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BRIEF ARTICLE

Spinal accessory neuropathy in patients with chronic neck pain

Mohamed A Hefny, Mona S Ghaly, Sahar M Greish, Noha M Abogresha, Ayman E Fahim

Mohamed A Hefny, Mona S Ghaly, Department of Rheumatology and Rehabilitation, Faculty of Medicine, Suez Canal University, 4111 Ismailia, Egypt
Sahar M Greish, Noha M Abogresha, Department of Physiology, Faculty of Medicine, Suez Canal University, 4111 Ismailia, Egypt
Ayman E Fahim, Department of Occupational Medicine, Faculty of Medicine, Suez Canal University, 4111 Ismailia, Egypt
Author contributions: Ghaly MS, Hefny MA, Greish SM, Abogresha NM and Fahim AE wrote the paper; Fahim AE performed the statistics and revised the manuscript; Greish SM and Abogresha NM revised the literature and the electrodiagnostic data and helped in editing the manuscript; Ghaly MS and Hefny MA recruited the patients, performed rheumatologic examination and electrodiagnosis, revised statistical data, and helped in submitting the manuscript.
Correspondence to: Mona S Ghaly, MD, Department of Rheumatology and Rehabilitation, Faculty of Medicine, Suez Canal University, 4111 Ismailia, Egypt. xmghaly@gmail.com
Telephone: +20-14-3516507 Fax: +20-64-3230539
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Abstract

AIM: To assess the presence of spinal accessory neuropathy in patients with chronic neck pain.

METHODS: Patients with pain either regional or focal in the neck or shoulders for at least 6 mo (chronic neck pain) were recruited randomly from the Rheumatology and Rehabilitation Outpatient Clinic at the Faculty of Medicine-Suez Canal University. Two groups were compared: 30 patients with chronic neck pain with mean age (36.97 ± 12.45 years) and 10 apparently healthy controls. Trapezius muscle examination including inspection and range of motion both active and passive was performed. A full clinical neurological examination was carried out to exclude peripheral neuropathy and motor neuron disease. According to the subject's type of work, cases were categorized into labor-intensive and non-labor intensive tasks. A nerve conduction study (NCS) was performed on spinal accessory nerves at both sides for all patients and controls. Parameters including latencies and amplitudes of compound motor action potential (CMAP) were compared with the chronicity of neck pain using the neck disability score. This cross sectional study was carried in the Rheumatology and Rehabilitation Department, at Suez Canal University Hospital, Ismailia, Egypt.

RESULTS: Physical examination revealed that 80% of cases had spinal trapezius muscle spasm. Restricted neck motion was present in 16.6% of cases. No one suffered from muscle wasting or weakness. Pain was bilateral in 18 patients (60%), localized to the right side in six patients (20%) and localized to the left side in six patients (20%). The causes of neck pain in the patients studied were nonspecific, due to physical stresses, cervical spondylosis and mild cervical disc herniation. Mean disease duration in patients with labor-intensive tasks was (3.9 ± 2.1 years), which was longer than that in patients with non-labor intensive tasks (3.1 ± 1.9 years); however, this difference was statistically insignificant. Spinal accessory NCSs were performed while subjects were in sitting positions and relaxed with naturally suspended arms to minimize muscular movement. The results of electrophysiological studies revealed that mean right and left latencies of the spinal accessory nerve were 2.96 ± 0.69 ms, 2.98 ± 0.61 ms in the patient group and 2.44 ± 0.38 ms, 2.33 ± 0.36 ms in control group respectively. These differences were statistically significant with P = 0.028 and 0.006 respectively. Spinal accessory NCS showed normal CMAP amplitude in both patients and controls. Comparing the results of the neck disability index (NDI) to different characteristics in patients with chronic neck pain, showed that patients with labor-intensive work had a higher NDI score mean (34.7 ± 9.5) compared to those with non-labor-intensive work, with significant statistical difference (P = 0.011). In addition, mean NDI scores were higher in males, and patients aged over 40 years and this difference was statistically sig-

nificant (P = 0.007 and P = 0.009 respectively). Correlation studies between right and left spinal accessory nerve latencies and disability percent calculated using the NDI revealed a positive correlation. Moreover, there was a positive correlation between age and disability percent.

CONCLUSION: This study demonstrates electrophysiological evidence of demyelination in a significant proportion of patients with chronic cervical pain.

Key words: Accessory nerve; Electrophysiology; Chronic neck pain; Neck disability index questionnaire

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INTRODUCTION

Chronic neck pain is pain that can come from any number of disorders and diseases that may affect almost any tissue, bone, or gland located in the neck. Neck pain is a common problem, with two-thirds of the population having it at some point in their lives[1] and of whom about 19% suffer from chronic neck pain[2].

Typically, neck pain is not caused by anything serious; emotional and physical stresses can create tension in the neck muscles, and chemical stress (tobacco, unhealthy foods, or even medication) can affect muscle tone and the nerves of the neck[3]. Major causes of neck pain include: carotid artery dissection, head and neck cancer, referred pain from acute coronary syndrome, infections as retropharyngeal abscess, spondylosis, spinal canal stenosis and severe spinal disc herniation[4].

When the neck muscles contract, they can apply pressure to the bones of the neck, causing slight deviations in positioning resulting in pain and a stiff neck. If the stress situation continues, the pain persists and becomes chronic[5]. Pain develops in the neck and may spread to the shoulder or base of the skull. Movement of the neck feels restricted[6].

The head is supported by the neck, which is made up of seven vertebrae stacked one on top of the other and cushioned by discs of cartilage. The lower joints in the neck provide the main supportive structure for the head to sit on. Muscles of the neck provide movement and additional support. Thus, when the support system is affected muscles in the area tighten[7].

Anatomically, the trapezius muscle is a large, superficial muscle that is supplied by the spinal accessory nerve and is composed of upper, middle, and lower-functional segments. Physiologically, the trapezius muscle is a major scapular stabilizer and contributes to scapulothoracic rhythm by elevating, rotating and retracting the scapula[8].

To keep the body and head in an erect posture and coordinate the neck and upper-back movements, this muscle always requires sustained contraction. It has been found that trapezius muscle spasm is common with chronic neck pain whatever its cause[9].

Therefore, we hypothesize chronic trapezius spasm associated with chronic neck pain, might result in compression of the spinal accessory nerve, leading to weakness of the trapezius muscle, thus weakening one of the cervical spine support systems and as a result causing neck pain.

Several causes were found to affect the spinal accessory nerve; for instance, nerve injury occurs after a penetrating trauma to the shoulder or surgical dissection in the posterior triangle of the neck[10]. Neuropathy may result in association with Vernet syndrome (i.e., tumor near jugular foramen) poliomyelitis, motor neuron disease, brachial neuritis, syringomyelia, or enlarged posterior cervical lymph nodes near the nerve[11].

Therefore, we aimed to investigate the presence of spinal accessory neuropathy in patients with chronic neck pain.

MATERIALS AND METHODS

Patients

Thirty patients diagnosed with chronic neck pain were included in the study and were referred for neurophysiological evaluation. They included patients of both genders between 17 years and 64 years of age (36.97 ± 12.45 years). A control group of 10 healthy subjects of both sexes and age matched with no prior history of cervical pain were included in the study.

Patients, who had given their permission, were recruited randomly at the Rheumatology and Rehabilitation outpatient clinic from December 2011 through February 2012 by the two senior residents at the Suez Canal University Hospital. Inclusion criterion was pain either regional or focal in the neck or shoulders for at least 6 mo. Patients were excluded if they had history of trauma, surgical procedure in the posterior neck triangle, injections or manipulation in the cervical area; history of diabetes mellitus, motor neuron disease, brachial neuritis and syringomyelia; or swellings (soft tissue or lymph nodes) in the posterior triangle of the neck. Trapezius muscle examination was performed by inspection for muscle status, presence of fasciculation and palpation of the muscle for spasm. To assess range of motion, we observed the patient while tilting and rotating the head, shrugging both shoulders, and abducting both arms. To assess the strength of the trapezius muscle we asked the patient to perform the same range of motion, testing against resistance. Full neurological examination was performed to clinically exclude peripheral neuropathy and motor neuron disease.

Table 1 Electrophysiological results of the study groups (mean ± SD)

	Cases (n = 30)	Control (n = 10)	P value
Latency in millisecond (ms)			
Left	2.98 ± 0.61	2.33 ± 0.36	0.006[1]
Right	2.96 ± 0.69	2.44 ± 0.38	0.028
Amplitude in millivolt (mv)			
Left	3.29 ± 0.39	3.32 ± 0.42	0.924[1]
Right	3.36 ± 0.39	3.38 ± 0.48	0.899[1]

[1]Mann-Whitney U test.

Cases were categorized into stressful work according to tasks that require more manual handling, specific posture, ergonomic stressors, repetitive actions and intensity of labor *vs* the amount of time or money. Otherwise, work tasks were classified as non-stressful. Informed consent was obtained from all patients and controls before the study according to the regulations mandated by the Research Ethics Committee at Suez Canal University.

Methods

Dantec Keypoint® 4 electromyography was used for spinal accessory nerve conduction studies (NCSs). During the NCSs, subjects were seated and relaxed with naturally suspended arms to minimize muscular movement in the test. We then used a bipolar electrode for stimulation, which was performed at the posterior border of the sternocleidomastoid, midway between the mastoid process and the suprasternal notch at the level of the upper margin of the thyroid cartilage.

Surface electrodes were placed using a technique similar to that of Cherington[12], we placed paired electrodes with the active electrode at the midpoint between the acromion of the scapula and the bony prominence of the seventh cervical spinal process and the reference electrode on the acromion. The ground electrode was placed between the stimulation and recording electrodes.

The latency and amplitude of the compound motor action potentials (CMAPs) were measured from baseline to peak and calculated automatically; the results were interpreted according to Kraft[13] (latency, 1.8-3.0 ms, amplitude, 3-4 mv). Skin temperature, measured at the neck by surface temperature-recording label, ranged from 32 ℃ to 34 ℃.

To assess the disability caused by neck pain, we used the neck disability index (NDI) questionnaire. The NDI is a 10-item self-administered questionnaire measuring disability in patients with neck pain. Each item is scored from 0 to 5 for a maximum score of 50; the higher the score, the greater the disability. Disability percent is calculated by multiplying the results by two[14].

Statistical analyses

Student t tests, χ^2, and Mann-Whitney U test were performed for two sample comparisons of neck pain duration, neck pain questionnaire results and NCS findings between patient groups and controls. The analysis of variance test was used for three sample comparisons in the results of NDI between the symptomatic sides and non-symptomatic sides of neck pain patients. Level of significance was set at 0.05. All statistical analyses were performed with SPSS version 19.0 for Windows.

Table 2 Characteristics of subjects studied and neck disability index score

Characteristics	Number of patients	Score of NDI[3]	P value
Work task			
Stressful	22	34.7 ± 9.5	0.011
Non-stressful	8	24.5 ± 3.1	
Handedness			
Right	28	32.2 ± 9.7	0.766
Left	2	34.1 ± 8.7	
Sex			
Male	13	37.5 ± 9.8	0.007
Female	17	28.4 ± 7.4	
Pain site			
Right	6	27.3 ± 9.1	0.197[1]
Left	6	30.1 ± 6.8	
Both	18	34.8 ± 9.8	
Age (yr)			
< 40	18	28.2 ± 6.8	0.009[2]
⩾ 40	12	38.1 ± 9.8	
Disease duration (yr)			
< 3	11	30.1 ± 8.4	0.377
⩾ 3	19	33.4 ± 10.1	

[1]Analysis of variance test; [2]Mann-Whitney U test; [3]mean ± SD. Statistically significant at $P < 0.05$, comparison of patients in the study group. NDI: Neck disability index.

RESULTS

Thirty patients (17 females; 56.7% and 13 males; 43.3%) diagnosed with chronic neck pain were submitted in the study. Mean disease duration in patients with stressful work was 3.9 ± 2.1 years, which was longer than the mean disease duration in patients with non-stressful work (3.1 ± 1.9 years); however this difference was statistically insignificant.

Pain was bilateral in 18 patients (60%), localized to the Right (Rt.) side in 6 patients (20%) and localized to left (Lt.) side also in 6 patients (20%) (Table 1). Muscle spasm was experienced by 24 patients (80%). Restricted neck motion was present in five patients (16.6%). No one suffered from muscle wasting or weakness. The causes of neck pain in the patients studied were nonspecific due to physical stresses (8 patients, 26.7%), cervical spondylosis (17 patients, 56.7%) and mild cervical disc herniation (5 patients, 16.6%).

There was significant difference between cases and controls among means of Rt. and Lt. spinal accessory nerve latencies (P = 0.028, P = 0.006 respectively) with recordings on the upper segments of the trapezius muscles. No significant difference was found in Rt. and Lt. spinal accessory amplitude means between cases and controls (Table 2). Comparing the results of the NDI

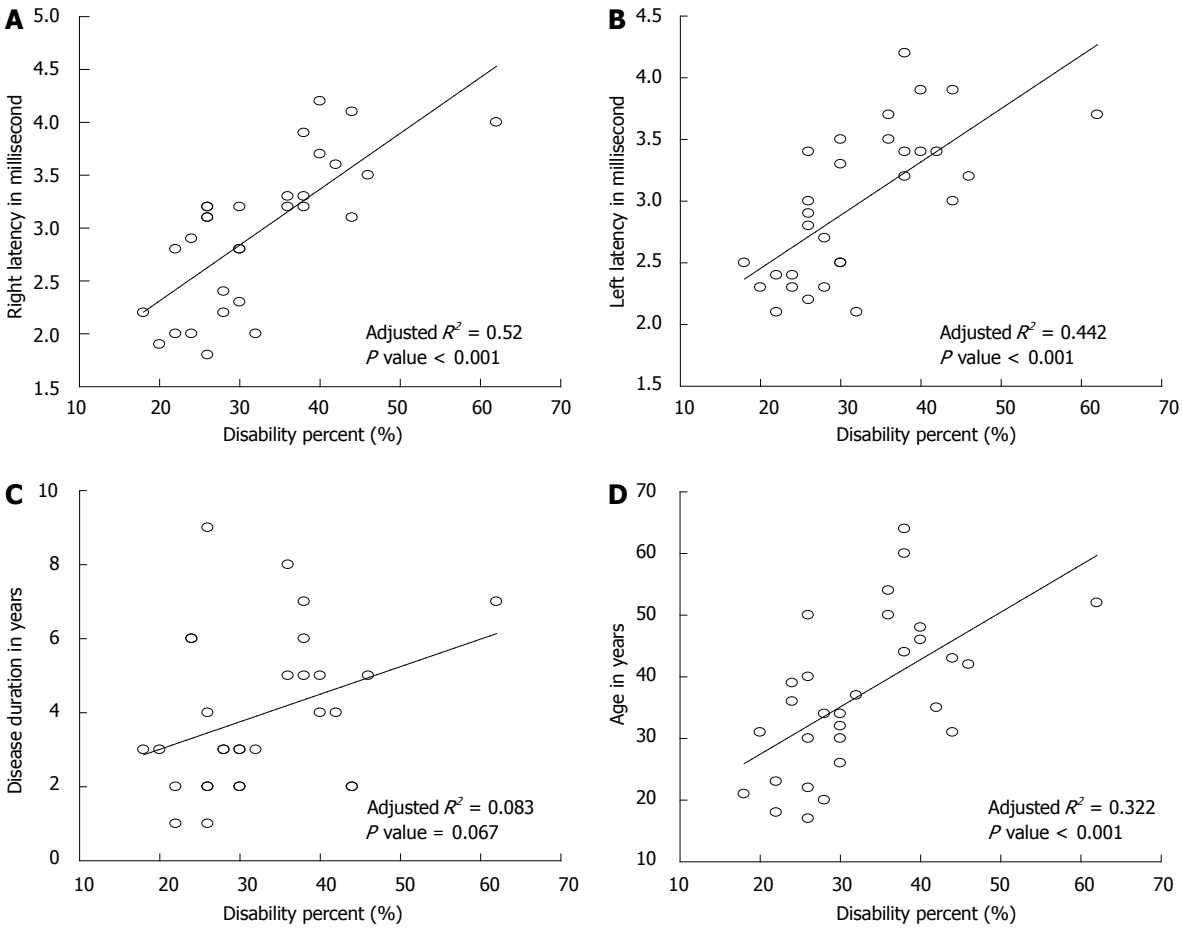

Figure 1 Relation between neck disability index and right latency (A), left latency (B), disease duration (C) and age (D).

to different characteristics in patients with chronic neck pain, we found that there were higher means in males, labor-intensive work and patients aged over 40 years; these differences were statistically significant (Table 2). Figure 1 consist of scatter plots showing positive correlation between Rt. and Lt. latencies and age with disability percent calculated by NDI.

DISCUSSION

Chronic neck pain is pain that occurs over a long period, usually more than six months. There are many causes for this condition[7]. Chronic neck pain is associated with spasm in neck muscles one of which is the trapezius muscle[15].

The trapezius is a large muscle that anatomically consists of three distinct parts: descending, transverse and ascending, which play different but complementary roles in trapezius muscle function[16]. Its main role is related to shoulder movement but it is also essential to keep the head in an erect posture and coordinate neck and back movements by sustained contraction. It is supplied by the spinal accessory nerve[17].

Our study of spinal accessory nerve conduction shows normal values for CMAP amplitude but with prominently prolonged latencies in comparison to the control group.

These results contradicted those of Chang *et al*[9] who searched for spinal accessory nerve neuropathy in myofascial pain syndrome (MFPS) and found that the amplitude of CMAPs of spinal accessory nerves recorded from the upper segments of trapezius muscles were significantly smaller in the symptomatic and asymptomatic sides of MFPS patients than in controls. There were no significant differences regarding latencies and nerve conduction velocities between the symptomatic and asymptomatic sides neither of MFPS nor between cases and controls. They explained these electrophysiological findings by axonal loss or axonal degeneration, which affect a small fraction of nerve and translated clinically as asymptomatic or normal muscle strength, as they found in their MFPS patients. They found that this degeneration may result from fibrosis and taut band associated with MFPS.

Our study found different results as the pathology is different between the two cases. The prolonged latencies in our results indicated that the fastest conductive fibers in the spinal accessory nerve are affected. However, the nerve fibers reacting to stimulation and their supplying muscle fiber are normal. This phenomenon is typical electrophysiologically evident of demyelination. These results confirm our early hypothesis that the spinal accessory nerve may be affected by prolonged neck spasm associated with cases of chronic neck pain.

These findings can be explained as the upper segment of the trapezius muscle is the major portion that is responsible for most of the shoulder and neck movements, and stabilization of the scapula. Certain postures or positions of the shoulder and neck, especially neck spasm, may increase pressure around the spinal accessory nerve. This has been recognized with increased frequency for nerve compression, progressing to demyelination of the nerve, which leads to electrophysiological changes[18].

The exact pathological changes affecting the nerves after prolonged compression have been thoroughly explained in many studies. Early changes consist of edema of the subperineurial space occurring within four hours of compression. Inflammation and fibrin deposits occur from 24-36 h and are followed by proliferation of endoneurial fibroblasts and capillary endothelial cells[19,20]. Demyelination and Schwann cell necrosis appears at seven and ten days of compression[21,22]. Other findings include thinning of the myelin along with evidence of degeneration and regeneration of fibers[23]. Thus the most obvious function disturbance will be related to affection of the myelin sheath that is translated in nerve conduction as prolonged latency.

Measurement of the impact of neck pain on the sufferer presents a challenge due to the variability in pain intensity between patients, and the effect of the disorder on physical and psychological functions[24].

Overall, the literature agrees that the NDI is a valid, reliable, responsive and internally consistent clinical tool to measure self-reported disability as it relates to patients with neck pain[25]. We used the NDI to correlate the disability associated with chronic neck pain and our electrophysiological findings.

Our results revealed that there were strong correlation between Rt. and Lt. spinal accessory latencies and NDI disability percent. These may indicate that spinal neuropathy is associated with further burdens in addition to the primary pathology. This observation is in accordance with the results of Baker[17] (2008), who mentioned that spinal accessory neuropathy causes impaired arm mobility and neck pain.

COMMENTS

Background

Pain located in the neck is a common medical condition. Neck pain can come from a number of disorders and diseases of any tissue in the neck. Examples of common conditions producing neck pain are: degenerative disc disease, neck strain, neck injury such as in whiplash, a herniated disc, or a pinched nerve. The trapezius muscle is a large, superficial muscle that is supplied by the spinal accessory nerve, is a major scapular stabilizer, and contributes to scapulothoracic rhythm by elevating, rotating and retracting the scapula.

Research frontiers

Chronic neck pain is usually first treated by examination to discover the particular reason for an individual's suffering, which can occasionally be difficult. After discovering the reason for a patient's chronic neck pain, it is then treated. To keep the body and head in an erect posture and coordinate the neck and upper-back movements, the trapezius muscle always sustains contraction. It has been found that trapezius muscle spasm is common with chronic neck pain whatever its cause.

Innovations and breakthroughs

In this study, the authors tried to understand the relation between chronic trapezius spasm and chronic neck pain. We hypothesized that chronic neck pain might result in compression of the spinal accessory nerve, leading to trapezius muscle weakness, thus weakening one of the cervical spine support systems and as a result causing neck pain.

Applications

The study results suggest that there is electrophysiological evidence of demyelination of the spinal accessory nerve in a significant proportion of patients with chronic cervical pain.

Terminology

Chronic neck pain is pain that occurs over a long period, usually more than six months. There are many causes for this condition. The pain can range from mild to severe. The spinal accessory nerve is located under the skin on the side of the neck and controls the trapezius muscle, which stabilizes the scapula and shrugs the shoulder.

Peer review

This is a very interesting article which demonstrates the presence of demyelination of the spinal accessory nerve in a significant number of patients with chronic cervical pain. These findings open the discussion about some points such as, the use of certain drugs, mainly those that control neuropathy pain like Pregabalin, and what would be the economic impact of this pathology.

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