

TECHNIQUE

Radial Tunnel Syndrome

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■ ABSTRACT

True neurogenic radial tunnel syndrome is an uncommon condition caused by entrapment of the radial or posterior interosseous nerve. It is a subjective pain syndrome with rare motor findings. The chief complaint is generally pain at the dorsal aspect of the upper forearm; any weakness is usually secondary to pain. Electrodiagnostic studies are unreliable in radial tunnel syndrome. Although previous studies have found a high rate of good results, the authors believe that a high rate of morbidity is associated with both the disease and its treatment. Based on their results they suggest that great caution has to be taken before performing radial tunnel release, and strict adherence to the indications should be noted during the preoperative examination. A trial of nonsurgical treatment is warranted in all patients. Patients who do not respond or continue to progress despite conservative treatment are candidates for surgical decompression. Based on the recent literature, surgical decompression leads to approximately 60 to 70% good and excellent results.

Keywords: radial, tunnel, neuropathy, PIN, entrapment, supinator muscle

■ HISTORICAL PERSPECTIVE

In 1972, Roles and Maudsley,¹ proposed that some cases of “persistent tennis elbow” were the result of “radial tunnel syndrome”: entrapment of the radial nerve or its posterior interosseous branch in the radial tunnel. This concept has been perpetuated in the orthopedic literature despite cogent critiques. Since then, several investigators analyzed their experience with radial tunnel and defined the differences between lateral epicondylitis, radial tunnel syndrome, and posterior interosseous nerve (PIN) syndrome more clearly.^{2–4}

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The “radial tunnel” is defined as the potential space created by structures surrounding the radial nerve and its posterior interosseous branch as they travel through the proximal forearm from the humeroradial joint past the proximal edge of the supinator muscle. Some investigators believe the radial tunnel extends as far as the distal border of the supinator.⁵ Within the tunnel, motor branches provide innervation for the extensor carpi radialis brevis and supinator. The nerve provides sensory branches to the periosteum of the lateral epicondyle, the anterior radiohumeral joint, and the annular ligament. The bifurcation of radial nerve is not always within the radial tunnel. Over a distance of approximately 5 cm in the radial tunnel, the PIN can be compressed 1) dynamically by the conjoint tendon of origin of the wrist and finger extensors, 2) by fibrous bands, 3) by recurrent radial vessels (the leash of Henry; Fig. 1), 4) by the fibrous edge of the extensor carpi radialis brevis, 5) by the fibrous proximal border of the superficial portion of the supinator (arcade of Frohse; Fig. 2), and 6) by the distal edge of the supinator. At any level, the PIN also may be compressed by a ganglion or lipoma, or by marked swelling of the elbow capsule resulting from rheumatoid synovitis. The latter usually presents as palsy and not as a pain syndrome.

Four operative approaches have been described for surgical management of radial tunnel syndrome: the anterolateral approach (between the brachialis and brachioradialis), the posterior lateral approach⁶ (between the extensor carpi radialis brevis and the extensor digitorum communis), the transbrachioradialis approach⁷ (over the brachioradialis muscle), or the modified posterior lateral approach⁸ (between the finger extensor muscles and the extensor carpi ulnaris).

■ INDICATIONS/CONTRAINDICATIONS

Radial tunnel is a subjective pain syndrome with rare motor findings. The chief complaint is generally pain at

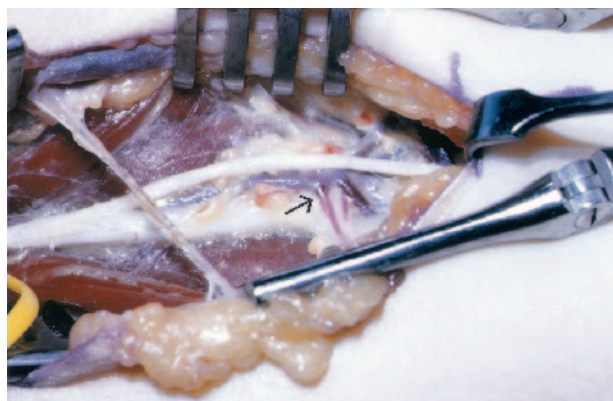


FIG. 1. Compression of the posterior interosseous nerve at the leash of Henry (**arrow**).

the dorsal aspect of the upper forearm; any weakness is usually secondary to pain. Deep and aching night pain may be a notable complaint in some patients on the lateral aspect of the elbow. Most affected are manual laborers performing work that requires forceful and repetitive movements involving elbow extension and forearm supination.

Tenderness to palpation occurs over the radial tunnel—the area of the radial neck—rather than the lateral epicondyle. The symptoms are exacerbated in passive pronation with the wrist flexed and active supination with the elbow extended against resistance. The “middle finger test” is positive if resisted middle finger extension produces pain resulting from compression of the PIN nerve at the edge of the extensor carpi radialis brevis in the proximal forearm. This test may also be positive in lateral epicondylitis.

Radiographic evaluation of the elbow should be performed to rule out other skeletal pathology. Electrodiagnostic studies should be obtained, although positive results are rare. The best surgical indication is a patient



FIG. 2. Compression of the posterior interosseous nerve at the arcade of Frohse (**arrow**).

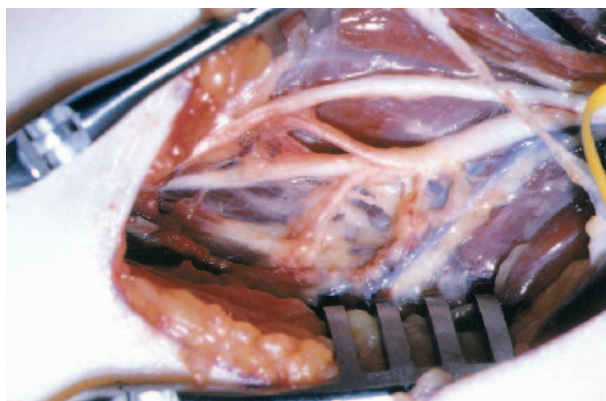


FIG. 3. The posterior interosseous nerve branches after complete release.

with classic subjective complaints and positive electromyographic findings.

Relief of symptoms after localized injection of an anesthetic into the radial tunnel, which produces a complete PIN palsy, confirms the diagnosis. The relief of pain brought about by the injection is indicative of the pain relief that can be expected after surgical decompression.

Nonoperative care, consisting of antiinflammatory medications, rest, and avoidance of provocative activities may alleviate symptoms. A splint can be used to maintain forearm supination and wrist extension. Stretching exercises for the structures proximal to the elbow also are helpful. Conservative treatment is highly recommended because delay of surgery has never been reported to compromise the final recovery.

Candidates for surgery are patients who do not respond to prolonged conservative treatment. Ideally, the best surgical candidate complains of pain in association with resisted supination, positive middle finger test, positive electrodiagnostic findings, and pain relief after anesthetic injection into the radial tunnel.

The differential diagnosis includes lateral epicondylitis, which can coexist with radial tunnel syndrome, posterior interosseous neuropathy, neuralgic amyotrophy, extensor tendinitis, lateral elbow instability, or cervical radiculopathy and brachial plexopathy.

Based on the recent literature, surgical decompression leads to approximately 60^{9–11} to 70% good and excellent results. A guarded prognosis is expected after decompression in patients who have work-related injuries, chronic pain, and poor localization of symptoms on physical examination.

■ TECHNIQUE

Anterior Approach

The anterior (Henry’s) approach is recommended because it allows the best exposure of the radial nerve. If

release of the extensor origin with lateral epicondylectomy is indicated, a separate lateral incision can be used. Alternatively, a dorsal Thompson approach can be used, although proximal exposure of the radial nerve is more difficult.

General or regional block anesthesia per the surgeon's preference is provided. The forearm is positioned in supination on a hand table, the arm is exsanguinated, and a tourniquet is inflated.

A curvilinear incision is made starting 3 cm superior the lateral humeral epicondyle, 3 cm medial to the lateral supracondylar ridge, which continues distally between the biceps and brachioradialis muscles, curving across the elbow flexion crease, and continuing dorsally.

The subcutaneous tissues are separated, the cephalic vein preserved or ligated for exposure, and the lateral cutaneous nerve of the forearm identified and protected. The fascia is divided along the brachioradialis muscle, which is then retracted laterally while retracting the brachialis in the proximal wound and the biceps and pronator teres in the distal wound medially. The radial nerve is identified proximally in the interval between the brachialis and the brachioradialis, and is traced distally into fibrous bands overlying the PIN along with the fibrous leading edge of the extensor carpi radialis brevis muscle, which is divided. The recurrent radial vessels (leash of Henry) are ligated. The arcade of Frohse (Fig. 3) is sectioned longitudinally. The five structures commonly implicated as possible offenders include the fibrous adhesions between the brachialis and brachioradialis, the leash of Henry, the fibrous edge of the extensor carpi radialis brevis, the arcade of Frohse, and fibrous bands associated with the supinator muscle. To visualize the entire length of the supinator, the mobile wad must be elevated and retracted. Lesions such as ganglia or lipomas are excised as indicated. The motor branch to the extensor carpi radialis brevis should be identified and protected. The tourniquet is released, careful hemostasis is obtained, and the subcutaneous layer and skin are repaired.

Posterior (Henry or Thompson) Approach

The skin incision starts at a point just distal to the lateral humeral epicondyle and continues 6 to 8 cm distally along the proximal two-thirds of a line extending from the mid-dorsal aspect of the wrist to the lateral epicondyle (Fig. 4). The lateral cutaneous nerves of the forearm should be identified and protected. The dissection plane is between the muscle bellies of the extensor carpi radialis brevis and the extensor digitorum communis. The extensor digitorum communis muscle can be detached from the lateral epicondyle if further exposure is needed. The supinator is identified and at the proximal edge of it, the PIN can be found surrounded by a small amount of

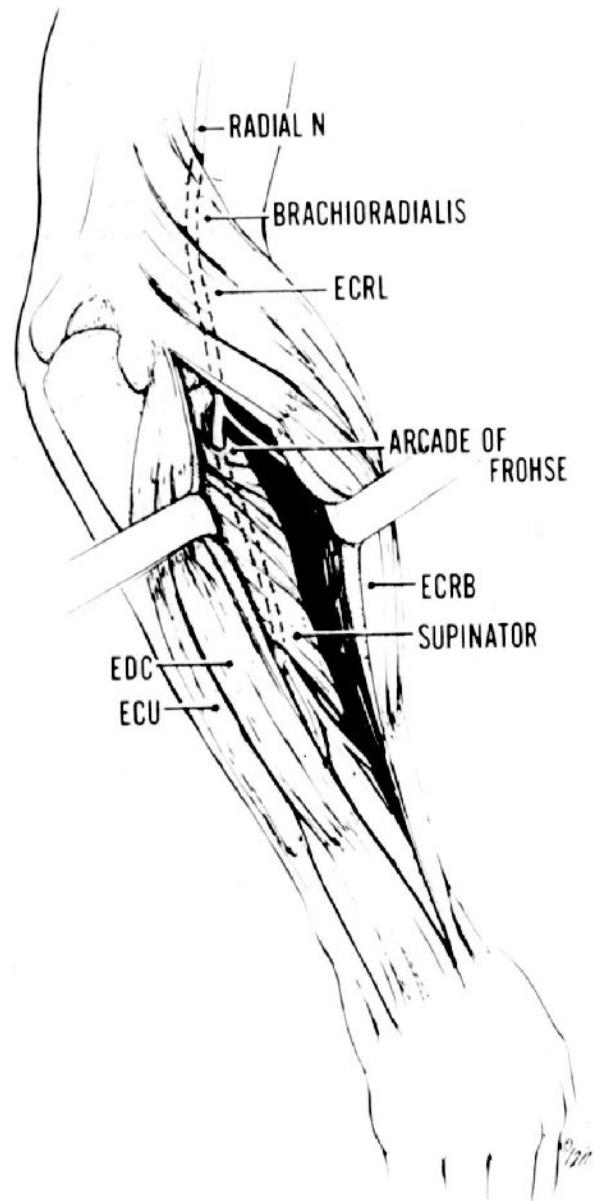


FIG. 4. Posterior approach of the radial tunnel. Path of radial nerve through the radial tunnel.

fat. Here the arcade of Frohse and the fibrous edge of the extensor carpi radialis brevis and the adjacent recurrent leash of Henry vessels can be identified. The PIN is then carefully decompressed under direct vision.

An advantage of the posterior approach is that degenerative fibroblastic tissue about the conjoint tendon and the radial head area may be excised and a lateral humeral epicondylectomy¹² and/or extensor origin release can be performed via a single incision.

REHABILITATION

After surgery, no splinting is required. A soft compression dressing with immediate mobilization is suggested.

Most patients may begin activities of daily living after 10 to 14 days. A return to work is usually possible 6 weeks after the operative procedure. Most workers are returned to part-time or to light duty initially and then gradually progress into a full workload schedule.

■ COMPLICATIONS

Recurrence of symptoms after a pain-free period of 2 to 3 months often correlates with return to work. One explanation is that of inflammatory neuritis with heavy repetitive manual activity, or scar formation may occur.

Postoperative superficial radial nerve neuropraxia is very common, which usually resolves uneventfully. PIN neuropraxia and radial nerve paresis are very uncommon. Dysesthesias along the course of the superficial radial nerve can occur but usually resolves spontaneously after a short period of time.

In summary, an imprecise definition of “radial tunnel syndrome” can lead to ill-conceived surgery. Patient selection is of great importance, including pain with resisted supination, a positive middle finger test, relief with local anesthetic injection, and failed nonoperative management. One must clearly differentiate radial tunnel syndrome from lateral epicondylitis before surgery.

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