

Somatosensory profiles in patients with non-specific neck-arm pain with and without positive neurodynamic tests

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Background

While clinical neurological examination and electrodiagnostic studies are usually normal in patients with non-specific neck arm pain (NSNAP), a subgroup of patients presents with clinical signs of heightened nerve mechanosensitivity upon neurodynamic testing¹. It remains however unclear whether this is associated with a subtle nerve injury.

Purpose

The aim of this study was to evaluate potential differences in somatosensory function among patients with unilateral NSNAP with and without positive neurodynamic tests and healthy controls.

Methods

Forty patients with unilateral NSNAP participated in the study. All patients had normal electrodiagnostic tests. Standardised upper limb neurodynamic tests were used to divide patients into those with heightened nerve mechanosensitivity (ULNT_{POS}) and those with normal nerve mechanosensitivity (ULNT_{NEG}). Quantitative sensory testing was performed according to the protocol of the German Research Network on Neuropathic Pain². All parameters were evaluated over the patients' maximal pain area. Corresponding areas were measured in 26 healthy controls³.

Results

Demographic and clinical characteristics of patients and healthy controls are documented in Table 1. Fifty-seven percent of patients with NSNAP had positive neurodynamic tests despite normal bedside neurological integrity tests and nerve conduction parameters. Patients had higher depression scores compared to healthy controls ($p < 0.001$), without differences between patient subgroups. However, patients' depression scores fell within the normal range.

Table 1: Demographics and clinical characteristics

| | HC (n=26) | ULNT _{NEG} (n=17) | ULNT _{POS} (n=23) | P value |
|---|--------------|-------------------------------|-------------------------------|---------|
| Age | 45.6 (12.5) | 46.5 (12.4) | 45.6 (12) | 0.969 |
| Gender (female) | 12 | 11 | 17 | 0.129 |
| Symptom duration (years) | | 6.47 (4.02) | 5.74 (3.52) | 0.435 |
| HADS | | | | |
| Anxiety (normal range ≤ 10) | 4.27 (4.2) | 6.41 (3.26) | 6.69 (4.45) | 0.060 |
| Depression (normal range ≤ 10) | 1.23 (1.8) | 5.12 (3.59) | 5.26 (4.75) | <0.001 |
| Sleep last week (VAS) | 2.9 (2.6) | 3.59 (2.42) | 4.57 (2.4) | 0.1371 |
| SF12 | | | | |
| Physical | | 39.76 (8.5) | 38.46 (10.33) | 0.673 |
| Mental | | 46.32 (9.58) | 46.23 (11.86) | 0.978 |
| NDI | | 24.94 (7.51) | 26.87 (7.23) | 0.417 |
| DASH | | 48.29 (14.8) | 57.96 (20.9) | 0.113 |
| PainDETECT | | 11.94 (6.35) | 15.43 (5.95) | 0.820 |

HC, healthy control subjects; ULNT_{NEG}, unilateral nonspecific neck-arm-pain patients with negative upper limb neurodynamic test; ULNT_{POS}, unilateral nonspecific neck-arm-pain patients with positive upper limb neurodynamic test; HADS, Hospital Anxiety and Depression Scale; NDI; Neck Disability Index; DASH, Disabilities of the Arm, Shoulder and Hand questionnaire, VAS, visual analogue scale; Data are mean (SD)

Somatosensory profiles – Detection thresholds

Patients with ULNT_{POS} had a significant deficit in cold, mechanical and vibration detection compared to healthy controls ($p=0.021$, $p=0.002$ and $p=0.001$ respectively); patients with ULNT_{NEG} had more difficulty feeling warm sensations ($p=0.013$) (Figure 1). Both NSNAP subgroups had loss of function in the thermal sensory limen compared to healthy controls ($p < 0.008$). There were no significant differences in detection thresholds between patient groups. Of note, the ANOVA linear trend analysis revealed a significant dose response relationship with the ULNT_{NEG} representing an intermediate phenotype between ULNT_{POS} patients and healthy controls for mechanical and vibration detection ($p < 0.004$).

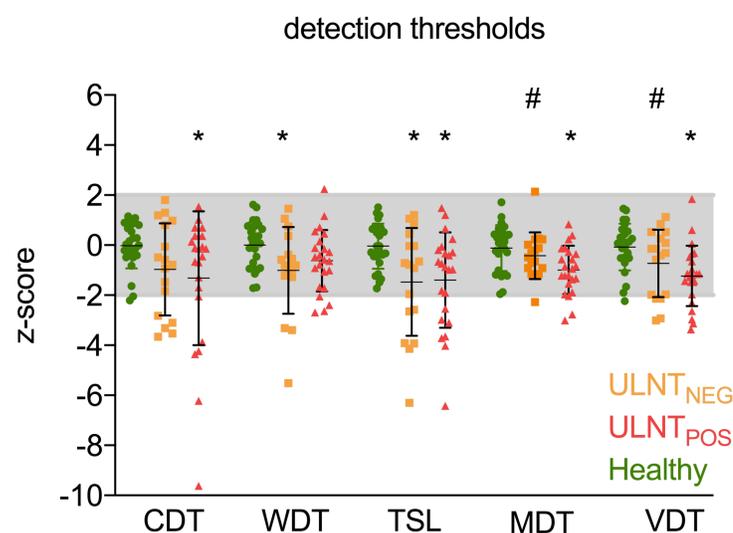


Fig.1. Sensory profiles (SEM) of CDT, cold detection threshold; WDT, warm detection threshold; TSL, thermal sensory limen; MDT, mechanical detection threshold; VDT vibration detection threshold; * indicates significant difference compared to healthy controls. # indicates significance of dose response analysis suggesting an intermediate phenotype of the ULNT_{NEG} group.

Somatosensory profiles – Pain thresholds

Patients with NSNAP demonstrated significantly lower pain thresholds for cold, heat and pressure pain compared to healthy controls ($p=0.001$, $p=0.002$ and $p=0.002$, Figure 2). There was no difference in any sensory parameters between patient groups. The ULNT_{NEG} subgroup represented an intermediate phenotype between ULNT_{POS} patients and healthy controls in both thermal and pressure pain thresholds ($p < 0.024$).

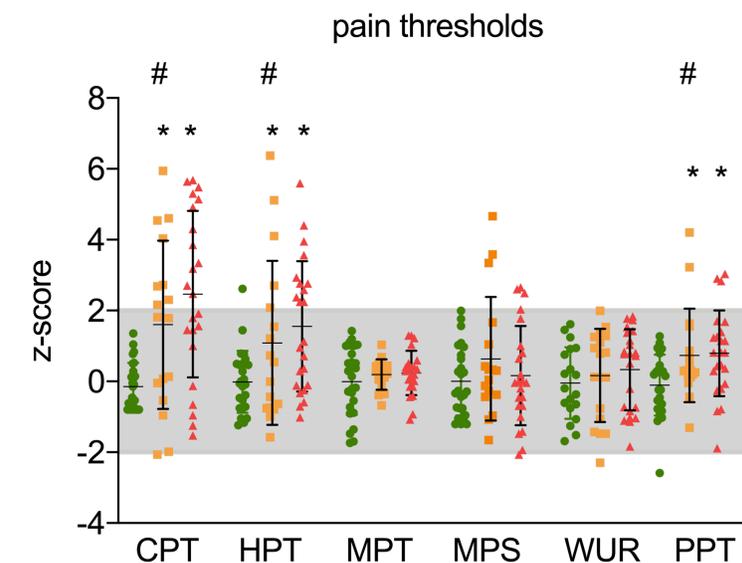


Fig.2. Sensory profiles (SEM) of CPT, cold pain threshold; HPT, heat pain threshold; MPT, mechanical pain threshold; MPS mechanical pain sensitivity; WUR, wind up ratio; PPT, pressure pain threshold. * indicates significant difference compared to healthy controls; # indicates significance of dose response analysis suggesting an intermediate phenotype of the ULNT_{NEG} group.

Conclusion

Heightened nerve mechanosensitivity was present in 57% of patients with NSNAP. Even though somatosensory phenotypes between the ULNT_{POS} and ULNT_{NEG} group did not differ, the comparison to healthy controls revealed a more pronounced loss of function phenotype of the ULNT_{POS} group. It stands to debate if this loss of function is suggestive of a subtle nerve dysfunction or should be interpreted as a consequence of altered central pain processing.

Acknowledgement

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References

- Elvey, R. L. (1997). Physical evaluation of the peripheral nervous system in disorders of pain and dysfunction. *J Hand Ther*, 10(2), 122-129.
- Rolke, R., Baron, R., Maier, C., Tolle, T. R., Treede, R. D., Beyer, A., Wasserka, B. (2006). Quantitative sensory testing in the German Research Network on Neuropathic Pain (DFNS): standardized protocol and reference values. *Pain*, 123(3), 231-243.
- Tampin B, Slater H, Hall T, Lee G, Briffa NK (2012). Quantitative sensory testing somatosensory profiles in patients with cervical radiculopathy are distinct from those in patients with nonspecific neck-arm pain. *Pain* 153(12),2403-14.