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RELATIONS BETWEEN SELF-RATED MUSCULOSKELETAL SYMPTOMS AND SIGNS AND PSYCHOLOGICAL DISTRESS IN CHRONIC NECK AND SHOULDER PAIN

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ABSTRACT. The purposes of the present study were to describe physical and psychological characteristics of 55 chronic pain patients with predominantly nociceptive neck and shoulder complaints, and to explore relationships between physical assessment methods, self-reported pain and psychological distress. The physical measures included cervical and shoulder mobility and muscle tenderness. The Pain Severity and Interference subscales from the Multidimensional Pain Inventory (MPI), Becks Depression Inventory (BDI), State-Trait Anxiety Inventory (STAI-Y), and a pain drawing assessed self-reports of pain and psychological distress.

The number of tender points (TP score) correlated significantly with pain severity, ($p < 0.01$) Interference ($p < 0.05$), pain drawing score ($p < 0.05$), BDI ($p < 0.05$) and state anxiety ($p < 0.05$). No significant correlation was seen between TP score and age, pain duration or trait anxiety. The results suggest that there are relationships between observers' ratings of muscle tenderness (TP score) and self-reports of pain severity, interference of pain and psychological distress in patients with chronic cervico-brachial pain.

Key words: anxiety, chronic pain, depression, disability, musculoskeletal, pain drawing, pain thresholds, psychometric, severity, tender points.

INTRODUCTION

Chronic musculoskeletal pain in the cervico-brachial region has become an increasing problem. National surveys in Sweden have shown that 12% of the working population experience pain in the neck and shoulder area every day or every other day (8). The aetiology of the problem is suggested to be multifactorial, with physical load, psychosocial factors and personal characteristics considered as important components (5, 12). An analysis of the complex aetiology requires investigation of the physical status, as well as of psychological and social parameters (33). Several types of physical measurements have been used to characterize musculoskeletal pain. Measurements of pressure pain thresholds (PPT) by manual palpation or algometers have shown increased pain sensitivity (10, 17, 22, 36). Furthermore, patients with neck and shoulder pain have shown decreased muscle strength (4) and lowered endurance (6) in the neck and shoulder region, and a decreased range of movement (ROM) in the cervical spine and shoulder (40). These signs are semi-objective and vary between patients, but are often associated with severe perceived disability.

While a great deal of research examining psychological factors has been conducted on low back pain, and musculoskeletal pain in general, rather fewer studies have investigated the same factors in neck and shoulder pain (20).

Psychological distress, such as depressive symptoms and anxiety, are often found in chronic pain patients (7, 24, 37, 38). A longitudinal study by Linton & Götestam (21) examined the correlation between self-rated pain, anxiety and depression in a sample of patients with unspecified chronic pain disorders. Significant correlation between the measures existed, although considerable variation occurred among patients (21). The notion of a causal relation between pain and psychological distress is supported by Magni et al. (24). From a prospective study, they concluded that depression promotes chronic musculoskeletal pain and that chronic musculoskeletal pain can predict depression. However, the hypothesis of depression and psychological distress as risk factors for developing chronic pain is controversial (38).

Many clinical trials have focused on patients' subjective pain reports or physical assessment of functional status in chronic neck and shoulder pain, whereas only a few attempts have been made to study the relationship between self-report assessments and functional measures. Kemmlert & Kilbom (14) found no correlation between self-reported pain and active mobility in a study of patients with neck and shoulder pain. Holmström & Moritz (11), however, found correlations between answers in a pain questionnaire, answers in a personal interview and clinical findings in low back pain patients.

Even though objective findings are often few in chronic musculoskeletal pain conditions, the presence of tenderness and lowered PPT can be taken as signs of increased pain sensitivity. In the present study, the number of tender points was used to reveal distribution and intensity of muscle tenderness in the neck/shoulder region.

The aims of this study were to characterize physical and psychological symptoms and signs in patients with long-term musculoskeletal pain predominantly in the neck and shoulder region, and to explore relationships between physical assessment methods, self-reported pain and psychological distress.

METHODS

Subjects

Fifty-five consecutive patients with chronic musculoskeletal pain referred to the Multidisciplinary Pain Center, Östra Hospital in Göteborg, were included in the study (Table I). Twenty-two patients were administrative employees, 13 were nurses, 11 had technical employment, 3 were bus drivers, 3 were working in service, 1 was a teacher and 2 were students.

The patients fulfilled the following criteria: (a) pain predominantly localized to the cervico-brachial region, and with a duration of at least 6 months; (b) no signs of neuropathic pain or widespread diffuse pain; (c) fluent in written and spoken Swedish; (d) no abuse of alcohol or drugs, and (e) not involved in litigation.

Procedure

On the first visit, the patients were informed about the study, demographic information was gathered and pain drawings were filled out. Within 5 days after their first visit to the Multidisciplinary Pain Center, the patients' physical status was assessed. Finally, the patients filled out several questionnaires assessing different aspects of pain and general psychological distress. All patients gave informed consent to procedures approved by the Ethical Committee of the Faculty of Medicine at Göteborg University.

Table I. *Descriptive statistics for the patients characteristics*

		mean	SD	range
Female:male (*n*)				40:15
Age (years)		46	10	(27–65)
	male	50	11	(28–62)
	female	44	10	(27–65)
Pain duration (months)		67	44	(7–150)
	male	72	37	(10–120)
	female	66	46	(7–150)
Working situation				*n*
Working, full time				21
Working, part time				3
Working/Sickness allowance				9
Studying				2
Sickness allowance, full time				10
Temporary disability pension				10

Pain drawing

The pain drawing consisted of front and back outlines of the upper part of the body, on which the patient indicated the region of pain. A transparency was made of front and back views and divided into 30 anatomical areas (Fig. 1). The pain drawing score (PDS) was based on the number of areas marked by the patient.

Physical status

Tender points. Tenderness in the neck, shoulder and arm muscles was assessed by manual palpation (19) using the second and third fingers at six anatomical sites bilaterally: (a) trapezius muscle at the midpoint of the upper border; (b) sternocleidomastoid muscle insertion at the lateral surface of the mastoid process; (c) levator scapula muscle insertion at the medial scapular border; (d) biceps bracchii tendon in the intertubercular sulcus of the humeral head; (e) deltoid muscle insertion on the lateral aspect of the humerus, and (f) extensor digitorum muscle insertion at the lateral epicondyle of the humerus. The sites were always examined in the same order. The finger pressure corresponded to a weight of approximately two kilograms measured on a scale. The scoring was defined as follows:

- 0 = no reaction and denial of tenderness;
- 1 = verbal report of tenderness;
- 2 = verbal report of pain;
- 3 = withdrawal or verbal report of marked pain.

Cervical range of motion (ROM). The Myrin® inclinometer (Medema AB, Bromma, Sweden) was used to measure cervical ROM. The method has been described in other studies measuring cervical ROM (16). ROM was

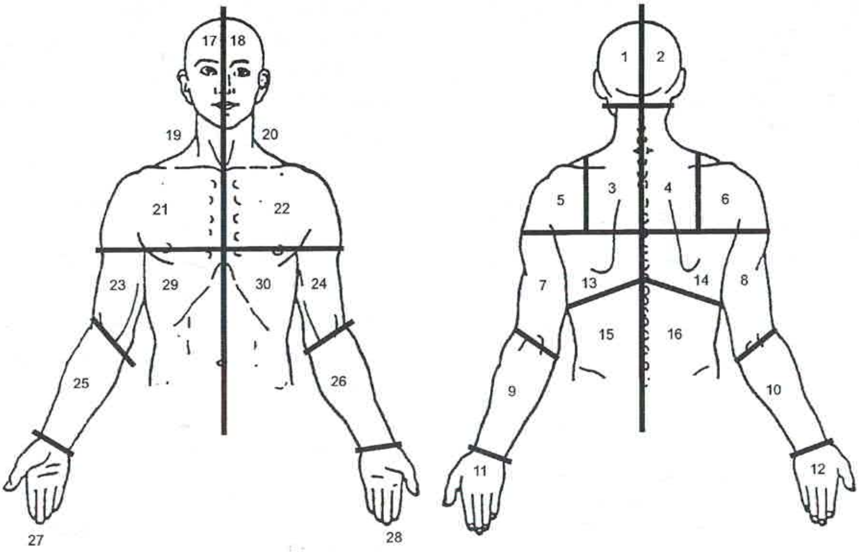

Fig. 1. Anatomical figure with 30 subdivisions of body surface for quantification in pain drawing.

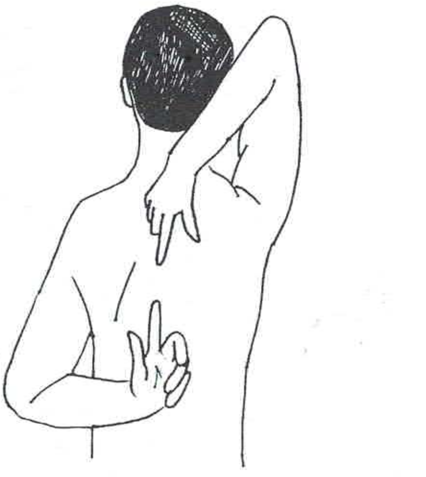

Fig. 2. Schematic description of the functional shoulder-arm movement (FSA).

assessed while the patient was sitting in a relaxed position with back support, looking straight ahead.

Cervical forward flexion/extension. A Velcro® band was fixed around the head. The inclinometer was placed just above the ear, the zero being lined up with the tragus. The patient inclined his head from a neutral position looking straight ahead, first towards his breast (flexion), then backwards (extension).

Cervical lateral flexion (lateral bending). ithout moving the band, the inclinometer was placed at the back of the head, with zero in line with the spinous process of C7. The patient bent his head to the side in both directions.

Cervical rotation. The Velcro® band was repositioned and attached under the chin. The inclinometer was placed on top of the head and the zero lined up with the bridge of the nose. The patient was asked to rotate the neck both to the left and right.

Patient's ROM was recorded twice in each of six directions. The maximum value for each direction was recorded. Identical instructions were given to each subject to make maximal excursion in each direction. Movement was carefully controlled that it only took place in the cervical joints.

Shoulder forward flexion. Sitting on a chair with back support, the patient lifted his/her arm forward and upward in the sagittal plane as high as possible, moving only the shoulder joint (2). The assessment, which was performed with a goniometer, was done twice for each arm. Only maximum value was recorded.

Functional shoulder/arm mobility (FSA). A composite movement assessing both shoulders/arms simultaneously was evaluated by asking the patient to rotate the left forearm/shoulder internally and position the hand as far up the spine as possible while making an abduction together with an external rotation in the right shoulder, trying to reach the indices behind his/her back (Fig. 2). This method is a common clinical test, but has not yet been validated. The diastasis (in centimetres) between the indices was measured with a measuring tape. The assessment was performed twice and the shortest diastasis recorded. Subsequently, the corresponding contralateral movement was performed (Right forearm/shoulder internal rotation; left shoulder abduction/externalrotation).

Psychometric measures

State-Trait Anxiety Inventory (STAI-Y). This scale consists of two parts of 20 items each, and evaluates how anxious the patient is "in general" (trait anxiety) and how anxious the patient is "at this very moment" (state anxiety) (31). Items are answered on a scale of 1 to 4, giving a theoretical range from 20 to 80 (maximal anxiety) for each part.

Beck Depression Inventory (BDI). This is a 21-item instrument which emphasizes cognitive symptoms of depression (3). The response format ranges from 0 to 3 (with 3 indicating maximal distress), giving a theoretical range from 0 to 63.

The Multidimensional Pain Inventory (MPI) (15). In this study, two out of the nine MPI subscales were used: Pain Severity and Interference. The Pain Severity subscale includes two items concerning pain intensity and one on degree of suffering due to pain. The Interference subscale contains eleven items concerning how pain interferes with daily activities.

Statistics

A Mann Whitney U-test was used to compare differences between men and women. The Wilcoxon signed-rank test was used to test differences within the subgroups. Correlations between variables were estimated using the Spearman rank correlation method. In order to make correlation analyses between ranges of movement in the cervical region and other variables assessed in the study, the patients were given a rank number depending on their relative results for the motion in the six directions being measured. A higher rank number equalled a larger range of movement. The six ranks were added together to form a "rank sum" for cervical range of motion. Adding the ranks to form a rank sum was also done for shoulder flexion (left and right) and shoulder rotation (left and right). The relationships between cervical and shoulder ROM scores and demographic and self-reports on pain and psychological distress were explored by means of correlation analyses. Results of $p < 0.05$ were considered significant. All tests were two-tailed.

RESULTS

Pressure pain thresholds

In clinical practice, the expression "tender point" refers to a point resulting in a pain sensation at weak or moderate pressure. A score of 2 or 3 was defined as pain (tender point), while a score of 0 or 1 was not. All tender points were added to a tender point score (TP score). The median TP score was 4 (range 0–11) (Table II). The sites most frequently rated as painful were: the insertion of the levator scapulae muscle and the origin of the extensor digitorum communis muscle (both on the right side), where 45 and 51% of the patients, respectively, rated the palpation as painful. The site which presented the fewest pain reports was the sternocleidomastoid muscle, with 7% (left side) and 18% (right side) of the patients reporting pain. Although the median TP score was 2 (mean 2.2) on the right side, and 1 (mean 1.7) on the left side, the difference was not statistically significant. The trapezius muscle, the sternocleidomastoid muscle, the levator scapulae muscle and the extensor digitorum communis muscle all showed significantly higher frequencies of tender points on the right side compared to the left side ($p < 0.05$). No significant difference was observed for the TP score between men and women. No significant correlation was seen between age or pain duration and TP score.

Cervical and shoulder motion

The average (SD) values for the six directions in cervical range of motion were as follows: flexion 50° (15), extension 55° (15), side flexion (left) 33° (8), side flexion (right) 33° (10), rotation (left) 59° (13), rotation (right) 56° (14). The values for forward flexion motion in the shoulder were 143° (17) and 149° (16) for the left and right sides, respectively. In the FSA mobility test, 2 out of 55 patients could reach their indices both ways. The distance (in centimetres) between the indices was 17 (12) when the left shoulder was rotated inward and the right shoulder rotated outward and 21 (14) when the right shoulder was rotated inward and the left rotated outward. No significant correlation was seen between any of the variables assessing range of motion in the neck/shoulder and the TP score. A significant correlation was seen

Table II. *Pain, depression and anxiety descriptors for the 55 patients*

	median	25th centile	75th centile	range
Pain severity	4	3.0	4.7	(1–6)
Interference	4	2.2	3.6	(1–6)
Pain drawing score	12	9.0	16.5	(3–26)
Tender point score	4	1.0	6.8	(0–11)
Depression (BDI)	10	6.5	15.0	(1–32)
State-anxiety (STAI-Y1)*	36	32.0	48.0	(20–68)
Trait-anxiety (STAI-Y2)	44	34.5	50.5	(21–64)

(* $n = 54$).

between cervical motion rank sum and age ($r = -0.336$, $p < 0.05$). Older patients had a lower range of motion than younger patients. A significant correlation with age was also found for shoulder rotation ($r = -0.381$, $p < 0.01$) but not for shoulder forward flexion. No correlation between pain duration and the neck and shoulder range of motion was seen.

Pain drawing

The median of the pain drawing score (PDS) was 12 out of 30 possible areas, ranging from 3 to 26 (Table II). All patients ($n = 55$) reported pain in the neck and shoulder region. Forty-three patients reported pain in their upper arms. Thirty-four and 37 patients experienced pain in their lower arms and hands, respectively. Thirty-three patients reported pain in the facial and head region. In the thoracic and lumbar regions, the numbers of patients reporting pain was 34 and 20, respectively (Fig. 3). In the analysis, the PDS correlated significantly with the TP score ($r = 0.280$, $p < 0.05$). A significant correlation between the PDS and the pain duration was also shown ($r = 0.363$, $p < 0.01$), while no significant correlation was seen for age ($r = -0.094$).

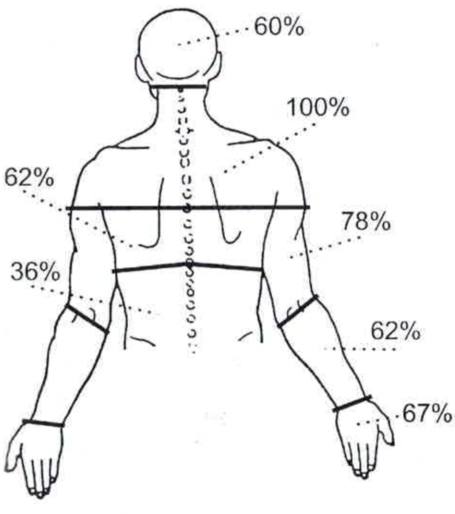

Fig. 3. Percentages of patients ($n = 55$) reporting painful sensations from the different areas in the pain drawing (see Fig. 1). Left and right side areas have been combined. Head and face (areas 1, 2, 17 and 18), neck and shoulder (3–6,19–22), upper arms (7, 8, 23 and 24), lower arms (9, 10, 25 and 26), hands (11, 12, 27 and 28), thoracic region (13 and 14) and lumbar region (15 and 16).

Depression

The BDI median score was 10 (range 1–32) (Table II). For six items, the patients' median score was equal to or higher than 1, showing that most subjects indicated some distress. These items included lack of satisfaction, irritability, work inhibition, sleep disturbance, fatigue and somatic preoccupation. A significant correlation between BDI and the TP score was observed ($r = 0.342$, $p < 0.05$). No correlation was seen between BDI and age or pain duration.

Anxiety

The median score for momentary perception of anxiety (state anxiety) was 36 (range 20–68) (Table II). The items most frequently rated with high scores were lack of satisfaction, lack of relaxation, feeling uncomfortable and lack of self-confidence. More than 20 of the subjects answered "moderately" or "very much so" on each of these items. A significant positive correlation was shown between state anxiety and the TP score ($r = 0.280$, $p < 0.05$)

The median score for perception of anxiety "in general" (trait anxiety) was 44 (range 21–64). The items most frequently rated with high scores included perceived lack of relaxation, feelings of tension, unstable mood and lack of satisfaction. More than 24 of the subjects answered "moderately" or "very much so" on each of these items. No correlation was found between trait anxiety and the TP score ($r = 0.113$).

Pain severity

The median score for the Pain Severity subscale was 4 (range 1–6) (Table II). Medians for the three items ranged from 3 to 4. A significant correlation was shown between pain severity and TP score ($r = 0.437$, $p < 0.01$).

Interference

The median value for the Interference subscale was 4 (range 1–6) (Table II). Medians for the eleven items constituting the subscale ranged from 1 to 5. Interference correlated significantly with TP score ($r = 0.279$, $p < 0.05$).

DISCUSSION

The major finding of this study was the relationship between TP score and self-ratings of different aspects of the pain condition. The higher the self-ratings of pain severity, the more sites were reported to be painful upon palpation. This is in agreement with the results of a study by Nakata et al. (28), who investigated the relationship between self-reported musculoskeletal discomfort and muscle pressure pain thresholds following repetitive light work tasks in healthy females. A significant difference in the number of tender muscles was found between the "most complaining group" and the "least complaining group". The relatively low correlation between pain severity and the TP score ($r = 0.437$) in our study could be due to the relative severity of tender points, i.e. one or two tender points could be very sensitive and thereby lead to a high pain severity score.

A comparison of the MPI scores for the patients with neck and shoulder pain in this study with the values for a group of 150 patients with long-standing pain in the lower back region (29) showed that our group had lower values of both pain severity and interference than the low back pain patients. The comparatively low values in our patients may depend on factors like pain aetiology, work/sick leave, pain duration, or age. Patients with organic causes for their pain have, in previous reports, shown higher pain tolerance than those without organic causes (27). A higher severity of pain also seems reasonable to find in patients on sick leave due to pain compared to patients who work. Since the majority of our patients were working or studying and were diagnosed as having nociceptive muscular pain, this could explain the rather low values for pain severity and interference of pain found in our study. The lack of a matched control group with pain in other locations limits the conclusion of a possible difference in perceived pain severity depending on the pain location.

Interference, the MPI subscale assessing disability due to pain, also showed significant correlation with TP scores. This finding agrees with the modest correlation found between physical measures and subjective disability reported previously (25).

A neuropharmacological basis for a common mechanism in both chronic pain and depression is suggested by the finding that both conditions are associated with changes in the serotonergic and noradrenergic transmission in the central nervous system. Substances implicated in the pain perception control (opioids, GABA) may also be linked to depression (23). In this study, significant correlations were found between pain (i.e. TP scores), BDI and state anxiety. However, the significant correlations between TP score and two out of the three psychological distress variables should be interpreted with caution, since significant intercorrelations were shown between BDI, state anxiety and trait anxiety. Six patients showed a BDI score above 21, which, in pain-free populations, may indicate depression. A symptom overlap between depression and chronic pain makes the assessment of depression difficult, and one should interpret the potential number of depressed patients with caution (7).

One of the items with the highest scores on the trait anxiety scale concerned feelings of tension. A long-standing increased muscle tension could lead to pain. Vasseljen (35) showed that perceived general tension was strongly associated with work-related neck and shoulder pain in employees in both manual and office work. He postulated that self-reported general tension possibly reflects a mismatch between work demands and personal control mechanisms, and might represent a link between poor psychosocial work environments and shoulder and neck myalgia. Theorell et al. (32) studied six different occupational groups and found that self-reported general muscle tension was associated with emotional factors, as well as with symptoms in the back, neck and shoulders.

The cervical motion ranges in this study were of the same magnitude as has been reported in other studies examining neck pain patients (10). Our results are consistent with previous reports, which suggest a progressive decrease in spinal mobility with increasing age (1). Alaranta and colleagues (1) also found significant correlation between cervical flexion–extension–movement and neck pain. The present study gave no support for this finding, nor was any correlation found between the TP score and the assessed mobility in neck and shoulder.

A somatic mechanism explaining the development of chronic neck and shoulder pain might have origin in long-standing static muscle load due to unfavourable body positions during work, leading to inflammation (26). Sensitization of polymodal nociceptors (18) resulting in primary hyperalgesia is common in inflammation due to the release of endogenous algogenic substances such as prostaglandins, bradykinin and substance P (13). Secondary to this event, the excitability changes in the spinal dorsal horn (secondary hyperalgesia) result in increased pain sensitivity also outside the inflamed region. The wide distribution of increased pain sensitivity in our patients suggests that descending pain inhibition from central structures is attenuated. Patients with fibromyalgia often have widely distributed pain and low pressure pain thresholds, expressed as multiple tender points. The pathogenesis of fibromyalgia is controversial; both peripheral and central mechanisms have been suggested (17). It is possible that some patients with symptoms similar to those in the present study may develop fibromyalgia at a later stage. However, patients with generalized pain and multiple tender points in all four quadrants of the body, according to the criteria for fibromyalgia (39), were excluded from this study.

Muscle tenderness was evaluated by finger palpation, which is the most commonly used method in clinical practice. Although the most reliable results are obtained when algometers are used, acceptable reliability has also been found for manual palpation (10, 30). Because of the difficulty in estimating exact pressure of palpation, differences between studies may be due to variations in pressure force.

Many researchers have explored possible gender differences in the occurrence of musculoskeletal pain. Hagberg & Wegman (9) have reported that female industrial workers have a risk six times greater of getting "tension neck syndrome" than male industrial workers. In our study, the difference in TP score between women and men did not reach statistical significance.

Significant positive correlation was found between the pain distribution in the pain drawing and the duration of pain. Whether pain has spread over time or been distributed widely from the debut of pain is not known. However, there is evidence that myofascial pain may spread over time (34). No other variables in our study showed any correlation with pain duration, suggesting that even if the pain spreads over time, severity, disability and distress seem not to be related to its duration.

The results of this study suggest that there are relationships between observers' rating of muscle tenderness (TP score) and self-reports of pain severity and interference of pain in patients with chronic cervicobrachial pain. However, psychological distress showed a low correlation to muscle tenderness.

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