International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 12; Issue: 12; December 2025
Website: www.ijrrjournal.com
Review Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Neurolysis in Carpal Tunnel Release for Carpal Tunnel Syndrome Patients

Made Bramantya Karna[1], I Made Bagus Surya Mahapriandana Sari[2]

[1]Orthopaedic Surgeon, Dept. Orthopaedic & Traumatology, Prof IGNG Ngoerah General Hospital, Udayana University, Bali, Indonesia
[2]Resident, Dept. Orthopaedic & Traumatology, Prof IGNG Ngoerah General Hospital, Udayana University, Bali, Indonesia

Corresponding Author: I Made Bagus Surya Mahapriandana Sari

DOI: https://doi.org/10.52403/ijrr.20251202

ABSTRACT

Background: After Open Carpal Tunnel Release (OCTR), up to 20% of patients experience persistent or recurrent symptoms, necessitating revision procedures. External neurolysis has emerged as a promising adjunct to OCTR, particularly in patients with adhesions or recurrent CTS. This study aims to systematically evaluate the functional outcomes and complications associated with Carpal Tunnel Release combined with neurolysis in CTS patients.
Methods: A systematic review was conducted following PRISMA 2020 guidelines and Cochrane Handbook standards. Literature was searched from 2019 to June 2024 across MEDLINE (PubMed), Embase (Ovid), CENTRAL, and Web of Science. Inclusion criteria encompassed clinical studies evaluating OCTR with neurolysis in CTS patients, focusing on functional outcomes and complications. A total of four studies involving 114 patients were included. Risk of bias was assessed using ROBINS-I and JBI tools.
Results: Of the four studies, one was cross-sectional and three were case series. Functional outcomes were measured using BCTQ-SS, BCTQ-FS, DASH, QuickDASH, VAS, grip strength, and distal motor latency. Across studies, OCTR with external neurolysis showed consistent improvements in symptom severity, functional status, pain reduction, and nerve conduction parameters. No major complications were reported. However, all included studies presented moderate to high risk of bias due to non-randomized designs and small sample sizes.
Conclusion: OCTR with external neurolysis shows promising functional improvement in patients with CTS, particularly in cases of persistent or recurrent symptoms. Nevertheless, due to methodological limitations and small sample sizes, higher-quality studies such as randomized controlled trials are warranted to confirm these findings.

Keywords: Carpal Tunnel Syndrome, Open Carpal Tunnel Release, Neurolysis, External Neurolysis, Functional Outcome, Systematic Review, Recurrent CTS, BCTQ, DASH, Visual Analog Scale.

INTRODUCTION

Carpal Tunnel Syndrome (CTS) represents one of the most frequent peripheral neuropathies and is widely observed across the general population, influenced by multiple predisposing factors. The condition develops when the median nerve, which extends from the forearm to the hand through the carpal tunnel in the wrist,

becomes compressed. [1] This compression can cause pain, tingling, and weakness in the hand and fingers. The main risk factors for CTS include occupations that require repetitive movements, such as housewives, motorcyclists, and people who use computers for long periods of time. [1,2] Carpal tunnel syndrome (CTS) affects an estimated 14.4% of the global population (95% CI: 6.7–28.2%), with higher prevalence in high-income settings (≈16.9%) than in low- or middle-income countries (≈11.4%).[1].[3] In Indonesia, based on occupational disease data in 2014, there were 40,694 cases of CTS, with Bali as the area with the highest number of cases, namely 5,609 cases. Each year, over 500,000 carpal tunnel release (CTR) procedures are performed to relieve symptoms associated with CTS. The underlying pathophysiology of CTS is chronic compression and ischemic damage to the median nerve, resulting in adhesions that prevent its ability to glide smoothly during wrist movements within the carpal tunnel. This requires surgical intervention to relieve the pressure on the median nerve.[4]

Despite high success rates reported for CTR, a significant number of patients between 3% and 20% experience persistent or recurrent symptoms after surgery, leading to revision surgery in up to 12% of cases.[5] Unfortunately, revision CTR tends to be less effective, with up to 40% of patients experiencing poor outcomes. Therefore, effective management of CTS requires an accurate diagnosis and a comprehensive treatment approach, which includes clinical evaluation, electrophysiological testing, and median nerve ultrasound.[6]

In mild cases of CTS, conservative treatments such as wrist braces and steroid injections can be effective. However, moderate to severe cases often require surgical intervention. Open Carpal Tunnel Release (OCTR) remains the gold standard for decompression, although endoscopic release has shown equal efficacy.[7] To address persistent symptoms following OCTR, surgeons in the 1990s began exploring additional procedures such as internal neurolysis, external neurolysis, epineurotomy, tenosynovectomy, and tendon transfers.[7] While internal neurolysis and epineurotomy have largely been abandoned due to lack of additional benefit, external neurolysis has been shown to be useful in addressing recurrent symptoms by separating the nerve from the surrounding scar.[5,6,8]

MATERIALS & METHODS

Study Design and Protocol Registration

This study is a systematic review aimed at evaluating the functional outcomes and complications of Open Carpal Tunnel Release (OCTR) with neurolysis in patients diagnosed with Carpal Tunnel Syndrome (CTS). The methodology was based on the *Cochrane Handbook for Systematic Reviews of Interventions* and reported following the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020* guidelines.

Eligibility Criteria

Studies were considered eligible for inclusion if they investigated patients with Carpal Tunnel Syndrome (CTS) who underwent Open Carpal Tunnel Release (OCTR) combined with neurolysis, and if they reported on relevant functional outcomes such as the Boston Carpal Tunnel Questionnaire (BCTQ), Disabilities of the Arm, Shoulder, and Hand (DASH) score, QuickDASH, Visual Analog Scale (VAS) for pain, grip strength, and/or postoperative complications. Only original clinical research studies were included, encompassing randomized controlled trials (RCTs), quasi-RCTs, cohort studies, case-control studies, case series, or case reports. Additionally, studies had to be published between January 2019 and June 2024, written in English, and available in full-text format.

Studies were excluded if they were systematic reviews, meta-analyses, editorials, letters, book chapters, study protocols, non-clinical or pre-clinical

studies (including cadaver, in vitro, or animal experiments), or conference abstracts. Articles were also excluded if they did not report relevant outcome measures or failed to provide a complete description of the surgical technique used.

Information Sources and Search Strategy

A comprehensive literature search was conducted in four databases: MEDLINE (PubMed), Embase (Ovid), Cochrane CENTRAL, and Web of Science. The search period covered January 2019 to June 9, 2024. Search strategies combined controlled vocabulary (MeSH and Emtree) with free-text terms relating to "Carpal Tunnel Syndrome," "Carpal Tunnel Release," and "Neurolysis." Boolean operators "AND" and "OR" were used to combine terms appropriately. Search filters included language (English) and publication date. Truncation (*) and phrase searching ("") were used to optimize sensitivity.

Study Selection

All identified articles were imported into the Rayyan software for systematic screening. Duplicate entries were excluded, and two reviewers independently assessed the titles and abstracts to determine eligibility. The full texts of studies deemed potentially relevant were then examined in detail. Any disagreements were addressed through discussion or, when necessary, by involving a third reviewer. Only studies that fulfilled all inclusion criteria were selected for final analysis.

Data Extraction

A structured data extraction sheet was created using Microsoft Excel. Data extracted included: author(s), publication year, country, study design, sample size, demographic characteristics (age, sex), affected hand, surgical technique, type of neurolysis, rehabilitation protocols, outcome assessment tools, follow-up duration, and complications.

Risk of Bias Assessment

Risk of bias in non-randomized studies was assessed using the ROBINS-I (Risk Of Bias In Non-randomized Studies - of Interventions) tool, which evaluates bias across seven domains. For case series and case reports, quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Series, comprising 10 quality criteria.

Data Synthesis

Due to the heterogeneity in study designs, outcome measures, and interventions, a qualitative synthesis was performed. Findings were summarized by comparing pre- and post-operative outcomes, including symptom severity scores, functional scores, pain (VAS), grip strength, and nerve conduction parameters. Continuous outcomes were reported as means ± standard deviations. No formal meta-analysis was conducted. All analyses and tabulations were conducted using Microsoft Excel version 16.64 (Microsoft Corp., USA).

RESULT

Study Search and Selection

The results of the literature search based on the search strategy in the four databases (MEDLINE (PubMed), EMBASE (Ovid), Cochrane library, and Web of science) online produced a total of 58 literatures. There were 33 duplicate articles from the total literature obtained which were removed from the articles obtained. The articles obtained, amounting to 25 articles, were evaluated according to the inclusion and exclusion criteria of this systematic review. A total of 21 articles were excluded because they did not meet the inclusion criteria. A total of 4 articles with a total of 114 patients were included in this systematic review. The search flow according to the PRISMA 2020 guideline is presented in Figure 4.1.

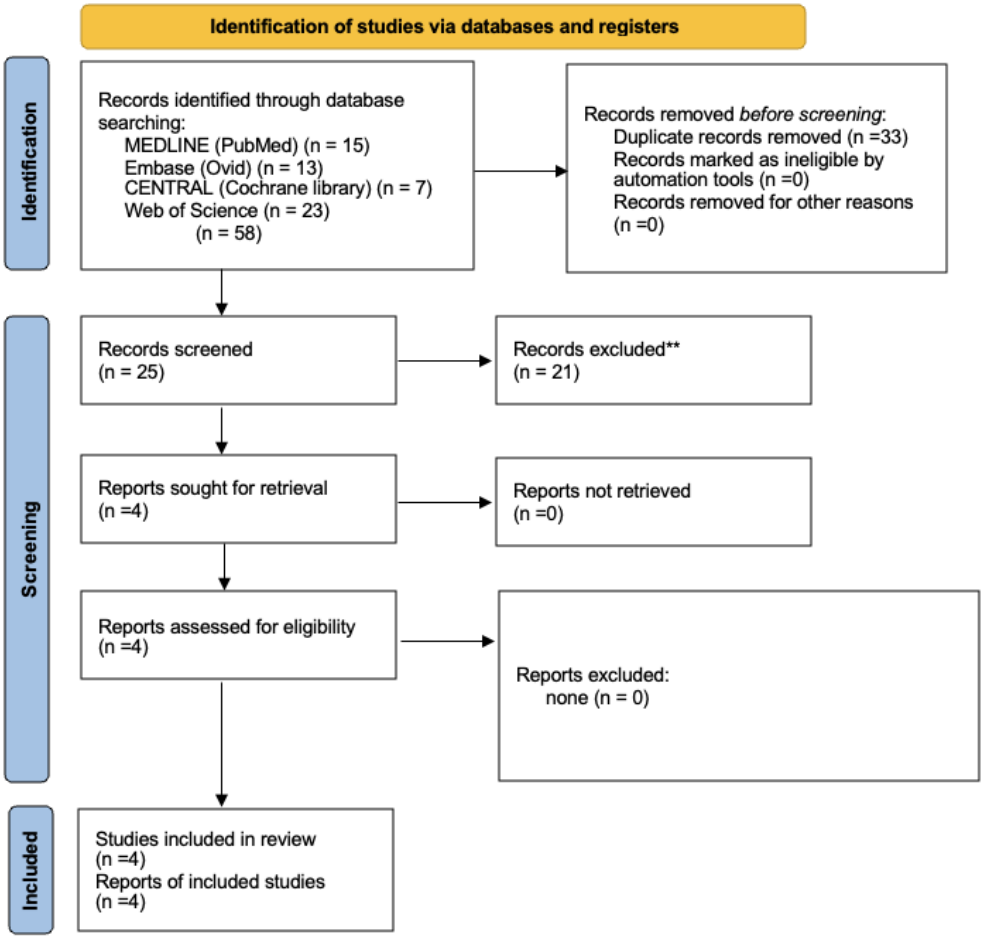

Figure 1. PRISMA Flowchart

Study Characteristics

This systematic review consists of 1 cross-sectional study and 3 case series studies. A total of 4 studies involved 114 patients consisting of 45 men and 69 women. The age range in this systematic review with an average of 65.1 with the youngest age of 42 years and the oldest age of 89 years. Reports of affected hands were only reported by 2 studies with a total of 12 left hands and 65 right hands. The characteristics of the articles are described in table 1. This systematic review also reviews the PICO concept in each article described in table 2.

Table 1. Study Characteristics

No	Author, Year	Country	Study Design	Sample Size	Age	Gender		Involved Side	
						L	P	Left	Right
1	Al-Dhafer, B.A et al, 2022[7]	Korea	Case series	9	60 (45-85)	3	6	3	6
2	Pattankar S, et al 2021[9]	India	Cross-sectional	68	57.94 (10.9)	11	57	9	59
3	Spielmana A.F et al, 2020[6]	USA	Case Series	30	67 (47-85)	26	4	NR	NR
4	Uemura T et al, 2019[4]	Japan	Case Series	7	64.4 (42-89)	5	2	NR	NR

Table 2. PICO of each study

No	Author, year	Population	Intervention	Comparator	Outcome
1	Al-Dhafer, B.A et al,	Patients with severe median nerve	External Neurolysis	NR	Boston Carpal Tunnel Questionnaire- symptom

	2022	adhesions			severity (BCTQ-SS)
					Boston Carpal Tunnel Questionnaire-Functional Status (BCTQ-FS)
					Disabilities of the Arm, Shoulder, and Hand (DASH) score
					Visual analog scale (VAS)
2	Pattankar S, et al 2021	Open Carpal Tunnel Release	Modified OCTR with an ancillary external neurolysis	Standard OCTR alone	Symptom severity scale (SSS)
					Functional status scale (FSS)
3	Spielmana A.F et al, 2020	recurrent or	Preoperative pain levels	Postoperative pain levels	Visual analog scale (VAS)
		persistent compression carpal tunnel syndrome	using visual analog scale (VAS)	using visual analog scale (VAS)	
4	Uemura T et al, 2019	Patients with persistent pain, tingling, and residual median nerve dysfunction after initial OCTR	complete external neurolysis	NR	1. VAS
					2. Quick Disability of the Arm, Shoulder, and Hand (Quick DASH)
					3. wrist ROM in flexion and extension
					4. median distal motor latency

Risk of Bias

One cross-sectional study in this systematic review has a high risk of bias. A high risk of bias was identified in domain 1, originating from confounding bias, where baseline patient characteristics were not assessed for differences between groups. A high risk of bias was also found in domain 2, due to sample selection bias, where the selection of study samples was determined by the operator. Furthermore, in domain 3, a moderate risk of bias was identified because randomization was not performed in the allocation of study groups. A visualization of the risk of bias assessment is presented in the figure 1.

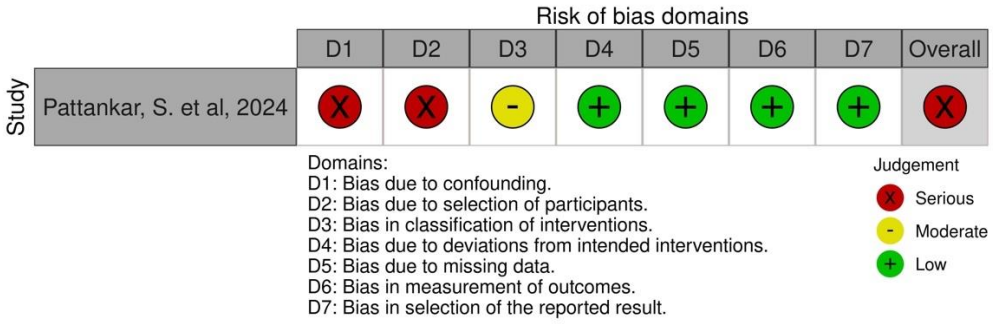

Figure 2. Risk of Bias Assessment Results Using the ROBINS-I Tool

Three case series in this systematic review have moderate risk of bias. The risk of bias was assessed using the JBI critical appraisal tool, consisting of 10 questions. In the study by Uemura et al., an unclear result was found for question 3, and a high risk of bias was identified for question 10. In the study by Al-Dhafer et al., an unclear result was

found for question 4. In the study by Spielman et al., a high risk of bias was noted for question 2, and an unclear risk of bias was observed for question 3. The results are presented in the table.

Table 3. Risk of Bias Assessment Results Using the JBI Appraisal Tools

No	Author, year	*Critical Appraisal Tools*									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Case series											
1	Uemura, T. et al, 2019										
2	Al-Dhafer, B.A. et al, 2021										
3	Spielman, A.F. et al, 2020										

Qualitative Synthesis

This systematic review presents the surgical techniques, rehabilitation protocols, and outcome evaluation methods. Two articles did not report details regarding rehabilitation. A summary of the qualitative synthesis results is presented in Table 4. Based on quantitative analysis, one study demonstrated improvement in BCTQ scores before and after surgery. An improvement in the DASH score was also observed, from 43.3 ± 37.84 preoperatively to 33 ± 12.04 postoperatively. Pain scores measured using the VAS also decreased, from 5 ± 1.7 before surgery to 2.83 ± 1.72 after surgery. A reduction in pain scores was similarly reported in three other studies. Grip strength increased from 18.33 ± 18.9 before surgery to 20 ± 15.4 after surgery. In one study, distal motor latency showed improvement from 11 ms to 4 ms. Improvements were also observed in the Hand20 and QuickDASH scores. The detailed results are presented in Table 5.

Table 4. The Result of Qualitative Analysis

No	Author, Year	Surgical Technique	Rehabilitation	Outcome Evaluation
1	Al-Dhafer, B.A et al, 2022	-Day surgery under loupe magnification and local anesthesia. - Standard incision (Taleisnik) was used. - The transverse carpal ligament and palmar aponeurosis were released to open the carpal tunnel. - Identification and management of potential recurrence or persistence. - Examination of the median nerve and palmar cutaneous branch for abnormalities. - External neurolysis of the median nerve without dissecting the epineurium. - Skin closure and pressure dressing.	NR	- BCTQ-SS- BCTQ-FS- DASH score- VAS- Grip strength
2	Pattankar et al, 2021	- The study group received either standard OCTR or modified OCTR with additional external neurolysis of the median nerve. - A 2–3 cm palmar skin incision along the radial side of the ring finger. - Incision extended proximally near the wrist crease and distally to Kaplan's cardinal line. - Transverse Carpal Ligament (TCL) released	NR	- BCTQ to assess CTS-specific symptoms. - SSS or FSS score ≥ 2 considered an unfavorable outcome based on prior studies. - BCTQ translated into Hindi according to standardized guidelines.

		longitudinally for decompression. - Additional external neurolysis to release adhesions and scar tissue around the median nerve.		
3	Spielman A.F et al, 2020	- Patient supine with arm on a hand table.- Upper extremity wrapped with Esmarch bandage; tourniquet inflated to 250 mmHg.- Standard palmar incision over the carpal tunnel including previous scar.- Incision extended distally and proximally, crossing the wrist crease at a 45° angle.- Dissection with Senn retractor and #15 scalpel through skin, subcutaneous tissue, and palmar fascia.- Median nerve identified, preserved, and exposed; external neurolysis if needed.- Nerve diameter measured; nerve wrap applied and secured with 8-0 prolene sutures.- Adipose flap raised and sutured across retinaculum ends.- Tourniquet deflated; hemostasis achieved; perfusion verified.- Skin closed with nonabsorbable sutures; soft bulky dressing applied.- Immobilized for 2 weeks with volar resting splint until first post-op visit.	- Patients referred to occupational therapy once wound healed. - Follow-up at 3 months post-op.- If symptoms resolved, follow-up as needed.	- Demographics collected: age, sex, hand dominance, comorbidities, alcohol use, smoking history. - Pre- and post-op symptoms, subjective outcomes, need for further surgery, and complications noted.- Pain assessed via 10-point VAS at 3-month follow-up.
4	Uemura et al, 2019	- Surgery performed under loupe magnification, tourniquet control, and general or brachial plexus anesthesia.- Zigzag incision from palm through volar distal forearm along radial artery axis.- Injured median nerve neurolysis performed, preserving palmar cutaneous branch.- Radial artery perforator adipose flap raised and wrapped around the nerve.- Blood supply from radial artery perforator proximal to radial styloid preserved.- Flap rotated 180° and secured with absorbable sutures.- V-Y plastic closure if flap was large at wrist crease.- Bulky dressing applied post-op, no anticoagulants or prostaglandins.- Early wrist range of motion exercises initiated.	- Bulky dressing applied without anticoagulants or prostaglandins. - Early wrist ROM initiated to prevent tethering. - Aim to restore adipose gliding surface for neurolyzed median nerve.	- VAS score assessed for pain with tingling. - Presence or absence of Tinel's sign at the wrist noted. - Wrist range of motion evaluated. - Patient-reported outcomes assessed using Japanese Society for Surgery of the Hand version of Quick DASH and Hand 20.

Table 2. The Result of Quantitative Analysis

No	Author, Year	Pre-operative score	Post-operative score
1	Al-Dhafer, B.A et al, 2022	(mean±SD) BCTQ-SS: 2.46±0.86 BCTQ-FS: 2.7±1.80 DASH score: 43.3±37.84	(mean±SD) BCTQ-SS: 1.73±0.51 BCTQ-FS: 1.96±0.43 DASH score: 33±12.04

		VAS: 5±1.7 Grip strength: 18.33±18.9	VAS: 2.83±1.72 Grip strength: 20±15.4
2	Pattankar S, et al 2021	NR	SSS OCTR: Favourable (31/38), non-favourable (7/38) OCTR+EN: Favourable (70/70), non-favourable (0/70) FSS OCTR: Favourable (33/38), non-favourable (5/38) OCTR+EN: Favourable (70/70), non-favourable (0/70)
3	Spielmana A.F et al, 2020	VAS: 4.37	VAS: 1.23
4	Uemura T et al, 2019	VAS: 8.6 QuickDASH: 55.2 Hand20: 60 Distal Motor Latency: 11.0 m.s	VAS: 1.8 QuickDASH: 21.4 Hand20: 28.7 Distal Motor Latency: 4.4 ms

DISCUSSION

Carpal Tunnel Syndrome (CTS) is a common compressive neuropathy caused by chronic entrapment of the median nerve within the carpal tunnel. Characterized by sensory disturbances, pain, and eventually motor deficits in the distribution of the median nerve, CTS can significantly impair hand function and quality of life. The standard of care for moderate to severe or refractory CTS remains surgical decompression via Open Carpal Tunnel Release (OCTR), which involves transecting the transverse carpal ligament to relieve pressure on the nerve. Although OCTR provides symptomatic relief in the majority of patients, up to 20% report persistent or recurrent symptoms postoperatively. These cases often present with perineural fibrosis, adhesions, or incomplete decompression, which may necessitate revision surgery. In such instances, adjunctive procedures such as external neurolysis are proposed to optimize nerve gliding and relieve secondary compression due to scarring or tethering. [10,11]

This systematic review identified and synthesized evidence from four studies published between 2019 and 2024, involving a total of 114 patients who underwent OCTR with neurolysis. These studies included one cross-sectional comparative study and three case series, all of which demonstrated favorable functional outcomes following surgery. Improvements were consistently noted in Boston Carpal Tunnel Questionnaire (BCTQ) scores, Disabilities of the Arm, Shoulder, and Hand (DASH) or QuickDASH scores, Visual Analog Scale (VAS) for pain, grip strength, and nerve conduction parameters such as distal motor latency.

The study by Pattankar et al. was the only comparative study included, evaluating outcomes between standard OCTR and OCTR combined with external neurolysis. Results showed that the group receiving neurolysis experienced significantly better outcomes in both symptom severity and functional domains, with no unfavorable outcomes reported. This suggests that external neurolysis, when added to OCTR, may provide superior decompression in selected patients, particularly those with severe fibrosis or recurrent CTS.[9]

Supporting these findings, the case series by Al-Dhafer et al. evaluated patients undergoing revision surgery for recalcitrant CTS. The authors reported significant improvements in BCTQ and VAS scores three months postoperatively, with high patient satisfaction. Similarly, Spielman et al. introduced a “triple-therapy” approach that combined neurolysis, tenosynovectomy, and collagen nerve wrapping. This

multimodal technique aimed not only to decompress the nerve but also to prevent recurrent scarring and promote vascularization, leading to meaningful symptom relief in patients with multiple prior surgeries.[7]

A particularly notable contribution comes from the study by Uemura et al., who utilized a vascularized radial artery perforator adipose flap in addition to neurolysis. Their technique not only provided mechanical decompression but also restored a gliding surface for the nerve. Electrophysiological outcomes also improved significantly, with distal motor latency decreasing from 11.0 ms to 4.4 ms postoperatively. The absence of major complications or symptom recurrence in their cohort underscores the potential benefit of combining neurolysis with vascularized soft tissue coverage in complex cases.[4]

Collectively, these studies highlight several key points. First, neurolysis—particularly external neurolysis—has a beneficial role in the surgical management of CTS, especially in revision cases where scarring and adhesions are major contributors to persistent symptoms. Second, functional outcomes measured across different tools consistently showed postoperative improvement, suggesting that the benefits are not only anatomical but also translate into clinical function. Third, despite the variability in surgical techniques and rehabilitation protocols among studies, the trend in outcomes remains positive, strengthening the argument for the adjunctive role of neurolysis. [4,7,9]

However, the review also has important limitations. All included studies were either case series or a single cross-sectional cohort, with no randomized controlled trials (RCTs) available. This significantly limits the level of evidence and introduces potential biases, including selection bias, observer bias, and lack of standardized outcome assessment. Furthermore, small sample sizes in most studies reduce statistical power and hinder subgroup analysis. Heterogeneity in surgical techniques, patient selection criteria, timing of surgery, and follow-up duration further complicates the interpretation of results.

Despite these limitations, this systematic review is strengthened by its rigorous methodology, including a comprehensive search strategy across multiple databases, standardized data extraction, and formal bias assessment using ROBINS-I and JBI appraisal tools. The consistency of positive outcomes across all included studies suggests that OCTR with external neurolysis may be a valuable technique, especially in cases of revision surgery or where intraoperative findings suggest significant perineural adhesions.

CONCLUSION

Neurolysis is a surgical procedure to free injured nerves from the scar tissue that surrounds them. External neurolysis techniques are more often performed because of the success rate of internal neurolysis because of its more promising success rate. Each article used in this systematic review research has a high risk of bias. In this systematic review, it was found that the CTR surgical method with neurolysis had better functional outcomes than CTR without neurolysis. We encourage the public to learn more about the CTR procedure with neurolysis through higher evidence studies and Randomized Controlled Trials.

Declaration by Authors

Ethical Approval: Not applicable

Acknowledgement: None

Source of Funding: None

Conflict of Interest: No conflicts of interest declared.

REFERENCES

1. Multanen J, Ylinen J, Karjalainen T, Ikonen J, Häkkinen A, Repo JP. Structural validity of the Boston Carpal Tunnel Questionnaire and its short version, the 6-Item CTS symptoms scale: a Rasch analysis one year after surgery. *BMC Musculoskelet Disord*.

2020;21(1):609. doi:10.1186/s12891-020-03626-2
2. Mekaj A, Mekaj Y. The Role of Pharmacological Agents in Nerve Regeneration after Peripheral Nerve Repair. In: *Peripheral Nerve Regeneration - From Surgery to New Therapeutic Approaches Including Biomaterials and Cell-Based Therapies Development*. InTech; 2017. doi:10.5772/intechopen.68378
3. Gebrye T, Jeans E, Yeowell G, Mbada C, Fatoye F. Global and regional prevalence of carpal tunnel syndrome: a meta-analysis based on a systematic review. Musculoskeletal Care. 2024;22(4):e70024.
4. Uemura T, Takamatsu K, Okada M, et al. A case series of seven patients with recurrent median nerve neuropathy treated by the revision surgery of median nerve neurolysis and wrapping with radial artery perforator adipose flap. *Journal of Plastic, Reconstructive and Aesthetic Surgery*. 2020;73(3):453-459. doi: 10.1016/j.bjps.2019.09.051
5. Bollmann G, Bouvet C, Beaulieu JY. Recurrent carpal tunnel syndrome: Outcomes after neurolysis and synovial flap. *Hand Surg Rehabil*. 2023;42(3):236-242. doi: 10.1016/j.hansur.2023.04.004
6. Spielman AF, Sankaranarayanan S, Skowronski P, Lessard AS, Panthaki Z. Recurrent and persistent carpal tunnel syndrome: "Triple-therapy approach." *J Orthop*. 2020; 22:431-435. doi: 10.1016/j.jor.2020.09.003
7. Al-Dhafer BA, Kim SY, Shin YH, Kim JK, Choi SW. Standard incision and median nerve external neurolysis for recalcitrant carpal tunnel syndrome. *Archives of Hand and Microsurgery*. 2022;27(2):187-192. doi:10.12790/ahm.21.0147
8. Baltodano PA, Tong AJW, Chhabra A, Rosson GD. The role of magnetic resonance neurography in the postoperative management of peripheral nerve injuries. *Neuroimaging Clin N Am*. 2014;24(1):235-244. doi: 10.1016/j.nic.2013.03.029
9. Pattankar S, Roy R, Warade A, Desai K. Analysis of the Long-Term Outcome in Open Carpal Tunnel Release Surgeries with and without External Neurolysis of Median Nerve, Using Boston Carpal Tunnel Questionnaire (BCTQ)-Hindi Version. *J Neurosci Rural Pract*. 2021;12(3):470-477. doi:10.1055/s-0041-1723100
10. Joshi A, Patel K, Mohamed A, et al. Carpal Tunnel Syndrome: Pathophysiology and Comprehensive Guidelines for Clinical Evaluation and Treatment. *Cureus*. Published online July 20, 2022. doi:10.7759/cureus.27053
11. Faour Martín O, Martín Ferrero M ángel, Valverde García JA, et al. La neurólisis del nervio mediano en el paciente anciano: Evaluación a largo plazo. *Rev Esp Geriatr Gerontol*. 2013;48(2):65-68. doi: 10.1016/j.regg.2012.03.003

How to cite this article: Made Bramantya Karna, I Made Bagus Surya Mahapriandana Sari. Neurolysis in carpal tunnel release for carpal tunnel syndrome patients. *International Journal of Research and Review*. 2025; 12(12): 10-19. DOI: *https://doi.org/10.52403/ijrr.20251202*

******