

# Ulnar neuropathy at Jordan University Hospital

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## ABSTRACT

**Objectives:** To study the causes, clinical and electromyography/nerve conduction study (EMG/NCS) findings and treatment modalities in Jordanian patients with ulnar neuropathy (UN) observed in a tertiary care referral center and compare the findings with those from Western literature.

**Methods:** The case notes of 20 patients with UN referred to the neurophysiology department at Jordan University Hospital, Amman, Jordan, between January 2002 and January 2004 were reviewed. The clinical presentation, causes, EMG/NCS and treatment modalities were registered.

**Results:** Among the 20 patients, 18 were male and 2 female with a mean age of 39 years (range 14-68 years). Ten cases were traumatic UN while the other 10 were presumably idiopathic cubital tunnel syndrome (CTS).

The most common clinical manifestations were paresthesiae of 4th/5th digits and weakness/atrophy of small hand muscles. All 10 cases of traumatic UN were axonal on EMG/NCS while among the other 10 with CTS, 3 diabetics had axonal injury and 6 out of 7 nondiabetics had a demyelinating injury, 3 sensorimotor and 3 pure sensory. Additional carpal tunnel syndrome was found in 5 patients. Needle EMG was abnormal only in cases of abnormal ulnar sensory action potential. Nine out of 10 with traumatic UN had surgery while only 3 out of 10 with CTS had cubital tunnel release.

**Conclusions:** Compared to previous studies from Western literature, our study shows a similar male predominance as well as comparable clinical and neurophysiological findings and treatment modalities.

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The most common focal neuropathies are carpal tunnel syndrome, ulnar neuropathy (UN) at the elbow and peroneal neuropathy at the fibular head.<sup>1</sup> Ulnar neuropathy at the elbow is the second most common entrapment neuropathy in the upper extremity because of its anatomy and superficial location.<sup>2</sup> However, diagnosis and management are considerably more difficult in ulnar lesions than in carpal tunnel syndrome.<sup>3</sup> Resulting from its importance, this study of 20 cases of UN seen at Jordan University Hospital (JUH) over a 2-year period was carried out with the aim of assessing: 1. age and sex distribution; 2. causes; 3. clinical and electrophysiological findings and 4. treatment. Results will be compared with data from Western literature.

**Methods.** The case notes of 20 consecutive patients with UN (age range 14-68 years, mean 39 years; 18 males, 2 females) seen at JUH, Amman, Jordan over a 2-year period were studied retrospectively. Jordan University Hospital is a 530-bed tertiary referral center serving a considerable proportion of the Jordanian population. These were cases of clinical UN referred to the neurophysiology department by neurologists, neurosurgeons or orthopedic surgeons between January 2002 and January 2004. All patients had clinical symptoms indicative of UN, and they were examined for hand weakness, atrophy, sensory loss as well as Tinel sign at the elbow. An ulnar nerve injury was confirmed by nerve conduction study in all patients. Causative factors were looked for, and

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x-ray of elbow as well as laboratory tests including fasting and postprandial blood sugar were carried out when clinically indicated. For nerve conduction studies (NCS), a Medelec MS 60 (Vickers Healthcare Company) machine was used at a room temperature of 25°C. The normal values of the ulnar motor and sensory distal latencies and amplitudes as well as motor and sensory conduction velocities (MCV, SCV) were established in our lab in 30 healthy controls. However, the criteria for conduction block were taken from Cornblath.<sup>4</sup>

**Mixed and sensory conductions according to Raynor:**<sup>5</sup> a) Sensory study (antidromic technique). Ulnar nerve stimulation at the wrist with recording at 5th finger at a distance of 14 cm then ulnar stimulation at the elbow: Abnormal distal sensory nerve action potential (SNAP) if peak latency >3.2 ms and amplitude <12 microvolts. Abnormal SCV from elbow to wrist if <50 m/s. b) Mixed study (orthodromic technique). Ulnar stimulation at the wrist with recording below and above the elbow at a distance of 5 cm below and above ulnar sulcus. Amplitude of SNAP not assessed due to normal temporal dispersion and phase cancellation. Comparison of SCV at 3 segments (across elbow, wrist to below-elbow and wrist to above-elbow): Abnormal if drop of SCV of 10 m/s in any segment compared to the others. Comparison of SCV across elbow between symptomatic and contralateral asymptomatic side: abnormal if difference >10 m/s.

**Motor Study.** a) Ulnar stimulation at wrist, below and above elbow (flexed position, distance across elbow = 10 cm) with recording at abductor digiti minimi (ADM): Abnormal if distal motor latency >3.2 ms, if compound muscle action potential (CMAP) <5 mV at all sites and if MCV of elbow-to-wrist or across elbow segments <50 m/s. Conduction block across elbow if drop of >30% in CMAP amplitude or area. b) None of our patients had short segmental studies (inching technique) across elbow due to technical difficulties.

**Needle electromyography (EMG).** A needle EMG was carried out in first dorsal interosseous (DIO), ADM and flexor carpi ulnaris (FCU). In addition, non-ulnar innervated C8 T1 muscles such as abductor pollicis brevis (APB) and flexor pollicis longus (FPL) as well as other muscles were included in the EMG examination to rule out cervical radiculopathies and amyotrophic lateral sclerosis. Treatment was either conservative, namely, environmental manipulation or surgical (nerve suturing or cubital tunnel release).

**Results.** Regarding age and sex distribution, 6 male patients were below the age of 30 years while 14 were above the age of 30 years (12 males and 2 females). Thus, there was a homogeneous distribution over all age ranges with clear male predominance (male to female ratio 9:1).

Concerning etiology, 10 patients had traumatic ulnar nerve injury (bullet injury in one, cut wound by glass or machine in 5 and elbow trauma without fracture in 4). All cut wound injuries were at upper or lower third of medial forearm. The 10 other patients had cubital tunnel syndrome (CTS) and were considered idiopathic because of the absence of a clear history of habitual or professional leaning on the elbow (a minor elbow trauma was reported by 2 patients). Among these patients, 3 were diabetic with cervical spondylosis on MRI cervical spine and 7 were nondiabetic with normal cervical spine. The clinical manifestations shown in **Table 1** demonstrate that the most common was paresthesiae of the 4th/5th fingers and weakness/atrophy of small hand muscles.

The results of NCS and EMG are shown in **Table 2** which clearly demonstrates that 9 out of 10 patients with post traumatic UN had an axonal injury, severe in 6 (neurotmesis) and moderate partial axonal in 3. The 10th patient had a demyelinating conduction block but eventually suffered an axonal injury on follow-up study. The majority (6 out of 7) of nondiabetic patients with CTS had a demyelinating neuropathy across the elbow, 3 sensorimotor and 3 purely sensory where the only abnormality was the mixed study across the elbow. Additional carpal tunnel syndrome was found in 3 patients. All 3 diabetic patients with CTS had axonal injury and among them 2 had additional carpal tunnel syndrome.

Needle EMG was abnormal in all patients with post traumatic UN by showing denervation in DIO and ADM for all patients, with however, sparing of FCU in 6. Among the 10 patients with CTS, needle EMG was abnormal only in 7 patients with abnormal ulnar SNAP by showing denervation in DIO/ADM in all patients with sparing of FCU in 5.

Table 1 - Clinical manifestations of ulnar neuropathy (20 patients).

Symptom/sign	n (%)
Paresthesiae at 4th and 5th fingers	17 (85)
Weakness and atrophy of small hand muscles	15 (75)
Decreased sensation at medial aspect of hand	8 (40)
Positive Tinel at elbow	3 (15)
Claw hand deformity	5 (25)
Froment sign*	2 (10)

\*Froment sign - The patient is asked to pull a piece of paper apart with both hands. The affected hand flexes the thumb by using the median-innervated flexor pollicis longus to prevent the paper from slipping out of the hand thus substituting for the weakness of the adductor pollicis.

Table 2 - Results of EMG/NCS of ulnar neuropathy (20 patients).

Etiology (n)	Sensory NCS (n)		Mixed NCS (n)	Motor NCS (n)		Needle EMG (n)
	Distal ulnar SNAP(F5)	SCV elbow to wrist	SCV across elbow	CMAP (wrist, below/above elbow)	MCV across elbow	
Traumatic ulnar neuropathy (10)	NR (8) Amp (2)	NR (8) Slow (2)	ND ND	NR (6) Amp (3) CB (1)	NR (6) Slow (4)	Denervation in DIO and ADM (10) and in FCU (4)
Cubital tunnel syndrome (10)						
No DM or cervical spondylosis (7)	Normal (3) Amp (4)	Normal (3) Slow (4)	Slow (3) ND	Normal (3) CB (2) Amp at all sites (2)	Normal (3) Slow (4)	Normal (3) Denervation in DIO and ADM with normal FCU (4)
DM and cervical spondylosis (3)	NR (3)	NR (3)	ND	Amp at all sites (3)	Slow (3)	Denervation in DIO/ADM (3) and in FCU (2)

EMG - electromyography, NCS - nerve conduction study, NR - not recordable; CB - conduction block; ND - Not done ; Amp - amplitude, DM - diabetes mellitus, SNAP - sensory nerve action potential, SCV - sensory conduction velocity, CMAP - compound muscle action potential, MCV - motor conduction velocity, DIO - dorsal interosseous, ADM - abductor digiti minimi, FCU - flexor carpi ulnaris

Concerning treatment, surgery was carried out in 9 out of 10 patients with post traumatic UN (nerve suturing in 6, excision of neuroma in one and cubital tunnel release in 2). Surgery was planned for the 10th patient but was cancelled due to spontaneous clinical and NCS improvement. Cubital tunnel release was carried out in 3 out of 10 patients with CTS while conservative treatment was given to the other 7. Carpal tunnel release was also performed in 3 out of 5 patients with carpal tunnel syndrome.

**DISCUSSION.** Several points emerge from this retrospective study of 20 patients with UN seen at JUH over a 2-year period. Regarding age distribution, 14 out of 20 patients were above the age of 30 years, the majority being between 31-50 years. The striking male predominance (M/F ratio = 9:1) is similar to that found by Barrios.<sup>6</sup> Leroux<sup>7</sup> also noted that all his 51 patients who had surgical decompression were men with an average age of 59 years which is higher than ours (39 years). This may be because men are more involved in tough professions, industrial or otherwise. The most common clinical findings in our patients were paresthesiae of the 4th and 5th fingers followed by weakness/atrophy of small hand muscles and sensory loss on medial hand. This is in full agreement with Benini.<sup>8</sup> This was also found by Stewart<sup>9</sup> in a study of 25 cases of UN at the elbow where sensory fibers to hand muscles were more frequently involved than those to forearm muscles suggesting a variable damage to the fascicles within the nerve. However, Barrios<sup>6</sup> concluded that posttraumatic UN and nontraumatic CTS has different clinical manifestations and neurophysiological findings and that they should be

considered as 2 different clinical entities. Our findings are also in disagreement with Steiner<sup>10</sup> who found in 41 patients with CTS that the leading preoperative sign was motor loss in ulnar distribution in 89% followed by sensory impairment in 59% and less frequently pain or paresthesiae.

Concerning etiology, all our 10 patients with CTS were considered idiopathic, elbow trauma being reported in 2 patients, and among them 3 were diabetic. This was also reported by Steiner,<sup>10</sup> where among 41 patients with CTS, 65% (27 patients) had unknown cause and only 9 patients (22%) reported elbow trauma. Leroux<sup>7</sup> also concluded among 46 patients with UN that in 23 cases (50%) no predisposing condition could be identified, whereas 15 (33%) abused alcohol and 8 patients (17%) had diabetes mellitus.

All 10 of our patients with CTS were included when they had relevant clinical symptoms and abnormal NCS. Yet Britz<sup>11</sup> found, in a population of 31 elbows in 27 patients with clinical signs of ulnar entrapment at the elbow, that electrodiagnostic evaluation confirmed UN only in 24 (77%) elbows of the 31, with localization to the elbow region in 21 (68%). Among our 10 patients with CTS, motor studies to ADM were abnormal in 7 patients (conduction block, decreased amplitude, focal slowing across elbow) while mixed sensory study across the elbow was abnormal in only 3 patients. This higher yield of motor studies was also reported by Kothari,<sup>12</sup> where consecutive sensitivities of motor and ulnar mixed sensory study across the elbow were 81% and 57%. Kincaid<sup>13</sup> also concluded that slowing of the motor velocity in the elbow segment was the most frequent abnormality in his study. However, this should not underestimate the value of sensory or mixed NCS across the elbow in

cases of mild UN with pure sensory symptoms. Raynor<sup>5</sup> found among 43 patients that motor conduction across elbow was abnormal in 14 out of 21 patients (67%) with clear UN on physical examination but only in 2 out of 22 (9%) with subtle or no physical abnormalities. However, the sensitivity was increased to 86% and 68% in both groups by the finding of segmental slowing of sensory studies across the elbow. In addition, Kimura<sup>14</sup> noted in 12 of 64 symptomatic extremities of 44 patients with a presumptive diagnosis of UN at the elbow, that MCV of all segments were normal and only SCV across the elbow was significantly slowed, thus showing that it is a more sensitive parameter. Motor NCS was performed in our patients in the flexed position because it is more sensitive than the extended one. This is agreeing with Kincaid<sup>15</sup> who concluded that motor conduction carried out with the elbow flexed produced less segment-to-segment conduction velocity variation than those obtained with the elbow extended, but this was disproved by Bielawski.<sup>16</sup> Yet all 35 of Kothari's<sup>17</sup> patients demonstrated focal slowing at the elbow in the flexed position whereas only 5 (14%) did so in the extended position.

Among our 10 patients with CTS, the 3 diabetic patients had ulnar axonal injury compared to the other 7 nondiabetics where the UN was demyelinating sensorimotor or sensory. This is in full agreement with Schady<sup>18</sup> who concluded that motor UN is not uncommon in patients with longstanding diabetes, especially in those with severe systemic complications and he noted that in many, the lesion is axonal and damage may occur through ischemia. However, the 4 patients with diabetes and UN at the elbow reported by Acosta<sup>19</sup> had a demyelinating neuropathy and, although they had also a mild diabetic peripheral neuropathy, yet ulnar nerve abnormalities were disproportionately severe thus showing that they may be a localized manifestation of the generalized polyneuropathy.

Additional carpal tunnel syndrome was found in 5 out of 10 (50%) of our patients with CTS. This was highlighted by Seror<sup>20</sup> who concluded that in many cases of persistent hand symptoms following carpal tunnel release, the problem may be related to an undiagnosed ulnar nerve lesion, thus, a complete neurophysiological evaluation of the upper extremity necessitates both median and ulnar studies. Kuntzer<sup>21</sup> also found among 100 patients with suspected clinical carpal tunnel syndrome that 6 had a concomitant UN at the elbow on NCS. Needle EMG was abnormal in 7 out of 10 of our patients with CTS by showing denervation in DIO and ADM with a striking sparing of FCU in 5 out of 7 patients. This agrees with Campbell,<sup>22</sup> who found in 36 cases of UN at the elbow with fibrillations in

DIO that FCU was normal in 10, mildly abnormal in 11 and severely abnormal in 15. He, thus, concluded as well as Oswald,<sup>23</sup> that sparing of the FCU in UN at the elbow is related to the internal neural topography and the severity and level of compression. Conspicuously 3 out of 10 of our patients with CTS with normal ulnar SNAP had normal needle EMG, while 7 out of 10 with nonrecordable or small SNAP had denervation in DIO and ADM. This was also reported by Kimura<sup>14</sup> who found unobtainable SNAP in 25 out of 64 symptomatic extremities of 44 patients with a presumptive diagnosis of UN at the elbow and in these 25 hands, evidence of denervation in DIO and ADM was detected in 50% of hands tested.

Concerning treatment, 3 out of 10 patients with CTS had cubital tunnel release because it is less invasive than medial epicondylectomy with anterior transposition, in accordance with Steiner.<sup>10</sup>

In conclusion, compared to previous reports from Western literature, our study shows a similar male predominance as well as comparable clinical and neurophysiological findings and treatment modalities.

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