DIFFERENCES IN ULNAR NEUROPATHY AT THE ELBOW (UNE) ACCORDING TO NEUROGRAPHIC LOCALIZATION OF ULNAR NERVE DAMAGE. A PRELIMINARY REPORT.

C. Vinciguerra[1], M. Mondelli[2], A. Aretini[2], P. Ciaramitaro[3], A. Farioli[4], G. Greco[5], S. Giorgi[3], F. Sicurelli[1], S. Mattioli[4]

1 Dpt. of Medical, Surgical and Neurosciences, University of Siena; 2 EMG Service, Local Health Unit 7, Siena, 3 Clinical Neurophysiology, CTO, Dpt. Neuroscience, AO "Città della Salute e della Scienza"Torino, 4 Dpt. Medical and Surgical Sciences, University of Bologna , 5 EMG Service, Local Health Unit 7, "Nottola" Hospital, Montepulciano (Siena)

Background

The most common locations of UNE are just proximal to the medial epicondyle (ME) in the retroepicondylar groove (REG) in 80–85%, and just distal to ME under the humeroulnar aponeurotic arcade of Osborne (i.e., cubital tunnel) in 15–20% of affected arms (Fig.1). A recent study described the demographic, occupational, and handedness differences between the two different UNE localizations .[1,2]. By May 2014 we started a prospective multicentre case-control study on the risk factors of UNE, the study design was elsewhere reported.

Aim of the study

The ultimate goal of the study is to demonstrate the association between UNE and the demographic, anthropometric and lifestyle factors, comorbidities and occupational biomechanical exposures with particular attention to non-neutral postures, forceful and repetitive elbow movements, vibrations. The aim of actual study is to report preliminary results about the differences of demographic, anthropometric, lifestyle and associate pathologies considered risk factors of UNE between the two UNE localizations.

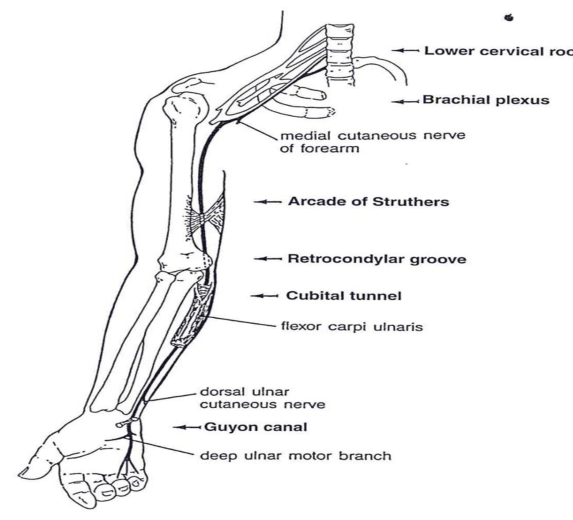

FIG 1 (Wertsch JJ, Park TA:Electrodiagnostic medicine. Occup Med 779, 1992)

Subjects

We prospectively enrolled 185 consecutive patients affected by UNE (mean age 51.4±11.9 years, 60% males) referred to 4 EMG labs from May 2014 to April 2016. Subjects with age <14 and >70 and with history of hereditary neuropathy, and PNS diseases mimicking UNE were excluded.

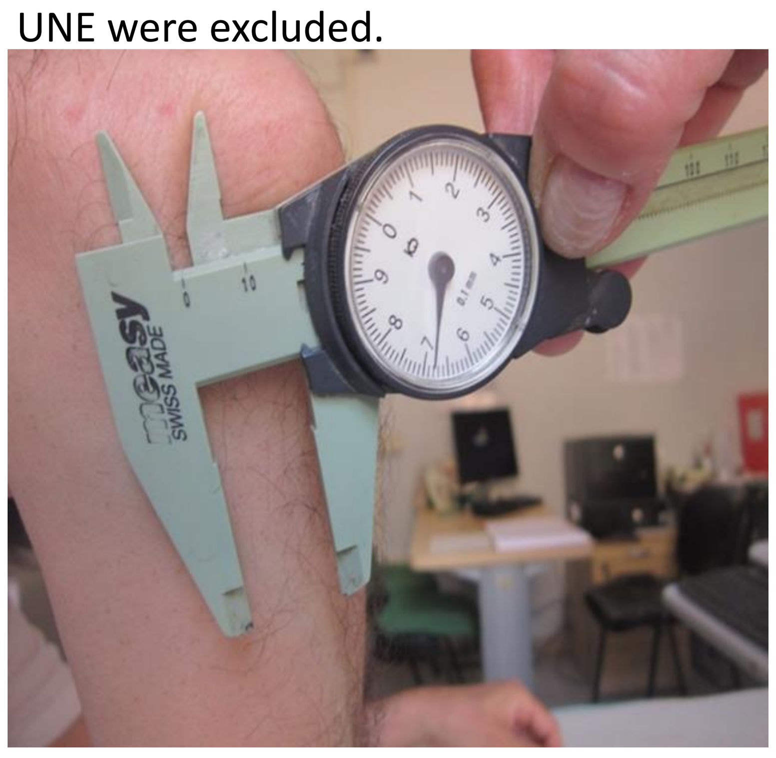

FIG 2: Measurement of the elbow flexed at 90°.

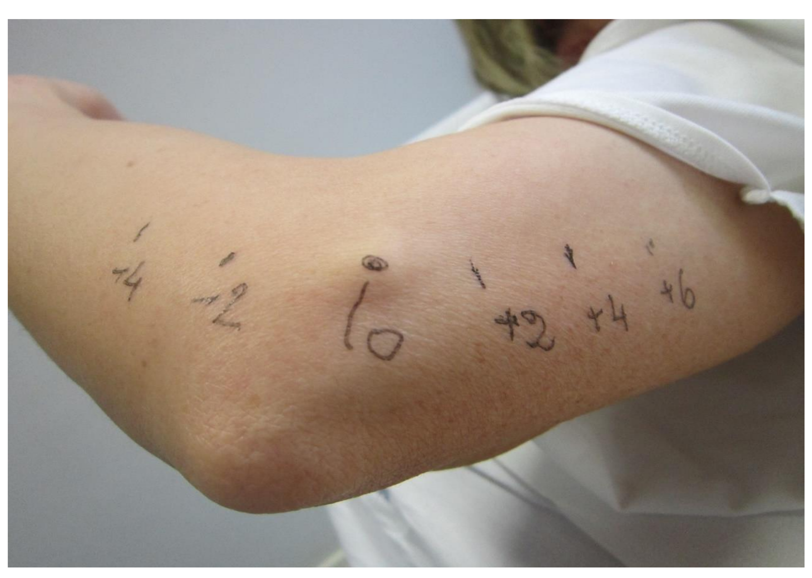

FIG 3. 2 cm short-segment MCV study

Methods

UNE diagnosis was made according to clinical and electrophysiological findings. Self-administered "hand diagram protocol" proposed by Werner et al. was also used. [3, 4] Patients filled in a questionnaire on symptoms severity and another including queries on demographic data, handedness, lifestyle factors (smoking, alcohol consumption, fast weight loss, tendency for supporting the elbow in various positions, hand-arm intensive sport or hobby), medical history (general anaesthesia, diabetes, renal failure, thyroid diseases, elbow and wrist fracture or trauma). We also considered body and arm anthropometric measures (BMI, waist-to-hip ratio (WHR) elbow dimension) .

The elbow dimensions were: a) width of the elbow measured between the tips of medial and lateral humeral epicondyles and b) width of the cubital groove (WCG) at the level of the medial epicondyle between the two inner edges. The measurements of the elbow were done with the elbow and wrist flexed at 90°, the arm abducted at 90° and the hand palm leaned against a hard surface using a sliding caliper (accurate to 0.1 mm) (Fig. 2).The length of the upper limb was measured from the acromion of the scapula to the ulnar styloid with a stretch-resistant tape (accurate to 0.5 cm). The ratio between WGC and elbow width and between this ratio divided by the arm length were also calculated. After training the inter-observer variability of body, elbow and arm measures were tested in a single session on 16 volunteers. In order to define the UNE localization we applied the 2-cm short-segment MCV study with the elbow flexed at 90° and stimulating markers placed at the medial epicondyle (ME), 2 and 4 cm distal , and 2, 4 and 6 cm proximal along the course of the ulnar nerve (Fig. 3) [5, 6]. UNE was localized if at least one 2-cm short-segment interlatency was >0.55-0.65 ms or CMAP amplitude drop >15-20% (Fig 4,5)

Descriptive statistics and differences between REG and HUA UNE were calculated with Mann-Whitney and chi-squared tests. Because some independent variables might be interrelated multivariate logistic regression was carried out to evaluate the risk factors associated to one type of UNE in respect to the other (dependent variables: REG UNE=0, HAU UNE=1 and independent variables: demographic and anthropometric findings and other factors demonstrated significantly different between the two types of UNE at univariate analysis).

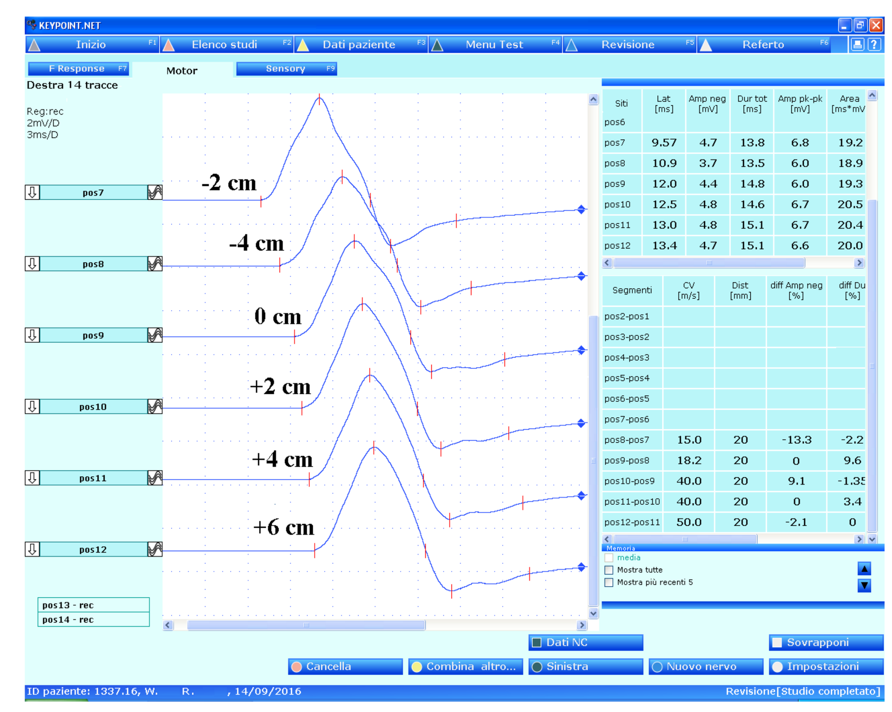

FIG 4 HUA UNE localization

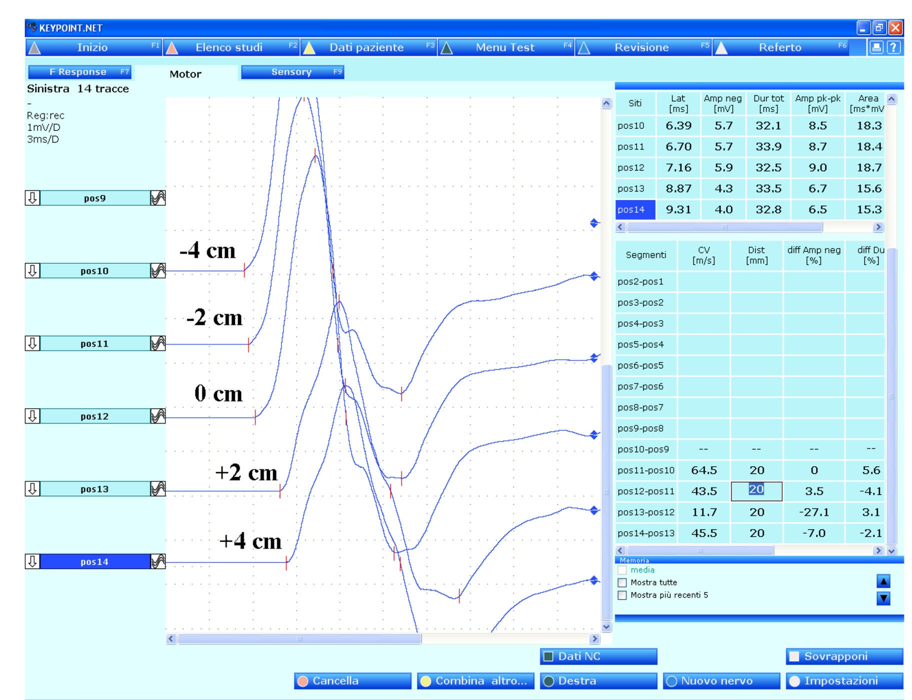

FIG 5:REG UNE localization

Results

We enrolled 99 REG (mean age 51.2±13.3 years, 62.6% males) and 44 HUA UNE (mean age 53.7±10.3 years, 61.4% males). We excluded 17 and 25 cases because short-segment MCV was not performed or was inconclusive. There were no differences in demographic, no-occupational lifestyle factors including elbow position at risk, handedness, UNE side, body measures, symptoms and clinical severity of UNE. Cubital groove was smaller in HUA, and MCV across elbow was more delayed in REG. Among associate comorbidities, elbow trauma was more frequent in HAU than in REG UNE. (Table 1, 2,3). At multivariate analysis one type UNE can be predicted in respect to the other only by MCV across elbow and elbow trauma (Table 4).

VARIABLES	HUA	REG	Chi/ Z values	P-value
Number	44	99		
Age (years)	53.7±10.3	51.2±13.2	Z -0.74	0.46
Gender (male)	27 (61.4%)	62 (62.6%)	Chi 0.02	0.89
BMI	26.7±5.5	27±5	Z -0.38	0.71
WHR	0.93±0.11	0.93±0.08	Z -0.44	0.66
Handedness (right)	39 (88.6%)	88 (87.9%)	Chi 0.002	0.97
UNE side (right)	22 (50%)	40 (40.4%)	Chi 1.14	0.29
Duration of symptoms (years)	1.3±1.5	1.21±1.43	Z -0.34	0.74
Severity of symptoms questionairre (score)	2.2±0.69	2.21±0.63	Z -0.24	0.81
Clinical severity scale (score)	2.39±1	2.4±0.9	Z -0.17	0.86
Cubital groove width (mm)	14.4±3.3	15.4±3.3	Z -2.25	0.025
Cubital groove width/elbow width (mm)	0.2±0.05	0.22±0.05	Z -2.21	0.027

TAB 1

VARIABLES	HUA	REG	Z value	P value
Number	44	99		
Abductor digit minimi recording				
MCV forearm (m/s)	54.8±7	53.4±8.4	-0.98	0.33
VCM across elbow (m/s)	41.6±6.6	36.6±10	-3.05	0.002
MCV across elbow -forearm differences(m/s)	13.2 ±5.2	16.8±7.9	-2.6	0.01
DML	3±0.53	2.91±0.6	-0.44	0.66
CMAP wrist (mV)	8.9±3.3	9.4±3.6	-1	0.34
CMAP drop %	-6.67±9.2	-12.8±17.2	-1.95	0.052
First interosseus dorsalis recording				
MCV forearm (m/s)	54.8±6.5	52.5±8.8	-1.33	0.18
VCM across elbow (m/s)	42.6±6.5	36.5±12.3	-3.56	< 0.0001
MCV across elbow -forearm differences(m/s)	12.1±6.1	16.1±9.9	-2.3	0.021
DML	3.88±0.56	3.83±0.7	-0.26	0.8
CMAP wrist (mV)	10.3±4.8	10.7±5.4	-0.26	0.8
CMAP drop %	-7 ±8.4	-17±23	-1.71	0.09
Sensory neurography				
U4 VCS (m/s)	43.8±23	36.9±26.7	-1.22	0.22
U4 PAS (µV)	4.4±5.4	4.3±5.9	-0.74	0.46
U5 VCS(m/s)	45.9±19.1	40±23.8	-0.88	0.39
U5 PAS (µV)	6.6±8.3	6.2±7.7	-0.64	0.52
DUC VCS(m/s)	48.6±12.1	44.2±20	-0.48	0.63
DUC PAS (µV)	11.4±9.1	10.8±9.7	-0.5	0.61

TAB 3

VARIABLES	HUA	REG	Chi values	P-values
Number	44	99		
Smokers	27 (61.4%)	65 (65.7%)	0.25	0.62
Alcohol consumers	38 (86.4%)	80 (80.8%)	0.65	0.42
Mobilephone/smartphone users	43 (97.7%)	96 (97%)	0.06	0.8
Anaesthesia	6 (13.6%)	5 (5.1%)	3.16	0.08
Diabetes	4 (9.1%)	8 (8.1)	0.04	0.84
Tiroid disease	4 (9.1%)	4 (5.5%)	1.47	0.22
Kidney failure	0	1 (1%)	0.45	0.5
Elbow fractures	6 (13.6%)	8 (8.1%)	1.07	0.3
Elbow trauma	14 (31.8%)	14 (14.1%)	6.05	0.014
Polineuropathy	2 (4.5%)	6 (6.1%)	0.13	0.72

TAB 2

Dependent variables: REG UNE=0, HAU UNE=1		
Independent variables	P	OR (95% CI)
Age (years)	0.09	1.03 (0.99-1.08)
Gender (male)	0.25	1.79 (0.67-4.8)
BMI (kg/m²)	0.55	0.97 (0.88-1.07)
WHR	0.6	0.2 (0.00-83.2)
Ulnar groove (mm)	0.08	0.89 (0.78-1.01)
UNE side (left)	0.69	0.85 (0.37-1.94)
Elbow trauma	0.019	3.08 (1.2-7.89)
MCV across elbow (m/s)	0.001	1.16 (1.05-1.19)
U5 SAP (microV)	0.5	0.98 (0.92-1.04)

TAB 4

Discussion

A recent study showed that UNE at HUA might be related to years of hard labor affecting mainly dominant hand caused by work-related changes. By contrast, UNE in the RTC groove affects mainly the non-dominant arm of younger administrative workers and might be is caused by external compression of the ulnar nerve. [1] We have not found these demographic, handedness and side differences. Elbow trauma predisposes more to HUA than to REG UNE. In addition REG cases had more delayed MCV of the ulnar nerve across the elbow without differences in clinical findings and symptoms probably because the nerve it is not covered by any ligament in retroepicondylar groove. Our study has a limit compared to the previous research. We used only electrophysiological techniques and not also ultrasonography in the diagnosis of UNE. We exclude 17% cases of UNE with MCV delay across the elbow because 2-cm inching tecnique was inconclusive.

Conclusions

Our findings showed there are no relationship between demographic, anthropometric, handedness findings and UNE localization. When we will complete the recruitment of our population, we will check whether some occupational tasks with tendency for supporting the elbow in various positions, repetitive movements or vibration exposure coupled to some anthropometric features might predispose the subjects to HUA rather than REG or vice versa.

References
1] Omejec G, Podnar S. What causes ulnar neuropathy at the elbow? Clin Neurophysiol. 2016;127:919-24.
[2] Svendsen SW et al. Ulnar neuropathy and ulnar neuropathy-like symptoms in relation to biomechanical exposures assessed by a job exposure matrix: a triple case-referent study. Occup Environ Med. 2012;69:773-80.
[3] AAEM, AAN, AAPNR. Practice parameter. Electrodiagnostic studies in ulnar neuropathy at the elbow. Neurology 1999;52:688-90.
[4] Werner RA., et al. Use of hand diagrams in screening for ulnar neuropathy: comparison with elecrodiagnostic studies. Muscle Nerve 2012;46:891-894.
[5] Azrieli Y et al. The utility of segmental nerve conduction studies in ulnar mononeuropathy at the elbow. Muscle Nerve 2003;27:46-50.
[6] Omjec G, Zgur T and Podnar S. Diagnostic accuracy of ultrasonographic and nerve conduction studiesin ulnar neuropathy at the elbow. Clin Neurophysiol, 2015.126 (9): p. 1797-804