

Complications of Compressive Neuropathy Prevention and Management Strategies



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KEYWORDS

- Median nerve • Ulnar nerve • Carpal tunnel syndrome • Carpal tunnel release
- Ulnar tunnel syndrome • Cubital tunnel syndrome • Complications

KEY POINTS

- Prevention of complications begins with a solid understanding of the normal anatomy and anatomic variations that may exist.
- Carpal tunnel release is among the most common hand surgical procedures performed, but complications occur in up to 25% of cases. Revision carpal tunnel surgery may be indicated in patients who present with recurrent, persistent, or new symptoms due to inadequate release, iatrogenic injury, recurrent symptoms, or perineural fibrosis.
- Cubital tunnel syndrome is the second most common compressive neuropathy, but recurrence or failed decompression occurs in 25% to 35% of patients. Frequently reported complications include injury to the medial antebrachial cutaneous (MABC) nerve, ulnar nerve subluxation, and recurrent symptoms because of inadequate release or perineural fibrosis.

Compressive neuropathies of the upper extremity are common and can result in profound disability if left untreated.^{1–3} Nerve releases are frequently performed, but can be complicated by both iatrogenic events and progression of neuropathy. In this review, we examine the management of post-operative complications after 2 common nerve compression release procedures: carpal tunnel release and cubital tunnel release.

CARPAL TUNNEL SYNDROME

Carpal tunnel syndrome (CTS) is the most common compressive neuropathy, affecting 1.6% to 7.8% individuals.^{4–6} Carpal tunnel release (CTR) is one

of the most frequently performed outpatient procedures in the United States, and is typically considered to be a minor elective and routine procedure.⁷ Complications are rare, but can result in devastating loss of hand function.

Intraoperative Complications

Normal anatomy of the carpal tunnel guides incision placement for open release; however, several anatomic variants exist, and can increase the risk of iatrogenic injury.^{8–10} A solid understanding of the anatomic relationships of the proximal palm, carpal canal, and distal forearm can direct correct incision placement and prevent iatrogenic injury

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(Fig. 1).^{11–17} Fortunately, injury to major neurovascular structures during CTR is exceedingly low. Permanent nerve injury more commonly occurs to the branches of the median nerve, including the palmar cutaneous branch (0.03%), the deep motor branch of the median nerve (0.01%), or the common digital nerves (0.12%), compared with injury to the median nerve proper (0.06%).¹⁸

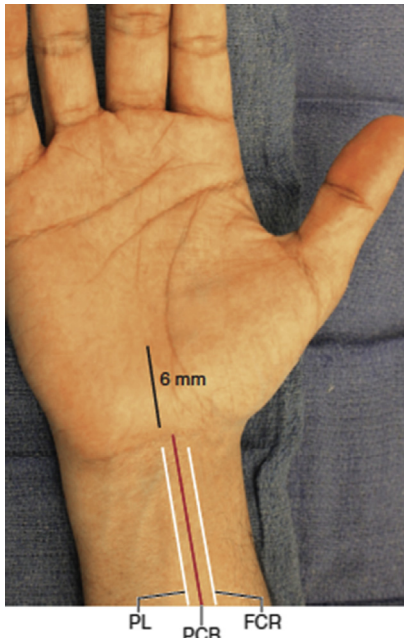


Fig. 1. Incision design for open CTR. Iatrogenic injury to the palmar cutaneous branch of the median nerve can result in persistent paresthesias and painful neuromas, an inadvertent division of the deep motor branch of the median nerve results in loss of grip strength due to lack of palmar abduction and weakness with opposition. To prevent this, incisions for an open release should lie 5 to 6 mm ulnar to the thenar crease, in line with the ulnar border of the middle finger. However, overcorrecting in the ulnar direction can result in entry into the more superficial Guyon canal, with potential injury to the ulnar neurovascular bundle. Inadvertent entry into the Guyon canal can be recognized if the dissection is carried down through the skin to reveal hypothenar fat, with diminutive palmar fascia, and no visualization of the transverse fibers of the transverse carpal ligament. Because the hand naturally is slightly pronated when placed on the hand table, entry into the Guyon canal can occur when the knife dissection is not perpendicular to the plane of the hand, but rather parallel to the transverse carpal ligament. FCR, flexor carpi radialis; PCB, palmar cutaneous branch; PL, palmaris longus. (From Sammer D. Open carpal tunnel release. In: Chung KC, editor. Operative techniques: hand and wrist surgery. vol. 2. Philadelphia: Elsevier Saunders; 2012; with permission.)

Injuries to adjacent structures, including the superficial palmar arch (0.1%), flexor tendons (0.1%), and the ulnar nerve (0.03%) also have been described.^{18,19} Endoscopic techniques may result in a slightly higher rate of major nerve injury (0.13%–0.3%) versus open techniques (0.10%–0.2%).^{18,20} However, other studies have not demonstrated a difference in major complications by technique. It is likely that overall complication rates are more dependent on surgeon experience with the specific technique.^{21–23}

Postoperative Complications

A description of potential postoperative complications and etiologies of treatment failures are outlined in **Table 1**. Superficial and/or deep space infections are uncommon, and occur in only 0.4% of cases. Currently, perioperative antibiotic prophylaxis and operating room sterility is not indicated for CTR procedures, given the low rates of perioperative infection.^{24,25} Symptomatic hypertrophic scarring and hypothenar “pillar” pain are more frequent, and have been correlated with perioperative mood disturbance. However, symptoms typically subside within 3 months, and can be managed by nonoperative techniques.²⁶ The incidence of pathologic pain syndromes, including complex regional pain syndrome (CRPS), has been described in up to 8% of patients after CTR.^{27,28} Early recognition and referral to specialists experienced in the management of pathologic pain syndromes and CRPS is critical to prevent the propagation of symptoms and permanent disability. Less commonly, flexor tendon complications have been described after division of the transverse carpal ligament, including bowstringing, adhesions, and triggering.^{29,30} Finally, wrist instability and pisotriquetral arthrosis has been reported in approximately 2% of patients, which often can be managed successfully with splinting, anti-inflammatory agents, and steroid injections. For those patients who have failed nonoperative measures, pisiform excision can be considered.³¹

Treatment Failure After Carpal Tunnel Release

After CTR, treatment failure can occur in up to 25% of patients, with approximately 12% of patients requiring secondary surgery.^{1,32,33} Treatment failure refers to the presence of neuropathic symptoms, and can be considered in the following way: (1) persistent symptoms, (2) recurrent symptoms, or (3) the presence of an alternate diagnosis.³³ Persistent CTS refers to the presence of ongoing symptoms after CTR without improvement following release, and is more commonly

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