RISK FACTORS OF ASYMPTOMATIC DELAY OF MOTOR CONDUCTION VELOCITY OF THE ULNAR NERVE ACROSS THE ELBOW. A CASE-CONTROL STUDY.

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Introduction

On May 2014 we started an observational multicenter prospective case-control study on risk factors of ulnar neuropathy at the elbow (UNE) [1]. From full database we extracted subjects with delay of motor conduction velocity (MCV) of the ulnar nerve across the elbow without symptoms/signs of ulnar neuropathy (asymptomatic UNE).
The aim of this study was to check risk factors of asymptomatic UNE.

Results

We enrolled 56 cases (75% males) with asymptomatic UNE and 460 controls (ulnar neuropathy symptoms-free) (47.4% males). There were more males than females in asymptomatic UNE (z=3.7, P=0.0002). Bilateral cases were 59.6%. The predominantly or exclusively concerned side was the right (64.3%, z=2.1, P=0.03) and the agreement between handedness and side of asymptomatic UNE numbered 34 (60.7%). According to 2 cm short-segment MCV across the elbow [2] the site of MCV delay of the ulnar nerve was at Osborne ligament in 9 (16.1%) and at the retrocondylar groove in 18 (31.1%). It was impossible to identify the site of the delay in 22 asymptomatic UNE and inching test was not performed in 7. Tables 2-5 show the results of the differences between cases and controls. The multivariate logistic regression analysis, adjusted for age and sex, showed that asymptomatic UNE was associated with diabetes, polyneuropathy, BMI and a special job task (staying with flexed elbows on a hard surface for at least 4 hours of a working shift) (for details see Tables 6-7).

Ulnar nerve neurographic findings	Asymptomatic UNE (no.56)	Controls (no.460)	Z and P values
MCV below elbow-wrist (m/s)	56.5±4.7	59.9±4.3	Z=-5.06, p<0.0001
MCV across elbow (m/s)	43.6±3.6	57.1±5.2	Z=-12.1, p<0.0001
Conduction block across elbow (%)	-4.13±4.2	-2.89±3.6	Z=-2.4, p=0.015
MCV drop between below elbow-wrist and across elbow tracts (m/s)	12.8±4.7	2.8±4.4	Z=-10.7, p<0.0001
CMAP Wrist Amplitude (mV)	11.1±2.6	11.1±2.4	n.s.
Distal motor latency (ms)	2.95±0.34	2.67±0.33	Z=-5.65, p<0.0001
IV digit-wrist SAP amplitude (µV)	4.44±2.5	7.9±5.9	Z=-5.6, p<0.0001
V digit-wrist SAP amplitude(µV)	7.53±7	13.3±10.4	Z=-6.93, p<0.0001
Dorsal ulnar cutaneous SAP amplitude (µV)	16.2±9.8	21.8±11.6	Z=-3.51, p<0.0001

Table 1 Neurographic results of the ulnar nerve.
Motor neurography was performed recording from abductor digiti minimi muscle.
Similar results were obtained recording from first dorsal interosseous of hand muscle

Lifestyle factors	Asymptomatic UNE (no.56)	Controls (no.460)	Differences Z or χ² and P values
Smoking (yes) no. (%)	35 (62.5%)	233 (50.7%)	n.s.
Pack-years of smoking no.	12.5±15	7.8±12.1	Z=-2.39, p=0.017
Current smokers no. (%)	17 (44.7%)	130 (36.4%)	n.s.
Alcohol (yes) no. (%)	43 (76.8%)	334 (72.6%)	n.s.
Alcohol score	1.93±1.61	1.57±1.41	n.s.
Alcohol abuse (>4 alcohol units/die)	4 (7.1%)	9 (2%)	χ²=5.48, p=0.048
Tendency of laying of pronated forearm on the edge of a hard surface	26 (46.4%)	223 (48.5%)	n.s.
Resting the head in the hand weighting on flexed elbow no. (%)	19 (33.9%)	180 (39.1%)	n.s.
Staying with flexed elbow on a table/desk no. (%)	29 (51.8%)	244 (53%)	n.s.
Leaning the arm against the armrest or window edge while driving no. (%)	12 (21.4%)	71 (15.4%)	n.s.
Hand-arm intensive recreational activities (>1h/week) no. (%)	25 (44.6%)	188 (40.9%)	n.s.
Smartphone/mobile use/abuse (>2h/day) no. (%)	1 (1.8%)	7 (1.5%)	n.s.
Housework (>1h/die) no. (%)	39 (69.6%)	348 (75.7%)	n.s.

Table 3

Discussion

The risk factors of asymptomatic UNE are different from UNE.
Only a male preponderance is common to both conditions.
No lifestyle factors are associated to asymptomatic UNE and the prevalence of the right side is not due to particular elbow postures. Between anthropometric factors only BMI is a risk factor. Lower BMI is slightly associated to asymptomatic UNE likely due to protective effects of fat on the nerve when the elbow is flexed.
Among comorbities diabetes is a risk factor, probably because MCV delay of ulnar nerve across the elbow is early manifestation of asymptomatic polyneuropathy in diabetes. Asymptomatic UNE with normal motor neurography of the other tracts of the ulnar nerve is also associated to polyneuropathy due to the site of the ulnar nerve at elbow.
Flexed elbow occupational posture on a hard surface is a risk factor only if stayed for long time (>2 hours/work shift) [3-6].
Only longitudinal studies will be able to check whether these subjects develop symptoms/signs of true mononeuropathy with time.
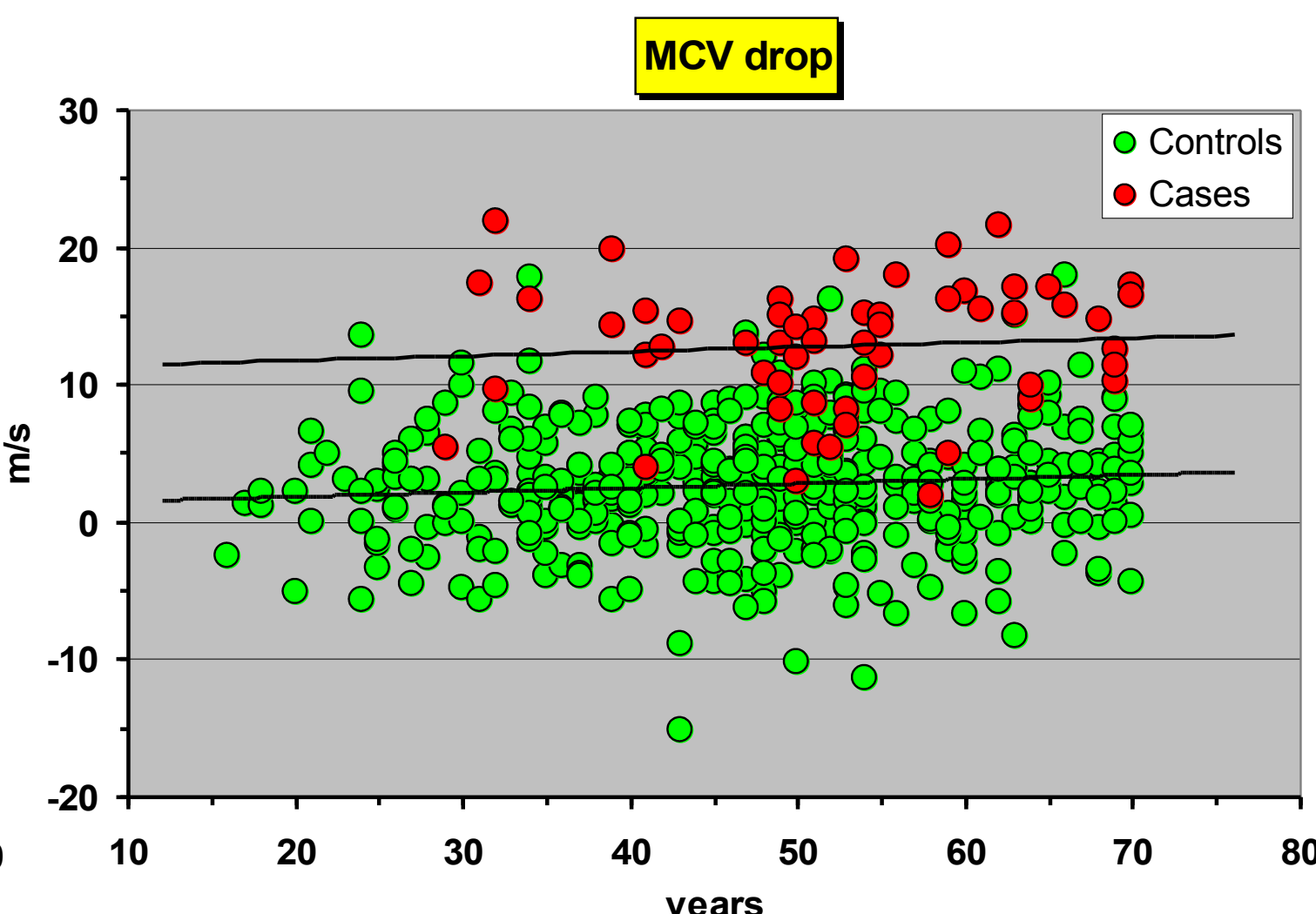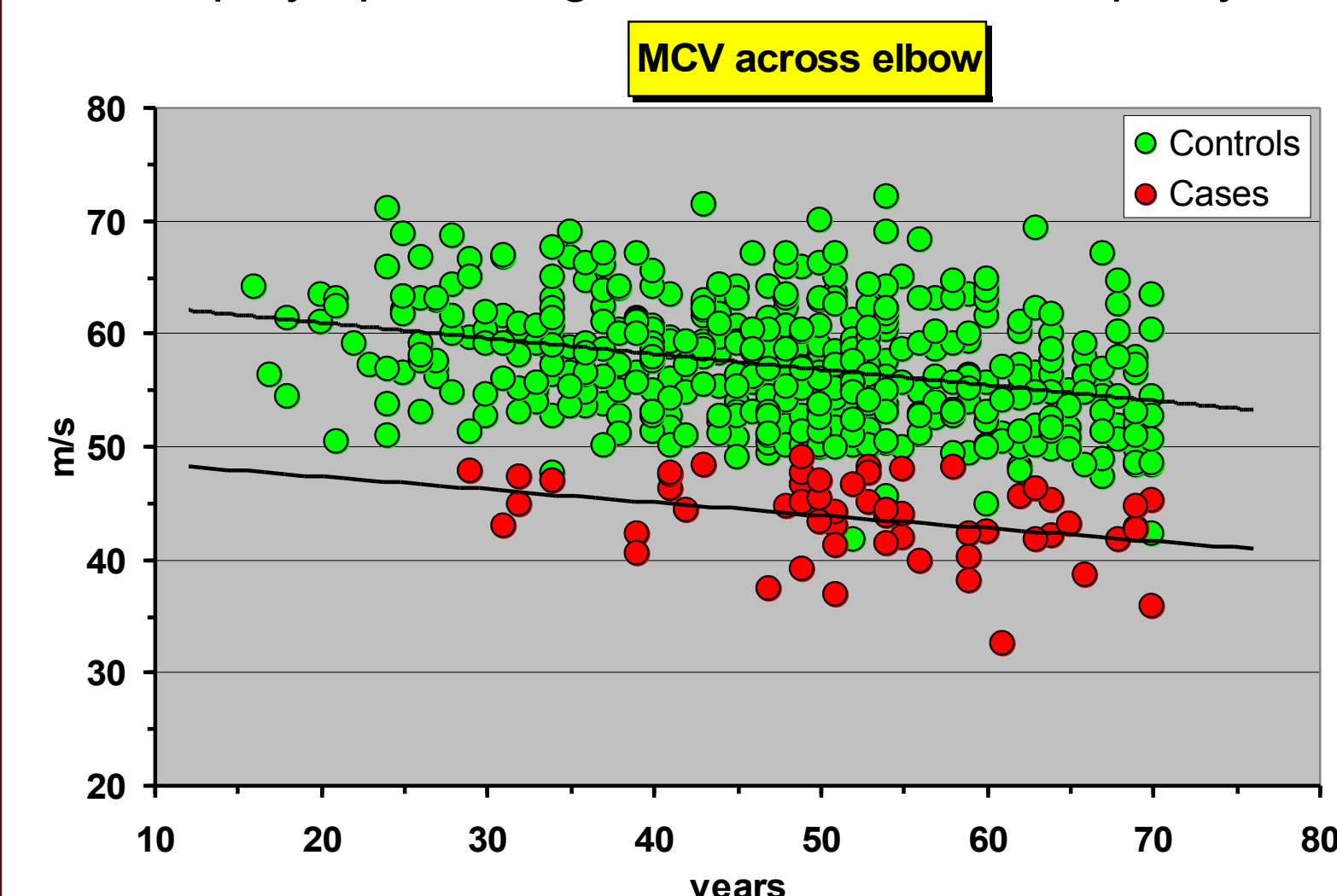
Methods

We consecutively enrolled all subjects admitted to four EMG labs from May 2014 to September 2016 because upper limb complains. We included in this study only subjects with ulnar nerve symptoms free (regardless of the electrophysiological results) and excluded all subjects with age <14 and >70 years, diseases mimicking ulnar neuropathy (C8-T1 radiculopathy, thoracic outlet syndromes and lower trunk of brachial plexopathy), hereditary neuropathies, amyotrophic lateral sclerosis and carpal tunnel syndrome.
All subjects filled in a questionnaire on education level, handedness, lifestyle factors (smoking status, alcohol use, hand-arm intensive recreational activities (>1h/week), smartphone/mobile use/abuse (>2h/day), fast weight loss, special usual non-neutral positions of elbow out of job (i.e. tendency of laying of pronated forearm on the edge of a hard surface, resting the head in the hand weighting on flexed elbow, staying with flexed elbow on a table/desk, leaning the arm against the armrest or window edge while driving), comorbidities (polyneuropathy, diabetes, connective and thyroid diseases, renal failure, history of wrist or elbow fractures and elbow trauma), full anaesthesia, occupation (including 7 queries on exposition to special repetitive and forceful tasks and prolonged non-neutral elbow posture with 4 possible responses according the number of hours of activity, for details see Table 5 of the results).
We took into account the following anthropometric measures: weight, height, waist and hip circumferences, elbow dimension (width of cubital groove between the inner edge of medial epicondyle and olecranon and size of elbow between medial and lateral epicondyles); we also calculated the relative ratios.
All subjects underwent a standardized electrophysiological protocol and also EMG and nerve conduction velocity of other muscles and nerves according to clinical suspicion [1] (see Table 1 of the results for ulnar nerve neurography).
We included in the "cases" all subjects with asymptomatic UNE and in the "controls" the other enrolled subjects according to exclusion criteria above reported.
One-sample proportion test was used for handedness, gender and side in asymptomatic UNE. Univariate (Mann-Whitney and chi-squared tests) and multivariate logistic regression analyses were performed to check differences between cases and controls and to identify the risk factors of asymptomatic UNE.

Demographic and anthropometric measures	Asymptomatic UNE (no.56)	Controls (no.460)	Differences Z or χ² and P values
Age (years)	52.7±10.6	47±12.4	Z=-2.88, p=0.004
Male no. (%)	42 (75%)	218 (47.4%)	χ²=15.2, p<0.0001
Handedness (right-handed) no. (%)	55 (98.2%)	423 (92%)	n.s.
Education level	3.52±0.9	3.66±0.8	n.s.
Weight (kg)	74±14.7	71.5±14.3	n.s.
Height (m)	1.71±0.08	1.67±0.09	Z=-2.48, p=0.013
Waist circumferences (cm)	92.6±11.8	89.7±12.7	n.s.
Hip circumferences (cm)	100.8±7.4	100.8±9	n.s.
BMI	25.29±4	25.38±4.2	n.s.
Waist-hip ratio	0.92±0.08	0.89±0.09	Z=-2.66, p=0.008
Cubital groove width (mm)	16.4±3.8	16.3±3.1	n.s.
Elbow size (mm)	70.1±6.9	68.6±9.1	Z=-2.03, p=0.043
Arm length (cm)	52.5±3.1	51.7±4	Z=-1.98, p=0.049
Cubital groove/elbow size	0.23±0.04	0.24±0.04	n.s.
Groove/elbow/arm	0.45±0.09	0.46±0.09	n.s.

Table 2

Comorbidities no. (%)	Asymptomatic UNE (no.56)	Controls (no.460)	Differences Z or χ² and P values
Polyneuropathy	7 (12.5%)	7 (1.5%)	χ²=22.8, p<0.0001
Diabetes	11 (19.6%)	17 (3.7%)	χ²=24.7, p<0.0001
Connective diseases	1 (1.8%)	16 (3.5%)	n.s.
Thyroid diseases	4 (7.1%)	38 (8.3%)	n.s.
Renal failure	1 (1.8%)	3 (0.7%)	n.s.
Wrist fracture	5 (8.9%)	42 (9.1%)	n.s.
Elbow fracture	2 (3.6%)	12 (2.6%)	n.s.
Elbow trauma without fracture (<5 years before)	8 (14.3%)	33 (7.2%)	n.s.
Full anaesthesia (<1 year before)	8 (14.3%)	47 (10.2%)	n.s.
Fast weight loss (>10 kg in 6 months)	3 (5.4%)	15 (3.3%)	n.s.

Table 4

Exposition to special repetitive and forceful tasks and prolonged non-neutral elbow posture during one work shift (>2 h/work shift) no. (%)	Asymptomatic UNE (no.44)	Controls (no.363)	Differences χ² and P values
Holding with the whole hand objects weighing ≥4.5 kg without support or exercising a strength ≥ 4.5 kg only with one hand	6 (13.6%)	66 (18.2%)	n.s.
Giving shots with the palm of your hand as it is a hammer	1 (2.3%)	29 (8%)	n.s.
Keeping your elbows flexed and resting on a hard surface like the work table	18 (40.9%)	82 (22.6%)	χ²=7.1, p=0.008
Highly repetitive movements (every few seconds) with your elbows	8 (18.2%)	83 (22.9%)	n.s.
Intensive use of vibrating tools (such as screwdriver, pneumatic hammer, cutter, grinder…)	3 (6.8%)	25 (6.9%)	n.s.
Driving trucks, tractors, heavy equipment, forklift or similar vehicles	8 (18.2%)	32 (8.8%)	χ²=3.89, p=0.049
Computer intense use (word processor, data entry, cad/cam, graphics)	12 (27.3%)	70 (19.3%)	n.s.

Table 5

Risk factors	P	Odds Ratio (95% confidence interval)
Age (years)	0.024	1.038 (1.005-1.071)
Sex (male)	0.001	5.038 (2.02-12.6)
Diabetes	0.002	4.86 (1.74-13.6)
Polyneuropathy	0.007	6.44 (1.66-24.9)
BMI	0.02	0.89 (0.8-0.98)

Table 6
Multivariate logistic regression analysis (without occupational risk factors) in all cases (no.56) and controls (no.460).

Risk factors	P	Odds Ratio (95% confidence interval)
Age (years)	0.023	1.042 (1.006-1.079)
Sex (male)	0.001	4.44 (1.91-10.33)
Diabetes	0.009	5.22 (1.52-17.9)
Polyneuropathy	0.004	8.85 (2.04-29.2)
BMI	0.041	0.89 (0.8-0.99)
Keeping your elbows flexed and resting on a hard surface like the work table	0.001	3.64 (1.74-7.6)

Table 7 Multivariate logistic regression analysis only in current workers (no.403): cases (no.44) and controls (no.363).

Fig 1 MCV across elbow

Fig 2 MCV drop

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