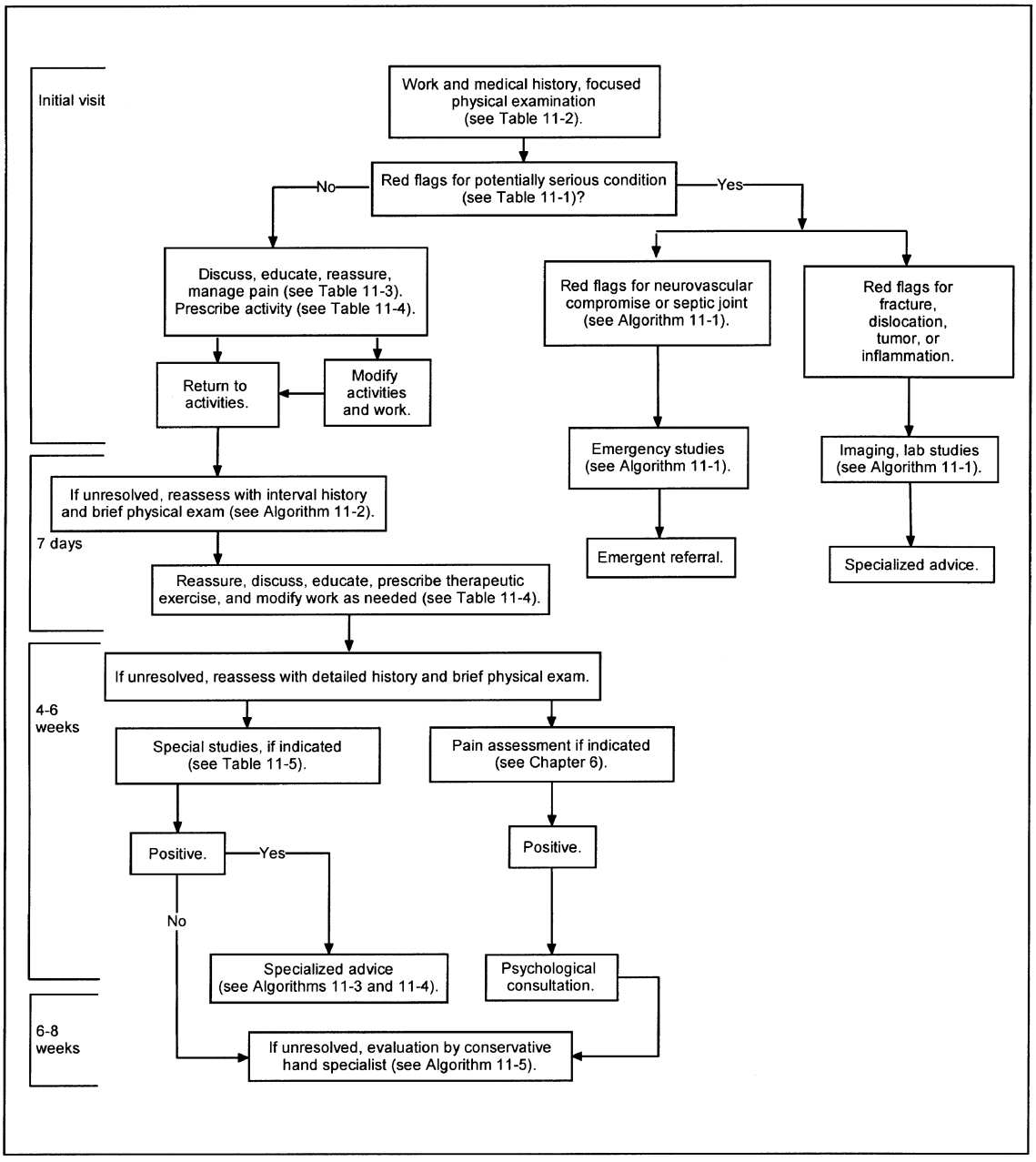
***Master Algorithm**. ACOEM Guidelines for Care of Acute and Subacute Occupational Forearm, Wrist, and Hand Complaints*



11 Forearm, Wrist, and Hand Complaints

General Approach and Basic Principles

Forearm, wrist, and hand complaints that may be work related are common problems presenting to occupational and primary care providers; they are among the five most common causes of reported work-related health complaints of workers' compensation claims. These complaints account for about 7 to 8% of total lost workdays in workers' compensation and 17-23% of cases and claims, ranking them in the top five for financial severity, much of the total expense is incurred for surgical procedures.

Recommendations on assessing and treating adults with work-related forearm, wrist, or hand complaints are presented in this clinical practice guideline. Topics include the initial assessment and diagnosis of patients with acute and subacute forearm, wrist, or hand complaints that may be 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 identification of clinical pathology, work-relatedness, modified duty and activity, and return to work, as well as further management considerations, including the management of delayed recovery.

Algorithms for patient management are included. This chapter's master algorithm schematizes how primary care and occupational medicine practitioners may generally manage patients with acute and subacute forearm, wrist, and hand complaints. The following text, tables, and numbered algorithms expand upon the master algorithm.

The principal recommendations for assessing and treating patients with acute and subacute forearm, wrist, and hand complaints are as follows:

- The initial assessment focuses on detecting indicators of potentially serious disease, termed red flags.
- In the absence of red flags, occupational or primary care providers can safely and effectively manage work-related forearm, hand, and wrist complaints. The focus is on monitoring for complications, facilitating the healing process, and facilitating return to work in a modified- or full-duty capacity.

- Relieving discomfort can be accomplished most safely by modifying activities, temporary immobilization, and systemic nonprescription analgesics.
- Encourage patients recovering from acute or subacute forearm, hand, or wrist problems to return to modified work as their condition permits.
- Referral for specialty care may be indicated if symptoms persist beyond four to six weeks.
- Address nonphysical factors (such as psychosocial, workplace, or socioeconomic problems) in an effort to resolve delayed recovery.

Initial Assessment

Thorough medical and work histories as well as a focused physical examination (see Chapter 2) are sufficient for the initial assessment of a patient complaining of potentially work-related forearm, wrist, or hand symptoms. The medical history and examination include evaluation for serious underlying conditions. This evaluation may consider the possibility of referred pain to the forearm, wrist, and/or hand due to a disorder in another part of the body (e.g., cervical nerve root). Certain findings on the history and physical examination raise suspicion of serious underlying medical conditions; these are referred to as red flags (see Table 11-1). Their absence rules out the need for special studies, referral, or inpatient care during the first four weeks, during which time spontaneous recovery is expected (provided any inciting workplace factors are addressed). Forearm, hand, and wrist complaints can then be classified into one of four working categories:

- Potentially serious forearm, hand, or wrist condition: fracture, acute dislocation, infection, neurovascular compromise or injury, or tumor, in rare cases.
- Mechanical disorders: derangements of the forearm, hand, or wrist related to acute trauma, such as ligament or tendon strain.
- Degenerative disorders: resulting from aging or repetitive use, or a combination thereof, such as arthritis, tendinitis, or tenosynovitis.
- Nonspecific disorders: occurring in the hand or wrist and suggesting neither internal derangement nor referred pain.

Medical History

Asking the patient open-ended questions, such as those listed on page 256, allows the clinician to gauge the need for further discussion or specific inquiries to obtain more detailed information (see also Chapter 2):

Table 11-1. Red Flags for Potentially Serious Forearm, Wrist, or Hand Conditions

Disorder	Medical History	Physical Examination
Fracture	History of significant trauma History of deformities with or without spontaneous reduction or self-reduction Point pain	Significant swelling Deformity with displaced fracture Point tenderness Swelling, hematoma Point tenderness Ecchymosis
Dislocation	History of significant trauma History of deformities with or without spontaneous or self-reduction Inability to use the joint	Deformity present Tenderness and instability with history of deformity with reduction Hemarthrosis
Infection	History of systemic symptoms: chills, fever, dizziness History of immunosuppression (e.g., transplant, chemotherapy, HIV) Diabetes Painful, red, swollen areas	Tenderness with motion Systemic signs of sepsis Local heat, swelling, erythema Drainage of a sinus
Tumor	History of rapidly growing, painful mass of hand or wrist, not consistent with ganglion History of immunosuppression (e.g., transplant, chemotherapy, HIV)	Mass of forearm, hand, or wrist, not consistent with ganglion or other benign lesion
Inflammation	History of inflammatory arthritis or consistent with inflammatory arthritis Painful, swollen joints, usually without systemic symptoms	Swelling and deformity
Rapidly progressive neurologic compromise	Rapidly progressive numbness, paresthesias, or weakness in radial, ulnar, or median nerve distribution Progressive atrophy	Sensory deficit in ulnar, median, or radial distribution Loss of grip strength when picking up objects
Vascular compromise	History of vascular disease History of diabetes Cold, cool, or pale hand	Decreased pulses Decreased capillary filling
Osteoarthritis	History of sudden onset, or worsening of symptoms	Redness, heat, or tenderness
Severe carpal tunnel syndrome	Indications of causality (see Table 11-2) Dysesthesias in median nerve distribution	Muscle atrophy and severe weakness of thenar muscles

WHAT ARE YOUR SYMPTOMS?

- Do you have pain, numbness, tingling, weakness, or limited motion?
- For traumatic injuries: Was the area deformed? Did you lose any blood or have an open wound?
- Are your symptoms located primarily in the hand or wrist? Do you have pain or other symptoms elsewhere (e.g., forearm, neck)?
- Are your symptoms constant or intermittent? What makes the problem worse or better?
- Is the pain better or worse at any particular time of day?

HOW DO THESE SYMPTOMS LIMIT YOU?

- Can you do hand intensive activities? For how long?
- What stops you from working? Are the symptoms worse at work?
- Can you grasp? How much? Are you dropping things?
- Are the symptoms worse at night? Do they wake you up? How often?
- What have you tried to make it better? Does it work?

WHEN DID YOUR CURRENT LIMITATIONS BEGIN? WAS THERE A SPECIFIC INCITING EVENT? HOW DID THE LIMITATIONS DEVELOP?

- How long have your activities been limited? More than four weeks?
- Have your symptoms changed? How?
- Have you had similar episodes previously?
- Have you had previous testing or treatment? With whom?
- What do you think caused the problem? How do you think it is related to work?
- What are your specific job duties? Do you use your forearm, wrist, or hand to perform them? How? How often?
- What are your hobbies? Do you use your forearm, wrist, or hand to perform them? How? How often?
- Do you use vibrating tools or devices at work or at home (anything from air guns to blow dryers)? What effect, if any, do these devices have on your symptoms?
- Do you have other medical problems? For example, pregnancy, diabetes, or hypothyroidism.[1]

WHAT DO YOU HOPE WE CAN ACCOMPLISH DURING THIS VISIT?

[1]If pregnant and has carpal tunnel syndrome, the problem will likely go away after delivery. Work reassignment or modification may be indicated for any of these comorbid conditions.

Physical Examination

Guided by the medical history, the physical examination includes:

- General observation of the patient
- Regional examination of forearms, wrists, and hands as well as neck evaluation, if indicated by the history
- Neurologic screening

In most cases, the examination is subjective because the patient must exert voluntary effort or state a response to the sensory examination. In some cases of forearm, wrist, or hand problems, there are no objective findings. Strictly objective findings do not in any way require the patient's cooperation for determination. A palpable trigger finger is an objective finding, but any sensory findings are subjective because the patient reports the finding. Thenar atrophy is objective, while tenderness over a ligament or tendon is subjective. The presence of a visible ganglion is objective, though not necessarily work related, but whether pain is associated with it or there is tenderness on examination is subjective.

Though it may seem a point too obvious to warrant mention, the physician should specifically note which forearm, wrist, or hand—left or right—is the subject of the patient's complaints. Not infrequently, injured workers have prior workers' compensation claims that involve the opposite forearm, wrist, or hand. Any ambiguity in documentation can lead to delay in acceptance of the patient's workers' compensation claim, delay in the authorization of time-loss benefits, delay in the authorization of payment of medical care, or even outright denial of the workers' compensation claim.

The physician should seek objective evidence of pathology that is consistent with the patient's subjective complaints. In many cases, careful examination will reveal one or more truly objective findings, such as swelling, deformity, atrophy, reflex changes or spasm. Any such findings should be thoroughly documented in the medical record both for reference during future visits, and for the value the information will have in the patient's workers' compensation claim. For some patients with forearm, wrist, or hand, complaints, however, there are no objective findings. Meticulous documentation of the patient's complaints at each visit is of the utmost importance in such cases.

A. Regional Examination of Forearm, Hand, and Wrist

Because they are interrelated structures, the forearm, wrist, and hand can be examined together for observation of any swelling, masses, redness, deformity, or other abnormality. This examination may be followed by evaluating active and passive range of motion within the patient's limits of comfort with the area as relaxed as possible. Local tenderness may be accentuated by specific motions or stresses on specific joints, and active muscle contraction may produce pain, indicating a specific tendinitis. If this latter finding is on the radial side of the

wrist, it suggests a diagnosis of DeQuervain's tenosynovitis. Specific areas of decreased pinprick sensation may indicate median or ulnar nerve compression; tapping the area of the nerve may produce dysesthesias in its distribution (a positive Tinel's sign). If the patient's flexing the wrist for a period of 60 seconds elicits dysesthesias in the median innervated digits, then this is a positive Phalen's test.

Several traditional findings of carpal tunnel syndrome (CTS) have limited specific diagnostic value. The various tests for CTS show a broad range of sensitivity, depending on the patient population. Clinicians should depend on more than one test. The most sensitive screening methods seem to be an abnormal Katz hand diagram, abnormal sensibility by Semmes-Weinstein testing, and night discomfort. Hypalgesia in the median nerve distribution and thumb abduction strength testing also have been found to be helpful in establishing the diagnosis of CTS. The flick sign is another diagnostic tool. (The sign is positive when a patient reports shaking his or her hand in an effort to relieve parathesias.) Table 11-3 lists various tests for CTS along with estimated sensitivity and specificity based on metaanalysis of existing studies.

Trigger finger nodules may be palpable both actively and passively. There may be only palmar tenderness over proximal interphalangeal joints. The presence of a ganglion is easily determined, but the severity of any symptoms is the basis for a decision to aspirate or, in persistent cases, to excise the cyst.

B. Neurovascular Screening

The neurologic and vascular status of the hand, wrist, forearm, and elbow, including peripheral pulses, and the motor, reflex, and sensory status of the forearm, hand, and wrist as well as the more proximal surrounding structures, can be assessed. Examining the neck and cervical nerve root function is also in order because C6 radiculopathy can affect the wrist extensors and T1 radiculopathy can present as dysfunction of the intrinsic muscles of the hand (see Table 8-3).

C. Assessing Red Flags

The forearm, wrist, and hand area may present with signs of serious infection or tumor (rarely metastatic) or manifest symptoms and signs of serious systemic disease (e.g., inflammatory arthritis, vascular disease), or neurologic conditions. Significant trauma requires evaluation for fracture or crush injury, while a history of deformity consistent with dislocation and spontaneous reduction requires surgical (preferably hand surgery) consultation.

Diagnostic Criteria

If there are no red flags present to indicate serious conditions, the clinician can then determine which common musculoskeletal disorder is present. The criteria presented in Table 11-2 follow the clinical thought process, from the

Table 11-2. Diagnostic Criteria for Non-red-flag Forearm, Wrist, or Hand Conditions that Can Be Managed by Primary Care Physicians

Probable Diagnosis or Injury	Unique Mechanism	Unique Symptoms	Unique Signs	Tests and Results
Ligament/tendon strain (ICD-9 842.00-.19)	Acute excess loading, worse with motion	Pain in tendon/ ligament area	Tenderness over tendon(s) or ligament(s) Pain or weakness on strength testing of the affected tendon	None
Tendinitis/ tenosynovitis (ICD-9 727.05)	Repetitive, forceful, awkward motion Direct pressure (*unusual*) Blunt trauma (*rare*)	Pain localized to muscle-tendon unit Triggering	Tenderness over tendon unit Synovial thickening Triggering or locking Crepitus Pain or weakness on strength testing of the affected tendon	None
DeQuervain's tenosynovitis (ICD-9 727.04)	Idiopathic Repetitive, forceful wrist or thumb motion Direct pressure (*unusual*) Blunt trauma (*rare*)	Pain over radial styloid or first dorsal compartment	Tenderness over radial styloid Mass over radial styloid Crepitus Thick tendon sheath Pain upon passive abduction Triggering Pain worse with ulnar deviation, thumb flexion, adduction, stretch of first dorsal compartment (Finkelstein test)	None
Trigger finger (ICD-9 727.03)	Idiopathic Repetitive, forceful, awkward motion (*unusual*) Blunt trauma (*rare*)	Triggering Pain at proximal interphalangeal joint Locked finger	Triggering Direct pressure Tender volar metacarpal crease Synovial thickening of specific parts of flexor retinaculum	None

Table 11-2. (continued)

Probable Diagnosis or Injury	Unique Mechanism	Unique Symptoms	Unique Signs	Tests and Results
Carpal tunnel syndrome (ICD-9 354.0)	Idiopathic Repetitive/ awkward grasp or pinch at the wrist Vibration Tenosynovitis	Numbness/ tingling in thumb, index, middle fingers, especially at night or with activity Hand pain radiating into the forearm Decreased grip strength Difficulty picking up small objects	Atrophy or decreased strength of abductor pollicis brevis, opponens (advanced cases) Decreased sensation in median nerve distribution + Semmes-Weinstein monofilament test + Durkan's test + Katz hand diagram	Median sensory latency > 3.2 msec Denervation potentials in abductor pollicis brevis possible (advanced cases) Median motor latency >4.5 msec
Nonspecific pain (ICD-9 719.43, 719.44, 719.5)	Idiopathic Possible occult trauma Other pathology Overuse	Varying if any underlying disorder	Varying if any underlying disorder	Plain films Coned in views if suspicion of bone chip, small fracture, etc. Bone scan positive after 72 hours if an occult fracture is present
Ganglion aggravation (ICD-9 727.41)	Unknown	Painful mass on wrist or hand	Tender mass over dorsal or volar wrist or hand	None

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

mechanism of illness or injury to unique symptoms and signs of a particular disorder and, finally, to test results if any tests are needed to guide treatment at this stage.

Carpal Tunnel Syndrome

CTS does *not* produce hand or wrist pain. It most often causes digital numbing or tingling primarily in the thumb, index, and long finger or numbness in the wrist. Symptoms of pain, numbness, and tingling in the hands are common in the general population, but based on studies, only about one in five symptomatic subjects would be expected to have CTS based on clinical examination and electrophysiologic testing.

Clinical testing may include:

- Administration of a Katz hand diagram: The patient is provided with a form that shows outlines of the arms, and the palmar and dorsal

surfaces of the hands. The patient identifies areas of discomfort—characterizing them as pain, numbness, tingling, or other—on each of the diagrams the patient finds necessary. The results are termed "probable," "possible," or "unlikely," depending upon specified criteria.

- Testing for Tinel's sign: Up to six taps to the soft tissue overlying the carpal tunnel. A positive test occurs when the taps cause paresthesias in the median nerve distribution.
- Performing the Semmes-Weinstein test: A test involving nylon monofilaments that collapse at specific amounts of force when pushed perpendicularly against the palm or fingers. A positive test results when a filament of greater than normal size is required in order for its application to be perceived by the patient.
- Durkan's test: The examiner holds the supinated wrist in both hands and applies direct, even pressure over the transverse carpal ligament with both thumbs for up to 30 seconds. A positive test is indicated by tingling or paresthesia into the thumb, index finger, and middle and lateral half of the ring finger within 30 seconds.
- Testing for Phalen's sign: Prolonged, forced hyperflexion of the wrist is produced by requesting the patient to push the dorsa of both hands together, and to hold that position with the wrists in 90 degrees of flexion for sixty seconds. A positive test produces paresthesias in the distribution of the affected median nerve.
- Checking for the square wrist sign: The square wrist sign is positive if the ratio of the thickness of the wrist divided by the width of the wrist is greater than 0.7.

Appropriate electrodiagnostic studies (EDS) may help differentiate between CTS and other conditions, such as cervical radiculopathy. These may include nerve conduction studies (NCS), or in more difficult cases, electromyography (EMG) may be helpful. NCS and EMG may confirm the diagnosis of CTS but may be normal in early or mild cases of CTS. If the EDS are negative, tests may be repeated later in the course of treatment if symptoms persist.

The American Association of Electrodiagnostic Medicine, the American Academy of Neurology, and the American Academy of Physical Medicine and Rehabilitation jointly published a practice parameter for electrodiagnostic studies in CTS. In patients with suspected CTS, the following EDS studies are recommended:

1. Perform a median sensory NCS across the wrist with a conduction distance of 13 to 14 centimeters. If the result is abnormal, compare the result of the median sensory NCS to the result of a sensory NCS of one other adjacent sensory nerve in the symptomatic limb.

2. If the initial median sensory NCS across the wrist has a conduction distance greater than 8 cm and the result is normal, one of the following additional studies is recommended:
   a. Comparison of median-sensory- or mixed-nerve conduction across the wrist over a short (7 to 8 cm) conduction distance with ulnar-sensory-nerve conduction across the wrist over the same 7- to 8-cm conduction distance
   b. Comparison of median-sensory conduction across the wrist with radial- or ulnar-sensory conduction across the wrist in the same limb
   c. Comparison of median-sensory or mixed-nerve conduction through the carpal tunnel to sensory- or mixed-nerve conduction velocity of proximal (forearm) or distal (digit) segments of the median nerve in the same limb

Many other in-office tests and symptoms have varying predictive value for CTS, as summarized in Table 11-3.

Work-Relatedness

A thorough work history is crucial to establishing work-relatedness. (See Chapter 2 for components of the work history.) Determining whether a complaint of a hand, wrist, or forearm disorder is related to work requires a careful analysis and weighing of all associated or apparently causal factors operative at the time. A predominance of work factors suggests that worksite intervention would be appropriate. A cluster of cases in a work group suggests a greater probability of associated work design or management factors.

Repetitive work, especially pinch grasping and, possibly, keyboard work, is currently thought to have the potential to contribute to wrist or hand tendinitis. Problems with workstations have been associated with CTS and DeQuervain's tenosynovitis. The strength of these associations is not clear. Identification and ameliorization of other factors may be important, including compression at the wrist, awkward posture interacting with force, and the effect of sustained head and shoulder postures for office workers and computer users. Acute trauma at work can be associated with tendon and ligament strains.

The clinician may recommend work and activity modifications or ergonomic redesign of the workplace to facilitate recovery and prevent recurrence. The employer's role in accommodating activity limitations and preventing further problems through ergonomic changes is key to hastening the employee's return to full activity. In some cases it may be desirable to conduct a detailed ergonomic analysis of activities that may be contributing to the symptoms. A broad range of ergonomic surveys and instruments is available for measuring range of activity, strain, weights, reach, frequency of motion, flexion, and extension, as well as psychological factors such as organizational relationships and job satisfaction. Such detailed measures may be necessary or useful for

*Table 11-3. Sensitivity and Specificity of Diagnostic Tests for Carpal Tunnel Syndrome Measured Against Nerve Conduction Studies**

Test	Sensitivity	Specificity
Combination of abnormal Katz hand diagram, abnormal Semmes-Weinstein test, positive Durkan's test, and night pain	96%	99%
Katz hand diagram scores	96%	76%
Night pain symptoms	96%	80%
Flick sign (shaking hand)	93%	96%
Durkan's compression test	89%	90%
Semmes-Weinstein monofilament test	83%	59%
Nocturnal paresthesias	77%	33%
Weak thumb abduction strength	66%	66%
Closed fist sign	61%	92%
Phalen sign	55%	45%
Hypoalgesia in the median nerve territory	51%	85%
Square wrist sign	47%	83%
Tinel's sign	42%	67%
Static 2-point discrimination > 6 mm**	32%	99%
Tourniquet test	21%	36%
Thenar atrophy**	20%	91%

* Reported sensitivity and specificity values have varied markedly. Combining tests may increase the positive predictive value. The above values are adapted from Light TR, *Hand Surgery Update 2*, American Society for Surgery of the Hand Staff, September 1, 1999; Szabo RM, Slater RR Jr, Farver TB, Stanton DB, Sharman WK. The value of diagnostic testing in carpal tunnel syndrome. *J Hand Surg [Am]*. 1999;24(4):704-14; and D'Arcy CA, McGee S. The rational clinical examination. Does this patient have carpal tunnel syndrome? *JAMA* 2000;283(23):3110-7, including *Cochrane Review.*
** While the 2-point discrimination test and thenar atrophy do not have high sensitivity in isolating the diagnosis of carpal tunnel syndrome, they are useful in distinguishing severe CTS from mild or moderate CTS.

modifying activity, for redesigning the workstation, or for suggesting organizational and management relief. Such cases may call for referral to a certified human factors engineer or ergonomist, either through the patient or the employer.

Initial Care

Comfort is often a patient's first concern. Nonprescription analgesics will provide sufficient pain relief for most patients with acute and subacute symp-

toms. If treatment response is inadequate (that is, if symptoms and activity limitations continue), prescribed pharmaceuticals or physical methods may be added. Clinicians should consider the presence of medical diseases such as diabetes, hypothyroidism, Vitamin B complex deficiency, and arthritis. Side effects, cost, and provider and patient preferences should guide the clinician's choice of recommendations. Initial treatment of CTS should include night splints. Day splints can be considered for patient comfort as needed to reduce pain, along with work modifications. For patients with mild-to-moderate CTS who opt for conservative treatment, studies show that corticosteroids may be of greater benefit than nonsteroidal anti-inflammatory drugs (NSAIDs), but side effects prevent their general recommendation. Vitamin B6 is often used in CTS when it is perceived to be deficient, but this practice is not consistently supported by the medical evidence. Table 11-4 summarizes comfort options.

Table 11-4. Methods of Symptom Control for Forearm, Wrist, and Hand Complaints

RECOMMENDED		
Nonprescription Medications		
Acetaminophen (safest) NSAIDs (aspirin, ibuprofen) (secondary choice)		
Physical Modalities		
Adjust or modify workstation, job tasks, or work hours and methods Stretching Specific hand and wrist exercises for range of motion and strengthening At-home local applications of cold packs first few days of acute complaints; thereafter, applications of heat packs Aerobic exercise to maintain general conditioning Initial and follow-up visits for education, counseling, and evaluating home exercise		
Prescribed Pharmaceutical Methods		
Other NSAIDs		
OPTIONS		
Ligament/Tendon Strain	**Tendinitis/Tenosynovitis**	**DeQuervain's Syndrome**
Limit motion that causes pain	Limit motion of inflamed structures Injections of lidocaine and corticosteroids	Limit motion of inflamed structures with wrist and thumb splint
Trigger Finger	**Carpal Tunnel Syndrome**	**Ganglion**
Injection of lidocaine and corticosteroids	Splinting of wrist in neutral position at night & day Injections of lidocaine and corticosteroids	Corticosteroid injection Aspiration
Nonspecific Hand or Wrist Pain		
None		

- Instruction in home exercise. Except in cases of unstable fractures or acute dislocations, patients should be advised to do early range-of-motion exercises at home. Instruction in proper exercise technique is important, and a physical therapist can serve to educate the patient about an effective exercise program.
- Manipulation has not been proven effective for patients with pain in the hand, wrist, or forearm. Studies show that therapeutic touch is no better than placebo in influencing median-motor-nerve distal latencies, pain scores, and relaxation scores. Using a magnet for reducing pain attributed to CTS is no more effective than using the placebo device.
- Physical modalities, such as massage, diathermy, cutaneous laser treatment, "cold" laser treatment, transcutaneous electrical neurostimulation (TENS) units, and biofeedback have no scientifically proven efficacy in treating acute hand, wrist, or forearm symptoms. Limited studies suggest there are satisfying short- to medium-term effects due to ultrasound treatment in patients with mild to moderate idiopathic CTS, but the effect is not curative. 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.
- Most invasive techniques, such as needle acupuncture and injection procedures, have insufficient high quality evidence to support their use. The exception is corticosteroid injection about the tendon sheaths or, possibly, the carpal tunnel in cases resistant to conservative therapy for eight to twelve weeks. For optimal care, a clinician may always try conservative methods before considering an injection. DeQuervain's tendinitis, if not severe, may be treated with a wrist-and-thumb splint and acetaminophen, then NSAIDs, if tolerated, for four weeks before a corticosteroid injection is considered. CTS may be treated for a similar period with a splint and medications before injection is considered, except in the case of severe CTS (thenar muscle atrophy and constant paresthesias in the median innervated digits). Outcomes from carpal tunnel surgery justify prompt referral for surgery in moderate to severe cases, though evidence suggests that there is rarely a need for emergent referral. Thus, surgery should usually be delayed until a definitive diagnosis of CTS is made by history, physical examination, and possibly electrodiagnostic studies. Symptomatic relief from a cortisone/anesthetic injection will facilitate the diagnosis; however, the benefit from these injections is short-lived. Trigger finger, if significantly symptomatic, is probably best treated with a cortisone/anesthetic injection at first encounter, with hand surgery referral if symptoms persist after two injections by the primary care or occupational medicine provider (see Table 11-4).
- When treating with a splint in CTS, scientific evidence supports the efficacy of neutral wrist splints. Splinting should be used at night, and may be used during the day, depending upon activity.

- Support for iontophoresis and phonophoresis is limited.
- Activity alteration.

Careful advice regarding maximizing activities within the limits of symptoms is imperative once red flags have been ruled out. Any splinting or limitations placed on hand, wrist, and forearm activity should not interfere with total body activity in a major way. Strict elevation can be done for a short period of time at regular intervals.

Activities that increase stress on the hand or wrist may contribute to structural damage and tend to aggravate symptoms. Limitations of keyboard work or pinch-grasping may be necessary during the first few weeks after onset of acute tendinitis, tenosynovitis, nerve impingement, or irritation around a ganglion.

Evidence shows that keyboard users may experience a reduction in hand pain after several months of using some alternative geometry keyboards, although the benefit appears to be dependent upon user preference.

Job Analysis

While not all CTS or other hand and wrist complaints are occupational in origin, complaints of workplace discomfort should be evaluated for ergonomic modifications as part of the treatment program. Careful ergonomic re-analysis of the job is indicated if the individual fails to improve. Delayed recovery or return of symptoms may suggest an association between job tasks or motions and the presenting complaint.

Work Activities

Table 11-5 provides recommendations on activity modification and duration of absence from work. These guidelines are intended for patients without

*Table 11-5. 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)
Tendon strain	Modification of activities involving the muscle-tendon unit, i.e., those that cause significant symptoms. Also workstation assessment to insure optimal ergonomics, as appropriate.	0-3 days	7-14 days	10 days	46%

Table 11-5. (continued)

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)
Tenosynovitis	Same as for tendon strain	0-3 days	7-14 days	15 days	58%
DeQuervain's syndrome	Same as for tendon strain	0-3 days	7-14 days	15 days	58%
Trigger finger	After injection (see Table 11-3), allow all activity	0-3 days	7-14 days	15 days	58%
Carpal tunnel syndrome	Same as for tendon strain. Also workstation adjustments, night splints, avoidance of prolonged periods in wrist flexion or extension	0-3 days	7-14 days	14 days	43%
Ganglion (aggravation)	Same as for tendon strain but allow full activity after aspiration	0-3 days	7-14 days	10 days	65%
Regional hand and wrist pain	Allow all activities as tolerated Modification of activities that aggravate symptoms, but range-of-motion and conditioning exercises should be performed by patient	0-3 days	7-14 days	9 days	43%

***** 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 non-severe 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. Additional limitations of the frequency or pressure of keyboard use or pinch grasp may be warranted.

******* 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.

comorbidity or complicating factors, including employment or legal issues. They are targets to provide a guide from the perspective of physiologic recovery.

Key factors to consider in disability duration are age and type of job, especially if the regular work includes activities that may aggravate the condition. By communicating with patients and employers, clinicians can make it clear that:

- Even moderate pinch-grasping or extension and flexion may aggravate forearm, hand, and wrist symptoms.
- Restrictions may allow for recovery or time to build activity tolerance through exercise

Follow-up Visits

Patients with potentially work-related forearm, wrist, and hand complaints should have follow-up every three to five days by a midlevel practitioner, or by a physical or hand therapist who can counsel them about avoiding static positions, medication use, activity modification, and other concerns. Take care to answer questions and make these sessions interactive so that the patient is duly involved in his or her recovery. If the patient has returned to work, these interactions may be done on site or by telephone, to avoid interfering with modified- or full-work activities.

Physician follow-up can occur when the patient needs a release to modified, increased, or full duty, 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 seven to fourteen days if the patient is working.

Special Studies and Diagnostic and Treatment Considerations

For most patients presenting with true hand and wrist problems, special studies are not needed until after a four- to six-week period of conservative care and observation. Most patients improve quickly, provided red flag conditions are ruled out. Exceptions include the following:

- In cases of wrist injury, with snuff box (radial-dorsal wrist) tenderness, but minimal other findings, a scaphoid fracture may be present. Initial radiographic films may be obtained but may be negative in the presence of scaphoid fracture. A bone scan may diagnose a suspected scaphoid fracture with a very high degree of sensitivity, even if obtained within 48 to 72 hours following the injury.
- An acute injury to the metacarpophalangeal joint of the thumb, accompanied by tenderness on the ulnar side of the joint and laxity when that side of the joint is stressed (compared to the other side), may

indicate a gamekeeper thumb or rupture of the ligament at that location. Radiographic films may show a fracture; stress views, if obtainable, may show laxity. The diagnosis may necessitate surgical repair of the ligament; therefore, a surgical referral is warranted.

- In cases of peripheral nerve impingement, if no improvement or worsening has occurred within four to six weeks, electrical studies may be indicated. The primary treating physician may refer for a local lidocaine injection with or without corticosteroids.
- Recurrence of a symptomatic ganglion that has been previously aspirated or a trigger finger that has been previously treated with local injections (see Table 11-4) is usually an indication for re-aspiration or referral, based on the treating physician's judgment.
- A number of patients with hand and wrist complaints will have associated disease such as diabetes, hypothyroidism, Vitamin B complex deficiency and arthritis. When history indicates, testing for these or other comorbid conditions is recommended.
- If symptoms have not resolved in four to six weeks and the patient has joint effusion, serologic studies for Lyme disease and autoimmune diseases may be indicated. Imaging studies to clarify the diagnosis may be warranted if the medical history and physical examination suggest specific disorders. Table 11-6 provides a general comparison of the abilities of different imaging techniques to identify physiologic insult and define anatomic defects.

Table 11-6. Ability of Various Techniques To Identify and Define Forearm, Wrist, and Hand Pathology

Technique	Ligament/ Tendon Strain	Tendinitis/ Tenosynovitis	DeQuervain's Tendonitis	Trigger Finger	Carpal Tunnel Syndrome	Ganglion	Infection
History	+ + +	+ + +	+ + +	+ + + +	+ + + +	+ +	+ + + +
Physical examination	+ + + +	+ + + +	+ + + +	+ + + +	+ + +	+ + + +	+ + + +
Laboratory studies	0	0	0	0	0	0	+ + + +
Electromyography/ nerve conduction velocity (EMG/ NCV) testing	0	0	0	0	+ + + +	0	0
Imaging studies							Lytic lesions
Radiography[1]	0	0	0	0	+	+ +	+ + +
Bone scan[1]	0	0	0	0	0	0	+ + + +
Arthrography[1]	0	0	0	0	0	0	0
Computed tomography (CT)[1]	0	0	0	0	0	0	+ + + +
Magnetic resonance imaging (MRI)[1]	0	0	0	0	+	0	+ + + +

[1] Risk of complications (e.g., infection, radiation) highest for contrast CT or arthrography; second highest for myelography; relatively less for bone scan, radiography, and CT; lowest for MRI.
Note: Number of plus signs indicates relative ability to identify or define pathology.

Referral for hand surgery consultation may be indicated for patients who:

- Have red flags of a serious nature
- Fail to respond to conservative management, including worksite modifications
- Have clear clinical and special study evidence of a lesion that has been shown to benefit, in both the short and long term, from surgical intervention

Surgical considerations depend on the confirmed diagnosis of the presenting hand or wrist complaint. If surgery is a consideration, counseling regarding likely outcomes, risks and benefits, and, especially, expectations is very important. If there is no clear indication for surgery, referring the patient to a physical medicine practitioner may aid in formulating a treatment plan.

A. Carpal Tunnel Syndrome

Surgical decompression of the median nerve usually relieves CTS symptoms. High-quality scientific evidence shows success in the majority of patients with an electrodiagnostically confirmed diagnosis of CTS. Patients with the mildest symptoms display the poorest postsurgery results; patients with moderate or severe CTS have better outcomes from surgery than splinting. CTS must be proved by positive findings on clinical examination and the diagnosis should be supported by nerve-conduction tests before surgery is undertaken. Mild CTS with normal electrodiagnostic studies (EDS) exists, but moderate or severe CTS with normal EDS is very rare. Positive EDS in asymptomatic individuals is not CTS. Studies have not shown portable nerve conduction devices to be effective diagnostic tools. Surgery will not relieve any symptoms from cervical radiculopathy (double crush syndrome). Likewise, diabetic patients with peripheral neuropathy cannot expect full recovery and total abatement of symptoms after nerve decompression.

Risks of surgical decompression include complications of anesthesia, wound infection, and damage to the median nerve. Incomplete decompression or recurrence of symptoms can lead to the need for further surgery. Based on the data from the randomized controlled trials, endoscopic carpal tunnel release seems to be an effective procedure compared to open surgery; however, greater emphasis must be given to training surgeons in this technique to avoid major complications such as median nerve injuries. With proper training and equipment, endoscopic carpal tunnel release can be done safely, with complication rates comparable to those for the open technique and with high patient satisfaction. Early return to work after either type carpal tunnel surgery is more dependent on the willingness of the employer and patient than on the surgical technique. Two prospective randomized studies show no beneficial effect from postoperative splinting after carpal tunnel release when compared to a bulky dressing alone. In fact, splinting the wrist beyond 48 hours following CTS release may be largely detrimental, especially compared to a home therapy program.

B. Trigger Finger

One or two injections of lidocaine and corticosteroids into or near the thickened area of the flexor tendon sheath of the affected finger are almost always sufficient to cure symptoms and restore function. A procedure under local anesthesia may be necessary to permanently correct persistent triggering.

C. DeQuervain's Syndrome

The majority of patients with DeQuervain's syndrome will have resolution of symptoms with conservative treatment. Under unusual circumstances of persistent pain at the wrist and limitation of function, surgery may be an option for treating DeQuervain's tendinitis. Surgery, however, carries similar risks and complications as those already mentioned above (see A, "Carpal Tunnel Syndrome"), including the possibility of damage to the radial nerve at the wrist because it is in the area of the incision.

D. Ganglion

Only symptomatic wrist ganglia merit or excision, if aspiration fails. Recurrences may be spontaneous or related to inadequate removal of the communication with the carpal joints or to satellite ganglia that the surgeon failed to excise.

Summary of Recommendations and Evidence

See Table 11-7.

Table 11-7. Summary of Recommendations for Evaluating and Managing Forearm, Wrist, and Hand Complaints

Clinical Measure	Recommended	Optional	Not Recommended
History and physical exam	Basic history, focused exam, and search for red flags (C)		
Patient education	Patient education regarding prevention, diagnosis, prognosis, and expectations of medical treatment (D)		
Medication (See Chapter 3)	Acetaminophen (C) NSAIDs (B)	Opioids, short course (C) Rarely, cortcosteroids (C)	Use of opioids for more than 2 weeks (C)
Physical treatment methods	Instructions for home exercises	At-home applications of heat or cold packs (D)	Passive modalities TENS units (C) Biofeedback (D)

Table 11-7. (continued)

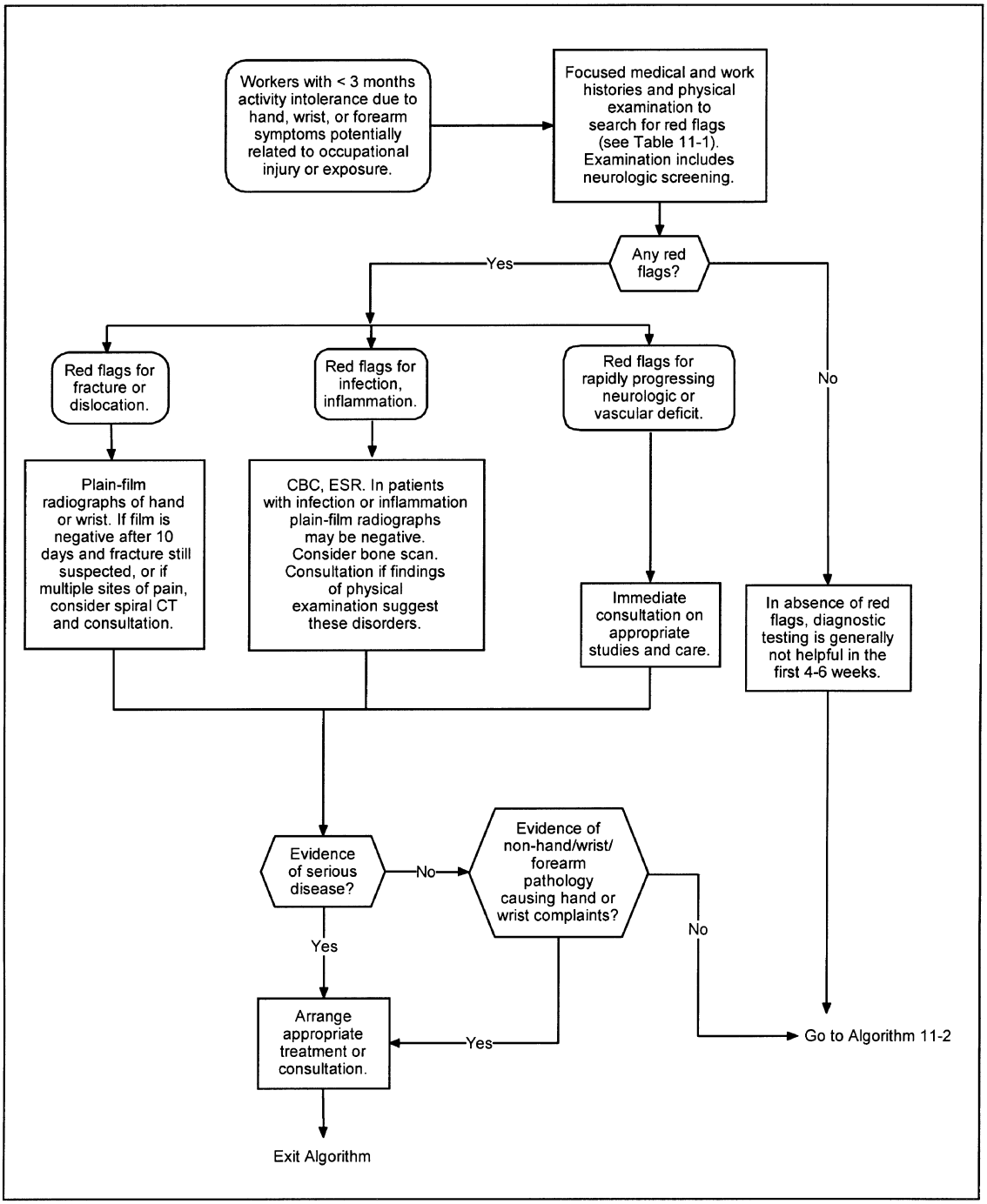
Clinical Measure	Recommended	Optional	Not Recommended
Injections	Injection of corticosteroids into carpal tunnel in mild or moderate cases of CTS after trial of splinting and medication (C) Initial injection into tendon sheath for clearly diagnosed cases of DeQuervain's syndrome, tenosynovitis, or trigger finger (D)	Initial injection of corticosteroids in moderate cases of tendinitis (D)	Repeated or frequent injection of corticosteroids into carpal tunnel, tendon sheaths, ganglia, etc. (D)
Rest and immobilization	Splinting as first-line conservative treatment for CTS, DeQuervain's, strains, etc. (C)	Prolonged splinting (leads to weakness and stiffness) (D) Prolonged post-operative splinting (C)	
Activity and exercise	Stretching Aerobic exercise Maintaining strength and mobility of all remaining body parts while recovering from wrist problems (C)		Reduced general activities while recovering (D)
Detection of neurologic abnormalities	NCV for median (B) or ulnar (C) impingement at the wrist after failure of conservative treatment		Routine use of NCV or EMG in diagnostic evaluation of nerve entrapment or screening in patients w/o symptoms (D) Use of vibrometry for screening (C)
Radiography	Plain films for suspected scaphoid fractures, repeat films in 7-10 days (D)	Limited bone scan to detect fractures if clinical suspicion exists (C)	Routine use for evaluation of forearm, wrist, and hand (D)
Other imaging procedures		Use of arthrography, MRI, or CT scans prior to history and physical examination by a qualified specialist (D)	

Table 11-7. (continued)

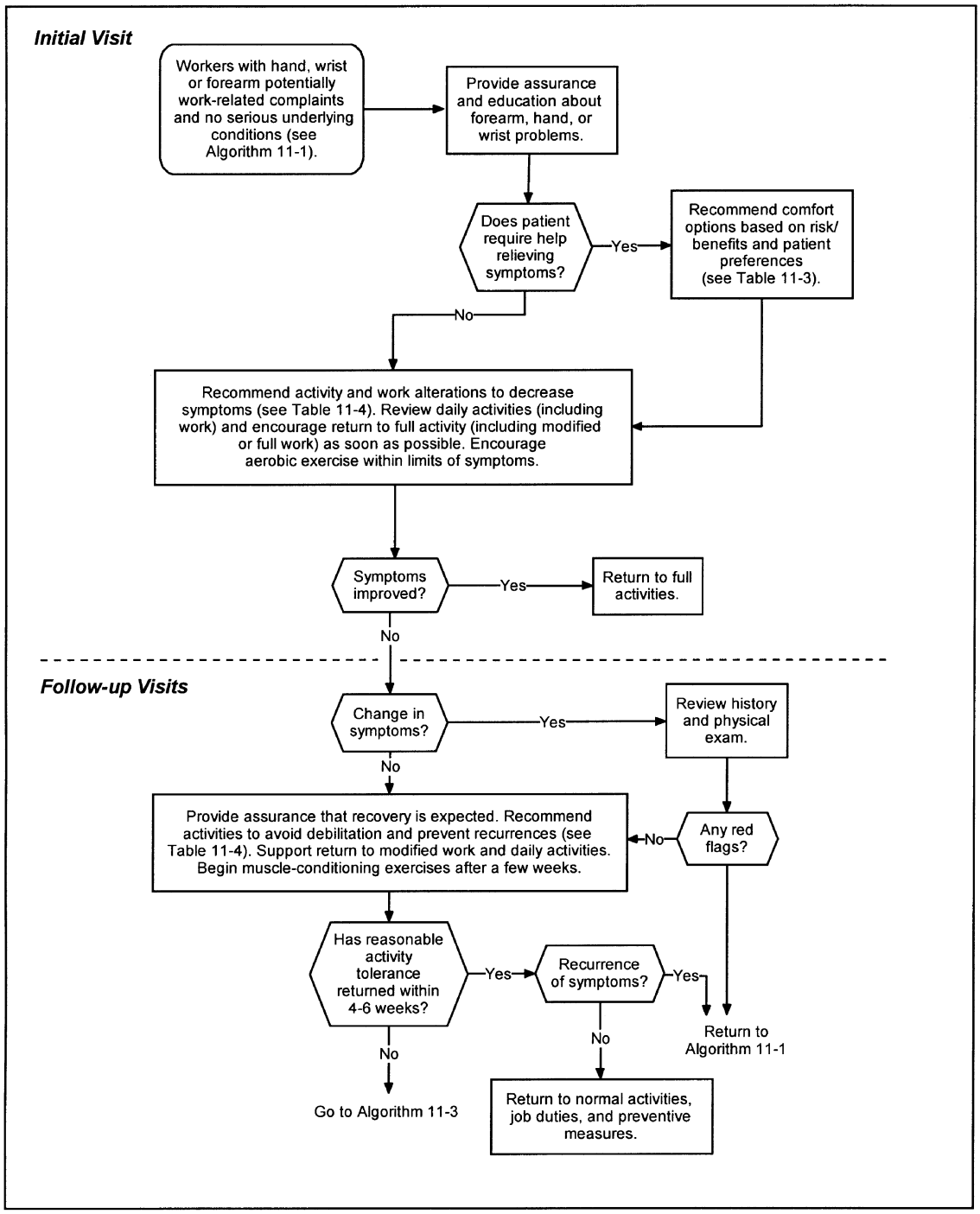
Clinical Measure	Recommended	Optional	Not Recommended
Surgical considerations	Early surgical intervention for severe CTS confirmed by NCV may be indicated (B) Tendinitis (DeQuervain's), ganglion, or trigger finger: referral to surgeon only after patient education and conservative treatment, including splinting and injection, have failed (C, D)		
Psychosocial factors	Consider counseling for severe hand injuries (D) Awareness by treating practitioner of interplay between physical, economic, and psychological factors in patients with MSDs (C, D)		

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 forearm, wrist, or hand disorders).
D = Reviewer or consensus interpretation of evidence not meeting inclusion criteria for research-based evidence.

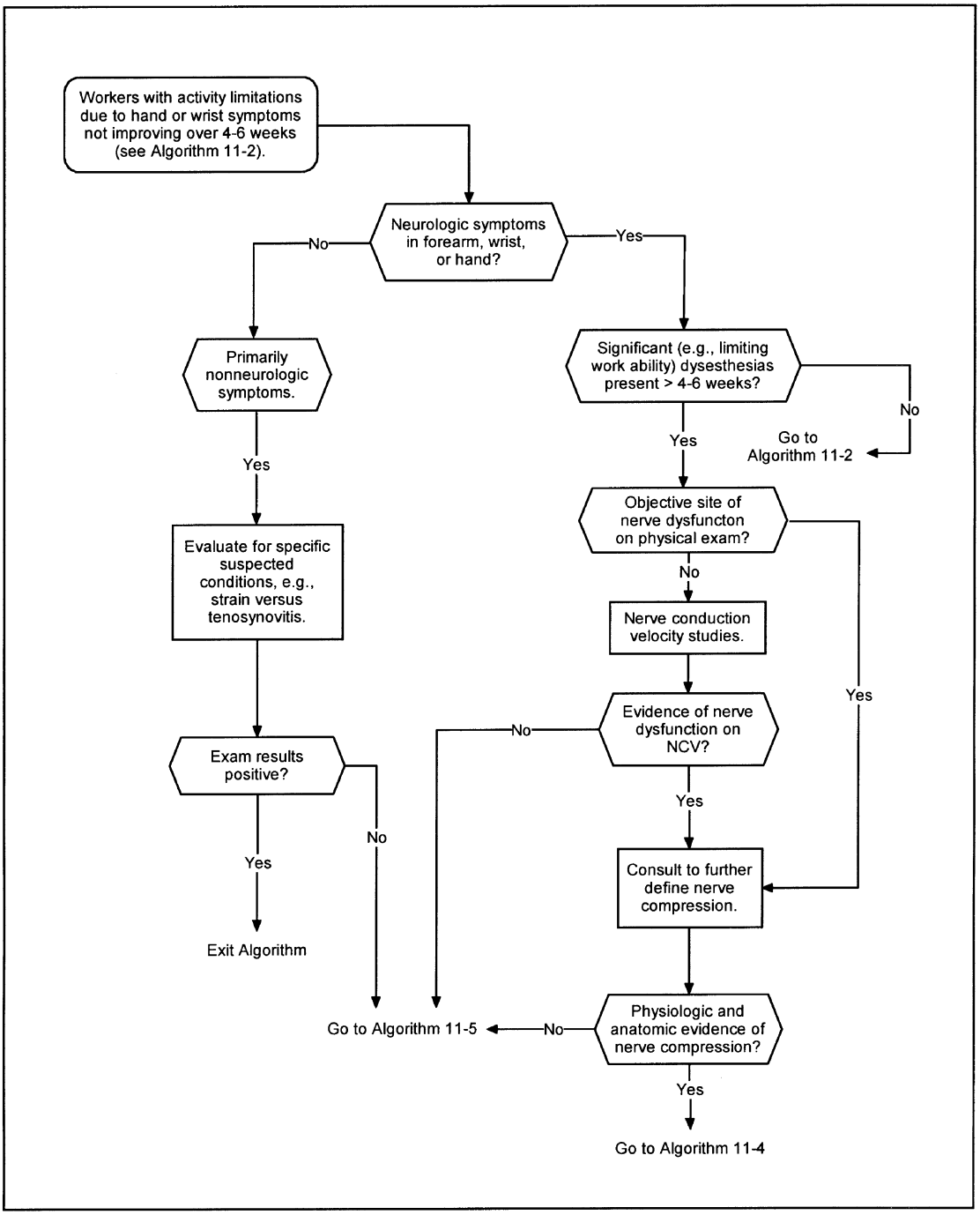
Algorithm 11-1. *Initial Evaluation of Occupational Forearm, Wrist, and Hand Complaints*



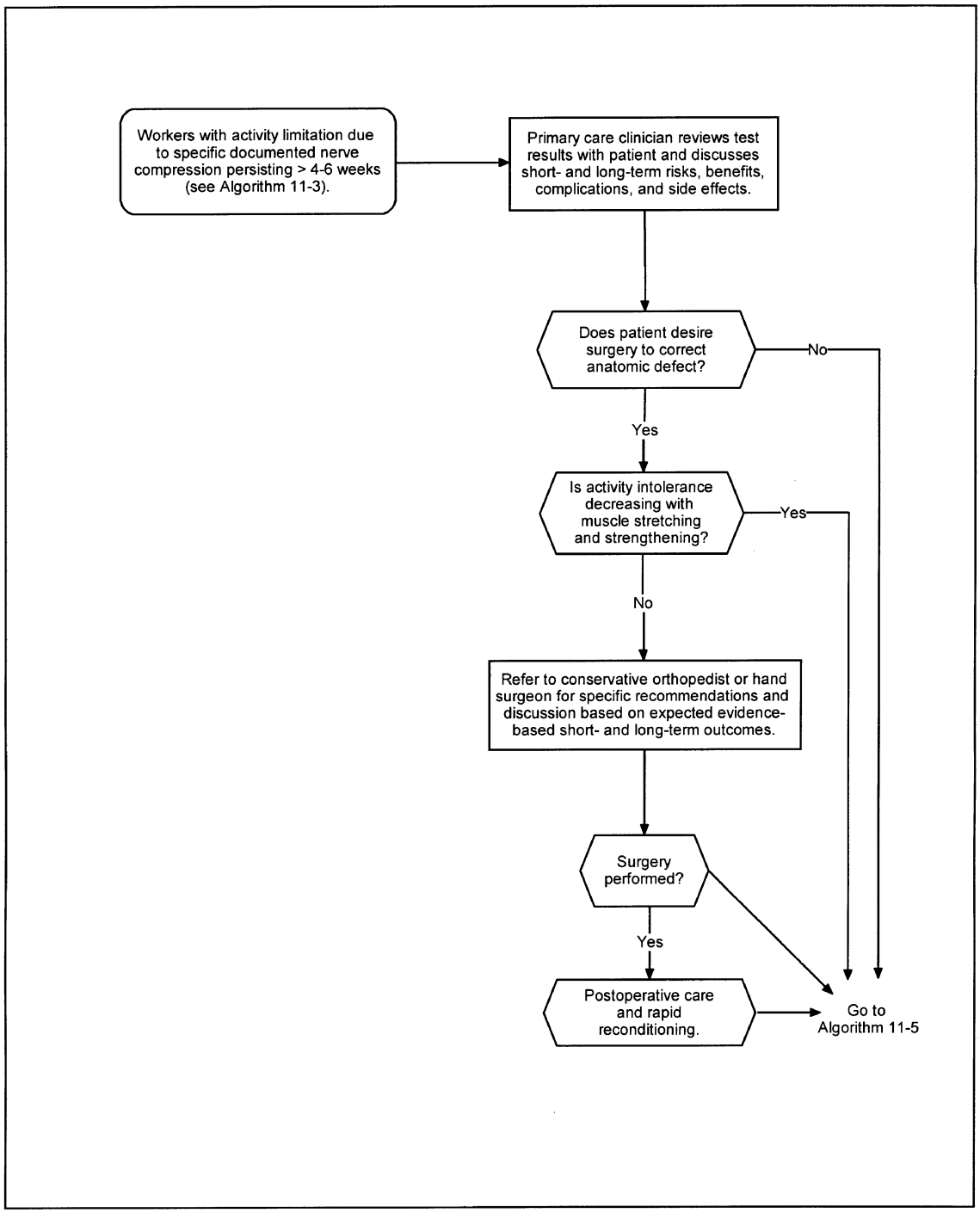
Algorithm 11-2. *Initial and Follow-up Management of Occupational Forearm, Wrist, and Hand Complaints*



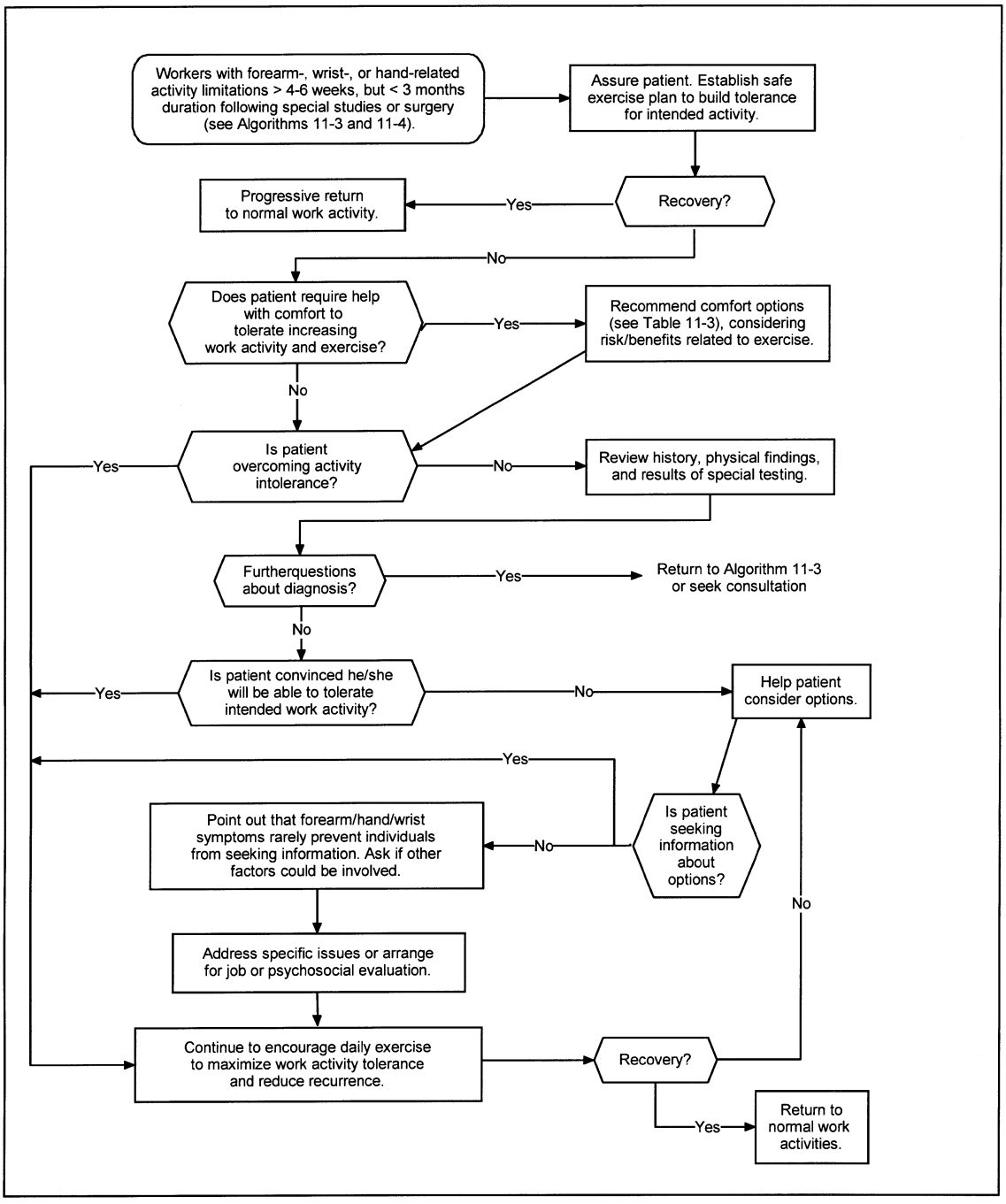
Algorithm 11-3. *Evaluation of Slow-to-recover Patients with Occupational Forearm, Wrist, and Hand Complaints (Symptoms > 4 Weeks)*



Algorithm 11-4. *Surgical Considerations for Patients with Anatomic and Physiologic Evidence of Nerve Root Compression and Persistent Forearm, Wrist, and Hand Symptoms*



Algorithm 11-5. *Further Management of Occupational Forearm, Wrist, and Hand Complaints*



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