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Case Report

Orthopaedics Section

Isolated Unilateral Ulnar Motor Neuropathy at Wrist- A Case Report

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ABSTRACT

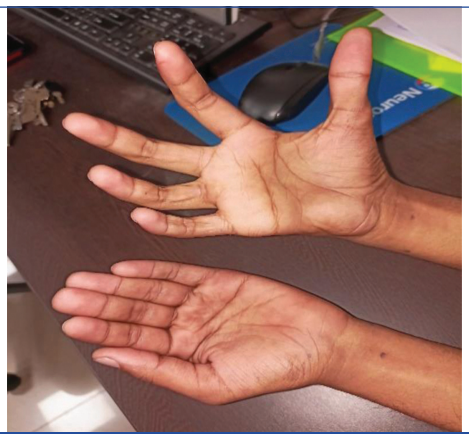
The ulnar nerve compression neuropathy commonly occurs around the elbow; however, focal compression or injury can also occur at the wrist, axilla, or neck involving the roots of the brachial plexus. Ulnar neuropathy at the wrist is caused by the compression of the ulnar nerve within Guyon's canal or distal to it, often referred to as 'ulnar tunnel syndrome.' It can manifest as mixed, pure sensory, or pure motor neuropathy depending on the specific site of compression and the branches involved. This case report of 21 years old male patient, a college student, discusses the clinical and electrodiagnostic features of a case involving unilateral isolated pure motor neuropathy of the ulnar nerve. The onset of the case was insidious and subacute, characterised by painless and non-progressive symptoms with no history of trauma or injury to the affected limb. The Nerve Conduction Studies (NCS) were conducted, indicating probable compression of the deep motor branch of the ulnar nerve distal to the wrist. The patient was subsequently referred for high-resolution Ultrasonography (USG) or Magnetic Resonance Imaging (MRI). Cases of ulnar neuropathy at the wrist are quite rare, and there is limited literature available on this topic.

Keywords: Motor loss, Neurophysiological finding, Ulnar neuropathy, Ulnar tunnel syndrome

CASE REPORT

A 21-year-old male patient, a college student was referred from the Department of Orthopaedics to the Neurophysiology Laboratory for an electrodiagnostic work-up of probable ulnar neuropathy. The patient presented with a chief complaint of weakness in his right hand and difficulty holding things for the past three months. There was no significant history of trauma or any other notable medical history. The weakness in his hand started after a period of heavy writing during university examinations. No significant aggravating or relieving factors were reported, and there was no history of localised pain or numbness. On general examination, the patient's vital signs were normal. There was no history of leprosy or arthritis in the past or within the family. The power and tone of the proximal arm muscles and deep reflexes were normal.

On examination, profound wasting was noted in the interossei and hypothenar eminence of the right hand. No typical ulnar clawing was evident upon inspection, but when the patient was asked to make a fist and open the fingers quickly and repeatedly, the fifth and fourth fingers lagged behind, displaying transient ulnar clawing. There was significant weakness in adduction, affecting all the digits of the right hand [Table/Fig-1].



[Table/Fig-1]: Image showing comparison of the both hands of the patient, where, the affected right hand has obvious wasting of hypothenar eminence, and inability of adduction of fingers.

On clinical examination, it was found that the patient had normal functioning of the Flexor Carpi Ulnaris and Flexor Digitorum Profundus (FDP) with a power of 5/5. The sensory perception, including light touch and pinprick sensation, in the ulnar area of the right upper limb was within normal limits. There was no tenderness elicited at the ulnar groove behind the medial epicondyle (Tinel's test negative), and no nerve thickening was felt upon palpation. The patient exhibited weakness in the book test (Adductor Pollicis power: 4/5), finger spreading test (Dorsal Interossei power: 4/5), and significant weakness in the card test (Palmar Interossei power: 3/5).

Compound Muscle Action Potentials (CMAPs) of the Abductor Digiti Minimi (ADM) and First Dorsal Interossei (FDI) were recorded at the wrist and elbow. Sensory Nerve Action Potentials (SNAPs) were recorded from the fifth digit and the Dorsal Ulnar Cutaneous nerve (DUC) at the wrist. The upper limits of normal values for Distal Motor Latency (DML) to the ADM and DML to the FDI were set at 3.3 ms and 4.5 ms [1], respectively. The lower limits of DML for the ADM and FDI were set at 6.0 ms and 7 ms [1], respectively. The normal reference range for sensory latency and amplitudes at the fifth digit and DUC were set at 3.23 ms, 2.5 ms, 3.17 μV, and 8 μV [1,2].

During the NCS examination, the distal latency of the CMAP of the ADM was prolonged, with a 62% increase on the right-side compared to the left-side. The amplitude of the CMAP was reduced by 84% on the right-side compared to the left-side. The amplitude of the CMAP of the FDI was 87% lower on the right-side compared to the left-side [Table/Fig-2a].

Nerve	Latency (ms)	Amplitude (μV)	Comment
R, 5th Digit	4.4	1.2	Prolonged distal latency and reduced amplitude
L, 5th Digit	2.7	7.6	Normal latency and amplitude
R, DUC	4.4	2.7	Normal latency and reduced amplitude
L, DUC	3.9	21.5	Normal latency and amplitude

[Table/Fig-2a]: Motor nerve conduction of upper limb nerves.
#ADM: Abductor digiti minimi; FDI: First dorsal interosseous DUC: Dorsal ulnar cutaneous

The SNAP of Ulnar D5 and DUC was within the normal limit on the right-side [Table/Fig-2b]. The CMAP and SNAP of the right median

and radial nerves were within the normal limit. All other respective electrophysiology parameters were within the normal limit on the left upper limb.

Nerve	Latency (ms)	Amplitude (μV)	Comment
R, 5th Digit	2.6	17.8	Normal latency and amplitude
L, 5th Digit	2.4	65.6	Normal latency and amplitude
R, DUC	1.2	17.8	Normal latency and amplitude
L, DUC	1.5	9.9	Normal latency and amplitude

[Table/Fig-2b]: Sensory nerve conduction of upper limb nerves.

From clinical examination and neurophysiological study, it was diagnosed as a case of ulnar neuropathy at the wrist (Type-III) with a motor lesion at the deep palmar branch, likely due to compression or pathology within Guyon's canal or distally. The hypothenar muscles were wasted or involved, and all palmar and dorsal interossei were weak or involved, as observed by the weak adduction-abduction movements of all digits of the right hand. Thus, the deep palmar branch of the ulnar nerve, which supplies these muscles, was affected (Type-III compression). The hypothenar muscles, all interossei, and adductor pollicis muscles were involved. The third and fourth lumbricals were also affected, leading to transient clawing, as they are supplied by the deep branch of the ulnar nerve.

This case was relatively rare, as most cases of ulnar nerve compression occur around the elbow, whereas in this case, it was at the wrist and presented as a pure motor lesion. There is limited data on ulnar neuropathy at the wrist, especially in Guyon's canal, and its causative factors, symptoms, and signs. The patient was advised to undergo a high-resolution Ultrasound (USG) or Magnetic Resonance Imaging (MRI) at a specialised center, and surgery was suggested. However, due to the cost, the patient could not afford the investigation and declined surgery. Subsequently, the patient was advised and referred to the department of physical medicine and rehabilitation for hand grip improvement through exercise. Follow-ups were conducted over the phone from the neurophysiology laboratory, but the patient did not show up.

DISCUSSION

Entrapment neuropathy frequently occurs in the upper limb nerves, with the most common being the median nerve at the carpal tunnel, followed by the ulnar nerve at the elbow and cubital tunnel [3,4]. A detailed neurological examination, along with neurophysiological investigations, helps in diagnosing and localising the site of compression. Persistent compression leads to microvascular damage, causing damage to the myelin sheath and endoneural oedema. Demyelination results in the slowing of nerve conduction and may partially or completely prevent the transmission of nerve action potential along the severely damaged nerve segment, ultimately leading to axonal degeneration [5,6]. It is already established that ulnar nerve compression most commonly occurs around the elbow, followed by the wrist, and rarely at the axilla, upper arm, and forearm due to other reasons [7].

The cubital tunnel, medial intermuscular septum, flexor carpi ulnaris aponeurosis, and deep flexor-pronator aponeurosis are potential sites for ulnar nerve compression at the elbow, while masses, particularly ganglia, and anatomical anomalies might cause compression at Guyon's canal at the wrist level [8-11]. In addition to these, various traumas, including compression by crutches, tourniquets, casts, fractures, abnormal muscles, surgery in adjacent regions, and vascular diseases, can cause ulnar nerve compression at respective levels [12]. The ulnar nerve enters Guyon's canal lateral to the pisiform bone and divides into superficial and deep fibers in the pisohamate tunnel. Ulnar neuropathy occurring at the wrist or distally, also referred to as "ulnar tunnel syndrome," is relatively difficult to diagnose clinically [13-15].

Based on electrophysiological findings, clinical presentations, and clinico-anatomic association, ulnar neuropathy at the wrist can be categorised into five types [1].

Type-I: a mixed motor and sensory neuropathy that develops near or inside the proximal end of Guyon's canal.

Type-II: a pure sensory neuropathy, in which the ulnar nerve's superficial branch is affected by the lesion.

Type-III: a pure motor neuropathy caused by a lesion of the deep branch of the ulnar nerve, which is located more proximal to the hypothenar muscles.

Type-IV: a pure motor ulnar neuropathy sparing the hypothenar muscles, occurring when the lesion is present on the deep branch of the ulnar nerve but is distal to both the superficial sensory branch and the hypothenar muscles.

Type-V: a distal motor neuropathy in which the lesion is located close to the branches leading to the adductor pollicis and first dorsal interosseous muscles.

In most of the previous cases diagnosed with ulnar neuropathy at the wrist or distally, electrodiagnostic evaluation was conducted to determine the probable site of compression. This was followed by high-frequency ultrasound or MRI. In many cases, intraneural or perineural ganglion cysts or synovial cysts were reported [12,16-18]. There were also a few cases that occurred as postoperative complications of carpal tunnel compression release surgery [10,19].

In a case report by Duggal A et al., a very similar case to the present case was reported [12]. A 20-year-old male packaging employee presented with severe motor weakness, without any history of hand trauma or remarkable medical history. The patient exhibited gross wasting involving the First Dorsal Interosseous (FDI) muscle. Motor conduction of the ulnar nerve to the FDI showed a very low amplitude delay and polyphasic response, indicating compression of the deep palmar branch of the ulnar nerve. MRI revealed a multi-lobular cyst originating from the third carpo-metacarpel joint, compressing the deep palmar branch of the ulnar nerve. Surgical excision of the cyst was performed, followed by hand splinting. The patient underwent initial immobilisation and subsequent hand physiotherapy. After 15 weeks of surgery, the patient regained normal motor strength.

Colbert SH and Lee MH also reported another case of ulnar motor neuropathy at the wrist [17]. In this case, MRI revealed an intraneural cyst compressing the ulnar deep palmar branch at Guyon's canal in a 69-year-old male, who was a wood splinter. The patient had a successful recovery despite a 14-month delay in diagnosis and surgery. Isolated ulnar nerve motor neuropathy, without numbness or pain and only presenting with atrophy of intrinsic hand muscles, has been rarely reported in scientific literature. In most of these cases, surgical exploration was performed for cyst excision, followed by hand splinting. Symptoms improved within a mean period of four weeks to eight months [9,12-14,17].

Considering the electrodiagnostic and clinical features, it was suspected that the present case may be classified as Type-III ulnar neuropathy at the wrist, caused by compression of the deep palmar branch of the ulnar nerve, most commonly by a ganglionic cyst. However, due to the unavailability of high-resolution ultrasound or MRI, the specific pathology could not be confirmed.

CONCLUSION(S)

In conclusion, isolated ulnar nerve motor neuropathy presenting with motor weakness and atrophy of intrinsic hand muscles, without numbness or pain, can be evaluated using electrodiagnostic studies as the gold standard for identifying the possible site of compression. Further investigations, such as high-resolution ultrasound or MRI, are necessary for definitive diagnosis by confirming the specific pathology and its location. In the present case, the patient was undergoing physiotherapy but could not undergo the recommended

investigations due to the high cost. The patient was not willing for surgical treatment and was subsequently lost to follow-up. It is important to have high-frequency neuromuscular ultrasound facilities available at an affordable cost and to perform these investigations in conjunction with nerve conduction studies to enable early diagnosis of such cases.

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