Ulnar Nerve Transposition

Surgical Indications and Considerations

Anatomical Considerations: The ulnar nerve runs just posterior to the medial epicondyle in the cubital tunnel (ulnar groove). This key depression helps protect the ulnar nerve and is the most frequent site for ulnar nerve injury. Posner defined 5 areas of potential compression around the elbow as follows:

- Under the heading intermuscular septum. Posner lists the arcade of Struthers (a musculofascial band about 8 cm proximal to the medial epicondyle), the medial intermuscular septum (which the nerve pierces to reach the olecranon groove), and the medial head of the triceps muscle (which can be hypertrophied or can chronically snap over the medial epicondyle, causing a neuritis).

- The area of the medial epicondyle is a valgus deformity caused by malunion of a condylar fracture, nonunion of a condylar fracture, or an epiphyseal injury to the lateral side of the elbow. These may cause tardy ulnar palsy secondary to chronic stretching of the ulnar nerve.

- The olecranon or epicondylar groove is a fibroosseous tunnel holding the ulnar nerve and its vascular accompaniment. A congenitally shallow groove or a torn fibrous roof can allow the nerve to chronically sublux or dislocate, causing neuritis and palsy.

- The cubital tunnel is the passage between the 2 heads of the flexor carpi ulnaris, which are connected by a continuation of the fibroaponeurotic covering of the epicondylar groove (Osborne ligament). During elbow flexion, the tunnel flattens as the ligament stretches, causing pressure on the ulnar nerve.

- Flexor-pronator aponeurosis is the fifth area. As the nerve exits the flexor carpi ulnaris, it perforates a fascial layer between the flexor digitorum superficialis and the flexor digitorum profundus. Entrapment can occur here also.

Pathogenesis: With the anatomic positioning of the ulnar nerve, it is subject to entrapment and injury by a wide variety of causes. The most common sites of entrapment around the elbow are the olecranon groove and the cubital tunnel. With its superficial position at the elbow, it is often injured by excessive pressure in this area (leaning on the elbow during work, while driving a car, using elbows to lift the body from bed, and resting elbows on car windows while driving, epicondylar fracture). Fracture fragments and arthritic spurs in or around the groove impinging on the nerve can also cause entrapment and subsequent neuritis. Traumatic hemorrhage, soft tissue tumors, ganglia, infections, osteochondromas, and synovitis secondary to rheumatoid diseases may also cause entrapment and nerve dysfunction.

Epidemiology: Ulnar nerve entrapment is the second most frequent entrapment neuropathy in the upper extremity (the first being the median nerve and its branches). Because of the anatomic arrangement of structures, the area around the elbow is the most common area for entrapment. The ulnar nerve can also be compressed at Guyon's canal.

Diagnosis: Presenting symptoms can vary from mild transient parasthesias in the ring and small fingers to clawing of these digits and severe intrinsic muscle atrophy. The patient may report severe pain at the elbow or wrist with radiation into the hand or up into the shoulder and neck. Patients may report difficulty in opening jars or turning doorknobs. Early fatigue or weakness may be noticed if work requires repetitive hand motions. If the patient rests on the elbows at work, increasing numbness and parasthesias may be noticed throughout the day. Tenderness to palpation along the course of the nerve is probable. Flexor carpi ulnaris and flexor digitorum profundus strength may be weak. Weakness of thumb pinch may be elicited by the Froment sign. Numbness usually precedes motor loss. Muscle wasting and clawing of the ring and small digits are indicative of a chronic compressive syndrome.

Ulnar nerve compression will either occur at the cubital tunnel or Guyon's canal. The dorsal cutaneous branch of the ulnar nerve comes off proximal to Guyon canal. Therefore, dorsal sensory involvement of the 4th and 5th digits would indicate a problem proximal to the wrist. Thus by assessing whether the numbness involves both volar and dorsal or just dorsal aspects of digits you can diagnosis compression site.

Radiographs of the elbow reveal abnormal anatomy, such as a valgus deformity, bone spurs or bone fragments, a shallow olecranon groove, osteochondromas, and destructive lesions (e.g., tumors, infections, abnormal calcifications). Electromyography tests and nerve conduction studies are indicated to confirm the area of entrapment, document the extent of the pathology, and detect or rule out the possibility of double crush syndrome.

Nonoperative versus Operative Management: Conservative treatment of ulnar nerve compression is most successful when parasthesias are transient and caused by malposition of the elbow or blunt trauma. Patient education and insight are important. Resting on elbows at work, using elbows to lift the body from bed, and resting elbows on car windows while driving all are causes of parasthesia that can be corrected without surgical treatment. Patient education, anterior elbow extension splinting (if necessary), nerve mobilization techniques, soft tissue mobilization, ultrasound, strengthening exercises, stretching and correction of ergonomics at work should correct these transient palsies.

Nonsteroidal anti-inflammatory medications also are useful adjuncts to relieve nerve irritation. Oral vitamin B-6 supplements may be helpful for mild symptoms. This treatment should be carried out for 6-12 weeks, depending on patient response. Indications for surgery are the following: 1) no improvement in presenting symptoms after 6-12 weeks of conservative treatment, 2) progressive palsy or paralysis, 3) clinical evidence of a long-standing lesion (e.g., muscle wasting, clawing of the fourth and fifth digits.) Dellon's investigation noted that ulnar nerve transposition was associated with an 88% rate of good to excellent results. Fitzgerald noted that the average duration of limited work capacity (full military active duty work status) was 4.8 months (range 3-7 months).

Surgical Procedure: Decompression with anterior transposition usually is the operation of choice for ulnar nerve compression at the elbow because it removes the nerve from its compressive bed and puts it in one that is more suitable. By transferring the nerve anteriorly, it effectively lengthens the nerve, decreasing tension on it in flexion. It is the most commonly used method of transposition because it is easy to perform and results are good. An incision begins 8 cm above the medial epicondyle and continues downward to a point midway between the medial epicondyle and the olecranon groove. It then continues for about 6 cm distally over the flexor carpi ulnaris. Once the nerve has been visualized the distal portion of the medial intermuscular septum, the fibroaponeurotic roof of the epicondylar groove, the Osborne ligament, and the fascia of flexor carpi ulnaris are incised, freeing the ulnar nerve. The nerve is positioned beneath the subcutaneous tissue and held to the muscle fascia with a few sutures through the epineurium. Postoperatively, the elbow is immobilized in a cast or splint at 45 degrees of flexion for 2 weeks.

Preoperative Rehabilitation

- Further injury protection using a splint – with the elbow in about 90 degrees of flexion for 2 weeks
- Instructions/review post-operative rehabilitation plan

POSTOPERATIVE REHABILITATION

Note: The following rehabilitation progression is a summary of the guidelines provided by Andrews, Hurd and Wilk. Refer to their publication to obtain further information regarding criteria to progress from one phase to the next, anticipated impairments and functional limitations, interventions, goals, and rationales.

Phase I for Immobilization and Rehabilitation: Weeks 1-3

Goals: Control edema and pain
Protect surgical site
Minimize deconditioning of upper extremity
Manage edema
Increase elbow ROM

Intervention:

- Posterior splint with elbow at 90 degrees of flexion
- At 2 weeks, place elbow in hinged elbow brace set a -30˚ extension and 100˚ flexion
- At 3 weeks progress brace ROM to -15˚ extension and 110˚ flexion
- Cryotherapy
- Submaximal isometrics for shoulder and wrist
- Active wrist flexion and extension

Phase II for Immobilization and Rehabilitation: Weeks 4-8

Goals: Elbow active range of motion 0-145˚
Continue to protect repair and from unprotected valgus force
Increase upper quarter strength
Improve tolerance to active range of motion

Intervention:

- Brace set at -10˚ extension and 120˚ flexion. May increase 5˚ extension and 10˚ flexion per week
- Isotonic exercise (1-2 lbs) – Wrist flexion/extension, forearm pronation/supination, elbow flexion/extension, and rotator cuff exercises avoiding internal rotation
- After 6 weeks, brace set at 0˚-130˚, add shoulder internal rotation exercises and progress all exercises as indicated

Phase III for Rehabilitation: Weeks 9-13

Goals: Increase strength of upper extremity
Increase muscular control of upper extremity
Full range of motion (ROM)
Allow patient to become pain free or self-manage with gradual return to activities
Strengthen upper extremity with sport-specific activities

Intervention:

- Progress with plyometric exercises
- Isotonic exercises – Progress wrist, elbow and shoulder
- Initiate eccentric elbow flexion and extension exercises
- Proprioceptive neuromuscular facilitation (PNF) patterns
- Light sporting activities such as golf or swimming

Phase IV for Rehabilitation: Weeks 14-26

Goals: Symmetric upper extremity strength
Gradual return to unrestricted sport activity

Intervention:

- Continue intervention strategies listed in Phase III as indicated by remaining impairments
- Return to competitive sports between 22 and 28 weeks

Selected References:

Andrews J, Hurd WJ, Wilk KE. Reconstruction of the Ulnar Collateral Ligament with Ulnar Nerve Transposition. In Maxey L, Magnusson J, eds., *Rehabilitation for the Postsurgical Orthopedic Patient*. St. Louis, MO: Mosby; 2001.

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