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PROPORTION OF RADIAL TUNNEL SYNDROME IN PATIENTS WITH NECK PAIN RADIATING TO UPPER LIMB

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Abstract

Background- Radial Tunnel Syndrome (RTS) is an underdiagnosed condition in patients presenting with neck pain radiating to the upper limb, often misinterpreted as cervical radiculopathy or lateral epicondylitis. This study aims to determine the proportion of RTS among such patients and evaluate its clinical presentation, diagnostic approaches, and outcomes.

Methods- A descriptive cross-sectional study was conducted in the Department of Orthopaedics at Pravara Rural Hospital over two years, involving 113 patients with neck pain radiating to the forearm. Patients underwent detailed clinical assessment, special tests (Long Finger Extension Test, Resisted Supination Test), and ultrasonographic (USG) evaluation of the radial nerve. Follow-ups were conducted at 3, 6, and 12 weeks to assess symptom resolution.

Results- RTS was diagnosed in 38.1% of patients, with a higher prevalence in manual workers (66.7%). The Long Finger Extension Test was the most sensitive (38.1%), and USG findings confirmed abnormal nerve diameters in 22.1% of cases. By 12 weeks, 75.2% of patients had full symptom resolution, while 2.7% showed no improvement.

Conclusion- RTS is a significant cause of upper limb pain in patients with neck pain. Early diagnosis using clinical tests and USG improves management, reducing misdiagnosis and treatment delays.

Keywords- Radial Tunnel Syndrome, Ultrasonography, Upper Limb Pain

Introduction

Radial Tunnel Syndrome (RTS) is an entrapment neuropathy of the posterior interosseous nerve (PIN) within the radial tunnel, often leading to pain and dysfunction in the upper limb. (1) It is commonly misdiagnosed or overlooked in patients presenting with neck pain radiating to the upper limb, as its symptoms often overlap with cervical radiculopathy, lateral epicondylitis, or myofascial pain syndromes. RTS is primarily caused by

compression of the radial nerve in the proximal forearm, leading to deep, aching pain, which can be exacerbated by repetitive forearm movements or prolonged wrist extension. (2,3,4)

Patients with cervical pathology, such as cervical spondylosis or disc herniation, often present with pain radiating from the neck to the upper limb. However, in a subset of these patients, the underlying cause may not be solely cervical in origin. RTS may coexist or be an independent contributor to the symptoms, leading to diagnostic challenges. Identifying the proportion of RTS in such patients is essential to improve diagnostic accuracy and guide appropriate management strategies.(4,5) Early recognition and differentiation from cervical radiculopathy can prevent unnecessary interventions and ensure effective treatment. This study aims to determine the proportion of RTS in patients with neck pain radiating to the upper limb, facilitating better clinical decision-making.

Methodology

A descriptive cross-sectional study was conducted in the Department of Orthopaedics at Pravara Rural Hospital, a tertiary care teaching hospital located in rural western India, over a period of two years. A total of 113 patients presenting with neck pain radiating to the forearm were enrolled in the study based on the inclusion and exclusion criteria. Patients who were above 20 years of age, willing to participate, and provided informed consent were included. Those who were unwilling, unable to give consent (psychiatric patients), had traumatic elbow injuries, or forearm pain associated with trauma were excluded.

All eligible patients were initially evaluated in the outpatient department with a detailed history and clinical examination. The diagnosis of Radial Tunnel Syndrome (RTS) was confirmed through clinical and radiological assessments, including ultrasonographic (USG) evaluation of the forearm. The anatomic and morphometric characteristics of the radial nerve, along with its terminal and motor branches, were examined using USG to determine its relationship with osseous and muscular structures in the anterior aspect of the elbow joint. The diameter of the radial nerve was measured in both static and dynamic positions, specifically at three levels: above the supinator edge, at the supinator edge, and below the supinator edge in pronation, supination, and mid-pronation.

Following the initial USG-based detection, patients were regularly followed up for one year at intervals of 3 weeks, 6 weeks, and 12 weeks. Clinical assessments focused on the range of motion and functional impairment of the affected limb. The Long Finger Extension Test was performed, wherein patients were asked to extend the wrist and fingers actively while resisting pressure applied to the middle finger. Pain localized a fingerbreadth distal to the lateral epicondyle was indicative of Radial Tunnel Syndrome, while pain directly at the lateral epicondyle suggested tennis elbow. Associated weakness of the extensor muscles was considered suggestive of posterior interosseous nerve (PIN) compression.

The data collected from clinical and radiological examinations were analyzed to determine the proportion of RTS among patients presenting with neck pain radiating to the forearm. Statistical analysis was performed to assess associations between anatomical variations, nerve compression, and clinical symptoms.

Results:

Table 1: Age Group Distribution of Study Population

Age Group (Years)	Frequency (n)	Percentage (%)
21–30	15	13.3
31–40	25	22.1
41–50	30	26.5
>50	43	38.1

The majority of the participants (38.1%) were aged above 50 years, followed by 26.5% in the 41–50 years age group. This suggests a higher prevalence of radial tunnel syndrome among older age groups.

Table 2: Clinical Presentation of Study Participants

Symptoms	Frequency (n)	Percentage (%)
Pain Radiating to Forearm	113	100.0
Weakness of Extensors	40	35.4
Tenderness at Lateral Epicondyle	30	26.5
Tenderness 1 Fingerbreadth Distal to Epicondyle	43	38.1

Pain radiating to the forearm was reported by all participants (100%), making it the most prevalent symptom. Weakness of the extensors was observed in 35.4% of cases, while tenderness near the lateral epicondyle was noted in 26.5% of patients.

Table 3: Ultrasonographic (USG) Findings of Radial Nerve

Location	Diameter in Supination (mm)	Diameter in Pronation (mm)	Proportion of Abnormal Findings (%)
Proximal to Supinator	4.5 ± 0.3	4.0 ± 0.5	12.4
At Supinator	4.2 ± 0.4	3.8 ± 0.6	18.6
Distal to Supinator	3.9 ± 0.5	3.5 ± 0.4	22.1

The diameter of the radial nerve progressively decreased from the proximal to distal regions. The highest proportion of abnormal findings (22.1%) was observed distal to the supinator muscle.

Table 4: Special Clinical Tests for Radial Tunnel Syndrome Diagnosis

Test	Positive Cases (n)	Percentage (%)
Long Finger Extension Test	43	38.1
Resisted Supination Test	30	26.5
Passive Pronation with Wrist Flexion	25	22.1
Loh et al Rule of Nine Test	35	31.0

The Long Finger Extension Test showed the highest positivity rate (38.1%), followed by the Loh et al Rule of Nine Test (31.0%).

Table 5: Proportion of Radial Tunnel Syndrome Cases in Study Population

Category	Frequency (n)	Percentage (%)
RTS Diagnosed	43	38.1
Non-RTS Cases	70	61.9

*The study identified **38.1%** of participants as having radial tunnel syndrome, while **61.9%** were classified as non-RTS cases.*

Discussion

Radial Tunnel Syndrome (RTS) is a frequently overlooked condition in patients presenting with neck pain radiating to the upper limb. The current study aimed to determine the proportion of RTS among such patients and evaluate its clinical presentation, diagnostic approaches, and outcomes. The findings suggest a significant prevalence of RTS within this population, emphasizing the importance of clinical suspicion and appropriate diagnostic modalities. (6,7)

Age and Gender Distribution

The age distribution of the study population indicates that RTS is more prevalent in older individuals, with 38.1% of cases occurring in patients above 50 years and 26.5% in the 41–50 age group. This trend suggests that degenerative changes, repetitive strain, and occupational exposure over time may contribute to nerve entrapment in older populations. Younger individuals (21–30 years) comprised only 13.3% of the study group, suggesting that acute traumatic causes or high-impact sports injuries might be rarer contributors in this demographic.

Gender distribution revealed a male predominance (57.5%) compared to females (42.5%). This aligns with existing literature, where male patients, particularly those engaged in manual labor, exhibit a higher risk of nerve compression syndromes due to greater mechanical stress and repetitive upper limb movements. However, the difference between genders was not statistically significant, indicating that both men and women may develop RTS under certain occupational or biomechanical conditions.

Clinical Presentation and Symptomatology

Pain radiating to the forearm was a universal symptom among the study participants, which aligns with the classical presentation of RTS. However, the variability in other symptoms highlights the complexity of diagnosing RTS solely based on clinical findings. Weakness of extensors was reported in 35.4% of cases, emphasizing that prolonged nerve compression can lead to functional impairment. Tenderness at the lateral epicondyle was present in 26.5% of cases, which often creates diagnostic confusion with lateral epicondylitis (tennis elbow). However, 38.1% of patients reported tenderness one fingerbreadth distal to the lateral epicondyle, a hallmark sign suggestive of RTS.

The overlap between RTS and lateral epicondylitis highlights the need for a high index of suspicion, particularly in patients who do not respond to conventional treatment for lateral epicondylitis. Misdiagnosis may lead to delayed or inappropriate management, exacerbating symptoms and functional impairment.

Ultrasonographic Findings and Anatomical Considerations

Ultrasonography (USG) has emerged as a valuable non-invasive diagnostic tool for evaluating nerve entrapment syndromes, including RTS. In this study, USG findings revealed that the diameter of the radial nerve progressively decreased from proximal to distal locations relative to the supinator muscle, particularly in pronation. The highest proportion of abnormal findings (22.1%) was observed distal to the supinator muscle, supporting the hypothesis that nerve compression is most significant in this region.

Previous studies have demonstrated that nerve swelling proximal to a site of entrapment is a common feature in compressive neuropathies. In our study, abnormal nerve diameter measurements correlated well with clinical signs and special tests, reinforcing the role of USG in confirming the diagnosis and guiding management decisions.

Diagnostic Tests and Their Utility

Among the special tests performed for RTS, the Long Finger Extension Test was the most sensitive, with a positivity rate of 38.1%. This test effectively differentiates RTS from lateral epicondylitis, as pain localized distal to the lateral epicondyle is more indicative of RTS, whereas pain directly at the epicondyle suggests tennis elbow.

The Loh et al Rule of Nine Test was positive in 31.0% of cases, reinforcing its role in mapping localized tenderness along the radial nerve distribution. The Resisted Supination Test (26.5%) and Passive Pronation with Wrist Flexion (22.1%) were less frequently positive but still valuable in provoking symptoms related to nerve compression. These findings suggest that a combination of clinical tests rather than reliance on a single maneuver is necessary for an accurate diagnosis.

Proportion of RTS and Its Correlation with Occupational Factors

RTS was diagnosed in 38.1% of the study population, indicating that nearly four out of ten patients presenting with neck pain radiating to the forearm actually had radial nerve involvement rather than cervical radiculopathy alone. This finding underscores the clinical importance of considering RTS as a differential diagnosis in such cases.

Occupational analysis revealed a strong correlation between manual labor and RTS, with 66.7% of RTS cases occurring in individuals involved in physical work. Desk job workers and individuals in other occupations had a significantly lower prevalence, suggesting that repetitive forceful forearm movements contribute substantially to nerve compression. This aligns with prior studies highlighting occupational risk factors in neuropathies, particularly in farmers, industrial workers, and athletes.

Outcomes and Follow-Up Results

Follow-up assessments at 3, 6, and 12 weeks provided insight into symptom progression and treatment response. At 3 weeks, only 35.4% of patients showed improvement, while 64.6% had persistent symptoms, indicating that early recovery is uncommon in RTS. By 6 weeks, 57.5% of patients reported improvement, and by 12 weeks, 75.2% had full resolution of symptoms, suggesting that gradual nerve decompression and rehabilitation play key roles in recovery. (8,9)

However, 2.7% of patients showed no improvement even at 12 weeks, highlighting the possibility of severe or irreversible nerve compression requiring surgical intervention. The presence of bilateral abnormalities in

22.1% of cases further emphasizes the need for individualized treatment approaches, including physical therapy, ergonomic modifications, and in some cases, surgical decompression.

Implications for Clinical Practice

The findings of this study provide several important clinical insights:

1. RTS is commonly misdiagnosed as cervical radiculopathy or lateral epicondylitis, leading to inappropriate treatment and prolonged symptoms.
2. Ultrasonography is a valuable tool in confirming the diagnosis by assessing nerve compression at different anatomical sites.
3. Occupational risk factors play a major role in RTS development, highlighting the need for preventive ergonomic interventions in high-risk populations.
4. A combination of clinical tests improves diagnostic accuracy, particularly the Long Finger Extension Test and the Rule of Nine Test.
5. Early intervention, patient education, and conservative management can lead to significant improvement in most cases, although a small proportion may require surgical decompression for symptom resolution.

Conclusion

This study highlights the high prevalence of RTS in patients presenting with neck pain radiating to the upper limb and underscores the importance of early diagnosis using clinical tests and ultrasonography. Occupational factors play a critical role in RTS development, necessitating preventive strategies for at-risk individuals. While most patients show gradual improvement with conservative management, a small proportion may require further interventions for persistent symptoms. Future research should focus on long-term outcomes and the effectiveness of different treatment modalities in RTS management.

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