies were more likely to find large benefits to hyaluronic acid injection.

Corticosteroid injections

Raynauld *et al.* [11••] conducted a placebo-controlled trial comparing intraarticular steroid injections (one every 3 months for up to 2 years) with placebo. Follow-up analysis was conducted at 1-year and 2-year intervals. No differences were found in the degree of joint space narrowing, but patients treated with steroid had significantly less pain and better function than the placebo-controlled group, suggesting that long-term use of steroid injection for treatment of knee osteoarthritis is both safe and effective.

Smith *et al.* [12] conducted a randomized controlled trial of arthroscopic lavage compared with arthroscopic lavage and corticosteroid injection (single injection after arthroscopy). Only a modest difference in favor of lavage plus steroid was found at 4 weeks after intervention, with the difference disappearing at all subsequent time points, suggesting that lavage and lavage plus steroid are equivalent therapies in the treatment of knee osteoarthritis.

Mini-invasive hip and knee surgery

Studies by Chung *et al.* [13] and Tria and Coon [14] demonstrated that minimally invasive surgical techniques for total hip replacement (THR) and total knee replacement (TKR) result in less perioperative blood loss, shorter lengths of stay, and smaller surgical scars for both types of surgery than the traditional open surgical techniques. Furthermore, Chung *et al.* [13] showed that minimally invasive THR reduced the need for walking aids after surgery compared with traditional THR. Tria and Coon [14] showed that minimally invasive TKR increased range of motion after operation compared with traditional TKR. Both of these studies had small sample sizes with short follow-up.

Woolson *et al.* [15••], however, published a retrospective cohort study of 50 mini-invasive THRs and 85 standard THRs and found no significant differences in surgical time, intraoperative blood loss, transfusion rate, length of stay, or disposition at discharge. The only significant findings were an increased risk of wound complication, acetabular component malposition, and poor fit and fill of femoral components inserted without cement for patients undergoing the mini-invasive THR.

Further research will need to be conducted to determine whether the patients have satisfactory long-term outcomes.

Also, the learning curve for these new procedures must be considered, which may or may not explain the findings of Woolson *et al.* [15••].

Surgery for shoulder arthritis

Edwards *et al.* [16•] compared total shoulder replacement (TSR) with hemiarthroplasty of the shoulder in a prospective, multicenter cohort study. Patients undergoing TSR experienced a significant improvement compared with patients treated with hemiarthroplasty of the shoulder for both pain and function measurements at 2 years after surgery. Both procedures demonstrated significant improvement in pain and function from measures before surgery to measures after surgery, but because TSR patients had lower baseline scores, they demonstrated significantly more improvement than hemiarthroplasty patients. This significant difference in improvement may be a result of the systematic treatment of patients with poorer function and more pain with TSR rather than hemiarthroplasty. A randomized controlled trial comparing these two procedures would provide better evidence.

Hettrich *et al.* [17], attempted to identify factors that identified patients who would benefit most from hemiarthroplasty of the shoulder. Patients without evidence of erosion of the glenoid (the surface not treated with hemiarthroplasty compared with TSR), patients without previous surgery, patients with intact rotator cuffs, and patients with diagnoses of osteonecrosis or primary or secondary degenerative joint disease had significant improvement after treatment with hemiarthroplasty of the shoulder. No alternatively treated comparison group was used in this analysis.

Active and passive computer-assisted surgery

Chauhan *et al.* [18] conducted a randomized study demonstrating that component alignment during TKR was significantly improved with the use of computer-assisted arthroplasty compared with a conventional jig-based technique. The clinical relevance of the improved alignment was not analyzed, however, and the computer-assisted technique took significantly longer to perform (13 more minutes on average). Sparmann *et al.* [19] found the same improvement in alignment in a randomized trial comparing computer-assisted TKR with conventional TKR techniques in a large patient population, but again without any measures of long-term outcome or the relevance of the improved alignment.

Honl *et al.* [20] demonstrated that computer-assisted THR was superior to conventional THR with regard to alignment, but that long-term follow-up revealed no difference in patient-based measures of outcome. Computer-assisted THR procedures were of significantly longer duration (25 min), 18% were converted from computer-assisted to conventional because of system failure, and dislocation was significantly more frequent in the computer-assisted hips than in the conventionally treated hips. This well designed randomized controlled trial suggests that the technique will need further refinement before general use is recommended.

Patellar resurfacing in total knee replacement

Waters and Bentley [21•] conducted a large randomized trial comparing patellar resurfacing during TKR with not resurfacing the patella during TKR. Patients undergoing patellar resurfacing had significantly lower rates of anterior knee pain, fewer secondary operations, and higher knee scores after operation. In a randomized trial by Mayman *et al.* [22•], 100 patients were followed for 8–10 years to establish the long-term effects of patellar resurfacing. While there were no significant differences in Knee Society Clinical Rating scores between the two groups, patients who underwent resurfacing had significantly less anterior knee pain with walking and climbing stairs. Patients with a resurfaced patella were also significantly more likely to be extremely satisfied with their TKR. These studies both support the advantages of patellar resurfacing during TKR.

Bisphosphonates after total knee replacement and total hip replacement

Wang *et al.* [23] conducted a randomized controlled trial in which women undergoing TKR were randomized into a group receiving oral alendronate at a dosage of 10 mg/day for 6 months compared with a control group. Bone mineral density was significantly increased in the treatment group and significantly decreased in the control group during the 6 months from surgery to follow-up. This study suggests that alendronate may have a clinically important effect on prosthetic fixation and the risk of fracture around the TKR implantation site.

Yamaguchi *et al.* [24] found a similar relation between cyclic therapy with etidronate in patients undergoing cementless THR compared with a control group. The treatment group had significantly higher bone mineral density measures than the control group after 12 months.

Volume–outcome relations in orthopedics

Many previous studies have demonstrated a relation between surgeon and hospital volume for TKR and THR and outcomes such as mortality, complications, infection, and reoperation rates. Virtually all associations have demonstrated improved outcomes with increased surgical volume. These results have been verified yet again by Hervey *et al.* [25], who found a linear relation between increasing surgeon volume and decreasing risk of mortality after TKR. This study was unique because it did not use Medicare data to evaluate these relationships. Most previous studies have relied on Medicare data, which eliminate most TKR or THR performed on younger patients. Another recent study by Katz *et al.* [26•] used Medicare data to

study the volume–outcome relation in TKR patients, but focused on in-hospital complications after TKR. This study found a significant decreased risk of pneumonia and other in-hospital complications (e.g., death, pulmonary embolus, acute myocardial infarction, or deep infection) with increased surgeon and hospital volumes.

Two studies published within the past year have found relationships between surgical volume and shoulder replacement (both TSR and partial shoulder replacement). Jain *et al.* [27•] found a significant increased risk of complications after partial shoulder replacement performed by low-volume surgeons compared with high-volume surgeons. They also found a significant increased risk of complications after TSR performed at low-volume or mid-volume hospitals compared with high-volume hospitals. Hammond *et al.* [28•] found a significantly increased risk of complication, increased length of stay, and increased total hospital charges for shoulder replacement patients treated by low-volume surgeons compared with high-volume surgeons. The increased length of stay was also significantly associated with lower hospital volume for shoulder replacement. Once other factors were controlled for, however, only increased risk of complication and increased length of stay were significantly associated with lower surgeon volume. No significant relationships were found for hospital volume after adjustment for other factors.

Conclusion

The findings of the past year should improve patient care for advanced arthritis through improved treatment modalities for knee osteoarthritis, improved designs for total joint replacements, and continued advancements in minimally invasive and computer/robot-assisted surgery. Many gaps still exist in the knowledge base concerning the efficacy and safety of many orthopedic procedures, but the high quality of randomized clinical research conducted over the past year demonstrates that procedures will continue to be studied objectively for both safety and effectiveness. One thing has become increasingly clear: higher-volume surgeons and hospitals have consistently better patient outcomes after total joint replacement.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

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This study is an example of a well-designed, well-executed, adequately powered randomized clinical trial, which should be the objective of all clinical research in musculoskeletal health.

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This study represents the first published data demonstrating a volume–outcomes relationship after shoulder replacement surgery.