



Prevalence of hand paresthesia and numbness in painful shoulders: a narrative review

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Contributions: (I) Conception and design: GAC Murrell; (II) Administrative support: GAC Murrell; (III) Provision of study materials or patients: C Zhang; (IV) Collection and assembly of data: C Zhang; (V) Data analysis and interpretation: Both authors; (VI) Manuscript writing: Both authors; (VII) Final approval of manuscript: Both authors.

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Background and Objective: While hand paresthesia and numbness are commonly associated with nerve compression, these symptoms also manifest in shoulder conditions not typically linked to direct nerve involvement, prompting questions about their underlying causes. This review aimed to explore the existing literature on hand paresthesia and numbness in patients with common shoulder pathologies. The goal was to identify gaps in our understanding of the prevalence and mechanisms behind these symptoms.

Methods: To conduct this review, a search strategy was formulated to target key terms related to hand paresthesia, numbness, and various shoulder pathologies. PubMed, Scopus, Embase via OVID, and Cochrane Library were searched, resulting in an initial pool of 33 articles. After screening and removing duplicates, three relevant studies were included for analysis.

Key Content and Findings: Our review analyzed three current studies that demonstrated varying rates of preoperative hand paresthesia and numbness among patients with different shoulder pathologies. Specifically, 54% of patients with subacromial impingement syndrome, 35% of patients with rotator cuff tears, and 40% of patients with either Bankart tears or superior labrum anterior and posterior (SLAP) tears reported experiencing hand paresthesia. Hand numbness was reported by 29% of patients with rotator cuff tears, 40% with Bankart tears, and 55% with superior labrum anterior and posterior tears. The prevalence of hand paresthesia and numbness was positively correlated with higher intensity of shoulder pain among all included studies.

Conclusions: Hand paresthesia and numbness have been reported by patients with subacromial impingement syndrome, rotator cuff tears, and glenohumeral labral tears. The prevalence of hand paresthesia and numbness across other shoulder pathologies and their pathophysiology remain to be investigated.

Keywords: Shoulder; painful; hand; paresthesia; numbness

Received: 31 July 2024; Accepted: 10 December 2024; Published online: 21 January 2025.

doi: 10.21037/aoj-24-33

View this article at: <https://dx.doi.org/10.21037/aoj-24-33>

Introduction

Hand paresthesia and numbness have not traditionally been associated with disorders of the shoulder joint (1). However, we have anecdotally noted that patients presenting with common shoulder pathologies that do not typically involve nerve entrapment, such as rotator cuff tears, glenohumeral labral tears, shoulder arthritis, and adhesive capsulitis, also suffer from hand paresthesia and numbness (2-5).

This review aims to explore the existing literature on the potential mechanisms and prevalence of hand paresthesia and numbness in patients with common shoulder pathologies.

Rationale and knowledge gap

Definitions

In this review, paresthesia refers to abnormal sensations

on the skin, and numbness refers to the absence of tactile sensation on the skin.

Aetiologies of compression neuropathies

Compression neuropathies such as carpal tunnel syndrome, brachial plexus injuries, thoracic outlet syndrome (TOS), and cervical radiculopathy where there is compression to the sensory neurons of the peripheral nerves, often present with hand paresthesia and numbness (1,6-10).

Carpal tunnel syndrome occurs when there is compression of the median nerve at the carpal tunnel (11). Brachial plexus injuries occur due to penetrating injuries, falls, and traumatic accidents that cause fracture or compression (12). Neurogenic TOS occurs when there is compression of the brachial plexus as it passes through the thoracic outlet (13). Lastly, cervical radiculopathy occurs when there is compression of a cervical nerve root caused by disc herniation, spondylosis, instability, trauma, or tumours (14). These compression neuropathies can cause direct nerve injuries such as neurapraxia, axonotmesis, and neurotmesis (15).

Neurapraxia involves mild myelin sheath damage while sparing the axon and the surrounding connective tissue. It carries the best prognosis where complete recovery of nerve function is possible. Axonotmesis involves damage to both the myelin sheath and its axon, but the perineurium and epineurium remain intact. Wallerian degeneration often occurs with axonal regrowth, carrying a good chance of partial nerve recovery. Lastly, neurotmesis is the most severe form of nerve injury where there is a complete disruption of the axon and connective tissue with no possibility for axonal regrowth without surgical intervention (16,17).

It has been postulated that when there is a partial nerve injury such as neurapraxia and axonotmesis, afferent signals from the hand are not fully transmitted to the primary sensory cortex, resulting in sensory impairment (18). In neurotmesis, there is a complete disruption of the axon preventing the transmission of afferent signals (19), causing hand numbness.

Epidemiology of hand paresthesia and numbness in compression neuropathies

Among 150 patients with neurogenic TOS, 141 patients (94%) reported paresthesia in the arm, hand, digits, or a combination (20), a finding consistent with Sanders *et al.* (21) where 49 out of 50 patients (98%) with the same syndrome also experienced hand paresthesia. Among 30 patients that suffered from traumatic total brachial plexus injury, 26 patients (87%) reported having upper limb paresthesia (22).

The high prevalence of hand paresthesia was further confirmed in another study where 19 out of 20 patients (95%) with traumatic brachial plexus injury experienced this symptom (23). In an epidemiology study of 561 patients with cervical radiculopathy, 503 patients (90%) reported experiencing upper limb paresthesia (10). Lastly, in a survey of 2,466 patients with carpal tunnel syndrome, 354 patients (14%) reported hand paresthesia and numbness (24).

The pathophysiology and prevalence of hand paresthesia and numbness are well-understood in compression neuropathies, where nerve injury is a known factor.

Clinical presentations in common shoulder pathologies

The most common clinical presentations patients presented with at our clinic were shoulder pain, instability, and stiffness. The most common diagnoses these patients had were glenohumeral labral tears, rotator cuff tears, shoulder arthritis, and adhesive capsulitis. These shoulder pathologies do not typically directly involve nerve compression, yet many of these patients also complain of concomitant hand paresthesia and numbness.

Pathophysiology

Rotator cuff tears are often caused by traumatic injuries or degenerative changes to the rotator cuff tendons, causing shoulder pain (25,26). The most commonly torn rotator cuff tendon is the supraspinatus (27).

Glenohumeral labral tears are also often caused by traumatic injuries or overuse of the shoulder. It often presents as either a superior labrum anterior and posterior (SLAP) lesion, a tear of the superior glenoid labrum and long head of the biceps tendon, or a Bankart lesion, a tear of the anteroinferior portion of the glenoid labrum (28,29). Patients often present with pain, instability, and frequent dislocations.

Osteoarthritis of the shoulder joint arises from chronic mechanical stress of the glenohumeral joint leading to cartilage degeneration, joint space narrowing, subchondral sclerosis, and osteophyte growth (30). Patients often experience pain during exertion, joint stiffness, limited range of motion, and potential crepitus in joint movements (31).

Lastly, adhesive capsulitis arises from excessive fibrous tissue formation in the glenohumeral joint either spontaneously or from repeated trauma leading to stiffness, pain, and dysfunction of the shoulder (32).

However, what is puzzling is that these shoulder pathologies primarily involve musculature, fibrocartilaginous

Table 1 Search strategy terms

Term	Alternative terms	Word variations	Search term
Prevalence	–	–	“Prevalence”
Hand	–	–	“Hand”
Paresthesia	Dysesthesia	Tingling, prickling, abnormal sensation	“Paresthesia” OR “Dysesthesia” OR “Tingling” OR “Prickling” OR “Abnormal + sensation/sensations”
Numbness	Hypoesthesia, impaired sensation, reduced sensation	–	“Numbness” OR “Hypoesthesia” OR “Impaired + sensation/sensations” OR “Reduced + sensation/sensations”
Shoulder	–	–	“Shoulder”
Pathology	–	Disease, injury, disorder, problem	“Pathology” OR “Disease” OR “Injury” OR “Disorder” OR “Problem”

tissue, and bone, but not the sensory neurons. Yet, patients are presenting with hand paresthesia and numbness. Currently, the prevalence of hand paresthesia and numbness in shoulder pathologies that do not typically cause nerve compression remain poorly understood.

Objective

The purpose of this narrative review will be to review the existing evidence on hand paresthesia and numbness in patients with shoulder pathologies, as well as identify future research directions regarding the prevalence of patients with shoulder pathologies who experience hand paresthesia and numbness. This manuscript is written following the Narrative Review reporting checklist (available at <https://aoj.amegroups.com/article/view/10.21037/aoj-24-33/rc>).

Methods

To perform the search on existing literature exploring the prevalence of hand paresthesia and numbness among patients with common shoulder pathologies, a terms table was formulated that first included identifying the key terms in my research topic, followed by identifying entry terms that mapped to the same Medical Subject Heading and any other word variations, before putting together my search term (Table 1, Appendix 1). The search strategy is summarized in Table 2.

The literature search was conducted across four key databases: PubMed, Scopus, Embase via OVID, and the Cochrane Library, to identify relevant studies. A total of 33 articles were identified. Upon removing duplicates and screening, only one article was included (33). By

going through the reference list of the article, two more studies were found (34,35), bringing the total number of studies investigating the prevalence of preoperative hand paresthesia and numbness in shoulder pathologies to three (Figure 1).

Current evidence

Sivan *et al.* (35) was the first study to point out that patients with shoulder impingement which typically does not involve nerve entrapment experienced hand paresthesia. Among 100 patients suffering from subacromial impingement syndrome undergoing arthroscopic decompression surgery, 54 patients (54%) reported that they experienced preoperative hand paresthesia. Subsequently, Latif *et al.* (33), under the instruction of Professor G. Murrell, reported that 75 out of 213 patients (35%) with rotator cuff tears experienced hand paresthesia and 61 out of 213 (29%) patients with rotator cuff tears experienced hand numbness. Building on this, Latif *et al.* (34) reported that 40% of patients who had a Bankart tear or SLAP tear experienced hand paresthesia, while 40% of patients with a Bankart tear and 55% of patients with a SLAP tear experienced hand numbness. However, the study by Sivan *et al.* (35) highlighted that the 100 patients recruited suffered from more severe pain that required surgical intervention, hence, the actual prevalence of hand paresthesia among patients with subacromial impingement syndrome cannot be predicted based on the study cohort. Both studies by Latif *et al.* (33) and Latif *et al.* (34) had a limited patient data collection period of up to 6 months, also limiting their ability to reflect the true prevalence of hand paresthesia and numbness among the study cohorts. Furthermore, there are currently no studies

Table 2 The search strategy summary	
Items	Specification
Date of Search	25th March 2024
Databases and other sources searched	Embase via OVID, Scopus, Cochrane Library, PubMed
Search terms used	See Table 1
Timeframe	2010 to March 2024
Inclusion and exclusion criteria	<div>Inclusion:<ul style="list-style-type: none">- Patients must have shoulder pathologies and present with hand paresthesia or numbness- Adult population >17 years old- Randomised controlled trials cohort studies, systematic reviews and meta-analyses- Studies in English<div>Exclusion:</div><ul style="list-style-type: none">- Patients with compression neuropathies- Case reports- Case series- Letters to editors- Commentaries- Book/book chapters- Conference abstracts- Study protocols- Animal Studies- Papers before 2010</div>
Selection process	Z.C. conducted the search and screening; G.A.C.M. conducted full text review

that have reported the prevalence of hand paresthesia and numbness among patients with frozen shoulders and shoulder arthritis. Hence, there is a huge gap in our understanding of the true prevalence of hand paresthesia and numbness among patients with different shoulder pathologies, emphasizing the need for further research.

The varying rates of preoperative hand paresthesia and numbness among patients with subacromial impingement syndrome, rotator cuff tears, and glenohumeral labral tears could also possibly be attributed to the pathology, severity and prevalence of pain, age, and side of the affected shoulder (Table 3).

Pathology of shoulder injury

Among the three studies, subacromial impingement syndrome had the highest rate of hand paresthesia (54%), followed by glenohumeral labral tears (40%), and rotator

cuff tears (35%). SLAP tears (55%) had the highest rate of hand numbness, followed by Bankart tears (40%), and rotator cuff tears (29%) (33-35). It can be postulated that the closer the site of pathology is to nociceptors, the higher the prevalence of hand paresthesia and numbness. Given the intense stimulation of nociceptors in these pathologies causing central pain sensitization (36), the potential alteration to the central nociceptive pathways (37) might have lowered the threshold for signal transduction of intrinsically sub-threshold afferent signals, and causing hand paresthesia (19). Increased pain from shoulder pathologies might have also increased the patient’s attention to the upper limb, lowering the threshold for signal transduction for intrinsically sub-threshold afferent signals, causing hand paresthesia to be perceived in the absence of peripheral input (29).

Latif *et al.* (33) and Latif *et al.* (34) also noted that there

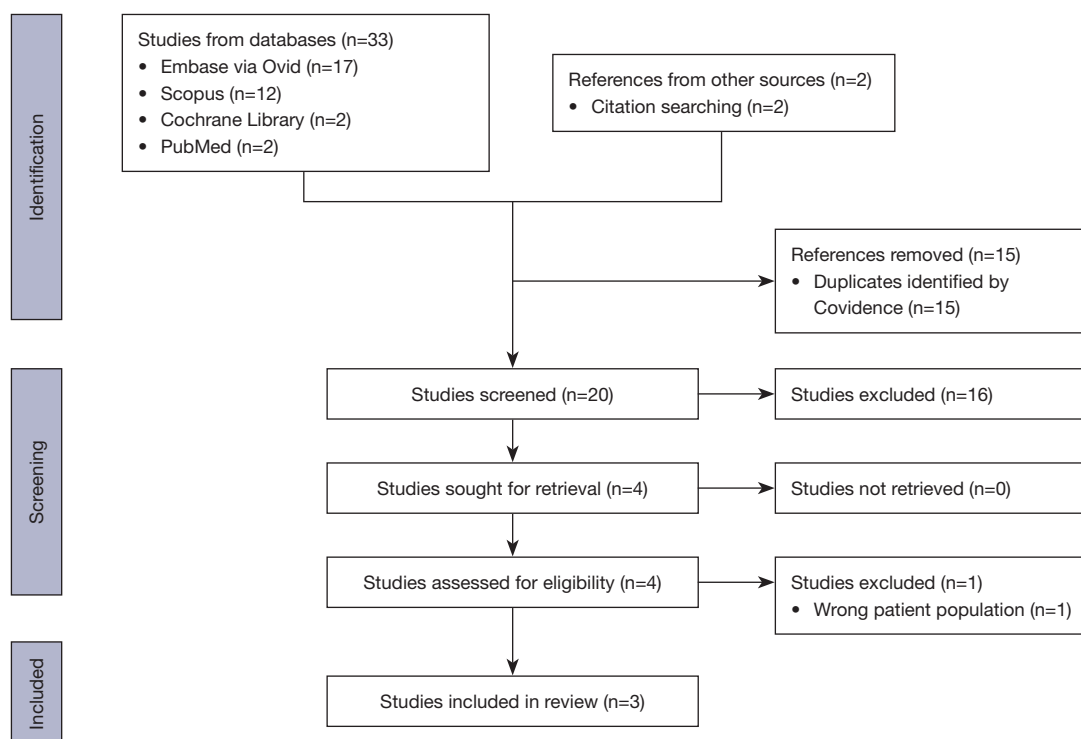


Figure 1 Search strategy flow diagram.

Table 3 Summary of evidence from current literature

Study	Shoulder disorder	Prevalence (preoperative)	Pain	Age	Side of shoulder (left:right)
Latif <i>et al.</i> (33)	Rotator cuff tear	35% reported hand paresthesia; 29% reported hand numbness	Higher frequency and severity of pain was associated with hand paresthesia and numbness at 6 months	–	86:127
Latif <i>et al.</i> (34)	SLAP tear	40% reported hand paresthesia 55% reported hand numbness	Higher level of sleep pain was associated with hand numbness preoperatively Higher frequency of extreme shoulder pain was associated with hand numbness at 6 months	Younger patients were more likely to have hand paresthesia preoperatively and at 6 months	9:10
	Bankart tear	40% reported hand paresthesia and numbness	Higher frequency and severity of pain was positively associated with hand paresthesia and numbness preoperatively and at 6 months	Older patients were more likely to have hand paresthesia and numbness at 6 months	22:25
Sivan <i>et al.</i> (35)	Subacromial impingement syndrome	54% reported hand paresthesia	Patient that had more pain were more likely to have hand paresthesia (OR: 5.05, 95% CI: 1.62–15.73)	Younger patients were more likely to have hand paresthesia (5 years increase, OR: 0.77, 95% CI: 0.63–0.94)	–

SLAP, superior labrum anterior and posterior; OR, odds ratio; CI, confidence interval; SLAP, superior labrum anterior and posterior.

was a correlation between a reduced range of motion and higher prevalence of hand paresthesia and numbness in patients with rotator cuff tears and Bankart tears. The highest degree of association was found between preoperative hand paresthesia in Bankart tears and external rotation range of motion ($r: -0.53$).

Pain

Latif *et al.* (33) reported that the prevalence of hand paresthesia and numbness was positively associated with the frequency and severity of shoulder pain 6 months after rotator cuff repair. Hand paresthesia was positively associated with increased frequency of shoulder pain during activity ($r: 0.40$), sleep ($r: 0.41$), and extreme shoulder pain ($r: 0.29$). It was also positively associated with increased levels of shoulder pain during rest ($r: 0.36$), overhead activity ($r: 0.37$), and sleep ($r: 0.42$). Hand numbness was also positively associated with increased shoulder pain during activity ($r: 0.41$), sleep ($r: 0.41$), and extreme shoulder pain ($r: 0.31$). It was also positively associated with increased levels of shoulder pain during rest ($r: 0.44$), overhead activity ($r: 0.40$), and sleep ($r: 0.38$). Similarly, Latif *et al.* (34) reported that preoperative prevalence of hand paresthesia and numbness in Bankart tears are positively associated with increased frequency of shoulder pain during activity (paresthesia $r: 0.32$, numbness $r: 0.27$) and extreme shoulder pain (paresthesia $r: 0.33$), as well as level of pain during rest (paresthesia $r: 0.44$, numbness $r: 0.31$), overhead activity (paresthesia $r: 0.44$, numbness $r: 0.40$), and sleep (paresthesia $r: 0.35$). In SLAP tears, only hand numbness was associated with increased levels of sleep pain ($r: 0.49$). Sivan *et al.* (35) also reported a significant association with the prevalence of hand paresthesia and worse shoulder pain experienced (P value: 0.005) in patients with subacromial bursitis. Sivan *et al.* (35) reported that the odds of hand paresthesia were 5.05 (95% CI: 1.62–15.73) times higher in patients suffering from severe pain (rated 9–10 on the visual analogue scale) compared to those suffering from moderate pain (rated 7–8 on the same scale). These studies suggest a positive relationship between hand paresthesia and numbness, and the frequency and severity of shoulder pain.

Age

Sivan *et al.* (35) observed a significant association between age and the incidence of paresthesia (P value: 0.01) where the odds of older patients having hand paresthesia were 0.77 (95% CI: 0.63–0.94) times patients 5 years younger.

Similarly, Latif *et al.* (34) reported that hand paresthesia was negatively associated with older age among patients with SLAP tears at both preoperative ($r: -0.57$) and 6-month postoperative ($r: -0.60$) time points, suggesting that younger patients were more likely to have hand paresthesia and numbness. A possible explanation could be both subacromial impingement syndrome and SLAP tears being caused by repeated overhead movements (38,39), commonly seen in younger athletes, leading to more frequent traumatic injuries.

However, this hypothesis is challenged by Latif *et al.* (34) where hand paresthesia ($r: 0.43$) and numbness ($r: 0.45$) were positively associated with older patients that had Bankart tears at 6 months postoperatively, an injury most commonly associated with traumatic anterior shoulder dislocation seen in young athletes (28). This contradiction remains to be investigated.

Left versus right shoulder

Lastly, Latif *et al.* (33) reported that the ratio of left to right rotator cuff tears was 86 to 127, and Latif *et al.* (34) reported that the ratio of left to right shoulder pathologies was 22 to 25 in Bankart tears and 9 to 10 in SLAP tears. The high ratio of left-sided shoulder pathologies is surprising given that the prevalence of right-handedness in the general population is 89% (40), and by extension, the right shoulder is likelier to be used and subjected to trauma and degeneration. However, neither paper conducted a comparison analysis on which shoulder was more significantly associated with the presence of hand paresthesia and numbness.

Our hypothesis

Based on current evidence linking hand paresthesia and numbness with painful, restricted shoulder movement and left-sided pathologies, we hypothesize that patients with adhesive capsulitis will have the highest incidence of hand paresthesia and numbness. This is because adhesive capsulitis is a painful condition characterized by inflammation of the glenohumeral synovium and fibrotic contracture of the joint capsule (5,41), which contains a high density of nociceptors (42,43). Adhesive capsulitis was also associated with stiffer and weaker shoulders (44). Additionally, a systematic review and meta-analysis revealed that out of 1,551 patients, 833 (54%) patients had adhesive capsulitis in the left shoulder (45).

Limitations and future research

This review is limited by the small number of studies available, many of which have small sample sizes and short follow-up periods. Of the three studies reviewed, only Sivan *et al.* (35) documented the dermatomal distribution of affected regions and conducted nerve conduction studies on seven patients with subacromial impingement and hand paresthesia to investigate the underlying pathophysiology. None of the patients showed significant entrapment neuropathy, leaving the pathophysiology of hand paresthesia and numbness unclear. Additionally, there is a notable lack of data on other shoulder pathologies, hindering a comprehensive assessment of the full extent and variation of these symptoms. Further research is needed to establish the true prevalence and underlying mechanisms of hand paresthesia and numbness across different shoulder pathologies.

Conclusions

Our review highlights the prevalence of hand paresthesia and numbness among patients with subacromial impingement syndrome, rotator cuff tears, and glenohumeral labral tears. Notably, these symptoms tend to be associated with more intense shoulder pain, younger patient age, and left-sided shoulder involvement, though the correlation with age was not consistently observed across all studies. Further research is required to determine the true prevalence of hand paresthesia and numbness across shoulder pathologies and their pathophysiology.

Acknowledgments

None.

Footnote

Reporting Checklist: The authors have completed the Narrative Review reporting checklist. Available at <https://aoj.amegroups.com/article/view/10.21037/aoj-24-33/rc>

Peer Review File: Available at <https://aoj.amegroups.com/article/view/10.21037/aoj-24-33/prf>

Funding: None.

Conflicts of Interest: Both authors have completed the ICMJE

uniform disclosure form (available at <https://aoj.amegroups.com/article/view/10.21037/aoj-24-33/coif>). G.A.C.M. reports the consulting fees from Smith and Nephew. He is also the Editorial or Governing board member of *JSES* and *Shoulder & Elbow* (UK). The other author has no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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doi: 10.21037/aoj-24-33

Cite this article as: Zhang C, Murrell GAC. Prevalence of hand paresthesia and numbness in painful shoulders: a narrative review. *Ann Joint* 2025;10:6.