

Surgical Release of the Carpal Tunnel in a Patient with Compressive Median Neuropathy: A Case Report

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ABSTRACT

Carpal tunnel syndrome (CTS) is the most common compressive neuropathy of the upper extremity and frequently coexists with other fibroproliferative disorders of the hand, particularly in patients with metabolic conditions such as diabetes mellitus. Trigger finger, a stenosing tenosynovitis caused by thickening of the A1 pulley, shares pathophysiological mechanisms with CTS, including collagen glycosylation and connective tissue alterations. We report the case of a 52-year-old right-handed woman with poorly controlled type 2 diabetes mellitus who presented with an 18-month history of progressive paresthesias in the median nerve distribution of the right hand, nocturnal pain, and decreased grip strength, associated with symptomatic triggering of the fifth digit. Physical examination and nerve conduction studies confirmed moderate to severe median nerve compression at the carpal tunnel. The patient underwent open carpal tunnel release combined with A1 pulley release of the fifth digit in a single operative session under regional anesthesia. Intraoperative findings included a thickened transverse carpal ligament and a flattened median nerve without structural disruption, as well as a fibrotic A1 pulley. Postoperatively, the patient experienced complete resolution of nocturnal pain and triggering, with progressive sensory recovery and restoration of thumb opposition strength at six-week follow-up. No complications were observed. This case highlights the frequent coexistence of CTS and trigger finger in diabetic patients and supports the safety and effectiveness of combined surgical management in a single procedure. Early recognition and comprehensive treatment of associated hand pathologies may improve functional outcomes and patient satisfaction.

KEYWORDS: Carpal tunnel syndrome; Median nerve compression; Trigger finger; A1 pulley release; Stenosing tenosynovitis; Open carpal tunnel release; Diabetes mellitus; Compressive neuropathy; Combined surgical treatment; Upper extremity surgery.

ARTICLE DETAILS

Published On:
06 April 2026

Available on:
<https://ijmscrs.com>

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common compressive neuropathy of the upper extremity and results from compression of the median nerve as it passes through

the carpal tunnel, an inextensible osteofibrous canal located on the volar aspect of the wrist. Its prevalence in the general population is estimated to range between 3% and 6%, with

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higher incidence in women and in patients between the fourth and sixth decades of life.

Pathophysiologically, increased intracarpal pressure leads to microvascular compromise of the median nerve, initially producing sensory disturbances and, in advanced stages, motor deficit and thenar atrophy. Clinically, it is characterized by paresthesias in the median nerve distribution, nocturnal pain, grip weakness, and positive provocative signs such as Phalen's and Tinel's tests.

Diagnosis is primarily clinical and may be confirmed with nerve conduction studies and electromyography, which allow determination of the severity of neurological involvement. Initial treatment is typically conservative; however, in moderate to severe or refractory cases, surgical release of the flexor retinaculum constitutes definitive management, with high rates of symptomatic improvement.

This study describes the case of a patient with carpal tunnel syndrome, including diagnostic evaluation and surgical management, highlighting clinical findings and postoperative outcomes.

CASE REPORT

A 52-year-old right-handed female with a history of type 2 diabetes mellitus of 8 years' duration, treated with metformin and with suboptimal metabolic control (HbA1c 8.2%), presented with an 18-month history of intermittent paresthesias in the thumb, index, and middle fingers of the right hand. Symptoms progressively increased in frequency and were associated with nocturnal burning pain that awakened her from sleep and required shaking the hand for relief. Over the preceding four months, she reported decreased grip strength, difficulty performing fine pinch activities, and occasional dropping of objects. Concomitantly, she experienced localized pain at the base of the fifth finger of the same hand, accompanied by painful triggering during flexion and episodes of locking in flexion requiring passive extension with the contralateral hand.

Physical examination revealed hypoesthesia in the median nerve distribution distal to the wrist, with preserved ulnar sensitivity. Phalen's test was positive at 15 seconds, and Tinel's sign was positive at the proximal wrist crease. Mild

thenar hypotrophy was observed without frank atrophy, with thumb opposition strength graded 4/5 according to the Daniels scale. Two-point discrimination measured 8 mm at the pulp of the index and middle fingers. A tender nodule was palpated over the A1 pulley region of the fifth digit, with evident triggering and intermittent locking consistent with grade III trigger finger. No signs of ulnar neuropathy or proximal nerve involvement were identified.

Nerve conduction studies demonstrated prolonged distal motor latency of the median nerve (5.8 ms), decreased sensory conduction velocity, and increased distal sensory latency, consistent with moderate to severe compressive neuropathy at the right carpal tunnel. Surgical management in a single operative session was elected due to clinical severity, failure of prior conservative treatment (night splinting and anti-inflammatory medication), and the coexistence of symptomatic trigger finger.

Under regional anesthesia via brachial plexus block and with application of a pneumatic tourniquet inflated to 250 mmHg after limb exsanguination, anatomical landmarks were marked, including the axis of the third digit, distal wrist crease, and the thenar and hypothenar eminences. A longitudinal incision approximately 3.5 cm in length was made slightly ulnar to the axis of the third digit, beginning 1 cm distal to the distal wrist crease and extending distally into the palm, respecting skin creases and avoiding injury to the palmar cutaneous branch of the median nerve. Dissection proceeded carefully through the subcutaneous tissue to expose the palmar aponeurosis, which was incised longitudinally. The transverse carpal ligament was identified and noted to be thickened. Controlled division of the flexor retinaculum was performed beginning at its most ulnar border to minimize risk to the recurrent motor branch, using blunt dissection and retractors for protection. Release was extended distally to visualize the fat of the superficial palmar arch and proximally to include the distal portion of the antebrachial fascia, ensuring complete decompression. The median nerve appeared flattened, with a pearly discoloration and partial loss of its normal superficial fascicular pattern, without masses, significant synovitis, or anatomical variations. Meticulous hemostasis was achieved.

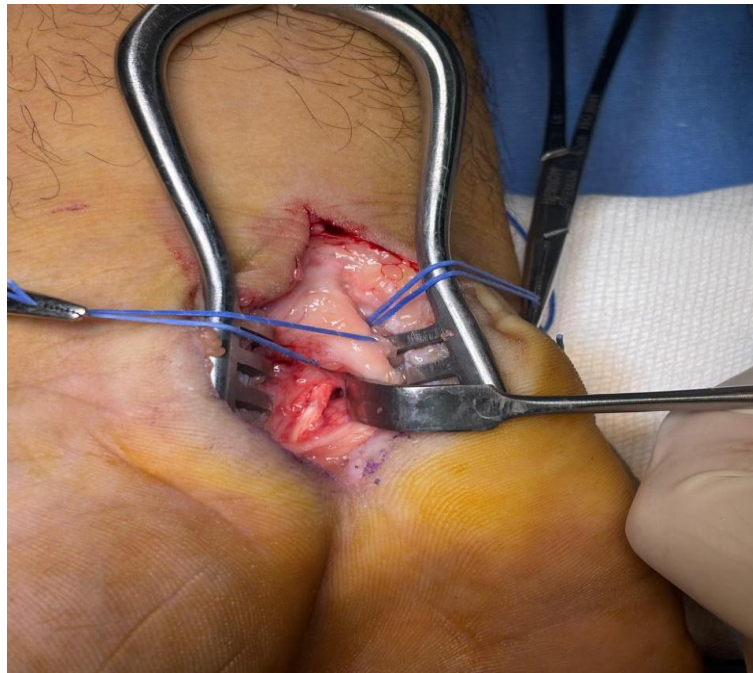


Figure 1. Intraoperative photograph demonstrating exposure and identification of the median nerve.

During the same operative session, the fifth digit was addressed through a 1.5 cm longitudinal incision centered over the distal palmar crease corresponding to the little finger. Careful dissection exposed the flexor tendon system and the thickened, fibrotic A1 pulley. The digital neurovascular bundles were protected, and complete longitudinal release of the A1 pulley was performed under direct visualization. Free excursion of the flexor digitorum superficialis and profundus tendons was confirmed through passive mobilization, demonstrating resolution of triggering and adequate tendon gliding. No significant synovitis or tendon lesions were observed.

Both surgical fields were irrigated with saline solution. The tourniquet was released, confirming adequate distal perfusion and absence of active bleeding. Subcutaneous

tissue was closed with absorbable 4-0 sutures and skin with interrupted 4-0 nylon sutures. A soft compressive dressing was applied without rigid immobilization, allowing immediate digital mobilization.

In the immediate postoperative period, the patient reported complete resolution of nocturnal pain. At two-week follow-up, wound healing was satisfactory with no evidence of infection or dehiscence. At six weeks, significant sensory recovery was noted, with two-point discrimination improving to 5 mm and thumb opposition strength to 5/5. Triggering of the fifth digit had completely resolved, without recurrence or residual stiffness. No complications such as recurrent branch injury, pillar pain, or persistent symptoms were documented.



Figure 2. Immediate postoperative photograph.

DISCUSSION

Carpal tunnel syndrome is the most common compressive neuropathy of the upper extremity and results from median nerve compression within the osteofibrous canal bounded by the carpal bones and the transverse carpal ligament. Its prevalence ranges from 3–6% in the general population, increasing to approximately 14% in patients with diabetes mellitus. Trigger finger, conversely, is a stenosing tenosynovitis caused by thickening of the A1 pulley, with a

prevalence of 2–3% in the general population and up to 10% in diabetic patients. Several studies have demonstrated a significant association between CTS and trigger finger, particularly in patients with metabolic disorders. This coexistence may be explained by shared pathophysiological mechanisms involving non-enzymatic collagen glycosylation, synovial thickening, and microvascular alterations.

Table 1. Pathophysiological Comparison Between Carpal Tunnel Syndrome and Trigger Finger

Characteristic	Carpal Tunnel Syndrome	Trigger Finger
Structure involved	Median nerve	Flexor tendon and A1 pulley
Primary mechanism	Increased intracarpal pressure	Fibrocartilaginous thickening of A1 pulley
Pathological type	Compressive neuropathy	Stenosing tenosynovitis
Histological changes	Endoneural edema, perineural fibrosis	Chondroid metaplasia, fibrosis
Association with DM	High	High

Diabetes mellitus promotes accumulation of advanced glycation end products (AGEs), leading to tissue stiffness, ligament thickening, and reduced connective tissue

elasticity, explaining the higher incidence and multifocal presentation.

Table 2. Impact of Diabetes Mellitus on CTS and Trigger Finger

Variable	Non-diabetic Patients	Diabetic Patients
CTS prevalence	3–6%	10–14%
Trigger finger prevalence	2–3%	8–10%
Bilateral presentation	Less frequent	More frequent
Clinical severity	Moderate	Greater severity
Postoperative recurrence	Low	Slightly higher

Table 3. Clinical Association Between CTS and Trigger Finger

Aspect	Reported Evidence
Simultaneous coexistence	10–20%
Development after CTS release	5–15%
Increased risk in DM	Yes
Proposed mechanism	Diffuse synovitis and collagen alteration
Recommendation	Systematic pulley evaluation in CTS patients

Open release was selected in this case. Although endoscopic techniques may offer earlier functional recovery, open release remains the reference standard due to direct

visualization, shorter learning curve, and low neurovascular complication rates.

Table 4. Open Versus Endoscopic Release in CTS

Characteristic	Open Technique	Endoscopic Technique
Direct visualization	Yes	Limited
Learning curve	Short	Longer
Risk to recurrent branch	Low	Low–moderate
Pillar pain	Similar	Similar
Return to work	Slightly slower	Faster

Simultaneous A1 pulley release is safe when performed with proper technique and digital neurovascular protection, with success rates exceeding 90%.

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Table 5. Expected Outcomes After Combined Surgical Release

Variable	Expected Outcome
Resolution of paresthesias	70–90%
Thenar strength recovery	Progressive (6–12 weeks)
Trigger resolution	>90%
Major complications	<5%
Recurrence	Low

Early decompression in moderate to severe neuropathies is associated with better functional recovery and reduced risk of irreversible axonal damage. Simultaneous treatment of associated flexor system pathology prevents staged procedures and improves patient satisfaction.

CONCLUSION

The coexistence of carpal tunnel syndrome and trigger finger represents a frequent clinical association, particularly in patients with diabetes mellitus, due to shared pathophysiological mechanisms involving collagen alterations and microvascular changes. Systematic identification of both conditions during preoperative evaluation is essential to establish comprehensive management.

Open carpal tunnel release remains a safe and effective technique, allowing direct visualization and complete median nerve decompression. Simultaneous release of the A1 pulley of the fifth digit is a safe procedure when performed with appropriate surgical technique, without significantly increasing complication rates.

Combined surgical management in a single operative session provides adequate symptomatic resolution, reduces the need for subsequent interventions, and promotes early functional recovery. In patients with metabolic risk factors such as diabetes mellitus, timely intervention is crucial to prevent progression of neurological damage and permanent functional sequelae.

Comprehensive hand evaluation in patients with compressive neuropathy should include active assessment for associated flexor system pathology, as concomitant treatment improves clinical outcomes and patient satisfaction.

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