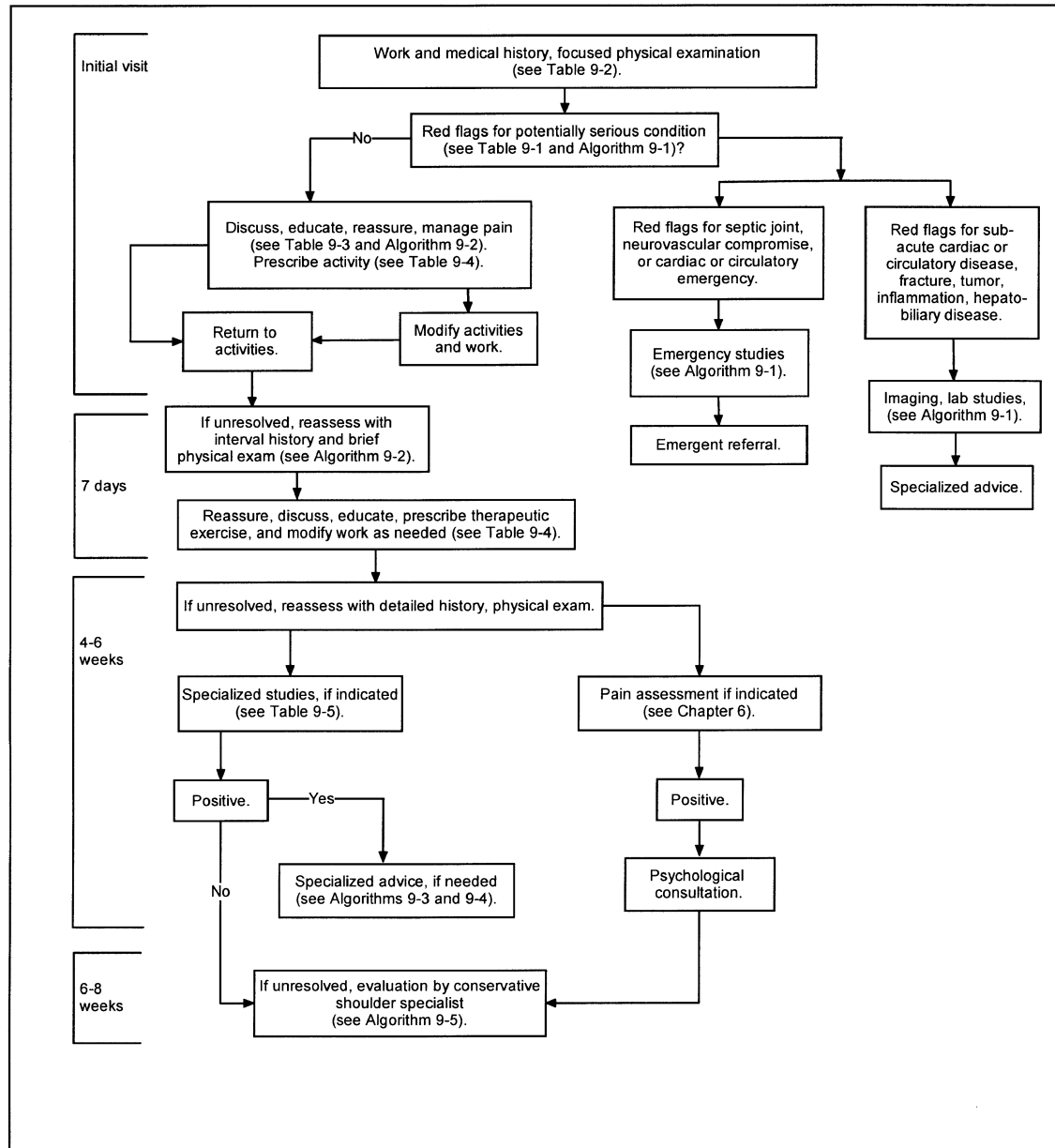


Master Algorithm. ACOEM Guidelines for Care of Acute and Subacute Occupational Shoulder Complaints



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9

Shoulder Complaints

General Approach and Basic Principles

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Occupational and primary care providers commonly see shoulder complaints that are potentially work related; they are among the five most common causes of reported work-related health complaints in workers' compensation claims. These complaints account for about 3-5% of total lost workdays and 10-11% of claims and costs in workers' compensation, ranking them in the top five for financial severity, although much of the total expense is incurred for surgical procedures.

This clinical practice guideline presents recommendations on assessing and treating adults with potentially work-related shoulder complaints. Topics include the initial assessment and diagnosis of patients with acute and subacute shoulder complaints that are potentially work related, identification of red flags that may indicate the presence of a serious underlying medical condition, initial management, diagnostic considerations, and special studies for identifying clinical pathology, work-relatedness, return to work, modified duty and activity, and further management considerations, including the management of delayed recovery.

Algorithms for patient management are included. This chapter's master algorithm schematizes the manner in which primary care and occupational medicine practitioners generally can manage patients with acute and subacute shoulder problems. The following text, tables, and numbered algorithms expand upon the master algorithm.

The principal recommendations for assessing and treating patients with shoulder complaints are as follows:

- The initial assessment focuses on detecting indications of potentially serious disease, termed red flags, and making an accurate diagnosis.
- In the absence of red flags, work-related shoulder complaints can be safely and effectively managed by occupational or primary care providers. The focus is on monitoring for complications, facilitating the healing process, and facilitating return to work in a modified- or full-duty capacity.

- Relief of discomfort can be accomplished most safely by activity modification and systemic nonprescription analgesics.
- Patients recovering from acute and subacute shoulder injury or infection are encouraged to return to modified work as their condition permits.
- If symptoms persist for more than 4-6 weeks, referral for specialty care may be indicated.
- Nonphysical factors (such as psychosocial, workplace, or socioeconomic problems) should be addressed in an effort to resolve delayed recovery.

Initial Assessment

Thorough medical and work histories and a focused physical examination (see Chapter 2) are sufficient for the initial assessment of the worker complaining of potentially work-related shoulder symptoms. The medical history and examination include evaluation for serious underlying conditions. This evaluation can consider the possibility of referred shoulder pain due to a disorder in another part of the body (most commonly from the cervical spine). Certain findings on the history and physical examination raise suspicion of serious underlying medical conditions, referred to as red flags (see Table 9-1). The absence of red flags rules out the need for special studies, referral, or inpatient care during the first four to six weeks, when spontaneous recovery is expected (provided any contributory workplace factors are mitigated). Shoulder complaints can then be classified into one of four working categories:

- **Potentially serious bone conditions**, including fractures, glenohumeral dislocation, infection, or serious nerve or circulation conditions, including referred neck, cardiac, or intraabdominal pain, thoracic outlet syndrome (TOS), or brachial plexus injury
- **Mechanical disorders**: derangements of the shoulder related to acute trauma, such as acute rotator cuff tear, acromioclavicular (AC) joint strain or separation, or a recently reduced dislocation
- **Degenerative disorders**: consequences of aging or repetitive use, such as impingement syndrome, rotator cuff tendinitis, degenerative rotator cuff tear, adhesive capsulitis (frozen shoulder), tendonopathy, bursitis, or recurrent dislocation
- **Nonspecific shoulder disorders**: suggesting neither internal derangement nor referred pain

Medical History

Asking the patient open-ended questions, such as those listed on pages 198-199, allows the clinician to gauge the need for further discussion or specific inquiries to obtain more detailed information (see also Chapter 2):

Table 9-1. Red Flags for Potentially Serious Shoulder Conditions

Disorder	Medical History	Physical Examination
Fractures	History of significant trauma (direct, deceleration)	Significant bruising or hemarthrosis Deformity consistent with displaced fracture (with fracture, check for pulmonary injury and rib fracture as well) Significant swelling
Dislocation (glenohumeral joint)	Severe pain and inability to move the shoulder History of significant trauma History of prior dislocation History of deformity, with spontaneous reduction or self-reduction	Deformity consistent with unreduced dislocation
Infection	Diabetes Persistent, severe shoulder pain History of systemic symptoms of infection History of immunosuppression (transplant, chemotherapy, HIV)	Limited range of motion due to severe pain Systemic signs of sepsis (elevated temperature, chills, hypotension, tachycardia)
Tumor	Pain at rest History of smoking History of cancer (especially lung) History of immunosuppression (transplant, chemotherapy, HIV)	Palpable mass Tumor vessels
Progressive neurologic compromise	History of neurologic disease History of diabetes Degenerative disk disease Trauma	Decreased upper-extremity sensation, motor strength, and/or reflexes
Progressive vascular compromise	History of vascular disease History of diabetes History of atherosclerotic History of syphilis History of dislocation, fracture, etc. History of high-impact collision	Decreased pulses in the upper extremities Cold, pulseless extremity Pain-free full range of motion Differential blood pressure in upper extremities Bruit (with thoracic aortic aneurysm)

Table 9-1. (continued)

Disorder	Medical History	Physical Examination
Cardiac condition	History of angina or coronary disease History of cardiac risk factors (smoking, high cholesterol, high blood pressure, obesity) Family history of heart disease	S3 or S4 heart sounds Arrhythmia Cold, clammy skin Apprehension Hypotension Pain-free full ROM
Subdiaphragmatic conditions	History of subdiaphragmatic condition (gallbladder or liver disorder, perihepatitis, PID, or cervicitis)	Tender right upper quadrant Palpable mass in right upper quadrant Evidence of pelvic infection
Acute rotator cuff tear in a young worker	Heavy lifting Sudden pull Pain in shoulder with overhead work Fall on outstretched arm	Weakness of abduction with thumbs down Weakness of external rotation Weakness on supra- and infraspinatus tests Weakness on elevation and external rotation

1. PREVIOUS SHOULDER PROBLEMS

- Have you had similar episodes previously (prior to the recent episode of this condition)?
- What investigations were conducted with prior episodes of this shoulder condition.
- What treatment did you have with prior episodes of this shoulder condition.

2. SYMPTOM ONSET

- When did your current limitations begin?
- Do you recall a specific inciting event?
- Was there an acute event that triggered the pain or limitation of motion?
- How did it occur?
- How did the limitations develop?

3. PROGRESS OF SHOULDER CONDITION

- Have your symptoms changed?
- How long have your activities been limited?
- What investigations and x-rays have you had?
- Have you had specialist consultations.
- What treatments have you had so far, including medication?

4. PRESENT SYMPTOMS

- Are you experiencing pain, weakness, popping, or limited motion in your shoulder?
- Are your symptoms located primarily in the shoulder joint?
- Do you have pain or other symptoms elsewhere (e.g., neck, chest, or abdomen)?
- Are your symptoms constant or intermittent?
- What makes the problem worse or better?
- Is your shoulder pain associated with pain, numbness, tingling, swelling, or color change in the hand or arm?

5. PRESENT SHOULDER CAPABILITIES

- Can you do overhead work?
- For how long can you perform overhead work?
- How much weight can you lift?
- Can you move your shoulder without pain?
- Can you sleep on the affected shoulder?
- Do you have weakness in your hand, arm, or shoulder?
- Have you noticed any loss of muscle mass?

6. JOB DEMANDS

- What are your specific job duties.
- Shoulder activities at work:
 - What postures and activities are required at work.
 - Are there job duties requiring shoulder activity.
 - How often are shoulder activities required?

7. OFF-THE-JOB ACTIVITIES (AVOCATIONAL ACTIVITIES)

- What other activities (hobbies, workouts, sports) do you do at home or elsewhere?
- Do you use your shoulder to perform these activities?
- Do you do any overhead arm actions? How? How Often?

8. DO YOU HAVE OTHER MEDICAL PROBLEMS?

- Do you have heart disease?
- Do you have gallbladder disease or any other digestive or liver disorder?
- Do you have vaginal discharge (in women)?
- Do you have neck pain or trauma?
- Have you ever had cancer?
- Do you smoke?

9. WHAT ARE YOUR GOALS IN RELATION TO THIS SHOULDER PROBLEM?

Physical Examination

Based on the medical history, the physical examination includes:

- General observation of the patient
- General level of fitness and physical condition
- Regional examination of the neck and shoulder girdle
- Neurovascular screening

The examination is mostly subjective, because the patient must exert voluntary effort or state a response to the sensory findings on the examination. In many cases of shoulder problems, there are no objective findings, but only painful range of motion (ROM), tenderness, or stiffness in the shoulder. Frozen shoulder or signs of infection or deformity due to fracture or dislocation may be present, but these causes are much less common than nonspecific pain, impingement syndrome, rotator cuff tendinitis, or rotator cuff tears (in that order). The clinician needs to be aware that a patient with a shoulder complaint but painless full range of motion of the shoulder may be experiencing referred pain.

A. Regional Shoulder Examination

A shoulder examination includes the neck region as well as the shoulder. Ask the patient to point to the area of discomfort with one finger. The range of motion of the shoulder should be determined actively and passively. The examiner may determine passive ROM by eliminating gravity in the pendulum position or by using the other arm to aid elevation. Atrophy of the deltoid or scapular muscles is an objective finding but arises only after weeks to months of symptoms. Deformities due to AC separations are visible, objective findings, as are signs of infection (elevated temperature, redness, heat, fluctuance) or gross tumor (visible vessels, palpable mass). The impingement sign of Neer and the modified impingement sign of Hawkins can be used to test for rotator cuff impingement. The apprehension test can be used to help detect dislocation (a positive test indicates glenohumeral instability, often due to previous dislocation). Strength of the supraspinatus and infraspinatus can be tested to diagnose rotator cuff tear or tendonopathy.

B. Neurologic and Vascular Screening

The neurologic and vascular status of the shoulder, proximal upper extremity, and neck can be assessed. Peripheral pulses in neutral and stress positions, edema and or color changes are assessed. The motor and sensory status of the shoulder and surrounding structures also can be assessed. Because C5 or C6 radiculopathy can present as shoulder pain or dysfunction, and soft tissue disorders of the neck also sometimes present as shoulder pain, examining the

neck and cervical nerve root function is also required. Thoracic outlet syndrome (TOS) has signs and symptoms of scalene tenderness, positive Tinel's sign over the brachial plexus, and positive maneuvers that provoke neurovascular signs and symptoms. Tests for TOS are of questionable value. Once all other diagnoses have been ruled out and TOS is suspected, referral to a specialist is recommended if invasive treatment is entertained as an option.

C. Assessing Red Flags

Physical examination evidence of septic arthritis, neurologic compromise, cardiac disease, or intra-abdominal pathology that correlates with the medical history and test results may indicate a need for immediate consultation. The consultations may further reinforce or reduce suspicions of tumor, infection, fracture, or dislocation. A medical history that suggests pathology originating in a part of the body other than the shoulder may warrant examining the cardiovascular and respiratory systems, abdomen, or other areas. Painless full ROM of the shoulder suggests referred pain.

Diagnostic Criteria

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If no red flags for serious conditions are present, then determine which common musculoskeletal disorder is present. The criteria presented in Table 9-2 follow the clinical thought process, from the mechanism of illness or injury to unique symptoms and signs of a particular disorder, and to test results, if any tests are needed to guide treatment at this stage.

Work-Relatedness

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A thorough work history is crucial to establishing work-relatedness. (See Chapter 2 for components of the work history.) Repetitive overhead work contributes to shoulder tendinitis or tendonopathy (see Table 9-1). Evidence of the work-relatedness of other entities discussed in this chapter, such as adhesive capsulitis, is not well delineated. Acute work-related trauma can be associated with rotator cuff tears, AC ligament strains, and AC separations.

Initial Care

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Pain relief is often a patient's first concern. Nonprescription analgesics may provide sufficient pain relief for most patients with acute and subacute symptoms. If treatment response is inadequate (i.e., if symptoms and activity limitations continue), prescribed pharmaceuticals or physical methods can be added. Comorbid conditions, side effects, cost, and provider and patient preferences

Table 9-2. Diagnostic Criteria for Non-red-flag Shoulder Conditions that Can Be Managed by Primary Care Physicians

Probable Diagnosis or Injury	Mechanism	Unique Symptoms	Unique Signs	Tests and Results
Nonspecific shoulder pain (ICD-9 719.41, 719.51, 726.0, 729.89)	No known specific mechanism Overuse relative to physical conditioning	Pain in shoulder	None	None indicated
Rotator cuff tear (ICD-9 727.61 [chronic], 727.61 [acute])	Heavy lifting Sudden pull Fall on out-stretched arm especially in > 30-year-old workers with preexisting degenerative changes Spontaneous in onset	Pain over the deltoid area with overhead work Weakness on elevation and external rotation of shoulder	Weakness of shoulder in “thumbs down” abduction Weak external rotation	MRI positive for acute tears in younger workers (preoperatively only) Arthrography positive for full-thickness tears (preoperatively only if MRI unavailable) MRI may show partial-thickness tears
Labral tear (ICD-9 718.01)	Direct trauma laterally to shoulder	Pain with movement	Instability	MRI positive for lateral tear
Impingement (ICD-9 718.91, 726.10, 726.11, 726.12, 726.19, 726.2)	Chronic rotator cuff degenerative changes May be exacerbated by repeated overhead work Acute irritation	Night pain in shoulder joint Nonradiating pain in deltoid area	Positive impingement sign Positive modified impingement sign	None indicated
Shoulder instability (ICD-9 718.81)	Congenital anatomic problem Trauma (rare)	Slipping Popping Feeling of instability “Dead arm” syndrome	Positive apprehension test Positive relocation test of Job	Positive stress films (weight bearing)
Recurrent dislocation (ICD-9 718.31) (nonacute)	Previous dislocation due to a fall or direct impact	Recurrent dislocation Fear of dislocation when shoulder is abducted in external rotation	Positive apprehension test	Radiographic films positive for dislocation if acute
AC joint strain (ICD-9 840.0)	Fall on top of shoulder	Pain over AC joint	Tender over AC joint	None indicated

Table 9-2. (continued)

Probable Diagnosis or Injury	Mechanism	Unique Symptoms	Unique Signs	Tests and Results
AC joint separation (ICD-9 831.04)	Fall on top of shoulder	Severe pain over AC joint	Deformity over AC joint (i.e., high-riding distal clavicle)	Weighted films show separation > 5 mm (typically not performed, because the disorder is clinically obvious and the test is painful)
Adhesive capsulitis (ICD-9 726.0)	Failed treatment or inactivity Idiopathic	Night pain in shoulder joint Lack of range of motion	Limited passive range of motion	MRI if diagnosis unclear (frozen shoulder)
Bursitis (ICD-9 727.3)	Overuse	Night pain	Tenderness over subacromial bursa	None indicated

Note: ICD-9 = International Classification of Diseases, 9th Edition.

guide the clinician's choice of recommendations. Table 9-3 summarizes comfort options.

- Instruction in home exercise. Except in cases of unstable fractures, acute dislocations, instability or hypermobility, patients can be advised to do early pendulum or passive ROM exercises at home. Instruction in proper exercise technique is important, and a few visits to a good physical therapist can serve to educate the patient about an effective exercise program.
- Manipulation by a manual therapist has been described as effective for patients with frozen shoulders. The period of treatment is limited to a few weeks, because results decrease with time. Scalene-stretching and trapezius-strengthening exercises have been found effective in relieving thoracic outlet compression symptoms.
- Physical modalities, such as massage, diathermy, cutaneous laser treatment, ultrasound treatment, transcutaneous electrical neurostimulation (TENS) units, and biofeedback are not supported by high-quality medical studies, but they may be useful in the initial conservative treatment of acute shoulder symptoms, depending on the experience of local physical therapists available for referral. Some medium quality evidence supports manual physical therapy, ultrasound, and high-energy extracorporeal shock wave therapy for calcifying tendinitis of the shoulder. Patients' at-home applications of heat or cold packs may be used before or after exercises and are as effective as those performed by a therapist. Initial use of less-invasive techniques provides an opportunity for the clinician to monitor progress before referral to a specialist.

Table 9-3. *Methods of Symptom Control for Patients with Shoulder Complaints*

RECOMMENDED		
Nonprescription Medications		
Acetaminophen (safest) NSAIDs (aspirin, ibuprofen)		
Nonprescribed Physical Methods		
Adjust or modify workstation after ergonomic assessment, job tasks, or work hours Stretching Specific shoulder exercises for ROM and strengthening Home, local application of cold during first few days of acute complaint; thereafter, then heat application Relaxation techniques		
Prescribed Pharmaceutical Methods		
NSAIDs Short course of narcotic analgesics for AC separation, if needed		
Prescribed Physical Methods		
Initial and follow-up visits for education, counseling, and evaluation of home exercise		
OPTIONS		
Impingement Syndrome	Nonspecific Shoulder Pain	Rotator Cuff Tear
Corticosteroid injection into subacromial bursa Global shoulder strengthening	Global shoulder strengthening Aerobic exercise	Refer young active workers with acute tears for surgical repair Sling for acute pain
Recurrent Dislocation	Shoulder Instability	AC Joint Strain or Separation
Rotator muscle strengthening	Global shoulder girdle strengthening	Sling for comfort

- Invasive techniques have limited proven value. If pain with elevation significantly limits activities, a subacromial injection of local anesthetic and a corticosteroid preparation may be indicated after conservative therapy (i.e., strengthening exercises and nonsteroidal anti-inflammatory drugs) for two to three weeks. The evidence supporting such an approach is not overwhelming. The total number of injections should be limited to three per episode, allowing for assessment of benefit between injections.
- Some small studies have supported using acupuncture, but referral is dependent on the availability of experienced providers with consistently good outcomes.

- If response to exercise is protracted, anterior scalene block has been reported to be efficacious in relieving acute thoracic outlet symptoms, and as an adjunct to diagnosis.
- Significant differences between traditional approaches and various alternative and multidisciplinary intervention programs for shoulder pain have not been demonstrated in the medical literature to date. Recommendations, prescription, or referral regarding such multidisciplinary programs or alternative care can be based on the practitioner's professional judgment and the patient's individual situation or condition. For example, the success of chiropractic manipulation is highly dependent on the patient's previous successful experience with chiropractors.

Activity Modification

Shoulder disorders may lead to joint stiffness more often than other joint disorders. Because patients with shoulder disorders tend to have stiffness followed by weakness and atrophy, careful advice regarding maximizing activities within the limits of symptoms is imperative, once red flags have been ruled out. If indicated, the joint can be kept at rest in a sling. Gentle exercise even during this time is desirable. Patients acutely should avoid activities that precipitate symptoms, but should continue general activities and motion. Therapeutic exercise, including strengthening, should start as soon as it can be done without aggravating symptoms. Patients usually can tolerate pendulum exercises even when discomfort is pronounced, and this method can preserve ROM.

Activities and postures that increase stress on the shoulder and contribute to structural damage tend to aggravate symptoms. Lifting and working at 90 degrees forward or sideways, as well as overhead work, can be proscribed or restricted during the first few weeks after onset of problems due to acute rotator cuff tear, AC joint strain or separation, and impingement syndrome.

Work Activities

Occupational clinicians often are asked to make specific recommendations about work activities for patients with acute limitations due to acute shoulder problems. Table 9-4 provides a guide for recommendations about activity modification. These guidelines are intended for patients without comorbidity or complicating factors, including employment or legal issues. They are targets to provide a guide from the perspective of physiologic recovery. The clinician can make it clear to patients and employers that:

- Even moderately heavy (more than 20 pounds) unassisted lifting or repeated work at "shoulder level" (90 degrees forward or sideways) or overhead may aggravate shoulder symptoms due to rotator cuff tears, inflammatory conditions, ligament damage, and impingement syndrome.

*Table 9-4. Guidelines for Modification of Work Activities and Disability Duration**

Disorder	Activity Modifications and Accommodation	Recommended Target for Disability Duration**		NHIS Experience Data***	
		With Modified Duty	Without Modified Duty	Median (cases with lost time)	Percent No Lost Time
Acute tears in rotator cuff in younger workers	Refer for possible repair. Avoid work at a 90-degree forward or sideways position, pushing, pulling, and heavy lifting if patient wishes to avoid surgical repair.	1-2 days	21 days	27 days	66%
Chronic tear in rotator cuff	Avoid work at a 90-degree forward or sideways position, pushing, pulling, and heavy lifting.	1-2 days	21 days	27 days	66%
Impingement syndrome	Avoid overhead work, pushing, pulling, and heavy lifting.	1 day	3-7 days	14 days	65%
Shoulder instability	Avoid pushing, pulling, and heavy lifting.	0 days	21 days	9 days	50%
Recurrent dislocation	Avoid overhead work, pushing, and pulling.	0 days	21 days	12 days	35%
AC joint strain	Avoid overhead work, pushing, and pulling.	1 day	3-7 days	14 days	23%
AC joint separation	Allow activity as tolerated, with arm in immobilizer.	7 days	21 days	14 days	18%
Regional shoulder pain	Allow all activities as tolerated; avoid those that aggravate symptoms but start range-of-motion exercises and conditioning.	0 days	3-7 days	4 days	49%

* These are general guidelines based on consensus or population sources and are never meant to be applied to an individual case without consideration of workplace factors, concurrent disease or other social or medical factors that can affect recovery.

** These parameters for disability duration are “consensus optimal” targets as determined by a panel of ACOEM members in 1996, and reaffirmed by a panel of ACOEM members in 2002. In most cases persons with one nonsevere extremity injury can return to modified duty immediately. Restrictions should take into consideration the opposite extremity also to prevent strain injuries to the uninjured extremity.

*** Based on the CDC NHIS (National Health Interview Survey), as compiled and reported in the 8th annual edition of *Official Disability Guidelines (ODG)*, © 2002 Work Loss Data Institute, all rights reserved.

- Any restrictions are intended to allow for spontaneous recovery or time to build activity tolerance through exercise.

Assist the patient in avoiding aggravating activities by reviewing work activities and responsibilities to decide whether modifications can be accomplished and to determine whether modified activity is an option. To aid recovery, make every attempt to maintain the patient at sufficient levels of activity, including work, hobbies, and sports activities.

Follow-up Visits

Patients with shoulder complaints can have follow-up every three to five days by an appropriate health professional who can counsel them about avoiding static positions, medication use, activity modification, and other concerns. The practitioner should take care to answer questions and make these sessions interactive so that the patient is fully involved in his or her recovery. If the patient has returned to work, these interactions may be done on site or by telephone.

Physician follow-up generally occurs when a release to modified, increased, or full activity is needed, or after appreciable healing or recovery can be expected, on average. Physician follow-up might be expected every four to seven days if the patient is off work and every seven to fourteen days if the patient is working.

Special Studies and Diagnostic and Treatment Considerations

For most patients with shoulder problems, special studies are not needed unless a four- to six-week period of conservative care and observation fails to improve symptoms. Most patients improve quickly, provided red-flag conditions are ruled out. There are a few exceptions:

- Stress films of the AC joints (views of both shoulders, with and without patient holding 15-lb weights) may be indicated if the clinical diagnosis is AC joint separation. Care should be taken when selecting this test because the disorder is usually clinically obvious, and the test is painful and expensive relative to its yield.
- If an initial or recurrent shoulder dislocation presents in the dislocated position, shoulder films before and after reduction are indicated.
- Persistent shoulder pain, associated with neurovascular compression symptoms (particularly with abduction and external rotation), may indicate the need for an AP cervical spine radiograph to identify a cervical rib.

Routine testing (laboratory tests, plain-film radiographs of the shoulder) and more specialized imaging studies are not recommended during the first month to six weeks of activity limitation due to shoulder symptoms, except when a red flag noted on history or examination raises suspicion of a serious shoulder condition or referred pain. Cases of impingement syndrome are managed the same regardless of whether radiographs show calcium in the rotator cuff or degenerative changes are seen in or around the glenohumeral joint or AC joint. Suspected acute tears of the rotator cuff in young workers may be surgically repaired acutely to restore function; in older workers, these tears are typically treated conservatively at first. Partial-thickness tears should be treated the same as impingement syndrome regardless of magnetic resonance

imaging (MRI) findings. Shoulder instability can be treated with stabilization exercises; stress radiographs simply confirm the clinical diagnosis. For patients with limitations of activity after four weeks and unexplained physical findings, such as effusion or localized pain (especially following exercise), imaging may be indicated to clarify the diagnosis and assist reconditioning. Imaging findings can be correlated with physical findings.

Primary criteria for ordering imaging studies are:

- Emergence of a red flag (e.g., indications of intra-abdominal or cardiac problems presenting as shoulder problems)
- Physiologic evidence of tissue insult or neurovascular dysfunction (e.g., cervical root problems presenting as shoulder pain, weakness from a massive rotator cuff tear, or the presence of edema, cyanosis or Raynaud's phenomenon)
- Failure to progress in a strengthening program intended to avoid surgery.
- Clarification of the anatomy prior to an invasive procedure (e.g., a full-thickness rotator cuff tear not responding to conservative treatment)

Laboratory studies, such as liver function tests, tests of gallbladder function, and tests for pelvic disease may be useful to determine if pain is being referred to the shoulder from a subdiaphragmatic source. Electrocardiography, and possibly cardiac enzyme studies, may be needed to clarify apparent referred cardiac pain. Chest radiographs may be needed to elucidate shoulder pain that could be the result of pneumothorax, apical lung tumor, or other apical disease such as tuberculosis. An erythrocyte sedimentation rate (ESR), complete blood count (CBC), and tests for autoimmune diseases (such as rheumatoid factor) can be useful to screen for inflammatory or autoimmune sources of joint pain. All of these tests can be used to confirm clinical impressions, rather than purely as screening tests in a "shotgun" attempt to clarify reasons for unexplained shoulder complaints.

Anatomic definition by means of imaging is commonly required to guide surgery or other procedures. A discussion with a specialist on selecting the most clinically valuable study can often help the primary care physician avoid duplication. Table 9-5 compares the abilities of different imaging techniques to identify physiologic insult and define anatomic defects. Selecting an imaging test takes into consideration any patient allergies to contrast materials (used in arthrography or contrast computer tomography [CT]), or concerns about claustrophobia (sometimes a problem in patients undergoing MRI), and costs.

Imaging may be considered for a patient whose limitations due to consistent symptoms have persisted for one month or more, i.e., in cases:

- When surgery is being considered for a specific anatomic defect (e.g., a full-thickness rotator cuff tear). Magnetic resonance imaging and arthrography have fairly similar diagnostic and therapeutic impact and comparable accuracy although MRI is more sensitive and less specific.

Table 9-5. Ability of Various Techniques to Identify and Define Shoulder Pathology

Technique	Impingement Syndrome	Rotator Cuff Tear	Instability	Recurrent Dislocation	Regional Pain	Tumor	Infection
History	++	+	++	+++	+	0	++
Physical examination	+++	++	+++	++	+	0	+++
Laboratory studies	0	0	0	0	0	++	+++
Imaging studies							
Radiography ¹	+	+	+	++	0	++	++
Bone scan ¹	0	0	0	0	0	++++	+++
Arthrography ¹	0	++++	0	+	0	0	+
Computed tomography (CT) ¹	0	0	0	++	0	++	++
Magnetic resonance imaging (MRI) ¹	+	++++	0	++	0	+++	+++

¹ Risk of complications, e.g., infection, radiation, highest for contrast CT or arthrography; second highest for, and relatively less for, bone scan, radiography, and CT; lowest for MRI.

Note: Number of plus signs indicates relative ability to identify or define pathology.

Magnetic resonance imaging may be the preferred investigation because it demonstrates soft tissue anatomy better.

- To further evaluate the possibility of potentially serious pathology, such as a tumor.

Selecting specific imaging equipment and procedures will depend on the availability and experience of local referrals.

Relying only on imaging studies to evaluate the source of shoulder symptoms carries a significant risk of diagnostic confusion (false-positive test results) because of the possibility of identifying a finding that was present before symptoms began (for example, degenerative partial thickness rotator cuff tears), and therefore has no temporal association with the symptoms.

Surgical Considerations

Referral for surgical consultation may be indicated for patients who have:

- Red-flag conditions (e.g., acute rotator cuff tear in a young worker, glenohumeral joint dislocation, etc.)
- Activity limitation for more than four months, *plus* existence of a surgical lesion
- Failure to increase ROM and strength of the musculature around the shoulder even after exercise programs, *plus* existence of a surgical lesion
- Clear clinical and imaging evidence of a lesion that has been shown to benefit, in both the short and long term, from surgical repair

Surgical considerations depend on the working or imaging-confirmed diagnosis of the presenting shoulder complaint. If surgery is a consideration, counseling regarding likely outcomes, risks and benefits, and expectations, in particular, is very important. If there is no clear indication for surgery, referring the patient to a physical medicine practitioner may help resolve the symptoms.

For postsurgical rehabilitation, key indicators for further assessment and treatment include:

- Prolonged course
- Multiple surgical procedures
- Use of narcotic medications

A. Acromioclavicular (AC) Joint Separation

Patients with AC joint separation may be treated conservatively. The expected period of pain is three weeks, with the pain gradually decreasing. If pain persists after recovery and return to activities, resection of the outer clavicle may be indicated after six months to one year, although local cortisone injections can be tried. The initial deformity decreases as healing and scar contracture take place. In one series, 79% of patients with moderate-to-severe AC separations had good-to-excellent late results with nonoperative treatment, and of the remainder, 90% had good-to-excellent results with simple excision of the outer clavicle.

B. Rotator Cuff Tear

Rotator cuff repair is indicated for significant tears that impair activities by causing weakness of arm elevation or rotation, particularly acutely in younger workers. Rotator cuff tears are frequently partial-thickness or smaller full-thickness tears. For partial-thickness rotator cuff tears and small full-thickness tears presenting primarily as impingement, surgery is reserved for cases failing conservative therapy for three months. The preferred procedure is usually arthroscopic decompression, which involves debridement of inflamed tissue, burring of the anterior acromion, lysis and, sometimes, removal of the coracoacromial ligament, and possibly removal of the outer clavicle. Surgery is not indicated for patients with mild symptoms or those whose activities are not limited.

Lesions of the rotator cuff are a continuum, from mild supraspinatus tendon degeneration to complete ruptures. Studies of normal subjects document the universal presence of degenerative changes and conditions, including full avulsions without symptoms. Conservative treatment has results similar to surgical treatment but without surgical risks. Studies evaluating results of conservative treatment of full-thickness rotator cuff tears have shown an 82-86% success rate for patients presenting within three months of injury. The efficacy of arthroscopic decompression for full-thickness tears depends on the

size of the tear; one study reported satisfactory results in 90% of patients with small tears. A prior study by the same group reported satisfactory results in 86% of patients who underwent open repair for larger tears. Surgical outcomes of rotator cuff tears are much better in younger patients than in older patients who may be suffering from degenerative changes in the rotator cuff.

C. Shoulder Dislocation

Multiple traumatic shoulder dislocations indicate the need for surgery if the shoulder has limited functional ability and if muscle strengthening fails. In the acute phase, shoulder dislocations can be immobilized for up to three weeks although recommendations for immobilization for a period as short as three days have appeared in the literature. If shoulder instability is present only with violent forceful overhead activity, activity modification is recommended. Surgery can be considered for patients who are symptomatic with all overhead activities and patients who have had two or three episodes of dislocation and instability that limited their activity between episodes. Rates of instability recurrence after surgery have been reported as 8% after open repair for anterior instability and 10% after arthroscopic anterior repair. A high incidence of rotator cuff tears accompanying anterior shoulder dislocations occurs in patients 40 years old or older. Although the dislocation recurrence rate is very low, persistent weakness several weeks after a primary dislocation dictates further study to define the anatomy of the rotator cuff.

D. Impingement Syndrome

Surgery for impingement syndrome is usually arthroscopic decompression. This procedure is not indicated for patients with mild symptoms or those who have no activity limitations. Conservative care, including cortisone injections, can be carried out for at least three to six months before considering surgery. Because this diagnosis is on a continuum with other rotator cuff conditions, including rotator cuff syndrome and rotator cuff tendinitis, also refer to the previous discussion of rotator cuff tears.

E. Ruptured Biceps Tendon

Ruptures of the proximal (long head) of the biceps tendon are usually due to degenerative changes in the tendon. It can almost always be managed conservatively because there is no accompanying functional disability. Surgery may be desired for cosmetic reasons, especially by young bodybuilders, but is not necessary for function.

F. Thoracic Outlet Compression Syndrome

Most patients with acute thoracic outlet compression symptoms will respond to a conservative program of global shoulder strengthening (with specific

exercises) and ergonomic changes. While not well supported by high-grade scientific studies, cases with progressive weakness, atrophy, and neurologic dysfunction are sometimes considered for surgical decompression. A confirmatory response to electromyography (EMG)-guided scalene block, confirmatory electrophysiologic testing and/or magnetic resonance angiography with flow studies is advisable before considering surgery.

Summary of Recommendations and Evidence

See Table 9-6.

Table 9-6. Summary of Recommendations for Evaluating and Managing Shoulder Complaints

Clinical Measure	Recommended	Optional	Not Recommended
History and physical exam	Focused history and exam Search for red flags (e.g., for tumor, infection, angina) (C)		
Patient education	Patient education regarding condition or disorder, expectations of treatment, side effects, etc. (D)		
Medication (See Chapter 3)	Acetaminophen (C) NSAIDs (B)	Opioids, short course (C)	Use of opioids for more than 2 weeks (C) Muscle relaxants (D)
Physical treatment methods, activities and exercise	Maintain activities of other parts of body while recovering (D) Maintain passive range of motion of the shoulder with pendulum exercises and wall crawl (D) Treat initially with strengthening or stabilization exercises for impingement syndrome, rotator cuff tear, instability, and recurrent dislocation (C, D)	At-home applications of heat or cold packs to aid exercises (D) Short course of supervised exercise instruction by a therapist (D)	Passive modalities by a therapist (unless accompanied by teaching the patient exercises to be carried out at home) (D)

Table 9-6. (continued)

Clinical Measure	Recommended	Optional	Not Recommended
Injections	Two or three sub-acromial injections of local anesthetic and cortisone preparation over an extended period as part of an exercise rehabilitation program to treat rotator cuff inflammation, impingement syndrome, or small tears (C, D) Diagnostic lidocaine injections to distinguish pain sources in the shoulder area (e.g., impingement) (D)		Prolonged or frequent use of cortisone injections into the sub-acromial space or the shoulder joint (D)
Rest and immobilization	Brief use of a sling for severe shoulder pain (1 to 2 days), with pendulum exercises to prevent stiffness in cases of rotator cuff conditions (D) Three weeks use, or less, of a sling after an initial shoulder dislocation and reduction (C) Same for AC separations or severe sprains (D)		Prolonged use of a sling only for symptom control (D)
Detection of physiologic abnormalities	Rarely, nerve conduction time of the suprascapular nerve for cases of severe cuff weakness unaccompanied by signs of a rotator cuff tear (D)		EMG or NCV studies as part of a shoulder evaluation for usual diagnoses (D)

Table 9-6. (continued)

Clinical Measure	Recommended	Optional	Not Recommended
Radiography		For acute AC joint separations, stress films (views of both shoulders, with and without patient holding 15-lb weights) (D)	Routine radiographs for shoulder complaints before 4 to 6 weeks of conservative treatment (D) Stress films for instability (D)
Other imaging procedures	MRI for preoperative evaluation of partial-thickness or large full-thickness rotator cuff tears (C, D)	Arthrography for preoperative evaluation of small full-thickness tears (C) Bone scan for detection of AC joint arthritis (D)	Routine MRI or arthrography for evaluation without surgical indications (D) Ultrasonography for evaluation of rotator cuff (C)
Surgical considerations	Anterior repair for recurrent dislocation after 2 to 3 dislocations (D) Resection of outer clavicle for chronic disabling AC joint pain after conservative care of acute separation (C) Rotator cuff repair after firm diagnosis is made and rehabilitation efforts have failed (D) Capsular shift surgery for disabling instability (D) Subacromial decompression after failure of non-operative care (C)		Anterior repair for initial shoulder dislocation (C) Acute repair of AC separation (C) Acute repair of rotator cuff tears, except for massive acute tears (C) Surgery for recurrent dislocation of instability before rehabilitation efforts (C)

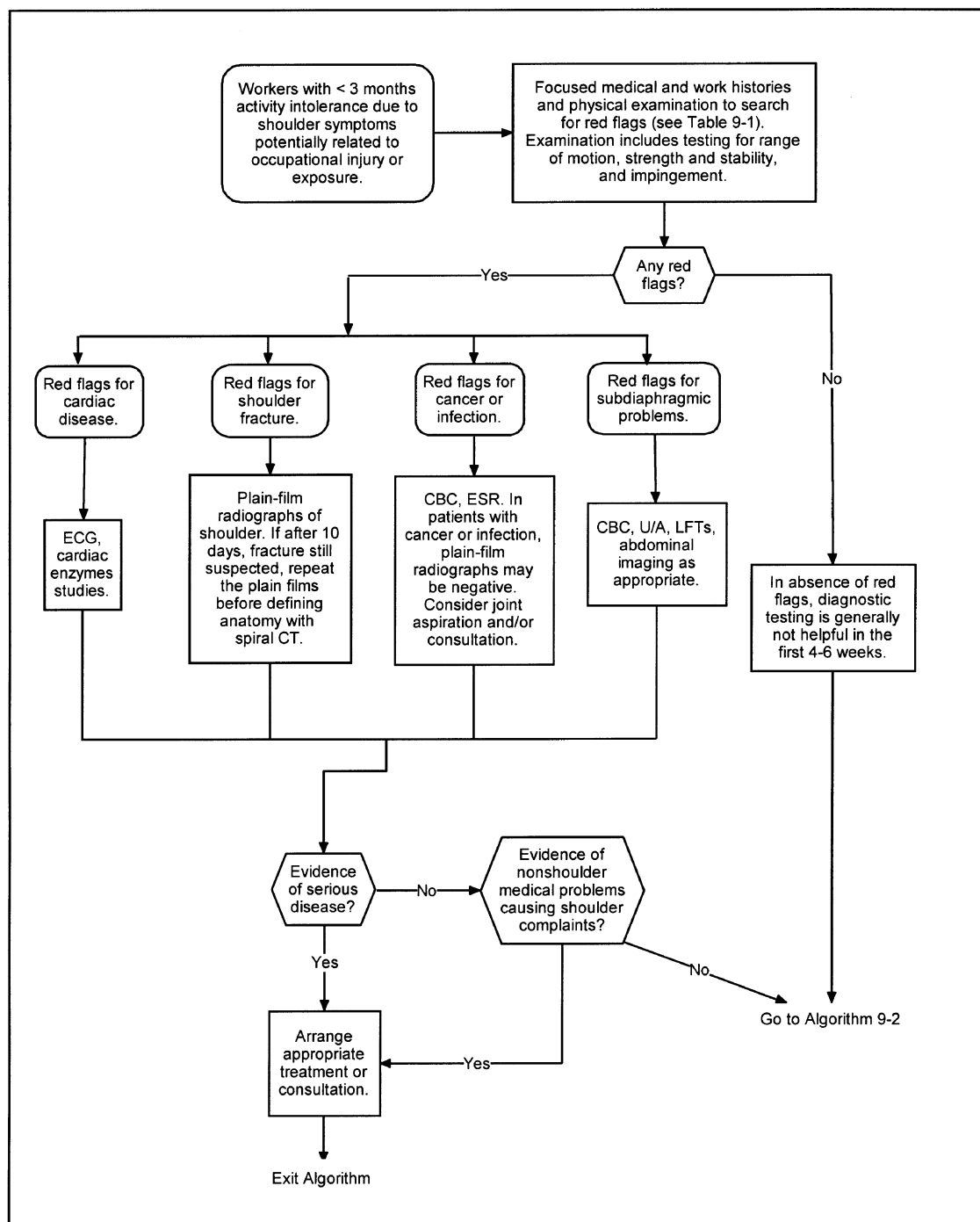
A = Strong research-based evidence (multiple relevant, high-quality scientific studies).

B = Moderate research-based evidence (one relevant, high-quality scientific study or multiple adequate scientific studies).

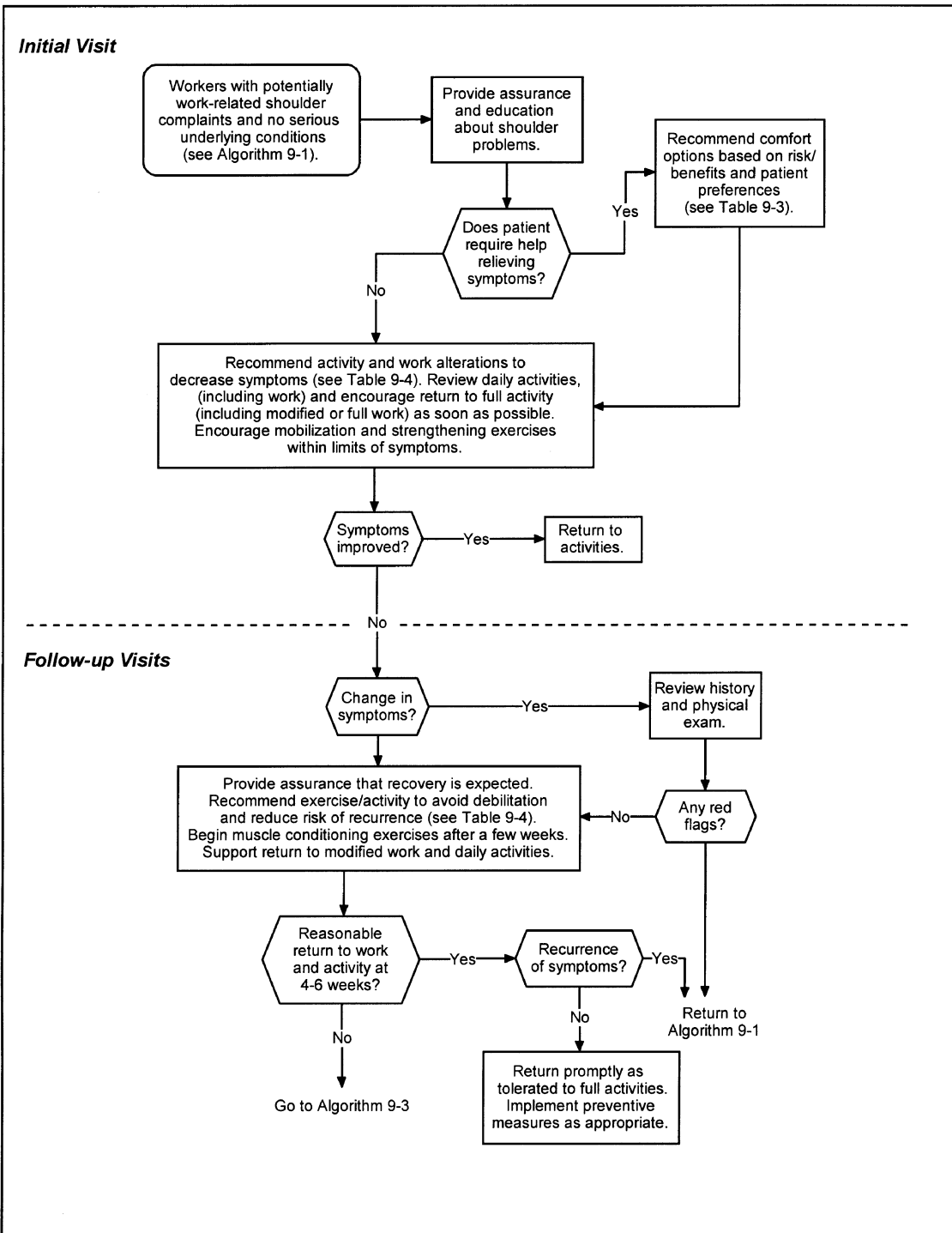
C = Limited research-based evidence (at least one adequate scientific study of patients with shoulder disorders).

D = Panel interpretation of information not meeting inclusion criteria for research-based evidence.

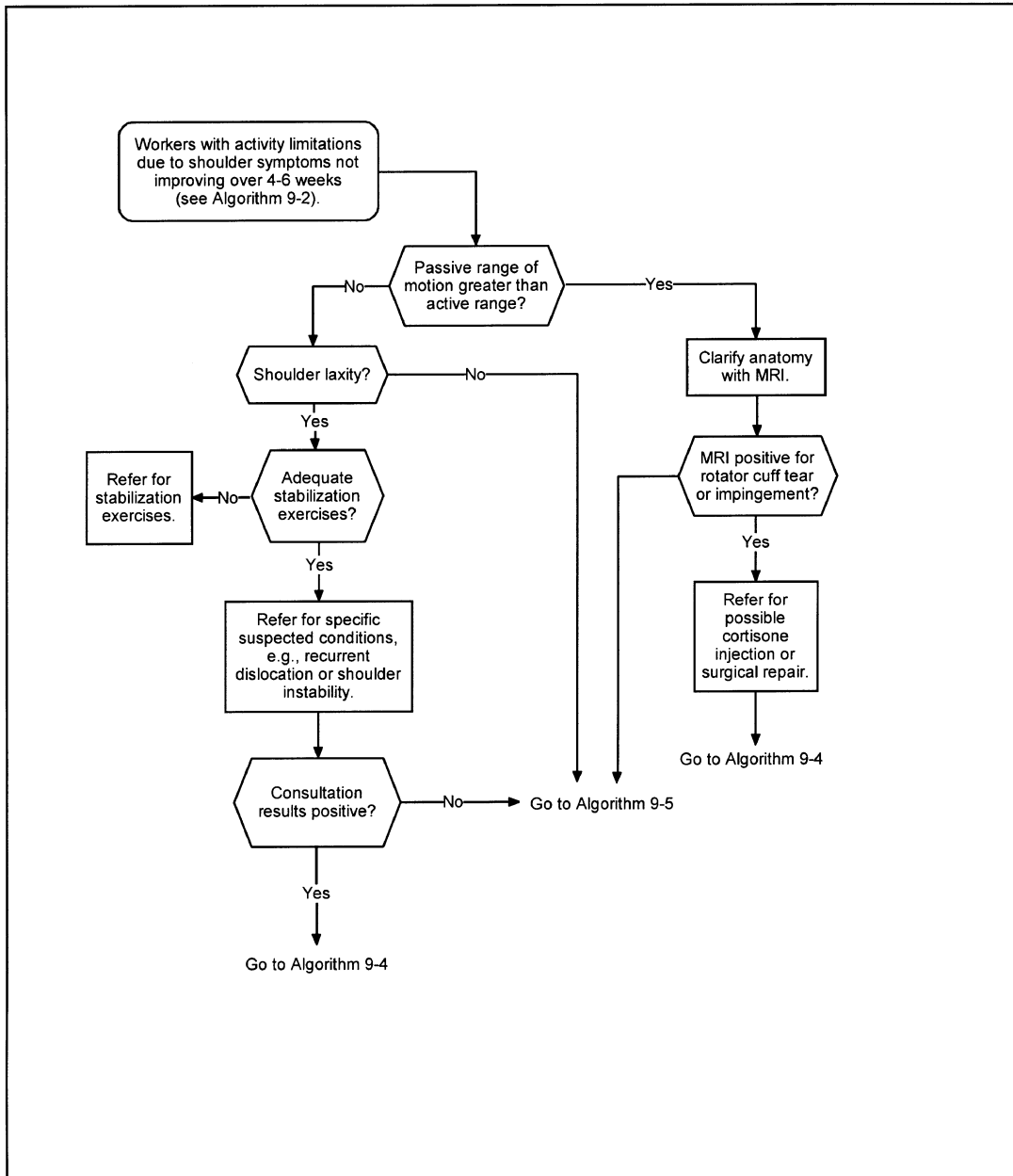
Algorithm 9-1. Initial Evaluation of Occupational Shoulder Complaints



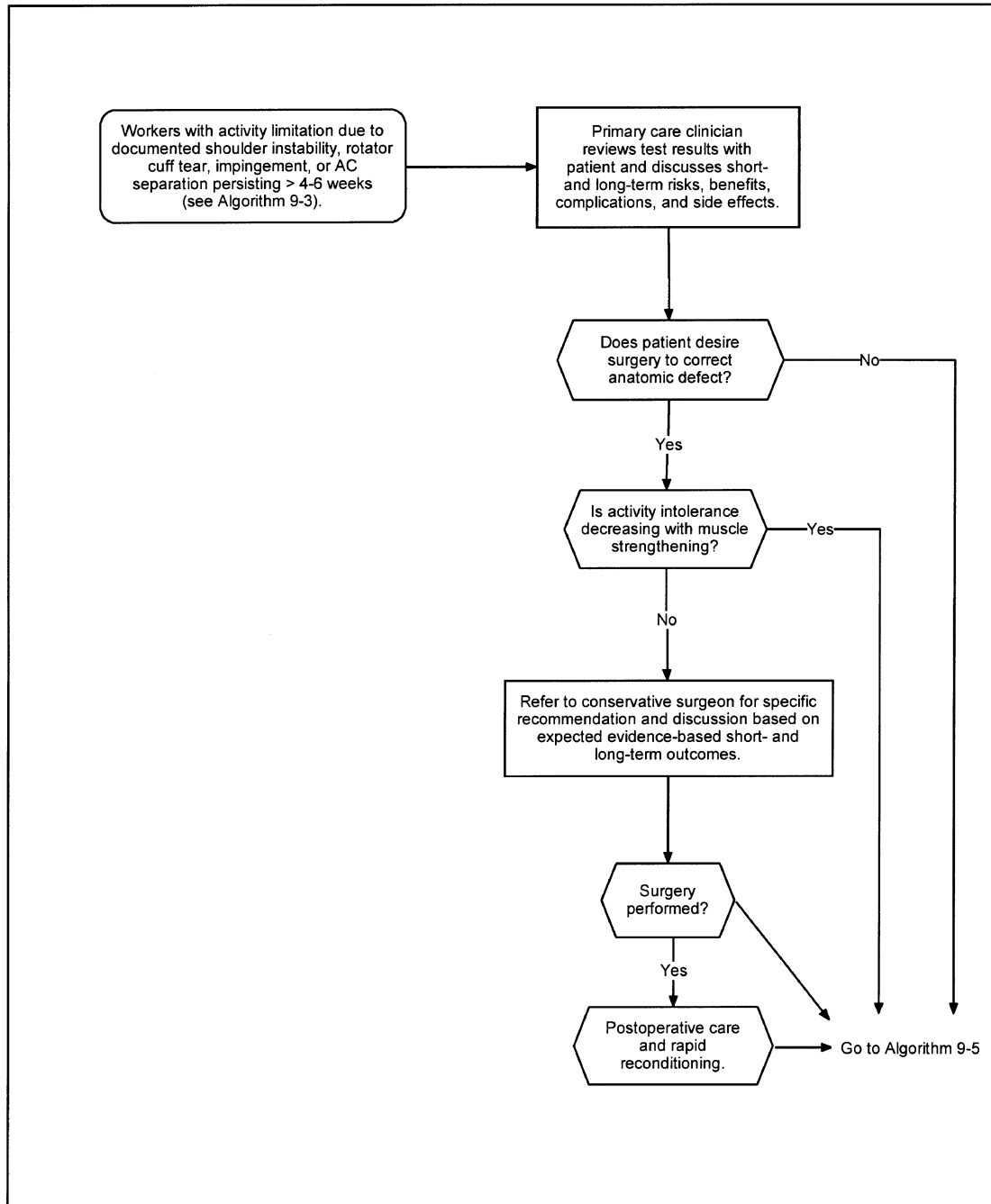
Algorithm 9-2. Initial and Follow-up Management of Occupational Shoulder Complaints



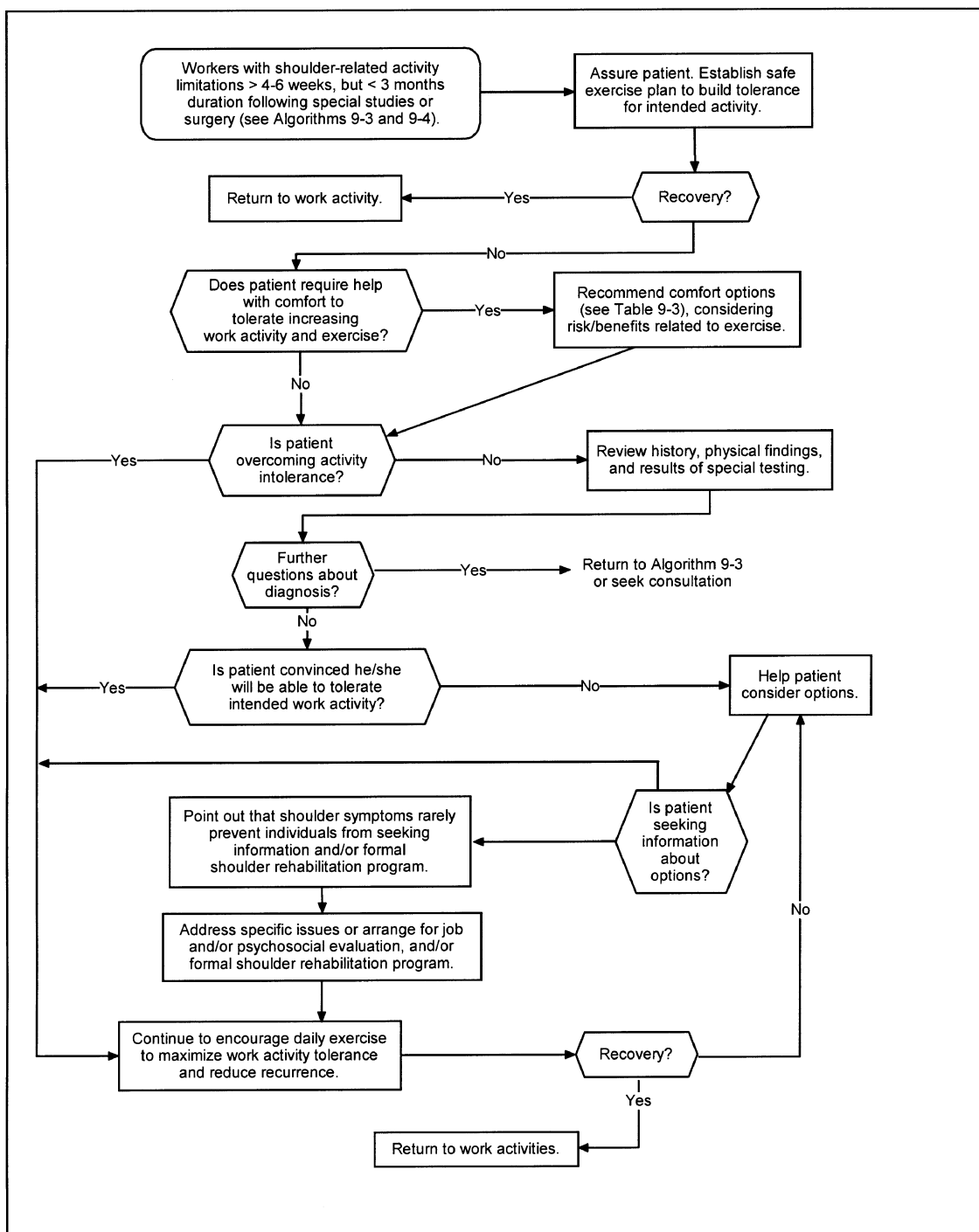
Algorithm 9-3. Evaluation of Slow-to-recover Patients with Occupational Shoulder Complaints (Symptoms > 4 Weeks)



Algorithm 9-4. Surgical Considerations for Patients with Anatomic and Physiologic Evidence of Shoulder Instability, Complete Rotator Cuff Tear, or Impingement Syndrome Coupled with Persistent Complaints



Algorithm 9-5. Further Management of Occupational Shoulder Complaints



References

HISTORY AND PHYSICAL EXAMINATION

- Boon AJ, Smith J. Manual scapular stabilization: its effect on shoulder rotational range of motion. *Arch Phys Med Rehabil.* 2000;81(7):978-83.
- Gockel M, Lindholm H, Vastamaki M, Lindqvist A, Viljanen A. Cardiovascular functional disorder and distress among patients with thoracic outlet syndrome. *J Hand Surg [Br].* 1995;20(1):29-33.
- Hawkins RJ, Abrams JS. Impingement syndrome in the absence of rotator cuff tear (stages 1 and 2). *Orthop Clin North Am.* 1987;18:375.
- Hayes K, Walton JR, Szomor ZR, Murrell GA. Reliability of five methods for assessing shoulder range of motion. *Aust J Physiother.* 2001;47(4):289-94.
- Jordan SE, Machleder HI. Diagnosis of thoracic outlet syndrome using electrophysiologically guided anterior scalene blocks. *Ann Vasc Surg.* 1998;12(3):260-4.
- Laursen B, Jensen BR. Shoulder muscle activity in young and older people during a computer mouse task. *Clin Biomech (Bristol, Avon).* 2000;15; Suppl;1:S30-3.
- Lyons, AR, Tomlinson JE. Clinical diagnosis of tears of the rotator cuff. *J Bone Joint Surg [Br].* 1992;74(3):414-5.
- Neer CS, Welsh RP. The shoulder in sports. *Orthop Clin North Am.* 1977;8:583-91.
- Pascarella EF, Hsu YP. Understanding work-related upper extremity disorders: clinical findings in 485 computer users, musicians, and others. *J Occup Rehabil.* 2001;11(1):1-21.
- Plewa MC, Delinger M. The false-positive rate of thoracic outlet syndrome shoulder maneuvers in healthy subjects. *Acad Emerg Med.* 1998;5(4):337-42.
- Roddey TS, Olson SL, Cook KF, Gartsman GM, Hanten W. Comparison of the University of California-Los Angeles shoulder scale and the simple shoulder test with the shoulder pain and disability index: single-administration reliability and validity. *Phys Ther.* 2000;80(8):759-68.

MEDICATION

See Chapter 3 references.

- van der Windt DA, van der Heijden GJ, Scholten RJ, Koes BW, Bouter LM. The efficacy of nonsteroidal anti-inflammatory drugs (NSAIDs) for shoulder complaints. A systematic review. *J Clin Epidemiol.* 1995;48(5):691-704.

PHYSICAL TREATMENT METHODS

- Anderson NH, Sojbjerg JO, Johannsen HV, Sneppen O. Self-training versus physiotherapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study. *J Shoulder Elbow Surg.* 1999;8(2):99-101.

- Aronen JG, Regan K. Decreasing the incidence of recurrence of first-time anterior shoulder dislocations with rehabilitation. *Am J Sports Med.* 1984; 12:382-91.
- Bang MD, Deyle GD. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *J Orthop Sports Phys Ther.* 2000;30(3):126-37.
- Bartolozzi A, Andreychik D, Ahmad S. Determinants of outcome in the treatment of rotator cuff disease. *Clin Orthop.* 1994;308:90-7.
- Brox JI, Staff PH, Ljunggren AE. Arthroscopic surgery compared with supervised exercises in patients with rotator cuff disease (stage II impingement syndrome). *Br Med J.* 1993;307:899-903.
- Ebenbichler GR, Erdogmus CB, Resch KL, et al. Ultrasound therapy for calcific tendinitis of the shoulder. *N Engl J Med.* 1999;340(20):1533-8.
- Hagberg M, Harms-Ringdahl K, Nisell R, Hjelm EW. Rehabilitation of neck-shoulder pain in women industrial workers: a randomized trial comparing isometric shoulder endurance training with isometric shoulder strength training. *Arch Phys Med Rehabil.* 2000;81(8):1051-8.
- Horneij E, Hemborg B, Jensen I, Ekdahl C. No significant differences between intervention programmes on neck, shoulder and low back pain: a prospective randomized study among home-care personnel. *J Rehabil Med.* 2001;33(4):170-6.
- Jensen I, Nygren A, Gamberale F, Goldie I, Westerholm P, Jonsson E. The role of the psychologist in multidisciplinary treatments for chronic neck and shoulder pain: a controlled cost-effectiveness study. *Scand J Rehabil Med.* 1995;27(1):19-26.
- Karjalainen K, Malmivaara A, van Tulder M, et al. Multidisciplinary biopsychosocial rehabilitation for neck and shoulder pain among working age adults: a systematic review within the framework of the Cochrane Collaboration Back Review Group. *Spine.* 2001;26(2):174-81.
- Kivimaki J, Pohjolainen T. Manipulation under anesthesia for frozen shoulder with and without steroid injection. *Arch Phys Med Rehabil.* 2001;82(9):1188-90.
- Kleinhenz J, Streitberger K, Windeler J, Gussbacher A, Mavridis G, Martin E. Randomised clinical trial comparing the effects of acupuncture and a newly designed placebo needle in rotator cuff tendinitis. *Pain.* 1999; 83(2):235-41.
- Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for shoulder pain. *Phys Ther.* 2001;81(10):1719-30.
- Sun KO, Chan KC, Lo SL, Fong DY. Acupuncture for frozen shoulder. *Hong Kong Med J.* 2001;7(4):381-91.
- van der Heijden GJ, Leffers P, Wolters PJ, et al. No effect of bipolar interferential electrotherapy and pulsed ultrasound for soft tissue shoulder disorders: a randomised controlled trial. *Ann Rheum Dis.* 1999;58(9):530-40.
- van der Windt DA, Koes BW, Deville W, Boeke AJ, de Jong BA, Bouter LM. Effectiveness of corticosteroid injections versus physiotherapy for

- treatment of painful stiff shoulder in primary care: randomised trial. *BMJ* 1998;317(7168):1292-6.
- van der Windt DA, van der Heijden GJ, van den Berg SG, ter Riet G, de Winter AF, Bouter LM. Ultrasound therapy for musculoskeletal disorders: a systematic review. *Pain*. 1999;81(3):257-71.
- Winters JC, Jorritsma W, Groenier KH, Sobel JS, Meyboom-de Jong B, Arendzen HJ. Treatment of shoulder complaints in general practice: long term results of a randomised, single-blind study comparing physiotherapy, manipulation, and corticosteroid injection. *BMJ*. 1999;318(7195):1395-6.

INJECTIONS

- Arslan S, Celiker R. Comparison of the efficacy of local corticosteroid injection and physical therapy for the treatment of adhesive capsulitis. *Rheumatol Int*. 2001;21(1):20-3.
- Bokor DJ, Hawkins RJ, Huckell GH, et al. Results of nonoperative management of full-thickness tears of the rotator cuff. *Clin Orthop*. 1993;294:103-10.
- Dahan TH, Fortin L, Pelletier M, Petit M, Vadeboncoeur R, Suissa S. Double-blind randomized clinical trial examining the efficacy of bupivacaine suprascapular nerve blocks in frozen shoulder. *J Rheumatol*. 2000;27(6):1464-9.
- Green S, Buchbinder R, Glazier R, Forbes A. Interventions for shoulder pain (Cochrane Review). In: *The Cochrane Library*. Issue 1; 2002. Oxford: Update Software.
- Itoi E, Tabata S. Conservative treatment of rotator cuff tears. *Clin Orthop*. 1992;275:165-73.
- Jones DS, Chattopadhyay C. Suprascapular nerve block for the treatment of frozen shoulder in primary care: a randomized trial. *Br J Gen Pract*. 1999;49(438):39-41.
- Pons S, Gallardo C, Caballero J, Martinez T. Transdermal nitroglycerin versus corticosteroid infiltration for rotator cuff tendinitis [Article in Spanish]. *Aten Primaria*. 2001;28(7):452-5.
- Rovetta G, Monteforte P. Intraarticular injection of sodium hyaluronate plus steroid versus steroid in adhesive capsulitis of the shoulder. *Int J Tissue React*. 1998;20(4):125-30.
- van der Heijden GJ, van der Windt DA, Kleijnen J, Koes BW, Bouter LM. Steroid injections for shoulder disorders: a systematic review of randomized clinical trials. *Br J Gen Pract*. 1996;46(406):309-16.

REST AND IMMOBILIZATION

- Henry JH, Genung JA. Natural history of glenohumeral dislocation—revisited. *Am J Sports Med*. 1982;10:135-7.

IMAGING

- Blanchard TK, Bearcroft PW, Constant CR, Griffin DR, Dixon AK. Diagnostic and therapeutic impact of MRI and arthrography in the investigation of full-thickness rotator cuff tears. *Eur Radiol.* 1999;9(4):638-42.
- Milgrom C, Schaffler M, Gilbert S, et al. Rotator-cuff changes in asymptomatic adults. *J Bone Joint Surg [Br].* 1995;77:296-8.
- Oh CH, Schweitzer ME, Spettell CM. Internal derangements of the shoulder: decision tree and cost-effectiveness analysis of conventional arthrography, conventional MRI, and MR arthrography. *Skeletal Radiol.* 1999;28(12):670-8.
- Paavolainen P, Ahovuo J. Ultrasonography and arthrography in the diagnosis of tears of the rotator cuff. *J Bone Joint Surg [Am].* 1994;76:335-40.
- Robertson PL, Schweitzer ME, Mitchell DG, et al. Rotator cuff disorders: interobserver and intraobserver variation in diagnosis with MR imaging. *Radiology.* 1995;194(3):831-5.
- Sher JS, Uribe JW, Posada A, et al. Abnormal findings on magnetic resonance images of asymptomatic shoulders. *J Bone Joint Surg [Am].* 1995;77:10-5.
- Traugher PD, Goodwin TE. Shoulder MRI: arthroscopic correlation with emphasis on partial tears. *J Comput Assist Tomogr.* 1992;16:129-33.
- Wang YM, Shih TT, Jiang CC, et al. Magnetic resonance imaging of rotator cuff lesions. *J Formos Med Assoc.* 1994;93:234-9.

SURGERY

- Adolfsson L, Lysholm J. Results of arthroscopic acromioplasty related to rotator cuff lesion. *Int Orthop.* 1993;17:228-31.
- Brostrom LA, Kronberg M, Nemeth G, et al. The effect of shoulder muscle training in patients with recurrent shoulder dislocations. *Scand J Rehabil Med.* 1992;24:11-5.
- Brox JJ, Gjengedal E, Uppheim G, et al. Arthroscopic surgery versus supervised exercises in patients with rotator cuff disease (stage II impingement syndrome): a prospective, randomized, controlled study in 125 patients with a 2-year follow-up. *J Shoulder Elbow Surg.* 1999;8(2):102-11.
- Cordasco FA, McGinley BJ, Charlton T. Rotator cuff repair as an outpatient procedure. *J Shoulder Elbow Surg.* 2000;9(1):27-30.
- Gartsman GM. All arthroscopic rotator cuff repairs. *Orthop Clin North Am.* 2001;32(3):501-10, x.
- Gartsman GM, Roddey TS, Hammerman SM. Arthroscopic treatment of bidirectional glenohumeral instability: two- to five-year follow-up. *J Shoulder Elbow Surg.* 2001;10(1):28-36.
- Goldberg BJ, Nirschl RP, McConnell JP, et al. Arthroscopic transglenoid suture capsulolabral repairs: preliminary results. *Am J Sports Med.* 1993;21:656-64; discussion 664-5.
- Haake M, Deike B, Thon A, Schmitt J. Exact focusing of extracorporeal shock wave therapy for calcifying tendinopathy. *Clin Orthop.* 2002;397:323-31.

- Jorgensen U, Svend-Hansen H, Bak K, Pedersen I. Recurrent post-traumatic anterior shoulder dislocation—open versus arthroscopic repair. *Knee Surg Sports Traumatol Arthrosc.* 1999;7(2):118-24.
- Kirkley A, Griffin S, Richards C, Miniaci A, Mohtadi N. Prospective randomized clinical trial comparing the effectiveness of immediate arthroscopic stabilization versus immobilization and rehabilitation in first traumatic anterior dislocations of the shoulder. *Arthroscopy.* 1999;15(5):507-14.
- Loew M, Daecke W, Kusnierczak D, Rahmanzadeh M, Ewerbeck V. Shock-wave therapy is effective for chronic calcifying tendinitis of the shoulder. *J Bone Joint Surg [Br].* 1999;81(5):863-7.
- MacDonald PB, Alexander MJ, Frejuk J, Johnson GE. Comprehensive functional analysis of shoulders following complete acromioclavicular separation. *Am J Sports Med.* 1988;16:475-80.
- Ogilvie-Harris DJ, Demaziere A. Arthroscopic debridement versus open repair for rotator cuff tears: a prospective cohort study. *J Bone Joint Surg [Br].* 1993;75:416-20.
- Rompe JD, Burger R, Hopf C, Eysel P. Shoulder function after extracorporeal shock wave therapy for calcific tendinitis. *J Shoulder Elbow Surg.* 1998;7(5):505-9.
- Rompe JD, Zoellner J, Nafe B. Shock wave therapy versus conventional surgery in the treatment of calcifying tendinitis of the shoulder. *Clin Orthop.* 2001;387:72-82.
- Speed CA, Richards C, Nichols D, et al. Extracorporeal shock-wave therapy for tendinitis of the rotator cuff. A double-blind, randomised, controlled trial. *J Bone Joint Surg [Br].* 2002;84(4):509-12.
- Sperber A, Hamberg P, Karlsson J, Sward L, Wredmark T. Comparison of an arthroscopic and an open procedure for posttraumatic instability of the shoulder: a prospective, randomized multicenter study. *J Shoulder Elbow Surg.* 2001;10(2):105-8.
- Taft TN, Wilson FC, Oglesby JW. Dislocation of the acromioclavicular joint: an end-result study. *J Bone Joint Surg [Am].* 1987;69:1045-51.
- Warner JJ, Miller MD, Marks P, Fu FH. Arthroscopic Bankart repair with the Suretac device. Part I: clinical observations. *Arthroscopy.* 1995;11:2-13.
- Zvijac JE, Levy JH, Lemak LJ. Arthroscopic subacromial decompression in the treatment of full-thickness rotator cuff tears: a 3- to 6-year follow-up. *Arthroscopy.* 1994;10:518-23.