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Simultaneous Upper Limb Multi-Nerve Decompression: Economic, Reliable & Safe

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Research Article

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Abstract

Purpose

Patients presenting with multiple nerve compression syndromes of the upper limb may benefit from a comprehensive surgical approach. Evidence regarding simultaneous decompression of three or more sites, particularly around the elbow, remains limited. This study described a single-stage, symptom-guided technique addressing multiple entrapment sites and reported clinical outcomes.

Methods

A retrospective consecutive series of 12 patients (13 upper limbs) was analyzed between November 2023 and July 2025. Inclusion criteria required ≥ 3 clinically confirmed nerve compression sites, absence of neurological comorbidities, and simultaneous decompression of all symptomatic sites within one surgical session. Diagnostic evaluation included clinical examination, electrodiagnography for carpal and cubital tunnel syndromes, and Hagert's triad for lacertus and radial tunnel syndromes. Outcomes included QuickDASH, VAS for pain and numbness, strength, and return-to-work time.

Results

All procedures were completed successfully under regional anesthesia with no intra- or postoperative complications. Each limb underwent decompression of at least three nerves (median, radial, ulnar, and/or carpal tunnel). QuickDASH and VAS scores improved markedly, and all patients returned to work between postoperative days 15 and 21. No recurrence or residual symptoms were observed at last follow-up.

Conclusion

Simultaneous multi-site nerve decompression is a safe and effective approach for selected patients with complex upper-limb compression syndromes. This technique provides rapid functional recovery with minimal morbidity and may be a valuable alternative to staged surgery.

Introduction

Multiple entrapment neuropathies of the upper limb are increasingly recognized in clinical practice, yet their pathophysiology, diagnosis, and optimal treatment remain incompletely defined. The concept of double crush syndrome, originally introduced by Upton and McComas in 1973, posits that a proximal nerve compression may render the distal segment more vulnerable to subsequent entrapment, resulting in cumulative or synergistic impairment of nerve function [1]. More recently, larger series have documented that multiple sites of nerve compression are not uncommon in patients undergoing surgical decompression of the upper limb [2].

Despite increasing awareness of this phenomenon, most surgical strategies continue to adopt a staged approach, targeting the single most symptomatic site first and deferring additional decompressions if symptoms persist. While cautious, this paradigm may prolong overall recovery, increase cumulative surgical morbidity, and fail to address the full extent of neural compromise in a timely fashion. This strategy, though cautious, exposes the patient to repeated anesthesia, prolonged recovery, and diagnostic uncertainty when symptoms persist. Several authors have shown that simultaneous decompression of two sites, such as carpal and cubital tunnels, can be performed safely without increasing morbidity [3, 4]. In fact, recent epidemiological data indicate that among patients with median neuropathy, the vast majority have two or more entrapment sites along the neural trajectory rather than an isolated lesion [5].

However, the literature is sparse regarding simultaneous multi-nerve decompression. This gap led us to analyze a consecutive series of patients managed with a single-stage, symptom-guided, multi-site decompression protocol. The aim of the present study is to describe the surgical technique, report the early outcomes, and evaluate the safety and feasibility of this comprehensive approach for multiple crush syndromes of the upper limb. This approach aimed to provide definitive relief from multi-level nerve compression while minimizing cumulative morbidity.

Materials and Methods

Between November 2023 and July 2025, 12 patients (13 upper limbs) presenting with multiple upper-limb nerve compression syndromes were included retrospectively. Inclusion criteria were: (1) the presence of at least three distinct nerve compression sites; (2) absence of comorbidities that could affect the peripheral nervous system (e.g., neuromuscular disorders, diabetes); (3) all compression sites were released during the same operative session. Exclusion criteria were: (1) a history of prior peripheral nerve surgery; (2) postoperative follow-up of less than 6 months.

The diagnosis of median nerve compression at the carpal tunnel was based on clinical examination and electromyography (showing severe involvement or axonal loss), or on the failure of appropriate conservative treatment for at least three months.

The diagnosis of ulnar nerve compression at the elbow was based on clinical examination supported by positive electromyographic findings.

For radial nerve compression at the arcade of Frohse and median nerve compression at the lacertus fibrosus, the diagnosis was clinical, based on Hagert's triad. [6].

Informed consent

was obtained for each patient. The study was conducted in compliance with the principles of the Declaration of Helsinki and its later amendments. All patients were informed that their anonymized data could be used for research purposes, and none expressed opposition.

Surgical Technique

All surgeries were performed under regional brachial plexus anesthesia with an upper-arm pneumatic tourniquet. Patients were positioned supine with the arm on a hand table. The limb was prepped from mid-arm to mid-hand, allowing all decompressions through separate incisions within a single sterile field.

The radial tunnel was approached through a 2.5-cm anterior incision just distal and lateral to the biceps tendon. After blunt dissection between the brachioradialis and extensor carpi radialis longus, the posterior interosseous nerve was identified and the arcade of Frohse opened longitudinally.

For the median nerve at the elbow, a 1-cm anteromedial incision was made. The lacertus fibrosus was divided, and median nerve was released.

The ulnar nerve was released through a posteromedial incision, freed from Osborne's ligament, and transposed anteriorly into a subcutaneous fat flap to prevent postoperative adhesion.

Fort the median nerve at the wrist, a single-portal endoscopic carpal tunnel release was performed. The transverse carpal ligament was divided under direct visualization.

All wounds were closed with absorbable sutures and simple dressings. No drains were used, and immediate active motion was encouraged. All procedures were outpatient.

Outcome measures

The primary outcomes were the pre- and post-operative QuickDASH. Secondary outcomes included the post-operative VAS for pain, numbness, subjective satisfaction with the surgery (VAS 0–10), and intra-operative return of strength. Complications were reported.

Differences between quantitative scores were analyzed with the Student t-test. Values of p less than 0.05 were considered statistically significant.

Results

Twelve patients (13 upper limbs) meeting the inclusion criteria were analyzed. There were 4 men and 8 women, with a mean age of 49.9 years (+/- 16.8 years). Symptoms had been present for an average duration of 6 to 19 months before surgery. The dominant limb was involved in 8 cases.

A simultaneous release of the median nerve at the wrist and the median and ulnar nerves at the elbow was performed in two patients. A simultaneous release of the median nerve at the wrist and the median and radial nerves at the elbow was performed in eight patients. Finally, in two cases, the three nerves at the elbow (median, radial, and ulnar) were decompressed during the same procedure (Table 1).

Table 1
Demographic Data

Patient	Age	Sex	Manual Worker	High Competitive Sport	Recent History of trauma	Duration between begging of symptomatology & surgery (months)	Main symptom	Median (Lacertus)	Radial (Frohse)	Ulnar (Elbow)	Carpal Tunnel Release
P1	46	M	No	No	No	6	Numbness	X		X	X
P2	41	M	No	No	Elbow Joint Dislocation 12 months ago	11	Less of hand strength	X	X	X	
P3	26	F	Yes (dental prosthesist)	Climbing	No	7	Numbness	X		X	X
P4	54	F	Yes (auxillary nurse)	No	No	9	Less of hand strength	X	X		X
P5	57	F	No	No	No	12	Less of hand strength	X	X		X
						7	Less of hand strength	X	X		X
P6	22	F	No	Climbing	Elbow Joint Dislocation 9 months ago	8	Painful hand	X	X	X	
P7	62	F	No	No	Distal Radius Fracture 8 months ago	6	Less of hand strength	X	X		X
P8	68	M	Yes (construction)	No	No	9	Painful hand	X	X		X
P9	30	M	No	Climbing	Sport forearm trauma undiagnosed 2 years ago	12	Less of hand strength	X	X		X
P10	76	F	No	No	Distal Radius Fracture 24 months ago	14	Painful hand	X	X		X
P11	54	F	Yes (cameraman)	No	Distal Radius Fracture 9 months ago	6	Painful hand	X	X		X
P12	56	F	No	No	No	19	Numbness	X	X		X

All procedures were completed during a single operative session under regional anesthesia. Mean operative time was 72 minutes. No intraoperative complications occurred. No case required conversion to a different surgical approach. There were no wound infections, hematomas, seromas, or transient neuropraxias.

The average preoperative QuickDASH was 42.1 (+/- 14.7) and the average postoperative QuickDASH was 8.3 (+/- 5.9). The mean post-operative VAS scores were as follows: pain VAS 1.2 (+/- 1.4); numbness VAS 0,8 (+/- 1.3); satisfaction with the surgical outcome VAS 8.9 (+/- 1.3). All patients reported good/excellent satisfaction with the surgical outcome (Table 2).

Table 2
Results Data

	Pre-operative	Post-operative	p
QuickDash	42.1 (+/- 14.7)	8.3 (+/- 5.9)	< 0.05
VAS pain	5.3 (+/- 2.5)	1.2 (+/- 1.4)	< 0.05
VAS numbness	6.6 (+/- 1.4)	0.8 (+/- 1.3)	< 0.05
VAS Satisfaction		8.9 (+/- 1.3)	

All patients reported complete disappearance of paresthesia and pain within days after surgery. Every patient resumed work and normal daily activity between postoperative days 15 and 21.

Regarding strength recovery, in the single case of ulnar nerve involvement at the elbow with axonal loss (n = 1), full motor recovery was achieved within 6 months. In all other cases, recovery of strength to a level comparable to the contralateral side was achieved within 3 to 6 weeks.

At the latest follow-up (10,7 months (+/- 4,2)), no recurrence or residual symptom was observed. None required additional surgery or physiotherapy.

Discussion

This study describes a consecutive series of patients treated with single-stage decompression of a minimum of three nerve entrapment sites in the same upper limb. These early results suggest that the procedure carries no additional risk compared with isolated decompressions, while dramatically shortening total recovery time.

These findings support the concept that, in selected patients presenting with symptoms suggestive of multi-level nerve involvement, a comprehensive single-session decompression may offer substantial clinical benefit compared with traditional staged procedures. The technique addresses a well-recognized clinical reality: in many patients, multiple nerve compressions coexist, producing complex, overlapping symptoms that rarely correspond to a single anatomical lesion. Failure to decompress all affected segments may therefore leave residual symptoms even after a technically adequate isolated decompression, potentially prolonging disability and delaying diagnosis of secondary entrapment zones. Our results align with previous literature supporting combined approaches. Skouteris and colleagues reported excellent outcomes after simultaneous median and ulnar decompression at the elbow [7]. Hagert et al. later confirmed the benefit of combined lacertus and carpal tunnel releases in patients with dual compression of the median nerve [8].

The concept is physiologically justified: once a nerve is compromised at multiple levels, relieving only one site may not restore normal axoplasmic flow. A single comprehensive release addresses the entire continuum of compression, allowing complete functional recovery. From a practical standpoint, this approach reduces cumulative exposure to anesthesia and operating room time and eliminates redundant convalescence periods. The uniformly rapid return to work is a strong argument in favor of this strategy, particularly for manual workers or those needing early functional recovery. hese findings suggest that multi-site decompression does not increase morbidity and may even shorten global recovery by addressing all symptomatic sites at once.

An important point of discussion concerns the pattern of symptom associations observed in these patients. As in previous publications[8–10], our surgical indications for elbow decompression were based exclusively on clinical examination, since each compression site presents with distinct and reproducible clinical signs. However, the absence of electrodiagnostic abnormalities in many cases raises a legitimate question: do these patients truly present with fixed mechanical compression, or rather with dynamic, position-dependent constriction caused by surrounding aponeurotic structures and altered nerve gliding?

This concept of reactive neuritis secondary to impaired fascial gliding is plausible, particularly in the absence of associated trauma. Nevertheless, in two patients of this series, triple nerve decompression at the elbow was performed after a documented episode of elbow dislocation in two cases. It is therefore reasonable to consider whether their symptoms may have reflected a component of subacute proximal forearm compartment-like compression, rather than isolated focal nerve entrapment at each site. This theory may be the same for the patient who had history of distal radius fracture before the myo-aponevrotic compressive syndrome of the forearm.

The study's limitations include its small sample size and short follow-up, as well as the absence of quantitative electrophysiological post-op data. Additionally, the possibility of selection bias cannot be excluded, as patients with diffuse symptoms may be more likely to present with multi-site involvement. Nonetheless, the total absence of complications and the consistent patient satisfaction suggest that this combined procedure can be adopted safely in well-selected cases. Future prospective studies should aim to compare simultaneous versus staged decompression and evaluate the cost-effectiveness of this approach.

To conclude, multiple nerve decompression is a safe, effective, and time-saving technique for treating multiple crush syndrome of the upper limb. Performed under a single anesthesia, it provides immediate and durable symptom relief, minimal morbidity, and a uniquely short recovery. These results support the integration of single-stage multi-site decompression into the therapeutic strategy for selected patients with complex nerve compression patterns. Further prospective studies are warranted to confirm long-term outcomes and to compare simultaneous versus staged approaches.

Declarations

Ethics approval and consent to participate :

This study was a retrospective observational study based on anonymized clinical and imaging data collected during routine clinical care. According to French regulations, retrospective studies using previously collected anonymized data do not require approval from an institutional review board nor written informed consent from patients, in accordance with the French Public Health Code (Articles L1121-1 and R1121-2). The study was conducted in compliance with the principles of the Declaration of Helsinki and its later amendments. All patients were informed that their anonymized data could be used for research purposes, and none expressed opposition.

Consent for publication :

Yes for all patient. No identifying images or personal clinical details that could compromise patient anonymity are included in this manuscript.

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Author Contribution

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Data Availability

The datasets generated and/or analysed during the current study are not publicly available due to patient confidentiality and local data protection regulations but are available from the corresponding author on reasonable request.

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