ORIGINAL ARTICLE

Ultrasonography versus Electrodiagnostic Studies in Assessment of Ulnar Neuropathy in Patients with Rheumatoid Arthritis

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Abstract

Background: ***Ulnar nerve entrapment at the elbow (UNE) is a common complication of rheumatoid arthritis (RA). Timely diagnosis and intervention are essential to mitigate the risk of long-term complications.***

Aim and objectives: ***To compare electrodiagnostic investigations (EDX) with neuromuscular ultrasonography for diagnosing ulnar neuropathy in RA patients.***

*Patients and methods****: The study included 60 individuals with RA, divided into two groups. Thirty RA patients had symptoms and evidence of ulnar neuropathy, while 30 did not. All patients had clinical, ultrasonographic, and electrodiagnostic tests.***

Results: ***RA patients with ulnar neuropathy had higher disease activity scores, abnormal nerve conduction studies (NCS), including delayed distal motor latency and slow conduction velocity, and significant enlargement of the ultrasound-measured ulnar nerve cross-sectional area (CSA) at the elbow.***

Conclusion: ***In RA patients, both electrodiagnostic tests and neuromuscular ultrasound are efficient in identifying ulnar nerve neuropathy. The higher ultrasonographic ulnar nerve CSA at the medial epicondyle in RA patients with ulnar neuropathy emphasizes the usefulness of these diagnostic methods.***

Keywords: Ultrasound; NCS; Ulnar neuropathy; RA

1. Introduction

RA has the potential to impact both the central and peripheral nervous systems, leading to a range of symptoms that go beyond just joint problems.[1]

Early stages of peripheral neuropathy might be asymptomatic or manifest a range of symptoms, including pain, paresthesia, and muscular weakness. These clinical manifestations might overlap with or mimic arthritis.[2]

Entrapment neuropathy, sensori-motor neuropathy, and mononeuritis multiplex are three types of peripheral neuropathy that can occur in RA patients.[3]

Neuropathy in RA can be caused by a variety of things, including nerve entrapment, medication toxicities, vasculitis, and, extremely infrequently, amyloidosis.[4]

The location, degree, and kind of injury (axonal or demyelinating) and disease prognosis can be ascertained with the use of electrodiagnosis (EDX) and NCS. It should also be done periodically to make sure there isn't any radiculopathy or thoracic outlet syndrome that could be causing intrinsic muscle atrophy. Due to EDX's limited availability, high cost, and potential discomfort, ultrasonography may be useful in confirming entrapment and diagnosing abnormal innervations as a supplement or replacement for EDX.5 The purpose of this study is to compare neuromuscular ultrasound with electrophysiological investigations in diagnosis of ulnar neuropathy in RA patients.

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2. Patients and methods

Sixty individuals with RA participated in this trial, which spanned from May 2023 to October 2024. Patients were recruited from the university hospitals' rheumatology and rehabilitation departments. RA patients were divided into two groups. The first group was made up of thirty RA patients who had clinical symptoms of ulnar neuropathy. The second group consisted of thirty RA patients who did not have clinically detectable ulnar neuropathy.

The study comprised RA patients who reported burning pain, paresthesia, or weakness at the ulnar nerve distribution. Patients with RA were diagnosed using the American College of Rheumatology's 2010 criteria. The exclusion criteria included individuals younger than 16 years old, those with a history of neurological illnesses, such as Guillain-Barré syndrome, and those who have recently undergone surgery, experienced a fracture, or have a congenital or acquired elbow deformity. Diabetes, hypothyroidism, connective tissue diseases, pregnancy, and upper limb edema were also excluded.

All subjects underwent a detailed medical history and physical assessment, which included a full neurological evaluation. Lab investigations, including RF and anti-CCP status, were done. DAS28-ESR was used to measure RA disease activity. All patients had their ulnar nerves scanned using ultrasonography. For the purpose of nerve tracing, all individuals were examined using ultrasound while resting on their backs with their arms extended, shoulders slightly abducted, and wrists neutral. An APLIO400-Toshiba California US linear array with frequencies ranging from 8 to 13 MHz was used for ultrasound scanning of the ulnar nerve along its course, with the CSA recorded at two sites: the wrist and elbow (Figure 1).

AUN in Guyon's canal. (a) Probe position along the medial aspect of the wrist. (b) The corresponding short-axis US image shows the UN (circled) between the Ulnar artery and the pisiform bone (P). UN in Guyon's canal. (a) Probe position along the medial aspect of the wrist. (b) The corresponding short-axis US image shows the UN (circled) between the Ulnar artery and the pisiform bone (P).

B in Guyon's canal. (a) Probe position along the medial aspect of the wrist. (b) The corresponding short-axis US image shows the UN (circled) between the Ulnar artery and the pisiform bone (P). UN in Guyon's canal. (a) Probe position along the medial aspect of the wrist. (b) The corresponding short-axis US image shows the UN (circled) between the Ulnar artery and the pisiform bone (P).

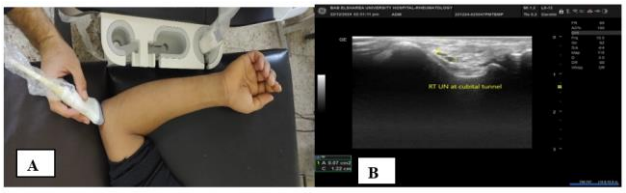

Figure 1. Ulnar nerve (UN) scanning at the ulnar groove. (A) The patient's position during examination of the ulnar nerve at the elbow. (B) A short-axis US image at the medial epicondyle shows the UN (circled) at the cubital tunnel.

All patients underwent an electrophysiological investigation following a standard methodology. The patient was lying down with a neutral wrist, a slight external rotation of the shoulder in right-angle abduction, and the elbow flexed at 135°. Electrodes were placed at certain points on the ulnar nerve to study motor nerve transmission. One electrode, G1, was implanted over the muscle's belly, while the other, G, was inserted three centimeters away at the fifth metacarpophalangeal joint. All EDX studies were carried out by an experienced rheumatologist using the Neuropack MEP-9400A/K. After assessing the technique, the Research Ethics Committee gave it its approval. All participants provided written consent after being informed of the study's purpose.

Statistical analysis

Data were reviewed, inputted, and analyzed using SPSS 23.0 (SPSS, IBM Inc., Armonk, NY, USA).

3. Results

Sixty RA patients with and without neurological signs of UNE were included in the study. We aimed to compare EDX with neuromuscular ultrasonography for diagnosing ulnar neuropathy in RA patients.

Table 1. Comparison of demographic data across study groups.

	RA + UNE (N = 30)	RA ONLY (N = 30)	P. VALUE
AGE (YS)	41.77 ± 11.67	34.27 ± 11.04	0.0478*
SEX			
FEMALE	22 (73.33%)	21 (70%)	0.7031
MALE	8 (26.67%)	9 (30%)	
RESIDENCE			
URBAN	18 (60%)	21 (70%)	0.7194
RURAL	12 (40%)	9 (30%)	
WEIGHT (KG)	83.63 ± 13.5	77.27 ± 13.67	0.155
HEIGHT (CM)	166.7 ± 6.66	167.53 ± 7.37	0.8989
BMI (KG/M^2)	29.64 ± 5.13	27.75 ± 4.94	0.3304

Table 1 displayed demographic information for the study groups. The mean age of the RA only group was 34.27±11.04 years, significantly younger than the RA with UNE group, which was 41.77±11.67 years (P=0.0478). Females made up most of both RA groups (73.33% and 70%, respectively); however, the sex distribution differences were not statistically significant (P=0.7031). Both groups (RA only: 60%, RA plus

UNE: 70%) were mostly urban inhabitants, and there was no discernible difference between them (P=0.7194). The RA group with UNE had a greater mean weight (83.63±13.5 kg) than the RA-only group (77.27±13.67 kg), although the difference was not statistically significant (P=0.1152). There was no significant difference in height or BMI across groups (P = 0.8989 and 0.3304, respectively).

Table 2. Clinical and lab data of our patients

	RA + UNE (N = 30)	RA ONLY (N = 30)	P. VALUE
2HPPBG	93.7 ± 14.75	94.3 ± 14.1	0.9144
RF	28 (93.33%)	24 (80%)	0.1288
ANTI CCP AB	28 (93.33%)	25 (83.33%)	0.2347[X]
DAS 28-ESR	3.77 ± 1.05	3.1 ± 1.21	0.0185*[t]

Our patients' clinical and lab data revealed a statistically significant difference in rheumatoid disease activity (DAS28-ESR) between groups. RA patients with UNE reported higher mean disease activity than those without neuropathic symptoms (P=0.0185). There was no significant difference in seropositivity for RF or anti-CCP between RA patients with and without ulnar neuropathy (Table 2).

Table 3. Electrodiagnostic findings of our patients

	RA + UNE (N = 30)	RA ONLY (N = 30)	P. VALUE
MOTOR LATENCY (MS)			
WRIST	4.12 ± 1.71	2.66 ± 0.45	<0.0001*
MOTOR AMPLITUDE (MV)			
WRIST	6.99 ± 3.16	7.07 ± 1.6	0.9895
BELOW ELBOW	6.12 ± 1.91	6.65 ± 1.58	0.4479
ABOVE ELBOW	5.29 ± 1.76	6.67 ± 1.66	0.0036*
MOTOR CV (M/S)			
WRIST TO BELOW ELBOW	53.37 ± 10.16	61.17 ± 8.35	0.0063*
BELOW TO ABOVE ELBOW	51.9 ± 9.42	60.7 ± 7.64	0.001*

Table 3 displays the parameters of NCS in our groups. Nearly all NCS measures showed a statistically significant difference between the groups. Patients with neuropathic symptoms had prolonged delayed ulnar nerve distal latency than those without (4.12 ± 1.71 vs 2.66 ± 0.45). Furthermore, neuropathic symptoms were linked to low above-elbow amplitude (p=0.0036) and slow conduction velocity in both the below- and above-elbow segments (p=0.0036 and 0.001).

Table 4. Ulnar nerve CSA in the studied groups

	RA + UNE (N = 30)	RA ONLY (N = 30)	P. VALUE
CSA (MM^2)			
AT WRIST	6.32 ± 0.72	6.01 ± 0.97	0.3934
AT ELBOW	12.49 ± 2.1	7.75 ± 1.46	<0.0001*

The mean ulnar nerve ultrasound CSA at the wrist did not change significantly across groups (6.32 ± 0.72 vs. 6.01 ± 0.97, P = 0.3934). RA patients with neuropathy had a significantly higher mean CSA (12.49 ± 2.1 vs. 7.75 ± 1.46, P < 0.0001) (Table 4).

4. Discussion

RA is a persistent inflammatory autoimmune disorder that can present in multiple extra-articular forms, including peripheral neuropathy, interstitial lung disease, and ophthalmic disorders such as episcleritis, scleritis, and vasculitis.[6]

Ulnar neuropathy at the elbow is the second most prevalent upper extremity entrapment neuropathy. Repetitive elbow movements, arthritic conditions, and valgus abnormalities in the elbow augment its susceptibility to injury.[7] The main objective of our study was to compare electrodiagnostic investigations with neuromuscular ultrasonography for diagnosing ulnar nerve neuropathy in RA patients.

The current study found a significant association between older age and ulnar neuropathy in RA patients. This link may be attributable to the longer disease duration in older people, resulting in cumulative joint damage, chronic inflammation, and vascular insufficiency, which raise nerve compression or ischemia injury risks.[8-9]

In line with our findings, Zhou et al.[10] found greater CRP levels and DAS28 scores in RA patients with ulnar neuropathy, implying that increased systemic and joint-specific inflammation exacerbates vascular and soft tissue damage, leading to nerve compression or ischemic neuropathy.

In the current study, aberrant ulnar nerve NCS, including delayed distal latency, low amplitude, and slowing of conduction velocity across the elbow segment, was consistently documented in RA patients with neuropathic concerns. In line with our findings, Power et al.[11] included eighty-three individuals who had cubital tunnel syndrome surgically treated over a five-year period. According to their findings, abnormal electrodiagnostic tests were found in 88% of patients. Recorded from the first dorsal interosseous, 54% of patients had a decrease in CMAP amplitude, and 79% had a decrease in conduction velocity across the elbow.

Furthermore, Podnar et al.[12] investigated UNE, nerve conduction velocity, and CSA. In 106 patients with UNE at the retrocondylar groove, the same short segment exhibited the slowest motor nerve conduction velocity (MNCV). The MNCV was the lowest in 54 UNE patients at the humeroulnar aponeurosis and was closely related to UNE. Ultrasound has proved useful in verifying the precise anatomical location of nerve injury, measuring nerve continuity, and detecting other

structural alterations in a variety of neuromuscular diseases.

It has been noted that in nerve entrapment syndromes, there may be discrete areas of nerve enlargement only proximal to the site of compression, along with loss of internal fascicular architecture and decreased nerve echogenicity.[13]

Our findings showed that the ultrasonographically measured CSA of the ulnar nerve at the elbow was considerably higher in RA patients with ulnar neuropathy than in those without neuropathy (12.49 ± 2.1 vs 7.75 ± 1.46, P<0.0001). However, the measured CSA of the ulnar nerve at the wrist revealed no significant change between groups. In agreement with our investigation, Letissier et al.[14] measured the ulnar nerve's CSA using ultrasonography at three distinct places and evaluated the consistency of the data from two independent ultrasonographers. In their healthy population, they discovered that at three different measurement levels, 21%, 24%, and 7% of the ulnar nerve's CSA upper limit was 8-10 mm^2.

4. Conclusion

Ulnar nerve entrapment at the elbow is a significant issue among patients with RA driven by the inflammatory process of the disease. Measuring the CSA of the ulnar nerve via ultrasound is a crucial aspect of diagnosing ulnar nerve entrapment in patients with RA. An increased CSA can indicate nerve compression linked to inflammatory changes from RA, making ultrasound an invaluable tool in both diagnosis and management. Further investigation may help establish standardized measurement protocols and thresholds for clinical practice.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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There are no conflicts of interest.

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