Review

Conservative treatment of older adult patients with shoulder diseases: a narrative review

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Running title: Conservative treatment of older adult patients with shoulder diseases

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Abstract

The purpose of this review is to provide a comprehensive guide for managing older adult patients with shoulder diseases, specifically rotator cuff tears and osteoarthritis, and to explore effective nonsurgical treatment options. Chronic rotator cuff tears are typically degenerative, whereas acute tears result from trauma. A key feature of these tears is tendon degeneration accompanied by type III collagen predominance, predisposing tears to progression. Osteoarthritis in the glenohumeral joint arises from wear-and-tear changes that compromise cartilage integrity, leading to pain and restricted motion. Accurate clinical assessment and imaging, including plain radiographs, ultrasonography, and magnetic resonance imaging, facilitate diagnosis and guide treatment. The physical examination emphasizes range of motion, rotator cuff strength, and scapular stability. Management strategies prioritize pain relief, function preservation, and improving mobility. Nonsurgical modalities, including exercise, manual therapy, and activity modification,

constitute first-line treatments, especially for older adults. Pharmacological approaches involve non-steroidal anti-inflammatory drugs, corticosteroid injections, and neuropathic pain medications. Steroid injections have short-term benefits, but repeated treatments may compromise tissue integrity. Platelet-rich plasma is a regenerative option that may improve tendon healing, but mixed findings highlight the need for further investigation. A structured physical therapy program focusing on range of motion and strengthening is essential, with alternative interventions used judiciously. Patients should be counseled regarding the potential progression of tears and the possible need for future surgical intervention if nonsurgical methods are unsuccessful. Multimodal approaches, including joint mobilization and personalized exercise regimens, hold potential for optimizing functional outcomes and supporting independence in older adults.

Keywords: Aged; Osteoarthritis; Physical examination; Rotator cuff injuries; Shoulder joint

Introduction

Background

Shoulder pain is a prevalent issue among older adults, affecting approximately 25% to 30% of this population and leading to significant symptoms and disability [1]. This condition imposes a considerable burden on both function and quality of life, yet it is frequently overlooked and, as a result, undertreated [1]. Emphasizing treatment is crucial, particularly for older adults with persistent shoulder pain, as maintaining independence is a key concern. The loss of function in the dominant upper limb can severely impact daily activities such as grooming, cooking, and driving. Moreover, shoulder pain or muscle weakness around the shoulder can complicate the use of assistive devices like walkers [2,3]. Thus, it is vital to implement effective treatment strategies to minimize pain and preserve or restore function as much as possible. However, in older adults, shoulder pain and the disabilities it causes are often dismissed as inevitable aspects of aging or are seen as issues that must be endured, leading to inadequate treatment [3]. Neither older age nor the presence of comorbidities should deter the pursuit of active treatment and

rehabilitation.

Objectives

This article provides a guide for approaching older adult patients with shoulder diseases, specifically focusing on rotator cuff tears (RCTs) and osteoarthritis, and explores effective nonsurgical treatment options.

Ethics statement

As this study is a literature review, it did not require institutional review board approval or individual consent.

Rotator cuff injury

Anatomy

The rotator cuff comprises four muscle-tendon structures: the supraspinatus, infraspinatus, subscapularis, and teres minor. The supraspinatus and infraspinatus originate from their respective fossae on the posterior surface of the scapula and insert into the greater tuberosity of the proximal humerus. The supraspinatus, forming the superior aspect of the cuff, is primarily responsible for initiating abduction at the glenohumeral joint (GHJ). In contrast, the infraspinatus, along with the teres minor, facilitates external rotation of the GHJ [4,5]. The subscapularis, the largest of the cuff muscles, is tasked with internal rotation of the GHJ [4]. It originates from the anterior surface of the scapula and inserts into the lesser tuberosity of the humerus. The teres minor, arising from the middle third of the lateral border of the scapula, also inserts into the greater tuberosity, aiding in external rotation [5].

Etiology

RCTs can be categorized as acute or chronic, and as partial or full thickness. Acute RCTs typically occur

in younger patients due to traumatic events such as falls or dislocations. In contrast, chronic RCTs develop in older adults and result from age-related degenerative processes. This article focuses on chronic RCTs.

The pathogenesis of RCTs in older adults is complex and multifactorial, involving degenerative processes associated with aging, impingement, and trauma. During tendon degeneration, there is a significant shift in collagen composition, notably an increase in type III collagen. This type of collagen forms thin, reticular fibers that are more susceptible to lesions, especially when compared to the sturdier type I collagen [6,7]. The degree of tendon degeneration can vary widely depending on the location of degradation and the condition of the tendon, with the supraspinatus tendon typically showing more pronounced degeneration. Tendon degeneration is a physiological process that occurs with aging and is closely linked to the individual's age [7,8]. Additionally, increasing age is associated with higher rates of retears [9].

Typically, RCTs begin as partial-thickness tears and gradually expand due to both intrinsic and extrinsic factors, eventually resulting in a complete tear. The fibers that are initially torn are unable to contribute to load distribution, causing the remaining fibers to further propagate the tear. This process is particularly pronounced in older adults, as the tendon quality is already compromised [10]. As the force required to move the arm increases, it exacerbates the tear, thereby compromising joint biomechanics. A full-thickness tear can cause significant chronic pathological changes, including muscle atrophy, fatty infiltration, and scapular contracture, which may lead to GHJ osteoarthritis [11].

Physical examination

The patient should initially be dressed in a gown that exposes the entire back and shoulder girdle for evaluation. All physical examination maneuvers must be compared with the opposite extremity. The physician should conduct a comprehensive shoulder examination, starting with a general inspection of the patient in a resting position to check for any signs of muscle wasting. Palpation should cover the entire shoulder girdle to identify any tender areas. Rotator cuff injuries frequently manifest as tenderness

at Codman's point, which is identified by rotating the proximal end of the humerus beneath the examiner's finger at the anterior corner of the acromion [12].

Both active and passive shoulder range of motion should be assessed. Forward elevation is evaluated by observing the patient from the side; it is measured as the angle between the axis of the scapula and a line extending from the shoulder to the elbow. External rotation is assessed with the elbow close to the side, rotating the forearm laterally. Internal rotation is measured by having the patient reach up their back, noting the highest spinal segments reached (Fig 1). Both external and internal rotations can also be measured with the arm abducted to 90 degrees. Abduction is tested in the scapular plane, and it is possible to isolate glenohumeral motion from scapulothoracic motion by stabilizing the scapula. In patients suspected of having a supraspinatus tear, forward shoulder elevation may be weak. In cases of larger posterior superior tears involving both the infraspinatus and supraspinatus muscles, external rotation and forward elevation are typically weak. In the case of anterior or subscapularis tears, internal rotation may be compromised.

Radiological imaging

Initial evaluation of a patient with shoulder pain and dysfunction should always include a complete set of plain radiographs of the shoulder. These are essential for assessing potential causes of pain and for evaluating conditions such as osteoarthritis, superior migration of the humeral head, avascular necrosis, osteoporosis, or tumors (Fig. 2). A supraspinatus outlet view may be particularly useful for visualizing bony structures involved in scapulohumeral motions, such as bony spurs or ligamentous calcifications that could impinge on the underlying rotator cuff. An axillary view is beneficial for ruling out shoulder dislocation in cases of trauma. The rotator cuff can be examined using ultrasonography (US) or magnetic resonance imaging (MRI). US is cost-effective and allows for real-time examination of the shoulder joint by the physician. It can determine the size and location of tears, although the results are highly subjective and depend on the operator [10]. A study found that preoperative US identified mixed hyperechoic and hypoechoic foci in the supraspinatus tendon with a sensitivity of 93%, a specificity of 94%, a positive

predictive value of 82%, and a negative predictive value of 98%. MRI is considered the gold standard for imaging the rotator cuff tendons [13]. It provides a comprehensive assessment of the entire rotator cuff musculotendinous unit (Fig.3). The presence of muscle atrophy and fatty infiltration can indicate the chronicity of tears, aiding in treatment decisions. Another study showed that MRI and US have similar diagnostic accuracy for detecting full-thickness RCTs. However, it noted that US had lower sensitivity than MRI in evaluating partial-thickness tears [14]. A diagnosis of partial-thickness tears is made when there is no evidence of tendon discontinuity on T1-weighted images, and MRI shows an increased signal in the rotator cuff. A partial-thickness RCT appears as an increased signal on T2-weighted images with a focal defect that is either intra-tendinous or limited to one surface and does not extend through the entire tendon. Rotator cuff tendinitis may cause increased rotator cuff signal and reduced anatomical definition on T1-weighted and proton density images, similar to the appearance of partial-thickness RCT. However, tendinitis is differentiated from partial-thickness RCT by the presence of only moderate or decreased signal on T2-weighted images [15].

Treatment

The goal of treatment is to restore normal shoulder function and biomechanics and to improve functional ability. The success of nonsurgical treatment for RCTs often depends on the size of the tear and the patient's level of activity. Generally, the more active the patient and the larger the tear, the greater the likelihood that surgical intervention will be necessary [16]. In cases of acute RCTs, it is important to initially administer short-term anti-inflammatory medications, coupled with a few days of relative rest and activity modification. Additionally, light exercise during this period is essential to maintain joint range and prevent adhesions. Once the inflammation has subsided and the pain is somewhat managed, it is important to promptly start an exercise program. This program should focus on strengthening the muscles of the internal and external rotators, as well as those around the scapula, and should be implemented swiftly. Such exercise programs can positively impact clinical outcomes, even if surgery becomes necessary later [16]. Patients opting for nonsurgical treatment should be informed that while this approach may alleviate symptoms and enhance function, it does not repair the tear [6]. It is also important

to convey that tears initially deemed reparable may become irreparable over time. Furthermore, the outcomes of surgery following unsuccessful non-operative treatment may be less favorable than those of primary repair [10].

Exercise and manual therapy

Exercise and manual therapy guided by a physical therapist represent the most commonly chosen initial treatment for older adult patients with RCTs [17]. A well-structured physical therapy regimen should include re-education of muscle recruitment, scapular stabilization, coordination of muscle contractions, and enhancement of proprioception [10]. Once inflammation and pain have subsided, a specialized physical therapy program should be initiated, aimed at eliminating capsular contracture and restoring full range of motion. As range of motion improves, the focus should shift to strengthening the rotator cuff and periscapular musculature. The role of the rotator cuff in dynamically stabilizing the shoulder joint is maximized through progressive resistive exercises using elastic bands or free weights. Numerous studies have reported that exercise protocols effectively provide pain relief and satisfaction for the majority of older adult patients with RCTs [18-20]. However, functional outcomes may be superior with surgical repair in cases of smaller tears that are amenable to surgery [20].

Corticosteroid injections

Corticosteroid injections are commonly utilized to treat tendon pathology due to their potent anti-inflammatory properties. Numerous studies have suggested that these injections can enhance pain scores and functional outcomes [21,22]. However, caution is advised when using these injections repeatedly, as they may compromise the internal structural integrity of the tendon. A systematic review indicated that subacromial corticosteroid injections provide only short-term pain relief and are ineffective in the comprehensive management of RCTs [23]. Another systematic review on the use of corticosteroid injections for RCTs concluded that corticosteroid injections are not efficacious [24]. Although no studies have specifically targeted the older adult population, a prospective randomized study involving patients with a mean age of 62 years found that 62.5% of those who received steroid injections were dissatisfied

and ultimately opted for surgery. Consequently, the evidence supporting the use of corticosteroids in managing RCTs is limited, suggesting their role may be confined to short-term pain management. Additionally, corticosteroid injections are associated with risks such as joint infection, tendon weakening, localized bruising, and a mild increase in blood sugar levels. Therefore, corticosteroid injections may be considered as a treatment option to alleviate pain, thereby facilitating physiotherapy.

Platelet-rich plasma injections

Platelet-rich plasma (PRP) is an autologous blood product that contains platelets in supraphysiological concentrations, which can activate various growth factors involved in tissue repair processes [25]. It possesses anti-nociceptive, anti-inflammatory, and regenerative properties [26]. Additionally, *in vitro* studies of tenocytes from degenerative RCTs have demonstrated that PRP increases cell proliferation and extracellular matrix synthesis [27,28]. However, clinical studies on PRP injections for RCTs have yielded mixed results. A systematic review reported that PRP injections were associated with better pain relief and functional outcomes compared to control interventions [29]. Two studies have explored the effects of PRP on healing after surgical repair in RCTs, but they have not conclusively shown clear clinical benefits [30,31]. Prospective randomized clinical trials comparing PRP to saline injections have indicated that PRP was no more effective than a placebo in improving quality of life, pain, disability, and shoulder range of motion. In contrast, another randomized prospective study found that PRP yielded superior results in terms of pain, function, and range of motion compared to dry needling [32]. A systematic review highlighted that the evidence regarding the optimal site for PRP injection in partial thickness RCTs remains unclear. PRP has shown improvements in functional outcomes for patients with partial thickness RCTs, regardless of the injection site. However, further research is necessary to determine the optimal concentration, injection frequency, and candidate selection for PRP therapy [33].

Osteoarthritis

Anatomy and etiology

The GHJ is structurally a ball-and-socket joint and functionally considered a diarthrodial, multiaxial joint. The glenohumeral articulation involves the humeral head and the glenoid cavity of the scapula, representing the primary articulation of the shoulder girdle. Normally, the articular surfaces of the GHJ are concentric, smooth, and securely bonded to the underlying bone. However, if the glenoid concavity is compromised, stabilization of the humeral head is lost. In an arthritic GHJ, the smooth, concentric joint surfaces deteriorate due to damage to the articular cartilage and the underlying bone. A review article noted that in cases of osteoarthritis, glenoid retroversion increased from 8° to 11° [34]. Degenerative joint disease, a common form of glenohumeral arthritis, occurs when the articular cartilage deteriorates due to heavy use, cumulative minor traumatic episodes, underlying structural defects in the joint, anomalies in cartilage composition, or a combination of these factors. Osteoarthritis, the most prevalent joint disease, is a non-inflammatory condition characterized by the weakening and deformation of joint cartilage, leading to abnormal bone formation on and around the joint surface. Osteoarthritis represents both a mechanical and biological phenomenon that arises when the normal processes of degeneration and formation of articular cartilage and subchondral bone fail. Although the causes are varied, it ultimately impacts all tissues of the movable joint, leading to joint dysfunction [35]. The majority of osteoarthritis cases in the GHJ are linked to non-specific factors, primarily advancing age, while specific risk factors are more commonly observed in younger patients [35].

Physical examination

The diagnosis of shoulder osteoarthritis is based on a combination of specific symptoms, physical examination findings, and radiographic evidence of changes to the bone. The most common initial symptom is a progressive, activity-related pain that is deep within the joint and often localized to the posterior aspect. As the condition worsens, patients frequently experience pain at night. For many, this pain is also present at rest and disrupts sleep [36]. The examination process starts by identifying which movements the patient finds most problematic. Understanding these limitations helps in determining potential treatment options. The evaluation then proceeds with a thorough assessment of shoulder mobility. This includes testing forward elevation, abduction, external rotation, external rotation in

abduction, internal rotation, internal rotation in abduction, and cross-body adduction. These tests evaluate the range of motion of the humerus relative to the thorax. For a more detailed assessment of glenohumeral motion, the examiner can stabilize the scapula with one hand while using the other to assess flexion, extension, and internal and external rotation of the humerus relative to the scapula. Demonstrating the difference in motion between the affected shoulder and the contralateral, normal or less affected shoulder can be informative for both the patient and family members.

Muscle strength in the shoulder girdle muscles is assessed using manual muscle testing [37]. However, this method is subject to inter-observer variability. Hand-held dynamometers provide clinicians with a valuable tool for quantitatively assessing muscle strength and validating the effects of interventions. Previous studies have introduced reliable clinical assessment methods for scapular motion, which are categorized into visual observation and objective assessment. Changes in scapular position and motion patterns are referred to as "scapular dyskinesis" [38]. The current guideline for assessing scapular dyskinesis clinically is to employ the dynamic scapular dyskinesis test [38]. Objective assessments of scapular position and motion utilize a digital inclinometer. To evaluate scapular upward rotation, the angle of inclination measured along the scapular spine with the digital inclinometer is recorded.

Radiological imaging

Shoulder imaging is crucial for confirming diagnoses, assessing the severity of pathological changes, aiding in surgical planning, and enhancing patient comprehension of their condition. Standard plain films are vital for evaluating patients with shoulder arthritis. Employing proper radiographic techniques is essential to capture the necessary images for effective treatment planning (Fig. 4).

The first image is an anteroposterior (AP) view captured with the X-ray beam directed through the GHJ in the scapular plane. This perspective reveals the superior-inferior positioning of the scapula, the presence of osteophytes on the scapular head and scapula, joint space narrowing, the extent of medial displacement of the humerus relative to the lateral acromion line, the condition of the humerus and scapula, the presence of loose bodies, and any collapse or deformity of the humeral head [39].

The second image is an axillary view captured with the arm functionally elevated in the scapular plane, oriented to display both the scapular notch and the scapular neck. This perspective offers a distinct visualization of the humeral anatomy, the quantity of glenoid bone, the shape of the glenoid, its version relative to the scapular plane, and the relationship between the humeral head and the glenoid.

Standardized AP and axillary views provide detailed insights into the thickness of the cartilaginous space between the humeral head and the glenoid, the relative positioning of the humeral head in relation to the glenoid, the presence of osteophytes, the degree of osteopenia, and the extent of bone deformities and erosions [39,40].

CT scans may be helpful for patients considering surgery, as they can provide a greater understanding of scapular, glenoid, and humeral anatomy and factors that may influence implant selection and placement.

Laboratory test

Laboratory tests of blood or joint fluid are not always required for evaluating an arthritic shoulder, except in two cases: when inflammatory or septic arthritis is suspected. In such instances, tests like rheumatoid factor, anti-cyclic citrullinated peptide antibody, C-reactive protein, and erythrocyte sedimentation rate may be useful [41].

Treatment

Activity modification

Most patients with shoulder osteoarthritis wish to maintain their daily, work, and recreational activities. However, continued full participation in these activities may exacerbate their arthritis symptoms. Typically, jobs that require pushing heavy loads or applying shock loads, as well as certain recreational activities, can accelerate the progression of the disease and its symptoms. Making modifications in occupational and recreational activities can alleviate symptoms and extend the lifespan of the natural joint. Occupational

therapy can facilitate workplace adjustments and may also recommend adaptive changes at home. Modifying sports activities can prove beneficial as well. Another crucial element of nonsurgical management involves optimizing the patient's overall health through regular aerobic exercise.

Exercise and manual therapy

Shoulder osteoarthritis is commonly linked to joint contracture and stiffness due to adhesions involving the GHJ capsule, rotator cuff muscles, and the non-articular humeroscapular motion interface. Disuse or tendon rupture can lead to weakness in the deltoid and cuff muscles. However, shoulder function can often be enhanced through a gentle range of motion and strengthening exercise program [42]. The exercise program starts with active shoulder range of motion exercises performed within a pain-free range. As pain decreases, passive shoulder range of motion exercises are introduced. Joint mobilization is a therapeutic technique used to enhance joint function and accessory motion, which can lead to pain relief and increased range of motion. Combining a structured exercise program with joint mobilization has proven effective in reducing pain and improving function in patients with various shoulder disorders [43]. Muscle strengthening begins with low-intensity resistance training using elastic bands for movements such as external and internal rotation, abduction, and forward flexion. This is complemented by modified push-ups against a wall to introduce gentle load-bearing. In more advanced phases, the program includes isometric exercises, where static pressure is applied against an immovable object to build stability, and light weightlifting to mimic functional tasks like overhead reaching. These exercises are carefully monitored to ensure they remain pain-free and are adjusted according to individual tolerance, thereby facilitating gradual improvements in strength, range of motion, and overall shoulder function.

Non-steroidal anti-inflammatory drugs

Non-steroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen, naproxen, and celecoxib, are widely used to relieve pain and reduce inflammation in arthritis. These drugs inhibit cyclooxygenase (COX) enzymes, thereby decreasing the production of prostaglandins that are responsible for mediating inflammation and pain. In osteoarthritis, NSAIDs have shown greater pain reduction compared to

acetaminophen [44]. Selective COX-2 inhibitors, such as celecoxib, are associated with fewer gastrointestinal side effects than non-selective NSAIDs. In addition to oral administration, topical NSAIDs are frequently used in treatment regimens. Due to their effective pain relief and anti-inflammatory properties, NSAIDs are recommended as the first-line therapy in the conservative management of shoulder osteoarthritis [45].

Corticosteroid injections

Intra-articular corticosteroid injections offer targeted relief for moderate to severe joint inflammation. Medications like triamcinolone or methylprednisolone are injected directly into the affected joint, providing strong anti-inflammatory effects. These injections are especially effective for acute flare-ups, quickly reducing swelling and pain. However, their repeated use can lead to complications such as cartilage damage, joint infection, or systemic side effects, including hyperglycemia. Consequently, their use is more appropriate for short-term symptom management rather than long-term treatment [46,47]. One study suggested limiting the number of injections to a maximum of three to reduce the risk of infection and other adverse effects [48].

Neuropathic pain remedies

In cases where arthritis pain includes neuropathic components, medications such as gabapentin or pregabalin can be effective. These drugs function by modulating calcium channel activity within the nervous system, which reduces the transmission of pain signals. They are particularly beneficial in scenarios where conventional pain relievers are inadequate for managing nerve-related pain. However, common side effects such as dizziness, fatigue, and weight gain necessitate careful dose adjustments to minimize adverse effects, particularly in older adult patients.

Platelet-rich plasma injections

PRP therapy involves drawing a patient's blood, concentrating the platelets, and then injecting the plasma into the affected joint to encourage healing and tissue regeneration. Platelets release growth factors that

can reduce inflammation and stimulate the repair of cartilage. PRP is recognized as a regenerative treatment option and has demonstrated the potential to enhance symptoms and functionality in cases of osteoarthritis [49]. However, one study indicated that serious complications, such as infections and inflammatory reactions necessitating multiple surgical interventions, can arise following biologic injection therapy [50].

Conclusion

Shoulder pain in older adults often results from chronic degenerative rotator cuff tears or osteoarthritis, which can lead to functional impairment and a reduced quality of life. Early detection through comprehensive physical examinations and imaging is crucial for effective management. Nonsurgical approaches such as physical therapy, activity modification, pharmacotherapy, and innovative treatments like PRP can help alleviate pain, maintain mobility, and possibly postpone the need for surgery. However, each treatment option has its own advantages and drawbacks. Developing tailored, individualized treatment plans is critical for ensuring safer outcomes, especially considering the unique comorbidities present in older populations. Ultimately, timely, evidence-based care is key to preserving independence and enhancing overall well-being in the daily lives of older adults.

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Figure legends

Fig. 1. The active range of motion is assessed by forward elevation (A), external rotation with the elbow at the side of the body (B), and the internal rotation angle is usually assessed by the height of the vertebral body (yellow line) from behind (C) (Provided by the authors after consent of the examinee).

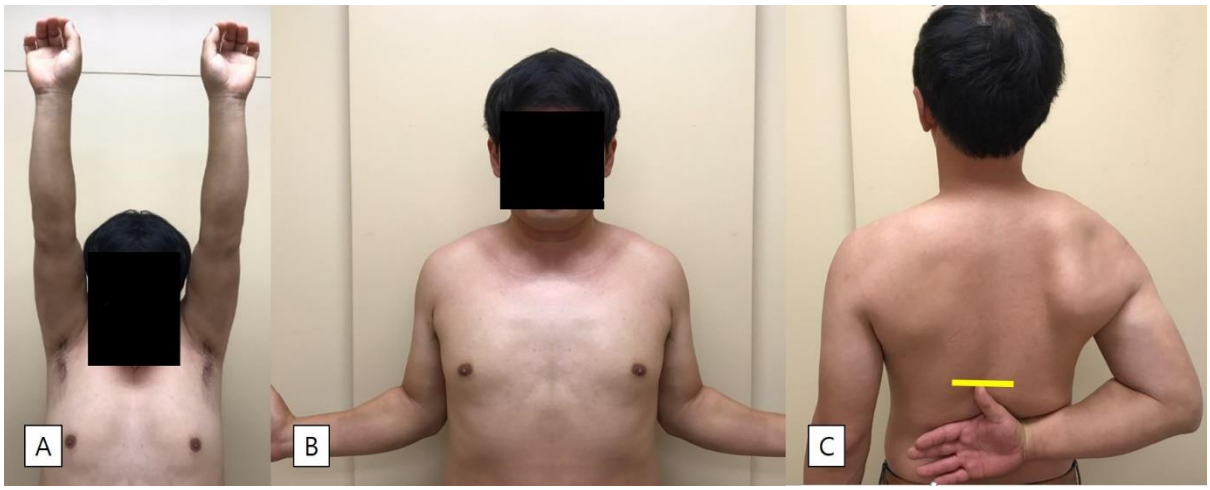

Fig. 2. The presence of osteophytes on the greater tuberosity and acromion of the humerus indicates that there is a high possibility of a rotator cuff tear. (Provided by the authors)

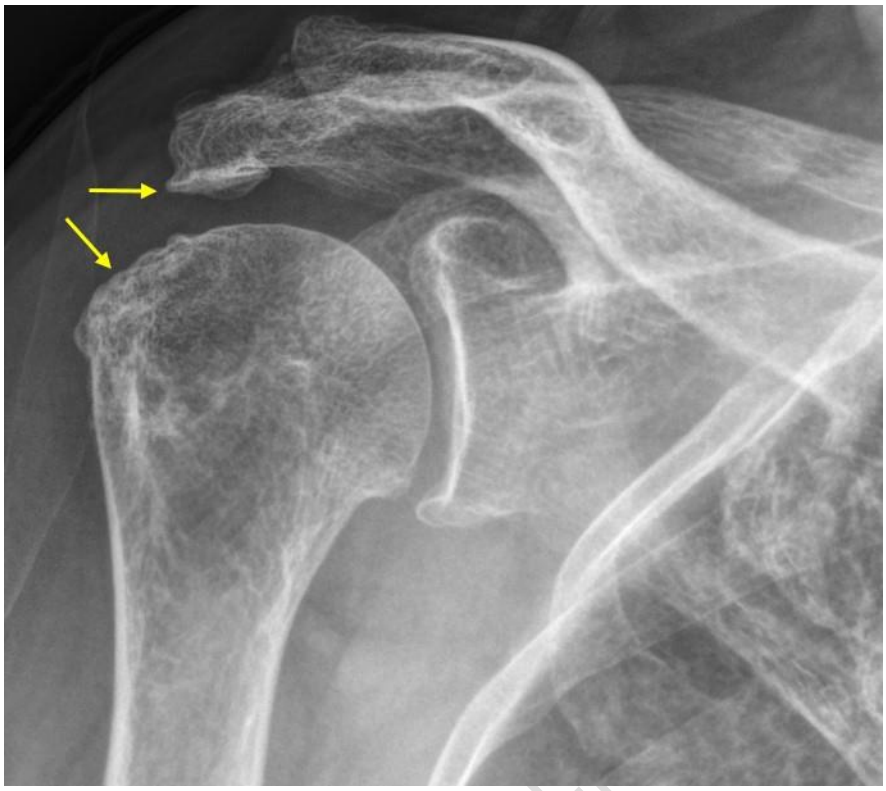

Fig. 3. Magnetic resonance images show a partial tear of the supraspinatus tendon (A), and a complete tear of the supraspinatus tendon (B) (Provided by the authors).

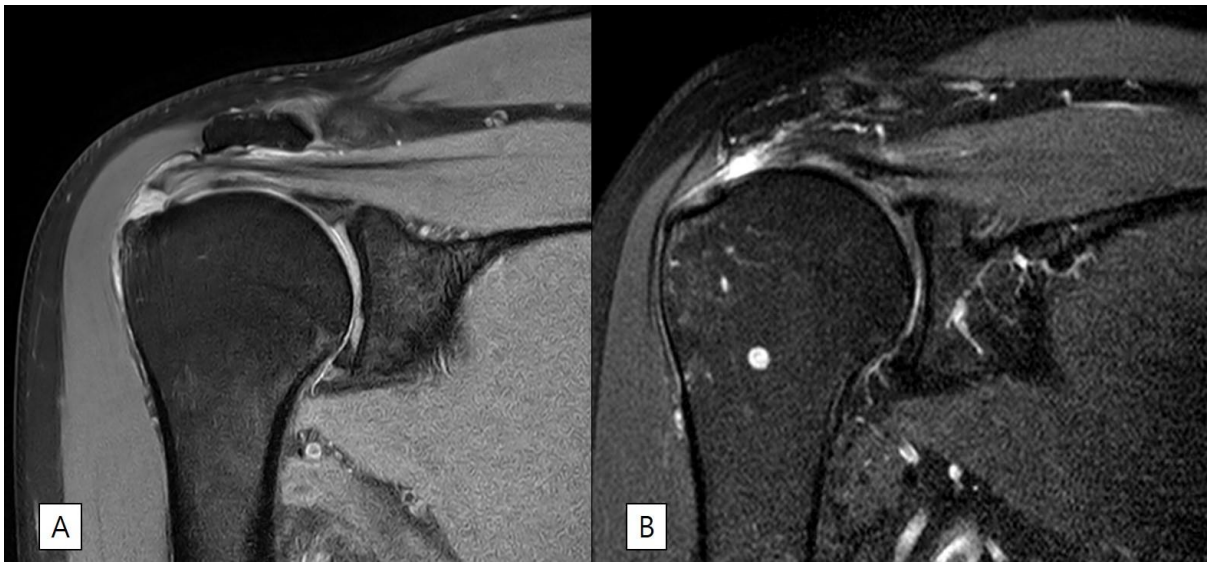

Fig. 4. Anteroposterior and axillary-lateral plain X-ray images of osteoarthritis of the shoulder joint show narrowing of the joint space and formation of osteophytes (Provided by the authors).