Work-Related Radial Nerve Entrapment: Diagnosis and Treatment*

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**This guideline does not apply to severe or acute traumatic injury to the upper extremities.*

I. Review Criteria

Review Criteria for the Diagnosis and Treatment of Work-Related Radial Nerve Entrapment (RNE*)				
CLINICAL FINDINGS				
SUBJECTIVE (Symptoms)	**OBJECTIVE (Signs)**	**DIAGNOSTIC**	**CONSERVATIVE TREATMENT**	**SURGICAL TREATMENT**
AND		**AND**		
Weakness of wrist or finger extension OR Pain/ache over the proximal, lateral forearm	Weakness in radial innervated muscles OR Pressure over the radial nerve provokes pain/ tenderness	Needle electromyography (EMG) showing RTS or PINS by: Evidence of denervation in muscles supplied by the posterior interosseous nerve (PIN) or radial nerve distal to the brachioradialis AND Normal findings in muscles innervated by the radial nerve proximal to the radial tunnel and PIN (brachioradialis, anconius and triceps muscles) AND Exclusion of other potential causes of neuropathic symptoms, such as neuralgic amyotrophy, brachial plexopathy, or cervical radiculopathy	Modification of activities that exacerbate symptoms AND Splinting to maintain forearm supination and/or wrist extension AND/OR Physical therapy AND/OR Anti-inflammatory drug therapy	Surgical treatment should only be considered if: 1. The patient has met the diagnostic criteria under Section III AND 2. The condition interferes with work or activities of daily living AND 3. The condition does not improve despite conservative treatment Without confirmation of nerve entrapment **by both objective clinical findings and abnormal EDS**, surgery will not be authorized.

*Work-Related Radial Nerve Entrapment: radial tunnel syndrome (RTS) or posterior interosseous nerve syndrome (PINS)

II. INTRODUCTION

This guideline is to be used by physicians, Labor and Industries claim managers, occupational nurses, and utilization review staff. The emphasis is on accurate diagnosis and treatment that is curative or rehabilitative (see WAC 296-20-01002 for definitions). An electrodiagnostic worksheet and guideline summary are appended to the end of this document.

This guideline was developed in 2010 by the Washington State Industrial Insurance Medical Advisory Committee (IIMAC) and its subcommittee on Upper Extremity Entrapment Neuropathies. The subcommittee presented its work to the full IIMAC, and the IIMAC made an advisory recommendation to the Washington State Department of Labor & Industries to adopt the guideline. This guideline was based on the weight of the best available clinical and scientific evidence from a systematic review of the literature* and a consensus of expert opinion. One of the Committee's primary goals is to provide standards that ensure a uniformly high quality of care for injured workers in Washington State.

Radial nerve entrapment (RNE) is uncommon in the absence of acute trauma. When it occurs in relation to work, RNE usually refers to one of two syndromes: radial tunnel syndrome (RTS) or posterior interosseous nerve syndrome (PINS)[1,2]. Although RNE may occur from compression at any point along the course of the radial nerve due to acute trauma (e.g. humerus fracture, Saturday night palsy), space-occupying lesion (e.g. lipoma, ganglion), local edema or inflammation, this guideline focuses on RTS and PINS, which are more typical for RNE arising from repetitive work activities.

RTS and PINS have been described to occur at one of five potential sites. These sites, from proximal to distal, include the fibrous bands of the radiocapitellar joint, radial recurrent vessels (the leash of Henry), the tendinous edge of the extensor carpi radialis brevis, the arcade of Frohse, and the distal edge of the supinator. Most cases of RNE have been described at the arcade of Frohse.

In general, work-relatedness and appropriate symptoms and objective signs must be present for Labor and Industries to accept RNE on a claim. Electrodiagnostic studies (EDS), including nerve conduction velocity studies (NCVs) and needle electromyography (EMG), should be scheduled immediately to confirm the clinical diagnosis. If time loss extends beyond two weeks or if surgery is requested, completion of EDS is required and does not need prior authorization.

III. ESTABLISHING WORK-RELATEDNESS

Work related activities may cause or contribute to the development of RNE. Establishing work-relatedness requires all of the following:

1. Exposure: Workplace activities that contribute to or cause RNE, and
2. Outcome: A diagnosis of RNE that meets the diagnostic criteria under Section III, and
3. Relationship: Generally accepted scientific evidence, which establishes on a more probable than not basis (greater than 50%) that the workplace activities (exposure) in an individual case contributed to the development or worsening of the condition (outcome).

When the Department receives notification of an occupational disease, the Occupational Disease & Employment History form is mailed to the worker, employer or attending provider. The form should be completed and returned to the insurer as soon as possible. If the worker's attending provider completes

* Evidence was classified using criteria defined by the American Academy of Neurology (see references)

the form, provides a detailed history in the chart note, and gives an opinion on causality, he or she may be paid for this (use billing code 1055M). Additional billing information is available in the Attending Doctor's Handbook.

Certain work-related activities have been associated with RNE, usually those requiring forceful and repetitive elbow extension and forearm supination, handling of loads greater than 1 kg, and firm pinching or squeezing of objects or hand tools[3,4]. Jobs where these activities often occur may include but are not limited to the following [3,5-8]:

Construction
Machine tuning
Sewing
Smelting
Assembly line inspection
Packing

Several occupations have been described in association with RNE. This is **not** an exhaustive list and is meant only as a guide in the consideration of work-relatedness [5-9]:

Truck driver
Assembly line worker
Television industry worker
Mechanic
Seamstress
Cement or brick layer
Automobile brakes industry worker
Shoes and clothing industry worker
Ice cream packer
Secretary

IV. MAKING THE DIAGNOSIS

A. SYMPTOMS AND SIGNS

A case definition of confirmed RNE includes appropriate symptoms, objective physical findings ("signs"), and abnormal electrodiagnostic studies. A provisional diagnosis of RNE may be made based upon appropriate symptoms and objective signs, but confirmation of the diagnosis requires abnormal EDS.

Symptoms associated with RNE may include weakness in radial innervated muscles and pain or aching over the proximal, lateral forearm. Patients may report an increase in pain severity with an increase in activity or during sleep. Loss of motor function is most common with PINS [10].

Signs on examination may include tenderness over the radial nerve distal to the lateral epicondyle. Tenderness on palpation is a useful objective finding, but cannot support the diagnosis of RNE alone. Motor findings include difficulty extending the thumb, fingers, or wrist [11]. Motor testing should compare strength of radial innervated muscles to strength of the same muscles in the non-affected limb as well as non-radial innervated muscles of the affected limb (see Table 1). Atrophy of affected muscles may be seen in chronic or severe cases.

Provocative tests have been described to help corroborate the diagnosis of RNE. These include pressure over the radial tunnel ("radial nerve compression test"), resisted supination with the elbow extended ("resisted supination test"), and resisted extension of the middle-finger at the metacarpophalangeal joint ("middle-finger test"). These tests are based on creating maximal tension on the anatomical sites that are involved in RNE [12]. However, sensitivity and specificity of these tests have not been established and these tests can not replace the objective signs discussed below.

Table 1. Muscles Innervated by the Radial Nerve

In the arm, via the muscular branch of the radial nerve • *triceps brachii (long head, medial head, lateral head)* • *anconeous* • *brachioradialis* • *extensor carpi radialis longus*
In the forearm, via the deep branch of the radial nerve • *extensor carpi radialis brevis* • *supinator*
In the forearm, via the posterior interosseous nerve: • *extensor digitorum communis* • *extensor digiti minimi* • *extensor carpi ulnaris* • *abductor pollicis longus* • *extensor pollicis brevis* • *extensor pollicis longus* • *extensor indicis proprius*

Every effort should be made to objectively confirm the diagnosis of RNE before considering surgery. A differential diagnosis for RNE includes extensor tendinitis and lateral epicondylitis (which can coexist with RNE), neuralgic amyotrophy, brachial plexopathy, or cervical radiculopathy [5,13 14].

B. ELECTRODIAGNOSTIC STUDIES (EDS)

Electromyographic (EMG) abnormalities are required to objectively confirm the diagnosis of RNE. NCV abnormalities, such as radial motor or sensory conduction block across the elbow, or reduced sensory nerve action potentials, are of unproven utility, so NCV alone should not be relied upon to confirm the diagnosis. EDS confirmation requires abnormal EMG, with evidence of denervation in muscles supplied by the posterior interosseous nerve with or without denervation in other radial-innervated forearm muscles. EDS should exclude other potential causes of neuropathic symptoms, such as cervical radiculopathy, brachial plexopathy, or neuralgic amyotrophy. A worksheet to help interpret EDS results is provided in Section VI.

C. OTHER DIAGNOSTIC TESTS

It has been suggested that Magnetic Resonance Imaging (MRI) neurography may be helpful in the diagnosis of RNE [15]. However, these services will not be authorized for this condition because their clinical utility has not yet been proven. While the Committee recognizes that MRI neurography may be useful in unusual circumstances where EDS results are normal in a patient with appropriate clinical symptoms, the Committee believes that at this time MRI for this purpose is investigational and should be used only in a research setting.

V. TREATMENT

No randomized controlled trials or controlled clinical trials have measured the effectiveness of any treatment interventions[16]. Non-surgical therapy may be considered for cases in which a provisional diagnosis has been made. Surgical treatment should be provided only for cases in which the diagnosis of

RNE has been confirmed by abnormal EDS. Under these circumstances, the potential benefits of radial nerve decompression may outweigh the risks of surgery.

A. CONSERVATIVE TREATMENT

Conservative treatment for RNE has been described in narrative reviews, case reports, and retrospective case series. Examples include modification of activities that exacerbate symptoms, splinting to maintain forearm supination and/or wrist extension, physical therapy, and anti-inflammatory drug therapy [6,8,10,17,18]. No specific method of conservative treatment has been proven to be most effective.

When feasible, job modifications that reduce the intensity of manual tasks may prevent progression and promote recovery from RNE. If symptoms persist despite appropriate treatment, permanent job modifications may still allow the patient to remain at work.

Patients do not usually need time off from work activities prior to surgery, unless they present with objective weakness or sensory loss in the distribution of the radial nerve that limits work activities or poses a substantial safety risk.

B. SURGICAL TREATMENT

Surgical treatment for RNE has been described in narrative reviews, case reports, and retrospective case series [6,9,17,19,20]. Surgery should include exploration of the radial nerve throughout its course in order to decompress it by resecting any compressive and/or constrictive structures. These may include any of the five sites of compression mentioned earlier. No specific method of surgical treatment has been proven to be most effective.

Surgical treatment should only be considered if:

1. The patient has met the diagnostic criteria under Section III, and
2. The condition interferes with work or activities of daily living, and
3. The condition does not improve despite conservative treatment

Without confirmation of radial nerve entrapment **by both objective clinical findings and abnormal EDS**, surgery will not be authorized.

VI. RETURN TO WORK (RTW)

A. EARLY ASSESSMENT

Timeliness of the diagnosis can be a critical factor influencing RTW. Among workers with upper extremity disorders, 7% of workers account for 75% of the long-term disability.[21] A large prospective study in the Washington State workers' compensation system identified several important predictors of long-term disability: low expectations of return to work (RTW), no offer of a job accommodation, and high physical demands on the job.[22] Identifying and attending to these risk factors when patients have not returned to work within 2-3 weeks of the initial clinical presentation may improve their chances of RTW.

Washington State workers diagnosed accurately and early were far more likely to RTW than workers whose conditions were diagnosed weeks or months later. Early coordination of care with improved timeliness and effective communication with the workplace is also likely to help prevent long-term disability.

A recent quality improvement project in Washington State has demonstrated that delivering medical care according to occupational health best practices similar to those listed in Table 1 can substantially prevent long-term disability. Findings can be viewed at:
Centers of Occupational Health & Education.

Table 2. Occupational Health Quality Indicators for Work-Related Radial Nerve Entrapment (RNE)

Clinical care action	Time-frame*
1. Identify physical stressors from both work and non-work activities; 2. Screen for presence of RNE 3. Determine work-relatedness 4. Recommend ergonomic improvements	1st health care visit
Communicate with employer regarding return to work (RTW) using 1. Activity Prescription Form (or comparable RTW form) and/or 2. Phone call to employer	Each visit while work restrictions exist
1. Assess impediments for RTW 2. Request specialist consultation	If > 2 weeks of time-loss occurs or if there is no clinical improvement within 6 weeks
Specialist consultation	Performed ASAP, within 3 weeks of request
Electrodiagnostic studies	If the diagnosis of RNE is being considered, schedule studies immediately. These tests are required if time-loss extends beyond 2 weeks, or if surgery is requested.
Surgical decompression	Performed ASAP, within 4-6 weeks of determining need for surgery

*"Time-frame" is anchored in time from 1st provider visit related to RNE complaints.

B. RETURNING TO WORK FOLLOWING SURGERY

How soon a patient can return to work depends on the type of surgery performed and when rehabilitation begins. Most patients can return to light duty work within 3 weeks and regular duty within 6 weeks of surgery. Hand therapy may help patients regain their range of motion and strength.

VII. ELECTRODIAGNOSTIC WORKSHEET

Claim Number: _____

Claimant Name: _____

PURPOSE AND INSTRUCTIONS

The purpose of this worksheet is to help medical and nursing staff interpret electrodiagnostic studies (EDS) done for an injured worker. The worksheet should be used only when the main purpose of the study is to evaluate radial nerve entrapment (RNE). It should accompany but not replace the detailed report normally submitted to the insurer. We encourage you to use the electrodiagnostic worksheet below to report electromyography (EMG) results, but we will accept the results on a report generated by your office system.

Electrodiagnostic Worksheet for Work-Related Radial Nerve Entrapment (RNE)

Electromyography criteria that confirm the diagnosis of Work-Related RNE (radial tunnel syndrome OR posterior interosseous nerve syndrome) include the following:	**Abnormal muscles**
1. Abnormal needle EMG with evidence of denervation (e.g. increased insertional activity, fibrillation potentials, positive sharp waves) in at least one muscle supplied by the posterior interosseous nerve (extensor digitorum minimi, extensor carpi ulnaris, abductor pollicus longus, extensor pollicus brevis, extensor pollicus longus, extensor indicis proprius) and/or radial innervated muscles distal to the brachioradialis including the extensor carpi radialis brevis and supinator (excluding the extensor carpi radialis longus due to its variable take off).	
AND	
2. Normal needle EMG of at least one muscle supplied by radial nerve branches above the elbow (triceps, anconeus, brachioradialis). If abnormal, consider alternative explanations for radial nerve injury above the elbow.	
AND	
3. Normal needle EMG of at least one muscle supplied by the ulnar or median nerve that includes C7 innervation. If abnormal, consider cervical nerve root compression or lower brachial plexopathy.	

Additional Comments:

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Signed Date

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Evidence was classified using criteria defined by the American Academy of Neurology[†]

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