CLINICAL AND NEUROLOGICAL MANIFESTATIONS OF RADIAL NERVE INJURY

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Abstract

Objective: To evaluate the clinical and neurological manifestations of radial nerve injuries of different etiologies and determine the relationship between the level of injury, severity of neurological deficit, and functional impairment. Eighty-six patients aged 18–67 years were examined. Traumatic injuries were identified in 53 patients (62%), compressive–ischemic lesions in 21 patients (24%), and iatrogenic injuries in 12 cases (14%). Clinical, neurological, and neurophysiological assessments included testing of muscle strength, sensory evaluation, neuropathic pain assessment, EMG, and hand functional tests. The most common manifestations were wrist drop, weakness of finger extensors, hypoesthesia of the dorsal hand surface, and neuropathic pain. Deficit severity was directly related to the level of injury: lesions located in the spiral groove of the humerus produced the most pronounced motor dysfunction. The results highlight the importance of early diagnosis and timely neurorehabilitation.

Keywords: radial nerve; peripheral neuropathy; nerve trauma; compression neuropathy; EMG; motor deficit; sensory impairment.

Introduction

Radial nerve injury (RNI) is one of the most common mononeuropathies of the upper limb, accounting for up to 18% of all peripheral nerve injuries (Kim, 2020). The radial nerve provides wrist and finger extension, forearm supination, and sensation of the dorsal hand surface and the first three fingers.

Etiological factors include fractures of the humerus, compression syndromes, iatrogenic injuries, chronic microtraumas, and toxic neuropathies (Sunderland, 2019).

Typical clinical manifestations of RNI include wrist drop, finger extension weakness, reduced supination, dorsal hand sensory deficits, and neuropathic pain. Early diagnosis and precise localization of the lesion are essential for appropriate treatment and prognosis.

Materials and Methods

Study population

A total of 86 patients were evaluated.

- **Men:** 52 (60%)
- **Women:** 34 (40%)
- **Age range:** 18–67 years (mean 39.1 ± 12.4 years)

Duration of symptoms ranged from 2 weeks to 14 months.

Clinical assessment

Neurological evaluation included:

- muscle strength (MRC scale),
- sensory testing (light touch, pain, vibration),
- neuropathic pain assessment (DN4 questionnaire),
- functional testing of wrist and finger extension,
- assessment of supination strength and hand dexterity.

Electroneuromyography (EMG)

EMG evaluation assessed:

- motor and sensory conduction velocity,
- M-wave amplitude,
- degree of axonal or demyelinating damage,
- precise level of nerve injury.

MRI and high-resolution nerve ultrasound

These were used to determine:

- level and type of compression,
- traumatic distortion of nerve anatomy,
- inflammation, scarring, or entrapment.

Statistics

Data were analyzed using SPSS 26.0. Statistical tests included ANOVA, χ^2, and Pearson correlation. Significance level: $p < 0.05$.

Results

Clinical manifestations

Table 1.

Frequency of symptoms

Symptom	n	%
Wrist drop	61	71%
Finger extensor weakness	58	67%
Dorsal hand hypoesthesia	49	57%
Paresthesia	44	51%
Neuropathic pain	39	45%
Reduced supination	31	36%

Association between injury level and clinical picture

Table 2.

Neurological manifestations at different levels

Level of injury	Predominant manifestations	Mean MRC (wrist extensors)
Axillary level	Reduced supination, mild weakness	3.6 ± 0.8
Spiral groove	Severe wrist drop, marked motor deficit	2.3 ± 0.7
Posterior interosseous branch	Isolated finger extensor weakness	3.1 ± 0.6

Compressive injuries were significantly associated with neuropathic pain ($r = 0.47$; $p < 0.01$).

EMG findings

- Axonal injury: **41%**
- Demyelination: **30%**
- Mixed pattern: **29%**

Correlation analysis

- The severity of motor deficit correlated strongly with the level of injury (**$r = –0.58$; $p < 0.001$**).
- Neuropathic pain correlated with fibrotic or compressive lesions (**$r = 0.42$; $p = 0.02$**).

Discussion

The findings of this study agree with previously published research (Sunderland, 2019; Kouyoumdjian, 2021), confirming that motor impairment is the dominant feature of radial nerve injury.

Lesions located in the spiral groove produced the most severe motor dysfunction, which is consistent with anatomical studies identifying this region as particularly vulnerable due to minimal soft-tissue protection and narrow anatomical boundaries (Kim, 2020).

Compression neuropathies produced more pronounced sensory symptoms and neuropathic pain, which corresponds to findings from Lee (2020) and Dellon (2020).

EMG proved essential for differentiating axonal from demyelinating injuries, which is crucial for predicting recovery potential and determining the need for surgical intervention.

Early rehabilitation measures — including neuromuscular activation, sensory retraining, splinting, and electrical stimulation — can significantly improve outcomes, as supported by Millesi (2018) and Novak (2020).

Conclusion

1. Radial nerve injury is characterized by wrist drop, finger extension weakness, and dorsal hand sensory disturbances.
2. The severity of motor deficit depends on the level of nerve injury, with the most severe dysfunction observed in lesions within the spiral groove of the humerus.
3. Compressive neuropathies are associated with more pronounced neuropathic pain.
4. EMG is a key diagnostic tool for determining the type and level of nerve damage.
5. Early diagnosis and timely rehabilitation significantly improve functional recovery.

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