Early Shoulder Arthritis

New research sheds light on treatment strategies for this challenging condition

By Matthew Busam, MD, and Brian J. Cole, MD, MBA

Orthopaedic surgeons have long sought means to allow patients with painful conditions to maintain active lifestyles. Osteoarthritis, a painful and sometimes debilitating condition associated with advancing age and many times signaling the end of youthful activities, is viewed as an inevitable aspect of the aging process. But joint arthroplasty, especially in the hip, knee, and shoulder, has allowed generations of patients to regain function and minimize pain.

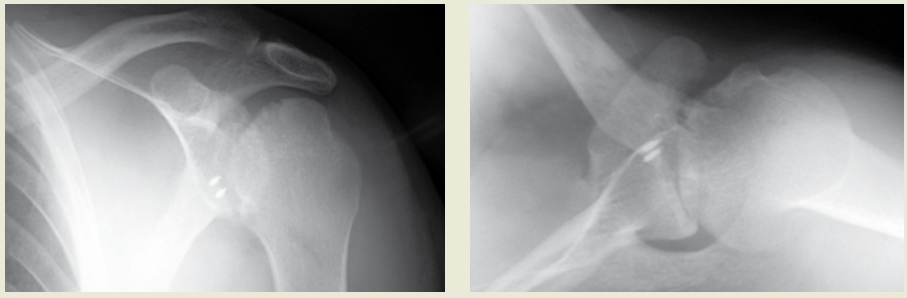
Ongoing research into component design and surgical technique has improved functional outcomes as well as the longevity of implants, allowing faster recovery. However, despite tremendous advances in the last several decades, arthritic conditions in younger patients continue to challenge orthopaedic surgeons.

When a 70-year-old patient presents with a painful arthritic shoulder, surgeons can reliably predict that a total shoulder arthroplasty will reduce pain and improve function and that the results will likely last the rest of the patient's life without the need for revision surgery. Unfortunately, surgeons can't offer the same prognosis to a teenager who presents with debilitating shoulder arthritis resulting from a variety of causes.

Traditionally, young, active patients with glenohumeral (shoulder) arthritis are not considered good candidates for arthroplasty. Heavy laborers are offered shoulder arthrodesis, and those wishing to return to sports or overhead activities often are left with no optimal surgical solution.[1] The number of very young people — teenagers and those in their 20s — with advanced shoulder arthritis has been very low until recently when the number of these patients referred to the Cartilage Restoration Center at Midwest Orthopaedics at Rush (MOR) has increased markedly. Fortunately, active research programs at Rush University Medical Center (Rush) has allowed basic science and animal research to be quickly translated into therapeutic alternatives for young patients with potentially devastating problems.

Active Research

In addition to finding novel therapies, active research has brought insight into the pathogenesis of early joint destruction. Osteoarthritis is a multifactorial process that includes metabolic and mechanical pathways that ultimately lead to the common endpoint of articular cartilage breakdown, pain, and dysfunction.



Radiographs at initial presentation of a 20-year-old male following a shoulder stabilization procedure demonstrate complete joint destruction.

Because forces across the shoulder are generally less than the hip or knee, shoulder arthritis is less likely to be appreciated radiographically and clinically. Patients often present with significant joint destruction but note an ongoing loss of motion and

This intraoperative photo shows severe humeral head chondrolysis.

function over the course of many years. If a teenager presents with a short duration of symptoms but advanced radiographic changes and marked functional deficits, degenerative arthritis would not be the most common cause. Our research has set out to determine the potential causes of this devastating problem.

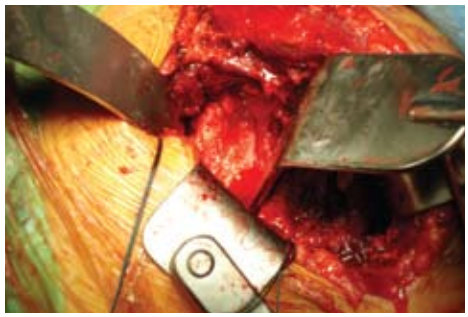
During the last decade, thermal capsular shrinkage or the use of radiofrequency energy or heat was initially hailed as a simple arthroscopic treatment for patients with glenohumeral instability. Over the last several years, however, surgeons around the country began reporting complications related to thermal capsular shrinkage procedures. For this and many other reasons, the procedure is largely abandoned for contemporary arthroscopic stabilization procedures using sutures.[2]

To limit the need for narcotic pain medicine, many surgeons advocate the use of pumps placed in the shoulder to deliver measured amounts of local anesthetic over the course of 24 hours or longer. The patient typically removes these pumps at home.

At the 2006 annual meeting of the American Academy of Orthopaedic Surgeons, a series of patients were presented by Charles Beck, MD, and colleagues from Salt Lake City, Utah, in a paper entitled "Post-arthroscopic Shoulder Chondrolysis with Associated Intra-articular Pain Pump Catheter Use." Twelve shoulders in 10 patients who underwent arthroscopic shoulder stabilization developed chondrolysis. All of the patients had been treated with an intra-articular pain pump postoperatively.[3]

Shoulder surgeons at MOR have seen several young patients with similar findings, namely rapid chondrolysis following intra-articular pain pump use, and have set out to determine whether a connection existed between the anesthetic and cartilage degeneration.

Andreas Gomoll, MD, Bernard R. Bach Jr., MD, and Brian Cole, MD, from the Section of Sports Medicine at MOR, along with Richard Kang, a Rush medical student, and James Williams, PhD, from Rush's Department of Anatomy, developed a rabbit model to mimic the use of intra-articular pain pumps. They then demonstrated that delivering



This intraoperative photo taken after humeral head resection shows the degenerative change on the glenoid.

local anesthetic in a closed system such as the glenohumeral joint led to significant chondrotoxicity. While not definitive, this basic science work cautions against using intra-articular pain pumps in a closed, small volume joint over longer time periods and in higher volumes and points to a possible cause of rapid cartilage breakdown in young patients who have undergone shoulder surgery combined with pain pump use.[4]

Notably, there is no evidence to date that the use of local anesthetics in joint injections or in the form of postoperative pain management for other joints, including the shoulder when rotator cuff repair has been performed, is associated with any negative effects.

Treatment Options

Though determining the causes of early, rapid cartilage loss in the glenohumeral joint may help surgeons prevent future cases,

Case Study

A 20-year-old Pacific Ten Conference college baseball player dislocated his nondominant shoulder diving into a base. He underwent arthroscopic shoulder stabilization without the use of thermal techniques. Postoperatively he was treated with an intra-articular pain pump for 24 hours. His postoperative course was complicated by severely restricted range of motion and continued pain developing within one year postoperatively.

Six months later, he underwent an arthroscopic evaluation with planned capsular release to improve his motion. Arthroscopy revealed complete destruction of both the humeral head and glenoid articular surfaces. He was subsequently referred to Midwest Orthopaedics at Rush for evaluation and treatment.

Upon presentation, his range of motion was severely restricted, and he had significant pain. Because of the patient's young age and desire to remain physically active, Brian Cole, MD, and his team at Rush University Medical Center elected to proceed with biologic glenohumeral arthroplasty (joint transplantation) consisting of a humeral head allograft replacement and a resurfacing of the glenoid with a lateral meniscus allograft.

Subsequent to this, the patient developed profound reduction in pain, improvements in motion, and has begun the initial phases of return to competitive collegiate-level baseball.

the challenge of how to treat patients who already have the condition remains. Osteochondral allografts have been used with success in the knee for many years. Recent reports from Rush[5] and other institutions[6] confirm improved functional outcomes and biologic incorporation. Biologic joint replacement allows patients to regain an active lifestyle with less concern about implant failure associated with artificial joint replacement. Basic science research at Rush, including measuring the effect of impaction on cell viability within the graft, is helping to further refine the techniques.[7]

In a young, active person's shoulder, loosening or outright failure of the glenoid component placed at the time of shoulder replacement is of paramount concern. Many patients who have undergone total shoulder replacement are restricted from heavy or repetitive shoulder activities to reduce the likelihood of implant failure. Hemiarthroplasty is one option, but results have been inferior to total joint replacement because the arthritic glenoid remains.[8]

This intraoperative photo shows the lateral meniscus allograft prior to implantation (left), the resected native humeral head (center), and the allograft humeral head prior to preparation for implantation (right).

Biologic resurfacing of the glenoid has been reported with success in the setting of metallic humeral head replacement.[1,9] Further basic research from the lab at Rush showed that use of lateral meniscus as a biologic glenoid resurfacing mechanism decreases contact pressure across the joint and centrally spares glenoid contact, thereby potentially leading to decreased progression of glenoid wear while improving function and reducing pain.[10] This research has been the subject of collaborations between shoulder surgeons at MOR, including Dr. Cole, Greg Nicholson, MD, and Anthony Romeo, MD.

While the problem of glenohumeral arthritis in the young person remains a therapeutic challenge, researchers from MOR, in conjunction with Rush, have used basic science and animal models to help understand the pathogenesis and shed light on treatment strategies that will hopefully allow patients to regain and maintain active lifestyles. Translational research involving animal models, as well as biomechanical studies and prospectively collected clinical research, has allowed rapid incorporation of new ideas into clinical practice, potentially improving patients' lives significantly.

This intraoperative photo shows the implanted humeral head. The lateral meniscus has been implanted but is not visualized.

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