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CASE REPORT

COMPREHENSIVE POST-ARTHROSCOPIC MANAGEMENT OF A MIDDLE-AGED ADULT WITH GLENOHUMERAL OSTEOARTHRITIS: A CASE REPORT

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ABSTRACT

Comprehensive Arthroscopic Management (CAM) is a new glenohumeral debridement procedure developed as a joint preserving alternative to total shoulder arthroplasty (TSA). The procedure consists of several arthroscopic components including: A. scar tissue and chondral debridement, B. synovectomy, C. inferior humeral osteoplasty, D. capsular release, E. axillary nerve decompression, and F. tenodesis of the long head of the biceps. In this case, an active, middle age patient who failed physical therapy treatment and corticosteroid injections was evaluated and diagnosed with glenohumeral osteoarthritis. Anterior-posterior (AP) and axillary radiographs showed grade IV changes of the articular cartilage, confirming the diagnosis. The patient was not an ideal candidate for TSA because of her age, activity level, and concern for implant survival; therefore surgical intervention was performed using the CAM procedure. After the surgery, the patient demonstrated increased joint space as shown using radiographic imaging. The patient underwent intensive postoperative rehabilitation with a heavy emphasis on joint range of motion (ROM) and capsular mobility. By eight weeks she achieved 85% active ROM compared to her uninvolved shoulder, and a 55% improvement on the Pennsylvania Shoulder Score. Radiographic imaging provided an understanding of the severity of the arthritic changes present in this patient, identified the limited potential of continued conservative management, and showed structural changes that may be correlated with improved function following the surgical intervention. For patients less than 55 years of age diagnosed with severe glenohumeral osteoarthritis, the CAM procedure and intensive, motion focused therapy presents a promising treatment combination.

Key Words: Comprehensive Arthroscopic Management; glenohumeral; middle age; osteoarthritis.

Level of Evidence: IIIb

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This case was seen at Howard Head Sports Medicine Center Physical Therapy Department, Vail, CO. At the time of the case, Nicholas Hagen was completing a sports physical therapy residency. The opinions or assertions contained herein are the private views of the authors.

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INTRODUCTION

A current challenge in the medical field is how to manage young and middle aged patients diagnosed with glenohumeral osteoarthritis (GHOA). In the general population, the incidence of GHOA is 5-17%.[1] The gold standard for treating GHOA is Total Shoulder Arthroplasty (TSA), but for younger patients the hardware utilized may erode and lead to a non-functional shoulder.[2] For this reason, only 10% of shoulder arthroplasties are performed on patients aged 55 years or younger.[3] As a result, there is no clear management option to treat active, young and middle aged patients who present with significant arthrosis of the glenohumeral joint.[4]

Total shoulder arthroplasty in a young population has been marked with a high percentage of unsatisfactory results.[5] Due to the lack of success of shoulder arthroplasty on young patients, more complex arthroscopic procedures have been developed as a method to delay the more invasive arthroplasty.[3,6] A new arthroscopic procedure for salvaging an arthritic glenohumeral joint has been named Comprehensive Arthroscopic Management (CAM).[4] The CAM procedure is used to restore joint stability, decrease pain, improve range of motion, and delay the need for arthroplasty in younger, active patients.[4] To date there are no studies on rehabilitation after a CAM procedure. Consequently, physical therapists need further information on how to treat patients who have undergone surgery using CAM techniques.

The CAM procedure for GHOA was developed by Dr. Peter Millet MD, of the Steadman Clinic in Vail, CO. The procedure involves several arthroscopic components including: A. scar tissue and chondral debridement, B. synovectomy, C. inferior humeral osteoplasty, D. capsular release, E. axillary nerve decompression, and F. tenodesis of the long head of the biceps. Previous arthroscopic procedures have not included humeral head osteoplasty or axillary nerve decompression as routine portions of an arthroscopic joint preservation procedure.

The primary purpose of this case report is to describe the course of treatment for a middle-aged woman with GHOA as well as the role that radiologic imaging played. This case report will benefit physical therapists and other medical professionals by describing the indications for the procedure and having a reference for the treatment of a patient following a CAM procedure.

PATIENT PRESENTATION

The subject of this case, a 46 year-old female, presented with a five year history of left shoulder pain that failed to respond favorably to injections and previous arthroscopic debridement. The patient was a competitive water skier and professional body builder. She complained of lateral and posterior arm pain and stiffness. Examination revealed 10° of active external rotation in neutral, 30° of active abduction, and 110° of forward flexion. Glenohumeral joint accessory glides revealed significant crepitation and hypomobility in both the posterior and inferior directions.[7]

Physical exam findings suggested GHOA and due to a prior course of failed rehab and the severity of joint restriction, the patient was referred to an orthopedist for imaging. Anterior-posterior (AP) and axillary radiographs showed the presence of grade IV arthritic changes[2] including a large inferior osteophyte (Figure 1), severe loss of joint space, and loss of joint

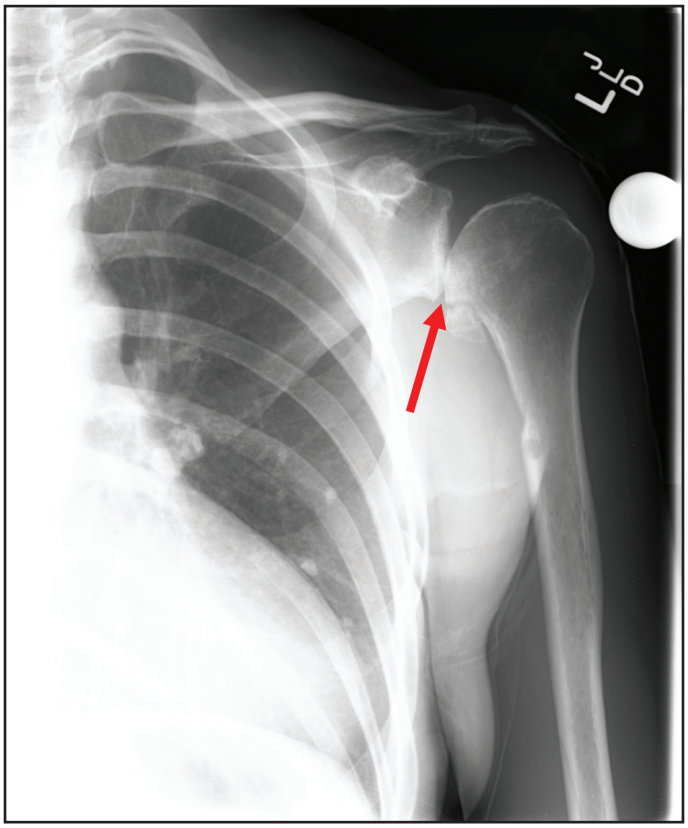

Figure 1. *Anterior to posterior radiographic view of the left shoulder revealing advanced osteoarthritis with a large inferior humeral head osteophyte.*

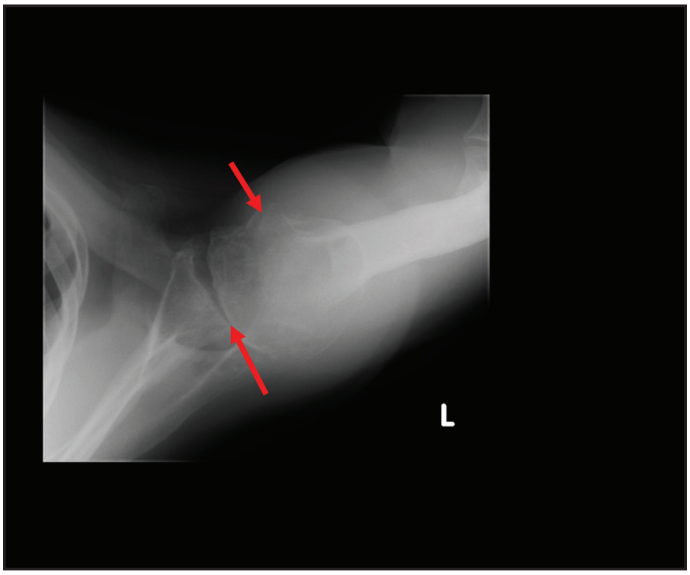

Figure 2. *Axillary radiographic view of the left shoulder. The patient shows evidence of a biconcave glenoid with loss of glenohumeral joint space (bottom arrow). An inferior osteophyte is also appreciated (top arrow).*

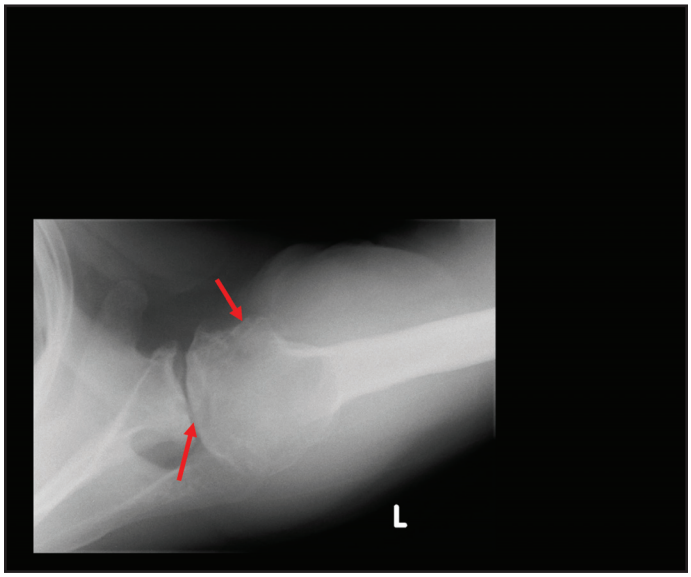

Figure 3. *Post-operative axillary radiographic view of the left shoulder revealing improved joint space (bottom arrow) and removal of osteophyte (top arrow).*

congruity (Figure 2). After reviewing the image, the conclusion was made the patient would unlikely regain ROM through therapeutic intervention alone. Also, it was determined that the patient was not an ideal candidate for TSA because of her age, desired activity level, and concern about implant survival.

Surgical Intervention

After a discussion of options, the patient elected to proceed with a CAM procedure. Post-operative radiographs confirmed an effective technical outcome with increased joint space and osteophyte removal (Figures 3 and 4). Physical therapy commenced the day after surgery.

REHABILITATION

The patient was seen in physical therapy a total of 44 times over eight weeks before returning home to finish her rehabilitation (Tables 1, 2, and 3). Almost daily visits were considered necessary in order to control post-operative inflammation and ensure that surgically achieved ROM gains were not lost. The frequency of treatment and the heavy emphasis placed on passive ROM and glenohumeral joint mobilization during each session was designed to maintain joint space and capsular mobility. They were the critical components to the patient's care and eventual success. Despite the capsular release performed as part

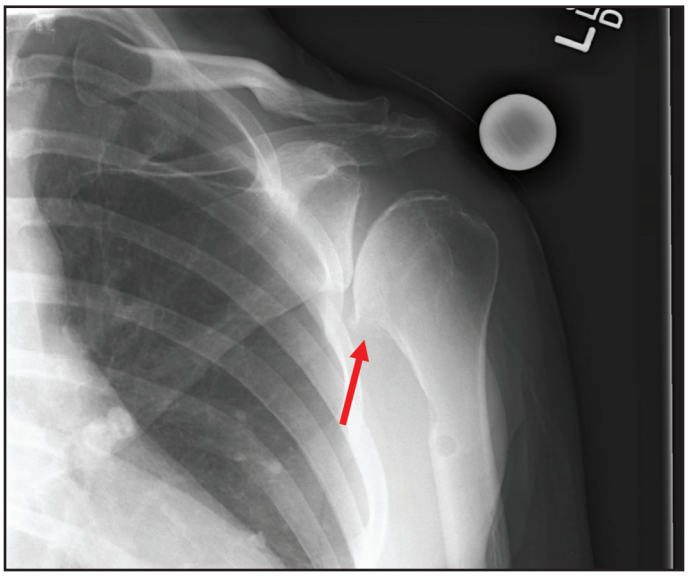

Figure 4. *Anterior to posterior radiographic view of the left shoulder demonstrating a dramatic decrease in size of inferior humeral head osteophyte status post humeral osteoplasty.*

of the CAM procedure, the risk of developing joint adhesions and restrictions remains high without the constant stresses placed on the healing tissues by ROM and joint mobilization. Strength training was secondary to the return of ROM.

As seen with hip and knee joint preserving surgical rehabilitation,[8,9] the early emphasis on ROM prevents the development of joint adhesions while allowing for

Table 1. *Phase 1. Post-operative day 1 through post-operative week 2 of treatment. Patient was seen daily for therapy.*

Exercise	Description	Parameters
1. Shoulder Passive ROM (PROM)	Supine glenohumeral joint (GHJ) PROM in flexion, abduction, external rotation (ER), internal rotation (IR)	30-40 min with each treatment session
2. Glenohumeral Joint Mobility	• Posterior-inferior and lateral distraction grade II-IV GHJ glides to promote capsular mobility • Anterior and posterior GHJ oscillations with PROM, used to decrease muscle guarding	12-15 min with each treatment session
3. Active and Active Assisted ROM of the Elbow, Wrist, Hand	AROM and AAROM for E/H/W to decrease stiffness in joints that are not in use	12-15 min with each treatment session
4. Periscapular Muscle Activation	Sitting, scapular retraction + depression, hold for 3sec, then relax	2x15 with each treatment session
5. Cryotherapy	Vasoneumatic compression of the GHJ with cryotherapy to assist with inflammation and pain management	20 min at end of each treatment session
6. Kinesiotape Edema Taping	Applied in a fan pattern over areas of greatest fluid concentration to increase lymphatic vessel uptake[11]	New tape applied every 2-3 days, weeks 1-4

Table 2. *Phase 2. Post-operative week 3 through post-operative week 6 of treatment. Patient was seen 3 to 4 times per week for therapy.*

Exercise	Description	Parameters
1. Shoulder PROM	Supine GHJ passive ROM in flexion, abduction, ER, IR to end of available range	30-40 min with each treatment session, daily
2. Glenohumeral Joint Mobility	• Posterolateral and inferolateral grade II-IV GHJ glides to promote capsular mobility • Anterior and posterior GHJ oscillations with PROM, used to decrease muscle guarding	12-15 min with each treatment session
3. Periscapular Muscular Activation	Prone, scapular retraction + depression, hold for 3sec, then relax	2x15 with each treatment session
4. AAROM	• Supine shoulder cane assisted ER, flexion • Supine slide board and sitting shoulder pole assisted abduction	2x10 for each direction each treatment session
5. Cryotherapy	Vasoneumatic compression with cryotherapy to assist with inflammation and pain management	20 min at end of each treatment session
6. Kinesiotape Edema Taping	Applied in a fan pattern over areas of greatest fluid concentration to increase lymphatic vessel uptake[11] as performed during weeks 1-2	New tape applied every 2-3 days, weeks 1-4

Table 3. *Post-operative week 7 through post-operative week 8 of treatment. Patient was seen 3 to 4 times per week for therapy.*

Exercise	Description	Parameters
1. Shoulder PROM	Supine GHJ PROM in flexion, abduction, ER, IR to end of available range	10-15 min with each treatment session
2. Glenohumeral Joint Mobility	Posterolateral and inferolateral grade II-IV GHJ glides to promote capsular mobility	12-15 min with each treatment session
4. Periscapular Muscle Activation	Prone, scapular retraction + depression with humeral elevation and ER, hold for 3sec, then relax	2x15 with each treatment session
5. AAROM	• Supine shoulder cane assisted ER, flexion both in semi-elevated position • Supine slide board and sitting shoulder pole assisted abduction • Supine and sidelying slide board gravity neutral abduction and flexion • Supine and seated "salute" or hand from waist to forehead in an army salute manner for ER	2x10 for each direction performed in various combinations throughout treatment sessions
6. Terminal Stretches	• Towel behind back IR stretch: pull the involved extremity up behind one's back with the assist of a towel and the non-involved extremity, • Sidelying sleeper IR stretch: lie on one's involved side with one's shoulder at a 90° to the torso and IR the shoulder from the forearm • Wall flexion stretch: with the assistance of the non-involved extremity, slide the involved upper extremity up the wall until the point of resistance and hold • Physioball abduction stretch: with a physioball lateral to the involved extremity place the involved hand on top of the ball and slide the ball away from one's body abducting the involved extremity	3x30 sec each treatment session
7. Strength	• Prone scapular protraction off end of table with physioball for serratus anterior strength • Prone scapular retraction + depression with upper extremity extension • ER and IR isometrics with arm in neutral • Rhythmic stabilization in supine at 90° and 120° of flexion and to ER at 45° and 90°	2x15 or for 1min intervals Used in various combinations throughout treatment sessions

Table 3. *Post-operative week 7 through post-operative week 8 of treatment. Patient was seen 3 to 4 times per week for therapy. (continued)*

Exercise	Description	Parameters
	• Supine manually resisted D1+D2 PNF patterns • Manual resisted ER and IR at 0° and 45° abduction	
8. Soft Tissue Massage	Infraspinatus, latisimmus dorsi, subscapularis, teres major/minor, trapezius	Single muscle group for 8-10 min per treatment session, working various muscles throughout rehabilitation as needed
9. Trigger Point Dry Needling	Infraspinatus, subscapularis, trapezius, teres major/minor	Done per patient presentation, each muscle needled 1-2 times
10. Cryotherapy	Cryotherapy to assist with post treatment inflammation and pain	20 min at end of each treatment session

Table 4. *Passive Range of Motion in Degrees, Measured in Supine.*

Involved Upper Extremity	Flexion	Abduction	ER at 45°	IR at 45°
Week 1	115	95	20	45
Week 2	145	135	45	65
Week 6	160	150	50	70
Week 8	160	150	52	70
Contralateral Upper Extremity	175	170	65	75

optimal ROM gains. Posterior-inferior glides and lateral distraction glides were performed daily with this patient, in order to prevent a return of the capsular constriction that was present pre-operatively, as well as to address the soft tissue tightening associated with prolonged disuse prior to surgery. Both of these conditions were suggested by the patient's limited pre-operative active ROM measures. Further, work by Johnson et al suggests that a posteriorly directed mobilization technique can be more beneficial for increasing external rotation than the more traditionally performed anterior glide.[10]

Inflammation control and soft tissue treatment were also addressed after surgery to assist in the development of joint mobility. Vasoneumatic compression with cryotherapy was applied to the GHJ at the end of each treatment session to address joint effusion. Likewise, kinesiotape was applied in a fan pattern over areas of greatest fluid concentration to increase lymphatic vessel uptake and decrease swelling.[11] Soft tissue massage along with trigger point dry needling were also performed to address shoulder girdle muscle guarding and restriction.[12]

PATIENT OUTCOMES

By eight weeks following the CAM procedure, the patient achieved 85% active ROM compared to her uninvolved shoulder (Table 4). Strength training was not initiated until postoperative week 6 and thus she was not able to develop full strength as compared to the uninvolved upper extremity by week 8 of therapy (Table 5). Her Pennsylvania Shoulder Score (PENN) increased by 44 points, or by 55% when both her initial evaluation score and the PENN's full function score of 100 points are considered ([100-Initial] – [100-Final]/[100-Initial]). According to recent work by Michener and colleagues, an increase of 21 points or more in a patient's PENN score suggests significant and lasting improvement in function and represents

Table 5. *Strength Measured in Supine with a Hand Held Dynamometer, in pounds.*

Involved Upper Extremity	Scapular Depression	Scapular Retraction	Shoulder Abduction	Shoulder Flexion	Shoulder ER at 0°	Shoulder IR at 0°
Week 2	10	13	0	9	0	0
Week 6	12	15	3	12	0	3
Week 8	12	17	10	15	5	9
Uninvolved Upper Extremity	15	20	25	30	20	30

Table 6. *Pennsylvania Shoulder Score (PENN).*

	Points	Minimal Detectable Change[5] (12 points) Y/N	Point Change Representing Significant Clinical Benefit[6] (21 points) Y/N
Week 0	20	NA	NA
Week 2	20	N	N – 0
Week 6	60	Y	Y – 40
Week 8	64	Y	Y – 44

a "substantial clinical benefit".[13,14] Here the patient more than doubled the clinical value suggestive of substantial clinical benefit for the PENN outcome tool (Table 6). Her rapid improvement is further illustrated by the initiation of resistance training eight weeks after surgery and by her return to water skiing at thirteen weeks postoperatively.

DISCUSSION

Alternative treatment must be considered for young and middle aged, active patients with advanced GHOA. In such cases, the CAM procedure can provide pain relief and may prolong joint function until TSA is appropriate. The CAM surgical components of osteophyte removal and axillary nerve decompression may provide symptomatic relief that is greater than simple debridement and capsular release alone. These additions remove the bony block to GHJ ROM as well as utilize a method for providing relief to a primary pain generator in the shoulder.[4]

The radiographic imaging in this case provided an understanding of the severity of the arthritic changes present and identified the limited potential of conservative management. The images created a platform for discussion between the patient, therapist, and orthopedist in order to determine the appropriate plan of care. Due to the patient's high activity level, age, and severity of arthritic changes identified radiographically, further conservative care was not appropriate. This decision making process was also supported by the patient's pre-operative functional level. The outcomes were confirmed by increased joint space on postoperative radiographs, along with the patient's pain relief and improved function.

The physical therapy plan of care involved a heavy emphasis on joint ROM and inflammation control during the acute stage. The first six weeks of therapy featured a high frequency of visits based on the need to prevent a return of capsular adhesions and to address the adaptive soft tissue shortening that occurred prior to the initiation of this incident of care. The clinic environment where the patient's rehabilitation was performed is unique in that it is open seven days a week. This allowed for the daily visits deemed necessary to maintain the ROM gains achieved using the CAM procedure. Additionally, the patient demonstrated outstanding commitment and was willing to devote all her efforts towards recovery. As seen with other joint preserving arthroscopic procedures, heavy doses of low load joint stretching tend to lead to favorable long term outcomes.[8,9] Strength training is delayed until almost

full ROM gains are achieved in order to capitalize on and maintain capsular mobility during the acute and subacute healing phases. Further, delayed initiation of strength training may help prevent the additional inflammation that often accompanies the body's physiological response to resistance training.

The CAM procedure is new and, as such, it lacks the support of long-term outcome studies. However, with twenty-seven cases currently having been described, with an average postoperative follow up of 20 months, there has been a high satisfaction rate reported, along with decreased pain, and increased range of motion.[4] Clearly, additional research is needed to support these findings, but the effects of the CAM procedure and its associated physical therapy protocol appear promising.

CONCLUSION

Optimal treatment of glenohumeral arthosis in young and middle aged patients has yet to be determined. A therapist must be able to evaluate a patient and recognize when it is appropriate to refer the patient on for potential operative intervention. Through the performance of a physical exam and the evaluation of radiographic images, the need for surgery can be determined, ideally with input from the patient, therapist, and medical provider. In young and middle-aged patients with GHOA, the CAM procedure may be an effective method to address a patient's impairments as it removes bony blocks and addresses common pain generators in the GHJ. High frequency rehabilitation emphasizes aggressive PROM and joint mobilizations postoperatively to prevent capsular adhesions, preserve or re-develop capsular mobility, and promote plastic elongation of adaptively shortened soft tissues. Because limited treatment options are available for patients less than 55 years of age with GHOA, the CAM procedure combined with high frequency, ROM focused physical therapy appears to be a viable treatment alternative that may prolong joint function until further, more aggressive treatment is appropriate.

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