

# Degenerative Shoulder Disease: Diagnosis and Management

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Degenerative joint disease of the shoulder is a gradual wearing of the articular cartilage that leads to pain and stiffness. As the joint surface degenerates, the subchondral bone remodels, losing its sphericity and congruity. The joint capsule also becomes thickened, leading to further loss of shoulder rotation. This painful condition is a growing problem in the aging population. In most cases, diagnosis of degenerative joint disease of the shoulder can be made with careful history, physical examination, and radiography. The symptoms and degree of shoulder arthritis visible on radiography determine the best treatment option. Mild degenerative joint disease can be treated with physical therapy and over-the-counter anti-inflammatory medications such as acetaminophen or nonsteroidal anti-inflammatory drugs. More advanced cases of degenerative joint disease that are refractory to nonoperative management can be managed with corticosteroid injections. In severe cases, surgery is indicated. Surgical options include arthroscopic debridement, arthroscopic capsular release, and, in the most severe instances, hemiarthroplasty or total shoulder arthroplasty. (*Am Fam Physician*. 2008;78(5):605-611, 612. Copyright © 2008 American Academy of Family Physicians.)

► **Patient information:**  
A handout on shoulder osteoarthritis, written by Uma Jayaraman, MD, AFP Editing Fellow, is provided on page 612.

**D**egenerative shoulder disease, also known as shoulder osteoarthritis, is a gradual, progressive, mechanical, and biochemical breakdown of the articular cartilage and other joint tissues, including bone and joint capsule. As the articular surface wears, friction within the joint increases, causing progressive loss of the normal load-bearing surfaces with pain and disability. There are many risk factors for shoulder osteoarthritis, including age, genetics, sex, weight, joint infection, history of shoulder dislocation, and previous injury. Certain occupations, such as heavy construction or overhead sports, are also risk factors. The prevalence of shoulder osteoarthritis is increasing as the population ages. Primary care physicians will be confronted with this disease at various levels of severity. This review highlights epidemiology, evaluation, current treatment options, and treatment results for degenerative joint disease of the shoulder.

## Epidemiology

Musculoskeletal disorders have had a significant impact on the world's population.

The current decade (2000–2010) has been named the “Bone and Joint Decade.”<sup>1</sup> In the United States alone, musculoskeletal conditions account for 131 million patient visits per year, costing society about \$215 billion.<sup>1</sup> Arthritis and chronic joint symptoms affect one out of three adults, making it the most widespread disease in America.<sup>2</sup> The prevalence of arthritis for all joints is higher in whites, men older than 45 years, women older than 55 years, overweight and inactive persons, and persons with less than eight years of education.<sup>2</sup> Nearly 60 percent of those affected by osteoarthritis are older than 65 years, and the incidence is increasing.<sup>2</sup>

Osteoarthritis affects many joints throughout the body.<sup>3</sup> Although not as common as other locations, shoulder osteoarthritis is just as debilitating. The loss of shoulder function can lead to depression, anxiety, activity limitations, and job-performance problems.<sup>4</sup> The causes of shoulder osteoarthritis are divided into primary and secondary categories. Primary osteoarthritis has no specific cause, but is more prevalent and not isolated to older persons.<sup>5</sup> Secondary osteoarthritis has a

**SORT KEY RECOMMENDATIONS FOR PRACTICE**

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>References</i>
Axillary radiography should be performed because it provides the best images of joint-space narrowing to diagnose degenerative shoulder disease. This view also helps rule out dislocation. Anteroposterior radiography with the arm actively held at 45 degrees of abduction may reveal joint-space narrowing in patients with otherwise normal neutral anteroposterior radiography.	C	10
The initial approach to early osteoarthritis should begin with activity modification, rest, and ice. Physical therapy, strength training, and aerobic exercise alleviate symptoms in certain cases; in other patients, over-the-counter medications may be sufficient for pain relief.	C	12, 23, 24
Acetaminophen should be the first pharmacologic agent used to manage pain. Therapeutic effects are achieved at dosages of 3 to 4 g per day.	C	13
The most common indications for shoulder arthroplasty are pain from shoulder arthritis with a loss of function that is unresponsive to conservative treatment; end-stage rotator cuff tear arthropathy; osteonecrosis; and a previously failed joint-sparing surgery or total shoulder arthroplasty.	C	16

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/jafpsort.xml>.

**Table 1. Classification of Degenerative Arthritis of the Glenohumeral Joint**

<i>Type</i>	<i>Etiology</i>
Primary	Unknown
Secondary	
Atraumatic osteonecrosis	Alcohol induced Corticosteroid therapy Cytotoxic drugs Gaucher's disease Lipid metabolism disorders Obesity Radiation Sickle cell disease
Postinflammatory	Crystal arthropathies Postinfection arthritis Rheumatoid arthritis Rotator cuff arthropathy
Postsurgical	Capsulorrhaphy arthropathy Intra-articular hardware (e.g., screws, staples) Overtightened anterior joint capsule (prior Putti-Platt repair)
Posttraumatic	Dislocation Malunion of the proximal humerus Posttraumatic avascular necrosis Subluxation

Adapted with permission from Gerber A, Lehtinen JT, Warner JJ. Glenohumeral osteoarthritis in active patients: Diagnostic tips and complete management options. *Phys Sportsmed*. 2003;4(31). <http://www.physsportsmed.com/issues/2003/0403/gerber.htm>. Accessed April 21, 2008.

known cause or predisposing factor, such as major shoulder trauma, chronic dislocations, infection, congenital malformations, or chronic rotator cuff tear (Table 1<sup>6</sup>).<sup>5</sup>

**Evaluation**

The diagnosis of shoulder degenerative joint disease involves a specific set of symptoms, physical examination findings, and changes to the bone, which are visible on radiography. The typical presenting symptom is progressive, activity-related pain that is deep in the joint and often localized posteriorly. As the disease progresses, night pain becomes more common. For many patients, the pain is present at rest and interferes with sleep. In advanced cases, the stiffness creates significant functional limitations. In younger patients, prior trauma, dislocation, or previous surgery for shoulder instability are factors associated with the development of osteoarthritis.

Patients in the early stages of degenerative joint disease may complain of mild pain and may have unremarkable examinations. Radiography may show only subtle changes to the bone until there is more advanced destruction. The only objective evidence of the disease is articular cartilage wear, which may be shown on magnetic resonance imaging (MRI). In advanced cases, there is a loss of active and passive range of motion, in addition to pain. Physical examination will reveal painful crepitus, joint enlargement, and swelling. In severe cases, audible and palpable grinding may occur when a mechanical stress is placed on the shoulder.

During the examination, it is important to exclude other shoulder pathologies that cause pain besides osteoarthritis (Table 2). Pain that is not induced by joint palpation or passive range of motion suggests bursitis,

**Table 2. Diagnosis of Shoulder Pathologies**

Finding	Probable diagnosis
<b>History</b>	
Joint effusion	Osteoarthritis Rheumatoid arthritis Septic arthritis
Joint pain	Osteoarthritis Rheumatoid arthritis Septic arthritis
Morning stiffness improved with activity	Rheumatoid arthritis
Night time shoulder pain	Impingement Rotator cuff disease (partial or complete cuff tears)
Pain or "clunking" sound with overhead motion	Labral disorder
Pain radiating down arm	Disk disease (cervical)
Stiffness worse with activity, improves with rest	Osteoarthritis
<b>Physical examination</b>	
Cervical range of motion decreased	Disk disease (cervical)
Crepitus	Osteoarthritis Rheumatoid arthritis
Decreased range of motion, specifically external rotation and abduction	Osteoarthritis Soft tissue injury (frozen shoulder)
Erythema, warmth	Septic arthritis Rheumatoid arthritis
Shoulder joint line tenderness	Osteoarthritis
<b>Radiography</b>	
Joint space narrowing (central, posterior, and superior erosion)	Cuff-tear arthropathy Osteoarthritis Rheumatoid arthritis
Marginal joint erosions	Rheumatoid arthritis
Normal joint	Frozen shoulder Septic arthritis
Osteophytes	Osteoarthritis
Subchondral sclerosis	Osteoarthritis

rotator cuff disease, or biceps tendinitis.<sup>7</sup> Loss of passive and active range of motion may also occur with calcific tendinitis or idiopathic adhesive capsulitis. Radiography will show calcific tendinitis as radiodense calcium in the rotator cuff. In patients with adhesive capsulitis, shoulder joint radiography is typically normal. Morning stiffness may suggest rheumatoid arthritis. Intense inflammation, swelling, and erythema can be caused by gout, pseudogout, or a septic joint. A blood panel can help identify infection (i.e., white blood cell count greater than 11,000 per mm<sup>3</sup> [11 x 10<sup>9</sup> per L] and white blood cell count in the joint fluid greater than 50,000 per mm<sup>3</sup> [50 x 10<sup>9</sup> per L]). An erythrocyte sedimentation

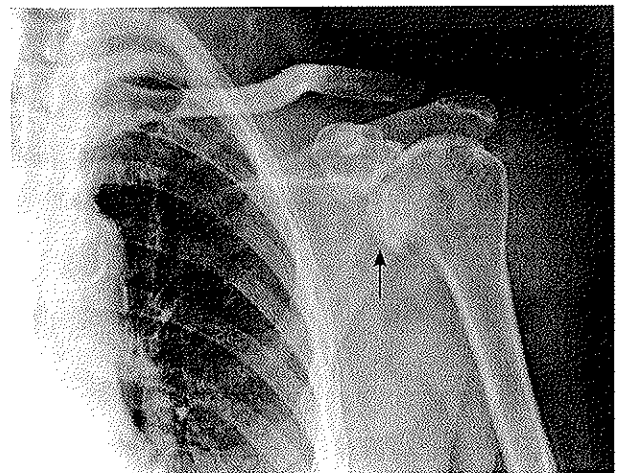
rate greater than 45 mm per hour may indicate rheumatoid arthritis, an underlying malignancy, or chronic infection. These blood tests are sensitive, but not specific in determining causes of shoulder pain.<sup>8</sup>

Imaging studies are essential to diagnosing degenerative joint disease. In most instances, conventional radiography demonstrates shoulder osteoarthritis (Table 2).<sup>9</sup> Early in the disease process, radiographic evidence of degenerative joint disease may include joint-space narrowing (mild), osteophytes (small), subchondral sclerosis, cysts, and eburnation or advanced articular cartilage loss (Figure 1). The axillary view provides the best image to look for joint-space narrowing and helps rule out dislocations. Anteroposterior radiography, with the arm held at 45 degrees of abduction, may also show early joint-space narrowing.<sup>10</sup> Computed tomography arthrograms can localize articular defects, whereas MRI reveals soft-tissue pathologies and subtle changes in articular cartilage. Subchondral edema visible on MRI suggests advanced articular cartilage involvement.<sup>11</sup>

## Current Treatment Options

### MEDICAL MANAGEMENT

Presently, there are no known interventions that alter the natural history of early degenerative joint disease; therefore, the main objectives in osteoarthritis treatment are to control pain and restore function. The initial approach to osteoarthritis treatment begins with activity modification, rest, and ice. Physical therapy, strength training, and aerobic exercise help alleviate symptoms.<sup>12</sup> Acetaminophen should be the first pharmacologic agent used to manage pain, with therapeutic effects achieved at dosages of 3 to 4 g per day.<sup>13</sup> Nutritional supplements,



**Figure 1.** Preoperative radiograph illustrating degenerative changes.

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such as glucosamine and chondroitin, are pharmacologic alternatives to acetaminophen, although only anecdotal evidence supports their use for shoulder osteoarthritis.

The mainstay of pharmacotherapy for degenerative joint disease has been the nonselective and selective cyclooxygenase-2 (COX-2) inhibitors, or nonsteroidal anti-inflammatory drugs (NSAIDs) (Table 3<sup>14</sup>). Non-selective COX-2 inhibitors (e.g., ibuprofen [Motrin], diclofenac [Voltaren], naproxen [Naprosyn]) and selective COX-2 inhibitors (e.g., celecoxib [Celebrex]) have been effective in alleviating osteoarthritis symptoms, but have varying side effects. Side effects can include gastrointestinal irritation, stomach ulcerations, bleeding, or renal failure from long-term use. In advanced osteoarthritis cases with inflammation, an injection of a corticosteroid, such as triamcinolone acetonide (Kenalog; 1 to 2 mL of 40 mg per mL) with lidocaine 1% (Xylocaine), into the affected joint can help relieve pain and swelling.

### SURGICAL MANAGEMENT

If conservative therapies fail, there are many surgical options available. Joint preservation surgery is preferable for patients younger than 55 to 60 years or those with early stage degenerative joint disease of the shoulder. The operative procedure should match the patient's symptoms or functional limitations. Arthroscopic debridement, capsular release, corrective osteotomies, and interposition arthroplasty are surgical options that attempt to reduce symptoms while preserving the native joint.<sup>15</sup> Arthroscopic debridement with capsular release

is the most common surgical treatment. It is most effective in patients younger than 55 to 60 years with moderate pain and significant passive motion restrictions. Debridement removes mechanical irritants, unstable cartilage flaps, or loose bodies. Inflamed synovium can be treated via synovectomy, and the stiff contracted joint capsule can be released to restore passive joint mobility and unload articular surfaces. Arthrodesis (shoulder fusion) is an option for patients younger than 45 to 50 years with severe arthritis or for those who are not suitable candidates for total shoulder replacement. This procedure eliminates pain by fusing the humeral head to the glenoid, thus eliminating painful motion interface.

Shoulder arthroplasty is recommended for patients with severe shoulder osteoarthritis. The most common indications for shoulder arthroplasty are pain from shoulder arthritis with a loss of function that is unresponsive to conservative treatment; end-stage rotator cuff tear arthropathy; osteonecrosis; and a previously failed joint-sparing surgery or total shoulder arthroplasty.<sup>16</sup> Most recent studies support the use of a total shoulder arthroplasty, which involves replacing the glenoid and humerus (Figure 2).<sup>17,18</sup> In certain instances, a hemiarthroplasty (humerus only) may be an acceptable option. Major contraindications to shoulder replacement are: active or recent infection, neuropathic joint, complete paralysis of deltoid or rotator cuff muscles, debilitating medical status, or uncorrectable shoulder instability.

Shoulder arthroplasty is typically done under general anesthesia. A regional nerve anesthetic (interscalene block)

**Table 3. Guide to NSAID Therapy**

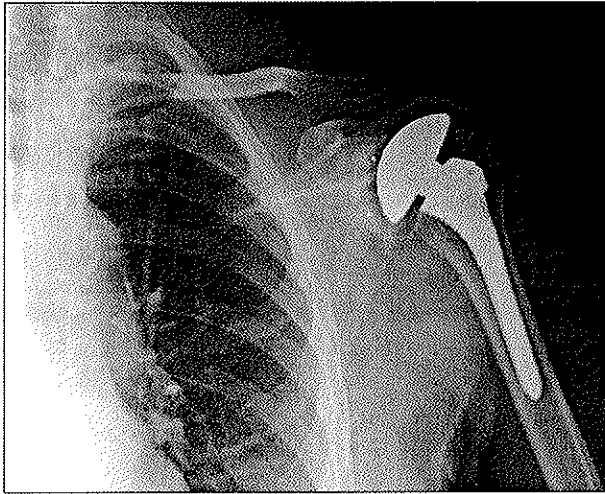
	No/low NSAID gastrointestinal risk	NSAID gastrointestinal risk
No cardiovascular risk (no aspirin)	Traditional NSAID	Traditional NSAID plus PPI or COX-2 inhibitor plus PPI* (if necessary) Consider non-NSAID therapy
Cardiovascular risk (consider aspirin)	Traditional NSAID† plus PPI if gastrointestinal risk warrants gastroprotection Consider non-NSAID therapy	A gastroprotective agent must be added if a traditional NSAID† is prescribed Consider non-NSAID therapy

COX-2 = cyclooxygenase-2; NSAIDs = nonsteroidal anti-inflammatory drugs; PPI = proton pump inhibitor.

\*—The U.S. Food and Drug Administration has determined that over-the-counter and prescription NSAIDs (including selective COX-2 agents), when used as monotherapy, may be linked to potentially life-threatening gastrointestinal bleeding.<sup>21</sup>

†—NSAIDs should be used cautiously in patients taking aspirin.

Adapted with permission from Fendrick AM. COX-2 inhibitor use after Vioxx: careful balance or end of the rope? [editorial]. *Am J Manag Care.* 2004;10(11):741.



**Figure 2.** Postoperative radiograph following total shoulder arthroplasty.

can supplement general anesthesia and provide perioperative pain control. After careful surgical exposure, the glenoid fossa is resurfaced with a solid polyethylene component, and the humeral head is resected along the anatomic neck and replaced with a metal prosthesis. Newer prostheses, called reverse or inverse shoulder replacements, have been designed specifically for use in rotator-cuff-deficient shoulders. The procedure lasts one to three hours, followed by a two- to four-day postoperative hospitalization. Blood loss is minimal, and patients who start with a preoperative hemoglobin above 11 g per dL (110 g per L) should not need transfusions. Donating blood before surgery is not recommended.<sup>19</sup> Pain is controlled in the hospital with opioids via intravenous patient-controlled analgesia. A sling should be used for three to six weeks to protect the repair. Patients usually require some assistance with normal daily activities for approximately four to six weeks after surgery.

Postoperative rehabilitation begins immediately with joint motion, in-home exercises, and a therapist-supervised program (Table 4).<sup>20</sup> The initial six weeks of rehabilitation focus on stretching exercises to optimize the flexibility of the joint. When flexibility and range-of-motion goals have been achieved (usually at six to eight weeks), the strengthening can begin. Normal activities of daily living can be resumed within six weeks of surgery, and patients can often return to athletic activities within four months. After shoulder arthroplasty, patients can expect alleviation of pain and a significant improvement in range of motion.<sup>18</sup> Improvement in function may continue up to two years after surgery.<sup>21</sup>

## Treatment Results

### NONSURGICAL TREATMENT

Nonsurgical osteoarthritis treatments can temporize symptoms; however, they do not alter natural history

and have had unsatisfactory results. Nonpharmacologic measures, such as aerobic exercise and strengthening, are unproven in the shoulder.<sup>22</sup> One study has shown that acetaminophen was more effective than placebo at pain reduction, but less effective than NSAIDs.<sup>23</sup> NSAIDs were also associated with more frequent gastrointestinal events than acetaminophen.<sup>23</sup> Two randomized placebo-controlled studies have been published since 2003. One found no significant difference between placebo and acetaminophen, and the other found acetaminophen to be more effective than placebo, and celecoxib to be more effective than acetaminophen.<sup>13,24</sup>

Pharmacologic results show that newer COX-2 selective inhibitors are not more effective than nonselective NSAIDs for treating knee and hip osteoarthritis.<sup>25,26</sup> However, the Celecoxib Long Term Arthritis Safety Study (CLASS) illustrated that the COX-2 inhibitor celecoxib was associated with significantly less gastrointestinal events than traditional NSAIDs.<sup>27</sup> In recent years, studies have shown certain COX-2 inhibitors to be associated with an increased cardiovascular risk, resulting in the removal of rofecoxib (Vioxx) from the market. Additional data suggest that the nonselective NSAIDs may also cause an increase in adverse cardiovascular events.<sup>28,29</sup> More studies are needed to demonstrate effectiveness and serious cardiovascular side effects of NSAIDs and COX-2 selective inhibitors.

Nutritional supplements are widely used for osteoarthritis treatment, although the U.S. Food and Drug Administration has not approved them for this use. Glucosamine and chondroitin are the most commonly used supplements. Glucosamine has been shown to provide moderate symptomatic relief over placebo, but the overall effectiveness of these supplements remains uncertain.<sup>30</sup> At this time, there is a paucity of evidence to support the use of these supplements in shoulder degenerative joint disease.

**Table 4. Postoperative Rehabilitation Sequencing**

<i>Exercise</i>	<i>Postoperative day</i>
Active hand, forearm, elbow motion	1
Passive shoulder motion	1
Pulley	21
Wand or cane	35
Isometrics	35

*Information from reference 20.*

### SURGICAL TREATMENT

Few studies exist on joint-preservation surgery for the shoulder. There are several case reports and small series that present cartilage resurfacing procedures for young patients with focal chondral defects.<sup>31,32</sup> The largest series on arthroscopic treatment consists of 25 patients with early to moderate osteoarthritis, treated with lavage, partial synovectomy, and subacromial decompression.<sup>15</sup> The mean follow-up was 34 months, and the authors demonstrated good or excellent outcomes in 80 percent of patients. The authors concluded that arthroscopic debridement was reasonable for early shoulder osteoarthritis treatment. Surgical prerequisites included concentric humeral head and glenoid with visible joint space on axillary radiography.

Prosthetic total shoulder arthroplasty is the treatment of choice for severe degenerative joint disease. Studies show that total shoulder arthroplasty provides excellent clinical results with good durability. The results of total shoulder arthroplasty have been shown to be superior to hemiarthroplasty, in which only the humerus is resurfaced.<sup>33</sup> As early as 1982, one study reported that 90 percent of patients who underwent total shoulder arthroplasty had satisfactory results at minimum two-year follow-up.<sup>34</sup> As of 1988, only two of the 615 patients who had undergone total shoulder arthroplasty required further surgery. Another paper with 12-year mean follow-up demonstrated satisfactory pain relief in 83 percent of shoulders, with an average improvement of 40-degree active abduction, and yielding an overall average range of motion of 117 degrees.<sup>18</sup> Despite concerns about glenoid loosening, long-term studies have shown high rates of survivorship. Another study of patients younger than 50 years, with minimum five-year and mean 12-year follow-up, found a prosthesis survival rate of 97 percent at five years, 97 percent at 10 years, and 84 percent at 15 years.<sup>16</sup> This study illustrates that total shoulder arthroplasty improves functional range of motion with good long-term pain relief.

The average orthopedic surgeon performs only two total shoulder arthroplasties per year, and recent data has shown that surgeon and hospital volume significantly influence surgical outcomes.<sup>32,35</sup> Surgeons with higher volumes of arthroplasties have better patient outcomes and fewer complications. When total shoulder arthroplasty is performed under appropriate clinical indication, complete pain relief and normal or near-normal restoration of function is often the result. Experts predict that surgical outcomes following total shoulder arthroplasty will continue to improve with newer implant designs and fixation methods.

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