

## Pillar Pain After Carpal Tunnel Release

(A Review Study)

### Abstract

**Introduction:** Pillar pain is one of the common sequelae after carpal tunnel release (CTR), presenting as deep pain or tenderness upon pressure on the thenar and hypothenar regions. It potentially interferes with return to work and patient satisfaction. This narrative review was conducted with a focus on the etiology, emerging therapeutic approaches, and a practical management algorithm for pillar pain.

**Materials & Methods:** A structured search of PubMed and complementary sources was performed from 2018 up to December 2025. Clinical trials, systematic reviews and meta-analyses, cohort studies, and high-quality narrative reviews addressing pillar pain, risk factors, pathophysiology, or post-CTR treatments were identified and categorized.

**Results & Discussion:** The evidence suggests that pillar pain is a self-limiting condition, and approximately half of the patients may experience it, with most cases resolving within 3 to 6 months. The etiology is multifactorial and includes biomechanical alterations of the carpal arch after division of the transverse carpal ligament, soft-tissue inflammation or scarring, irritation or neuroma of the palmar cutaneous branch of the median nerve, and central mechanisms. Non-surgical treatment is the mainstay of management and encompasses patient education and reassurance, occupational hand therapy modalities (desensitization, massage, graded exercises), non-opioid analgesics and anti-inflammatory medications. In refractory cases, minimally invasive options such as extracorporeal shock wave therapy (ESWT) and photo biomodulation may be used. Emerging evidence on fractional CO<sub>2</sub> laser therapy for treatment-resistant pillar pain is promising but still limited. From a preventive standpoint, minimally invasive techniques and appropriate choice of skin closure method may influence short-term pillar pain.

**Conclusion:** Pillar pain after CTR is usually benign and transient but requires a stepwise, multimodal approach. Combining patient education, targeted rehabilitation, and non-opioid pain strategies, with selective use of minimally invasive interventions in refractory cases, offer safe and efficacious treatment.

**Keywords:** Carpal tunnel syndrome, carpal tunnel release, pillar pain, postoperative pain

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### Introduction

Carpal tunnel syndrome (CTS) is the most common compressive neuropathy of the upper extremity, caused by entrapment of the median nerve at the wrist. This syndrome is associated with symptoms such as pain, paresthesia, and thenar weakness, and can significantly affect quality of life, work ability, and daily functioning. In cases resistant to conservative treatment or in moderate to severe cases, carpal tunnel release (CTR) is considered the gold standard treatment.<sup>(1)</sup> Although CTR often leads to significant improvement in neurological and functional symptoms, certain postoperative local complications, including scar tenderness, palmar pain, and so-called "pillar pain," can disrupt the rehabilitation process and undermine patient satisfaction.<sup>(2)</sup> Pillar pain typically refers to pain felt in the two palmar pillars: the radial pillar (thenar region) and the ulnar pillar (hypothenar region). This pain is exacerbated by direct pressure or leaning on the palm and is often accompanied by reduced grip strength, avoidance of hand use, and considerable patient anxiety.<sup>(4)</sup> Despite its relatively high prevalence (some studies have reported an incidence of nearly 50%), pillar pain remains incompletely understood, and a wide range of diagnostic and therapeutic approaches exist for its management.

These findings highlight that adopting a coherent strategy based on patient education, reassurance regarding the typically transient nature of symptoms, and a conservative approach in the early stages plays a key role in the successful management of this complication. Given recent advances in the etiology and novel minimally invasive treatment modalities, updating the available evidence and proving a practical management algorithm appears essential.

## Materials & Methods

This article is a narrative-analytical review incorporating elements of a structured search. English keywords including pillar pain, carpal tunnel release, postoperative pain, rehabilitation, extracorporeal shockwave therapy, photobiomodulation, skin closure, and endoscopic/open CTR were searched in PubMed. Systematic reviews and meta-analyses, clinical trials, and relevant cohort studies were then screened and selected based on methodological quality and clinical applicability. To emphasize “recent evidence,” priority was given to sources published between 2018 and 2025; however, classical references were also used for anatomical and pathophysiological foundations.

### Clinical Definition and Natural History

Pillar pain typically emerges within the first few weeks after CTR and gradually diminishes over time in most patients. In a recent meta-analysis, the highest prevalence was reported between 6 and 12 weeks postoperatively, with most cases resolving by 6 months.<sup>(5)</sup> In a prospective cohort study using a mini-open WALANT technique, the risk of experiencing pillar pain was approximately 49%, with a median symptom duration of nearly 3 months.<sup>(4)</sup> Nonetheless, a subset of patients may experience persistent pain lasting beyond 6 months, often associated with local factors such as adherent scar tissue, hypersensitivity of cutaneous nerve branches, adjacent joint pain syndromes, or mechanisms related to pain sensitization.<sup>(3)</sup>

### Etiology and Pathophysiology

Pillar pain is not a single-cause phenomenon; rather, it likely results from the interplay of multiple mechanisms. The most prominent hypotheses include: *Biomechanical alterations*: Division of the transverse carpal ligament increases the width of the carpal arch and alters carpal relationships, particularly on the ulnar side.<sup>(6, 7)</sup> These changes may increase abnormal loading on the thenar/hypothenar regions and at muscular attachment sites.

*Soft tissue inflammation and scarring*: Local inflammation, subcutaneous hemorrhage, and scar formation can stimulate nociceptors and produce tenderness with direct pressure.<sup>(3)</sup>

*Injury or sensitization of cutaneous nerves*: The palmar cutaneous branch of the median nerve (PCBMN) and ulnar cutaneous branches may undergo traction or adhesion during surgery or tissue healing; neuroma formation or entrapment of these branches can result in focal, sharp, or radiating pain.<sup>(8-10)</sup>

*Adjacent joint pain*: Previously unrecognized pisotriquetral arthritis or pathology of the hook of the hamate may manifest as ulnar-sided palmar pain after CTR.<sup>(11, 12)</sup>

*Mechanisms of persistent pain*: In prolonged cases, peripheral and central sensitization, along with psychosocial factors such as anxiety and fear of movement, may modulate symptom severity.<sup>(4, 13)</sup>

### Clinical Evaluation and Differential Diagnosis

The diagnosis of pillar pain is primarily clinical and is based on the characteristic location of pain (the palmar pillars), exacerbation with compression or weight-bearing through the palm, and the absence of classic signs of recurrent CTS. In cases of persistent pain or atypical features, alternative etiologies should be considered, including incomplete release, scar-induced nerve compression, Guyon’s canal syndrome, neuroma, pisotriquetral arthritis, fracture or inflammation of the hook of the hamate, and CRPS.<sup>(12, 14, 15)</sup> Ultrasonography can be helpful for evaluating scar tissue, hematoma, cutaneous nerve branches, and recurrence or incomplete decompression of the median nerve.<sup>(16)</sup>

### General Treatment Principles and Stepwise Management Algorithm

Given the generally self-limiting course of pillar pain, management should be tiered and tailored to symptom severity and functional impairment.<sup>(4)</sup> First-line measures include patient education and reassurance regarding the transient nature of the pain, activity modification (avoiding direct palmar pressure), and initiation of simple rehabilitation. If symptoms remain insufficiently controlled after 4 to 8 weeks, more specialized occupational therapy interventions and minimally invasive modalities, such as ESWT or PBMT, may be considered.<sup>(17-19)</sup> In persistent cases exceeding 3 to 6 months, reassessment for differential diagnoses is recommended, and if appropriate, selective injections or surgical interventions may be considered.<sup>(12, 15)</sup> The majority of patients improve with non-operative strategies, which include:

## Education, Occupational Therapy, and Rehabilitation

Scar-management approaches (scar massage, silicone gel, desensitization techniques), range-of-motion exercises, gradual return to activity, and targeted strengthening of the thenar muscles when indicated can help alleviate localized symptoms.

Intervention	Key Benefits	Limitations
Patient Education + Occupational Therapy (Scar Massage)	Low-risk; customizable; improves function and palmar load tolerance	Limited and heterogeneous RCT evidence
NSAIDs and Acetaminophen	Pain control without opioid-related adverse effects	Caution in patients with gastrointestinal or renal disorders
Gabapentinoids	May be useful for neuropathic-predominant pain	Sedation and dizziness; should be selective and short-term
Corticosteroid Injection in Pillar or Scar Region	Short-term relief reported in some studies	Conflicting evidence; may prolong symptom resolution
ESWT	Improved pain and function in refractory pillar pain	Protocol variability; need for larger RCTs
Photobiomodulation (PBMT)	Reduces pain and inflammation; non-invasive	Variable protocols; limited availability
Fractional CO <sub>2</sub> Laser	Emerging option for resistant cases	Limited evidence; high cost and limited accessibility CO <sub>2</sub>

Reviews of postoperative care following CTR emphasize the lack of high-quality evidence supporting a single standardized protocol; however, functional rehabilitation and desensitization techniques are commonly used in clinical practice.<sup>(20, 21)</sup>

## Pharmacologic Therapy

For short-term postoperative analgesia after CTR, acetaminophen and non-steroidal anti-inflammatory drugs are generally recommended as first-line options because they provide adequate pain control in most patients and have more favorable safety profiles. Evidence from clinical trials and recent reviews highlights the overall superiority of non-opioid approaches compared with routine opioid prescribing

after CTR. The effectiveness of non-opioid regimens (such as acetaminophen combined with ibuprofen) is not inferior to opioids and is associated with fewer adverse effects and lower risks such as nausea, constipation, sedation, and dependence.<sup>(22, 23)</sup> Recent systematic reviews report similar conclusions.<sup>(13)</sup> For predominantly neuropathic symptoms (burning or shooting pain), short-term use of agents such as gabapentinoids may be considered, but they should be prescribed selectively and with attention to their side-effect profiles.<sup>(24)</sup>

## Injections and Minimally Invasive Interventions

Corticosteroid injection into the pillar area or scar is used in some centers for persistent pain. However, a recent double-blind trial evaluating intraoperative pillar injections found no significant improvement in function or reduction in pillar pain, and even reported delayed symptom resolution in the steroid group.<sup>(25)</sup> Therefore, corticosteroid injections should be used cautiously, preferably after excluding other etiologies and within a shared decision-making framework.

## Extracorporeal Shockwave Therapy (ESWT)

ESWT represents a novel, noninvasive therapeutic option for refractory pillar pain. In a double-blind randomized clinical trial, ESWT demonstrated more rapid improvement in pain and functional outcomes compared with the control group.<sup>(17)</sup> Another study has also reported supportive findings.<sup>(18)</sup> Despite these promising results, heterogeneity in treatment protocols (e.g., number of sessions, energy levels) and relatively small sample sizes underscore the need for larger, well-designed trials to establish standardized recommendations.

## Photobiomodulation and Therapeutic Lasers

Photobiomodulation and low-level laser therapy are employed with the aim of reducing inflammation and modulating pain. A randomized controlled trial evaluating photobiomodulation after CTR reported improvements in certain pain and functional indices.<sup>(19)</sup> In refractory cases, fractional CO<sub>2</sub> laser therapy has emerged as a novel approach for reducing pillar pain and improving scar quality; a retrospective pilot study demonstrated favorable outcomes.<sup>(26)</sup> However, the level of evidence remains limited, and this modality is not yet considered a standard treatment.

## Surgical Interventions, Prevention, and Technical Modifications

The choice of surgical technique for carpal tunnel release (CTR), open, endoscopic, or minimally invasive, can influence local pain, scar tenderness, and the timeline for return to activity/work. In a recent

randomized controlled trial comparing endoscopic and open CTR, no significant differences were observed in symptom improvement or long-term outcomes; however, the endoscopic technique showed advantages in certain early postoperative functional measures and pain reduction.<sup>(27)</sup> Systematic reviews and meta-analyses similarly indicate that the endoscopic approach is often associated with modest improvements in patient satisfaction, faster return to work, and reduced scar-related sensitivity, while long-term outcomes remain largely comparable between the two techniques. Both methods are considered safe and effective, and technique selection should be based on surgeon experience and patient preference.<sup>(28)</sup>

### **Incision Location, Skin Closure, and Scar-Related Factors**

Incision placement and skin-closure technique may influence short-term localized sensitivity and discomfort. Earlier randomized trials found no significant differences in pillar pain among various incision designs, although scar tenderness may vary.<sup>(29)</sup> A recent RCT (2025) demonstrated that subcuticular closure using absorbable Monocryl, compared with interrupted nylon sutures, resulted in reduced pillar pain and improved early postoperative scar quality. Two studies evaluating the use of drains in CTR reported differing results; in the study by Abdali et al., drain placement did not yield superior clinical outcomes.<sup>(30, 31)</sup> Additionally, a 2025 randomized clinical trial comparing simple interrupted versus vertical mattress sutures in a palmar incision found no long-term difference in postoperative pain or scar quality attributable to suture technique.<sup>(32)</sup>

### **Technical Modifications to Reduce Pillar Pain**

A number of technical refinements aimed at minimizing tissue trauma and scar formation (e.g., altering incision trajectory, reducing tension over thenar and hypothenar eminences, or employing more proximal approaches) have been proposed. Newer studies examining direct-vision proximal incisions or mini-incision instruments have reported acceptable outcomes, though higher-level evidence is needed for definitive conclusions.<sup>(33, 34)</sup>

### **Management of Refractory Cases and Selective Surgical Options**

For pain persisting beyond 3 to 6 months, detailed evaluation for structural causes is essential. In refractory ulnar-sided pain with imaging evidence of hook of hamate pathology, surgical excision of the hook can lead to symptomatic improvement.<sup>(35)</sup> In cases involving neuroma or entrapment of the palmar

cutaneous branch, targeted procedures such as branch decompression or neuroma-focused techniques, including newer options like targeted muscle reinnervation (TMR) in selected patients, have been reported.<sup>(9, 36)</sup> For revision CTR, options such as hypothenar fat pad flap for median nerve coverage have been described, with recent studies providing supportive evidence for its effectiveness in selected cases.<sup>(37, 38)</sup>

## **Proposed Algorithm for the Management of Pillar Pain**

### **Stage 1 (0–6 weeks post-surgery)**

Conservative approach including patient education and reassurance regarding the expected symptom trajectory, modification of activities that increase palmar pressure, use of simple analgesics such as acetaminophen or NSAIDs if needed, along with scar care and initiation of gentle range-of-motion exercises.

### **Stage 2 (6–12 weeks)**

For persistent symptoms, begin structured occupational therapy focusing on desensitization techniques, controlled deep scar massage, and targeted functional exercises. Noninvasive modalities such as Photobiomodulation Therapy (PBMT) may be used as adjunctive treatments.

### **Stage 3 (beyond 12 weeks or moderate-to-severe refractory pain)**

Consider minimally invasive interventions such as ESWT.

### **Stage 4 (beyond 3–6 months or suspicion of structural pathology)**

If pain persists or underlying pathology is suspected, further diagnostic evaluation, including imaging and electrodiagnostic studies, is recommended. Based on findings, selective interventions such as targeted injections or corrective surgery (e.g., neuroma treatment or hook of hamate excision) may be pursued.

## **Discussion**

Emerging evidence indicates that the successful management of pillar pain depends less on any single intervention and more on accurate identification of the predominant underlying mechanism alongside a structured, stepwise treatment strategy. Meta-analyses emphasize that the majority of cases resolve within six months, highlighting the importance of patient education and the avoidance of premature invasive interventions.<sup>(5)</sup> At the same time, recent targeted

RCTs; such as those evaluating ESWT, and studies addressing post-CTR pain within the broader context of reducing opioid use have shifted clinical practice toward non-invasive approaches.<sup>(13, 22, 23)</sup> From a preventive standpoint, data on skin-closure techniques suggest that even minor technical details can meaningfully influence early pain experiences following surgery.<sup>(39)</sup> Looking forward, there is a clear need for multicenter trials employing standardized definitions of “pillar pain,” adequate sample sizes, and follow-up periods of at least 6 to 12 months.

## Conclusion

Pillar pain after CTR is common but typically self-limiting. Its etiology is multifactorial, encompassing biomechanical changes, cutaneous nerve involvement, and scar-related factors. A management approach centered on patient education, rehabilitation, and non-opioid analgesics, supplemented selectively with minimally invasive modalities such as ESWT or PBMT in refractory cases, is consistent with current evidence. For persistent pain, reassessment and targeted treatment (e.g., neuroma management or addressing underlying osseous or articular pathology) become essential.

## Conflict of interest

The authors declare no conflict of interest. No artificial intelligence was used in the writing of this article.

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