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Current Trends in Treatment Options for Glenohumeral Arthritis in the Active Adult

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Introduction

Glenohumeral (GH) degenerative joint disease (DJD) is a common cause of chronic shoulder pain in adults. In patients with this condition, clinical exam may reveal pain, and restricted range-of-motion (ROM), especially in external rotation[1]. Shoulder radiographs (Figure 1) and magnetic resonance imaging (MRI) can be helpful in assessing the joint surfaces, labrum, rotator cuff, and nearby structures. When DJD is diagnosed, the provider should note concomitant deficiencies such as musculotendinous tears. Treatment options are influenced by the patient's symptoms, age, underlying diagnosis (i.e. inflammatory arthritis, glenoid dysplasia, or humeral head AVN), concomitant injuries, activity demands, and overall health.

Figure 1. An anterior-posterior radiograph of a degenerative shoulder. Note the marked humeral head flattening, joint space narrowing, and osteophyte formation.

Non-operative Treatments

Activity Modification and Therapy

First attempts at treatment commonly include activity modification, over-the-counter (OTC) pain and anti-inflammatory medications, and formal or informal physical therapy focusing on flexibility and rotator cuff strengthening. Therapy should include ROM exercises and muscle strengthening, which may improve shoulder congruency and decrease pain. In the senior author's experience, the active adult with symptomatic GH DJD rarely achieves lasting improvement with physical therapy, activity modification, and OTC medications alone.

Joint Injections

A combined intra-articular injection of a corticosteroid with an anesthetic such as lidocaine or bupivicaine may provide the patient with temporary pain relief and functional improvement while medication effects last. Many providers are wary of these treatments since corticosteroid injections may hasten tendinopathy[2], pose a theoretical risk for increasing postoperative infection rates[3,4], and can cause systemic effects[5]. Recent research has further shown that methylprednisolone, lidocaine, bupivicaine, and a preservative commonly found in injection solutions can decrease in vitro chondrocyte viability[6-8]. Serial corticosteroid and/or anesthetic joint injections alone are therefore not recommended in the active patient seeking a return to activities.

Intra-articular injection of hyaluronan is now a promising treatment option. Noël et al. performed a prospective study of 39 patients with GH arthritis and an intact rotator cuff who were treated with hyaluronan injection. The authors found a mean pain decrease of 24 mm on the Visual Analog Scale (VAS) at 3 months post-injection, concluding that the treatment is safe and effective[9]. Another study reported similar clinical results[10], while a third reported in vitro findings suggesting that haluronan is chondro-protective[11]. Although these results are promising and American Academy of Orthopaedic Surgeons (AAOS) clinical practice guidelines endorse hyaluronan injection as a treatment option for GH DJD[12,13], these treatments still provide only temporary relief to the patient with advanced disease.

Operative Treatments

Although total shoulder arthroplasty (TSA) is the standard in surgical treatment of GH osteoarthritis, there remains debate regarding management of young, active adults with

advanced GH DJD.A large 2004 study by Sperling and Rowland assessed long-term outcomes after hemiarthroplasty (HA) or TSA in patients under age 50, finding that only 75% of HAs and 84% of TSAs survived without revision at 20-year follow-up. Although the patients in this study reported improved pain and ROM, assessment using the Neer rating system revealed unsatisfactory results in over half of HAs and almost half of TSAs. The authors' takeaway was that "great care must be exercised in offering HA or TSA to patients aged 50 years or younger, with active consideration of alternative treatment methods"[14]. These sobering findings stoked interest in GH joint preservation.

Arthroscopic Debridement

Arthroscopic debridement of the degenerative GH joint allows for a combination of procedures: removal of osteophytes and loose bodies, labral repair, rotator cuff repair, subacromial decompression, axillary neurolysis, and biceps tenodesis or tenotomy. Subacromial bursectomy should be performed at the time of debridement[15]. Capsular releases are commonly done to improve ROM. Chondral procedures including microfracture, autologous chondrocyte implantation, and osteochondral augmentation may also be performed, although their role in the shoulder remains unclear[16].

The Comprehensive Arthroscopic Management or "CAM" debridement procedure—consisting of glenohumeral chondroplasty, removal of loose bodies, humeral osteoplasty and osteophyte resection, 3-point capsular release, subacromial decompression, axillary neurolysis, and biceps tenodesis—has shown promising results leading to increased interest in debridement. Mitchell et al. reported mid-term results for a group of patients with mean age of 52 at the time of CAM. Out of 49 shoulders meeting the requirements for TSA at the outset of the study, only 23% advanced to TSA within 5-years after CAM[17]. Millett et al. separately found that patient satisfaction in a similar cohort at mean 2.6-year follow-up after CAM procedure was high with a median score of 9/10 (10 being "very satisfied")[18]. Another study similarly found high patient satisfaction scores persisting past 2-years postoperative[19]. Research suggests that debridement can delay the need for arthroplasty, with about 80% of patients avoiding TSA in the 5 years following debridement[1,17]. These procedures are attractive because they have a low risk of adverse outcomes[20], have minimal contraindications[15], and do not preclude future reconstructive operations. Arthroscopic debridement should be considered for concentric joints with visible radiographic joint space and no evidence of abnormal posterior glenoid shape[21,22]. Evidence shows that joint space under 2 mm, significant bipolar disease, and large osteophytes are associated with worse outcomes after debridement[23,24]. In the senior author's experience, arthroscopic debridement is best suited for patients with moderate, predominately glenoid-sided disease.

Some surgeons advocate for biologic glenoid resurfacing at the time of debridement in cases with extensive glenoid involvment. This involves first performing microfracture on exposed bony glenoid surfaces before arthroscopically affixing a patch of acellular dermal allograft or porcine intestinal submucosa to the glenoid surface (Figure 2). Early reports of these techniques have been promising, with one study showing a patient satisfaction rate of 75% at minimum 3-year follow-up[25] and another revealing a 6 point decrease in VAS pain scores at 2-4 year follow-up[25,26]. Future outcomes studies will help providers assess the utility of these procedures.

Hemiarthroplasty

Hemiarthroplasty, wherein a proximal humerus prosthetic implant is placed without glenoid replacement, can be an option in young adults with GH DJD, minimal glenoid pathology, and an intact coracoacromial ligament. While TSA is generally regarded as superior[12,13], prior work has suggested that this may not be the case in patients under the age of 50[27]. Various results have contributed to the lack of consensus concerning HA and TSA in this subpopulation. For example, research has shown that patients undergoing HA have a 28% chance of reoperation within 10 years, with most subsequent procedures involving conversion to TSA due to glenoid erosion[27]. Sperling and Rowland found a 76% rate of radiographic glenoid erosion at 15-year follow-up in their young HA cohort[14]. Despite these negative reports, one recent review of HA and TSA in young, active adults found that HA had a lower rate of complications such as loosening, erosion, and revision (13.2% versus 23.7%)[20]. In light of the clinical equipoise created by various findings, HA remains an option in those with humeral head-predominant disease.

Hetrrich et al. previously showed that HA outcomes are worse when the humeral head is not properly centered in the glenoid[28]. Centralization of the humeral head and concentricity of the glenoid is therefore of utmost important. In some patients, soft tissue balancing will be performed to yield a centered implant. Glenoid reaming may also be used to correct unsatisfactory glenoid shape or version[15]. This "ream-and-run" procedure induces the formation of a stable fibrocartilage glenoid surface that centralizes the humeral head, leading to improved patient-reported shoulder comfort and function[29]. The patient with a poorly centralized humeral head or a glenoid that is not concentric and not amenable to reaming is a poor candidate for HA.

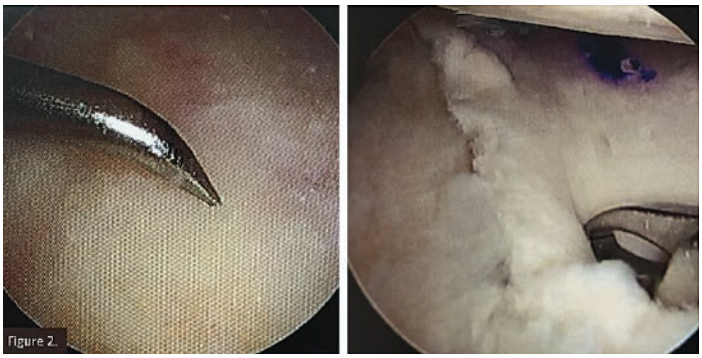

Figure 2. Preoperative (left) and intraoperative (right) arthroscopic photos in a patient undergoing arthroscopic biologic glenoid resurfacing.

Biologic glenoid resurfacing may be performed with HA (Figure 3). This can be done using adjacent anterior capsule, extracellular matrix product, or allograft obtained from the tensor fascia lata, meniscus, or achilles tendon[20,30]. Achilles allograft has been recommended as the superior material[31,32]. Although biologic resurfacing may help maintain radiographic joint space[30], evidence has not shown that it improves revision rates[30,33,34].

Humeral Head Resurfacing

An alternative to HA is humeral head resurfacing (HHR), which is similar to HA in that it replaces the humeral articulating surface and not the glenoid. However, HHR involves a smaller implant than HA with the goal of preserving the natural joint line[15]. In this technique, the humeral head is debrided and osteochondral tissue is removed to the level of the anatomic neck. A metal alloy prosthesis with polished or ceramicized surface is then implanted to replace the humeral articulating surface. Bailie et al. reported 2-year outcomes for patients age 55 or less who were managed with HHR. Out of 36 patients, 35 were satisfied with their outcomes at minimum 2-year follow-up. VAS pain scores showed statistically-significant improvement, and no cases of clinical or radiographic loosening were found[35]. The use of HHR in active patients is limited by high rates of glenoid erosion, with some surgeons advocating for simultaneous biologic glenoid resurfacing to lower this risk[36,37]. HHR yields its best results in cases of humeral predominant primary osteoarthritis and fares relatively poorly in patients with rotator cuff pathology or posttraumatic arthritis[15]. It should not be used in patients with >40% loss of the humeral articulating surface[15], those with severely injured or irreparable rotator cuff tears[15], or patients with marked humeral osteopenia. A more recent report of long-term outcomes with HHR in patients age 50 or younger found an 18.5% revision rate at 10-years, comparable to rates for HA or TSA. The authors concluded that HHR is a useful option in the treatment of GH DJD in the active adult[38]. In fact, some advocates of HHR believe that it is a better option than HA in young patients[39].

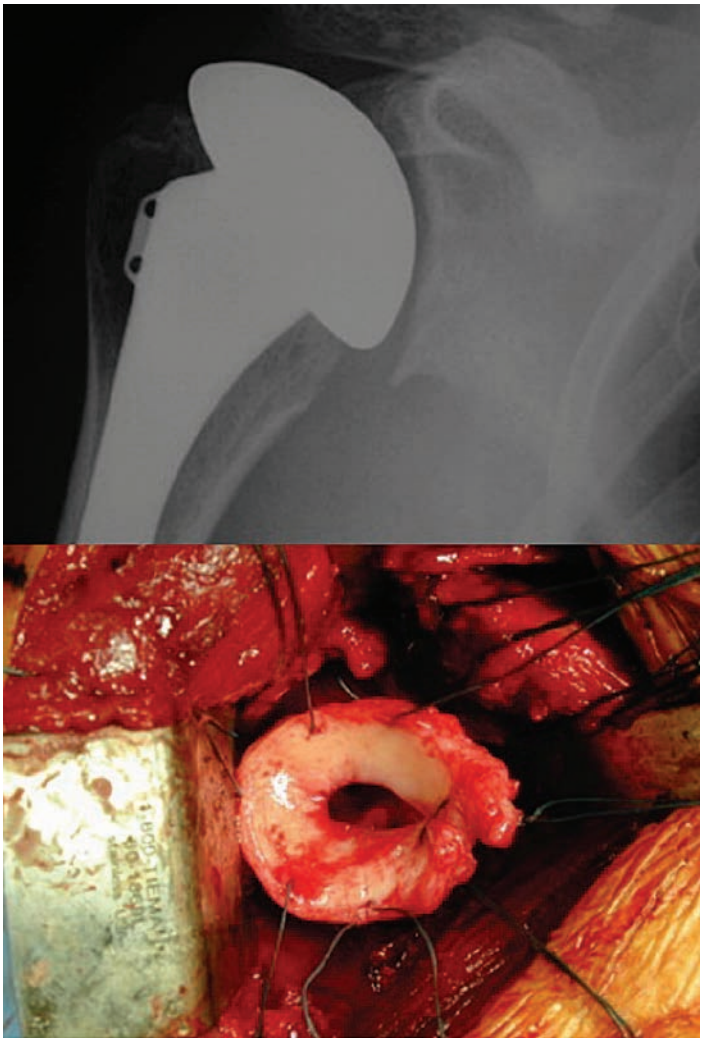

Figure 3. A postoperative radiograph showing a hemiarthroplasy implant in place (top) and an intraoperative photo illustrating simultaneous biologic glenoid resurfacing performed with the hemiarthroplasty (bottom).

Total Shoulder Arthroplasty

In a TSA, a long-stemmed metal humeral implant is placed along with a glenoid component, typically made of polyethylene. While HA is generally regarded as less technically-demanding with lower operative times, decreased blood loss, and lower cost, TSA is commonly considered the superior procedure for primary osteoarthritis because it provides reliable pain relief, improved ROM, and patient satisfaction[40]. Accordingly, AAOS clinical practice guidelines give a moderate-strength recommendation for TSA over HA in patients with GH DJD[12-13]. Despite this seeming endorsement, glenoid radiolucency and glenoid component loosening still pose a significant risk in TSA, particularly in younger, active adults. A recent systematic review of TSA in patients under age 65 found that, at mean 9.4-year follow-up, 54% had glenoid radiolucency and 17.4% had undergone revision[41]. Despite these issues, TSA can be a good option for treating young patients with severe GH DJD, especially those with extensive bipolar disease or concomitant shoulder deficiency such as chronic rotator cuff tear.

Conclusion

Due to uncertainty regarding the longevity of TSA implants, preservation of the native shoulder joint is a reasonable mid-term goal in relatively young adults with GH DJD. To move forward effectively, the provider and patient must understand the underlying disease and its severity, appreciate limitations in treatment, and manage expectations effectively. Nonoperative interventions rarely provide lasting improvement. Arthroscopic debridement can effectively decrease pain, improve ROM, and delay the need for arthroplasty. Hemiarthroplasty is reserved as an option for patients with minimal glenoid pathology. Some practitioners prefer HHR over HA. TSA remains an option for treating advanced GH DJD in adults of any age, although younger patients exhibit higher rates of component loosening. Future advances in the field may involve improved

biomaterials for glenoid resurfacing as well as reliable chondral tissue implants to repair articular surfaces.

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