Comparison of Median Nerve Mechanosensitivity and Pressure Pain Threshold in Patients With Nonspecific Neck Pain and Asymptomatic Individuals

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Abstract

Objective: The purpose of this study was to investigate the presence of median nerve mechanosensitivity by comparing median nerve neurodynamic test results of patients with nonspecific neck pain (NNP) and asymptomatic individuals.

Methods: A total of 40 patients (30 women, 10 men) with NNP between the ages of 21 and 62 years (39.53 ± 10.18 years) and 38 asymptomatic individuals (23 women, 15 men) between the ages of 18 and 60 years (37.13 ± 9.64 years) participated in the study. Pressure pain threshold was assessed with digital pressure algometer, cervical joint range of motion was assessed with a universal goniometer, and median nerve mechanosensitivity was assessed with Upper Limb Neurodynamic Test 1 (ULNT1). The test step where the first sensory response was given, the location and character of the sensory response, and the final elbow extension angle were recorded during ULNT1.

Results: Patients with NNP had significantly decreased pressure pain threshold ($P < .001$), decreased range of motion of cervical flexion ($P < .001$), and decreased cervical lateral flexion ($P = .001$) compared with asymptomatic individuals, whereas no change was identified in range of motion of rotation ($P = .100$). In ULNT1, 45% of patients with NNP reported pain and 40% of them reported stretch. A total of 65% of asymptomatic individuals reported stretch, and 13% of them reported pain. It was identified in ULNT1 that final elbow extension angle was lower in the NNP group compared with asymptomatic individuals ($P = .008$).

Conclusion: Median nerve mechanosensitivity increased, pressure pain threshold decreased, and active neck motion was limited in individuals with NNP compared with asymptomatic individuals. (J Manipulative Physiol Ther 2018; xx:1-7)

Key Indexing Terms: *Neck Pain; Median Nerve; Pain Threshold; Neuralgia*

Introduction

Neck pain is among the 4 most commonly reported diseases of the musculoskeletal system.[1-5] The high prevalence of neck pain and its effects on function and job performance are important problems for patients and society.[6] The characteristic of nonspecific neck pain (NNP) is unclear; it is not known with certainty whether it is a nociceptive pain or neuropathic pain.[7] The pain perceived as a result of the activation of nociceptors that are related to real or potential damage of nonneural structures is called nociceptive pain, whereas the pain perceived as a result of damage to somatosensory system is called neuropathic pain.[8,9] In neuropathic pain, excitability of neurons increases because of sensitivity of the central nervous system or the peripheral nervous system or both.[10] Neural sensitivity is thought to be a mechanism protecting nerves against mechanical stress occurring during movement.[11] Literature on neural mechanosensitivity in NNP is both limited and conflicting.[12,13] Assessment of increased peripheral nerve mechanosensitivity with neurodynamic tests is important in terms of determining the potential neural damage that might associated with neck pain.[14]

Upper limb neurodynamic tests consist of 4 different neurodynamic tests used in the diagnosis of neck pain and neurogenic conditions in the upper limbs without neck pain.[15] These tests were developed to assess the movement capability of peripheral nerves during upper limb movements.[16] Mechanical stress in the brachial plexus and/or spinal nerve

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and/or nerve root is induced during these tests. Symptoms that indicate increased nerve sensitivity as a result of mechanical stress include muscle spasm, endpoint sensation, and abnormal motor responses. Compression applied by neighboring structures and ischemia occurring in the nerves as a result of stress are thought to cause these symptoms.[17]

In previous studies, it was reported that upper limb neurodynamic tests except for median nerve Upper Limb Neurodynamic Test 1 (ULNT1) had high sensitivity in the diagnosis of neck radiculopathy and produced symptoms even in the absence of any problems. For this reason, it is quite difficult to interpret results of radial and ulnar nerve tests. On the other hand, the median nerve neurodynamic test was reported to be the only and the best test in elimination of cervical radiculopathy.[18,19] The number of studies investigating median nerve mechanosensitivity in NNP is limited.[20-22] Thus, the aim of our study was to assess differences present in patients with NNP regarding neural mechanosensitivity of the median nerve comparing those with healthy individuals. We hypothesized that individuals with NNP would report sensory responses in earlier stages of the ULNT1 compared with asymptomatic individuals; their sensory responses would have a different character, and elbow extension measured during the test would be limited. Therefore, patients with NNP would present greater mechanosensitivity than those with healthy individuals when the neural test was applied.

Materials and Methods

Sample Size Calculation

The sample size was calculated based on a previous study that was conducted by Coppieters et al.[20] It was estimated that 35 individuals for each group had to be included in this study for 90% power with 5% type I error level to detect a minimum clinically significant difference of 15° for elbow extension angle at ULNT1, when the avarage value in the control group was 159°, with a standard deviation of 17°. However, to account for dropouts, we decided that 40 patients for the NNP group and 38 asymptomatic individuals for control group would be recruited for this study.

Participants

A total of 40 patients (30 women, 10 men) between the ages of 21 and 62 years (mean age 39.53 ± 10.18 years) diagnosed with chronic NNP (longer than 3 months in duration) as a result of clinical examination and radiologic findings were included in this study. The asymptomatic group consisted of 38 pain-free individuals (23 women, 15 men) with an age range of 18 to 60 years (mean age 37.13 ± 9.64 years) who had not experienced neck pain for at least 1 year before the study. Participants were excluded if they had central nervous system disorders, root compression, distal peripheral nerve injury, nonsystemic arthritis, or cervical spine and upper limb fracture; had undergone cervical spine or upper limb surgery; or had limited joint motion in the upper limb and bilateral upper limb symptoms. They were also excluded if they had received any form of treatment (eg, physiotherapy, chiropractic, acupuncture, massage, nonsteroidal anti-inflammatory drugs, or local injection) in the previous 6 months. Ethical approval for this study was obtained from Hacettepe University's Non-invasive Clinical Research Ethics Committee (GO 13/366-08). Written consent forms were signed by all particpants included in the study.

Physical Measurements

Pressure Pain Threshold. Pressure pain threshold was assessed with digital pressure algometer (Commander Algometer, JTECH Medical, Midvale, Utah). Assessments were made from the middle point of both upper trapezius using 1 cm^2 tip and the minimum pressure causing pain during the measurement was recorded in kilograms per square centimeter (kg/cm^2). Measurements were repeated 3 times and averaged.

Active Neck Movement. Cervical joint range of motion was measured with 360° universal goniometer in an erect sitting position. The participants performed each movement 3 times, being encouraged to move as far as possible each time. The mean of triplicate readings for each direction was calculated.

Mechanosensitivity of the Median Nerve. Median nerve mechanosensitivity was assessed with ULNT1, which is one of the upper limb neurodynamic tests. The test was applied in the standardized position described by Butler.[16] To perform the test, all participants were asked to lie supine. ULNT1 was performed in the following sequence (Fig 1):

1. Gentle shoulder girdle depression, glenohumeral abduction, and external rotation in the coronal plane, and wrist and finger extension and elbow extension. The angle of elbow extension was measured at submaximal pain threshold using a standard goniometer aligned along the midhumeral shaft, medial epicondyle, and ulnar styloid.
2. If no pain was experienced, elbow extension was continued to the end of normal physiological range.
3. If no sensory response was reported at the end of the elbow extension, the neck was taken to lateral flexion of the other side.

Test steps were applied throughout the entire movement range of the participant or until the participant asked for the test to be ended. In case of sensory response (pain, burning, numbness, ache, pressure, tightness, tingling) at any step of ULNT1, the test stage and the location (neck, shoulder, arm, elbow, forearm, and hand) of the symptom were