

ORIGINAL REPORT

DO CERVICAL DEGENERATIVE CHANGES IN WOMEN WITH CHRONIC NECK PAIN AFFECT FUNCTION?

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Objective: Previous investigations suggest little association between clinical findings and radiographic degenerative findings. However, the association between degenerative changes and neck function has not been investigated.

Design: A cross-sectional study.

Subjects: Data were collected from 179 female office workers aged 25–53 years with chronic neck pain who were referred for institutional rehabilitation.

Methods: Radiographs of the cervical spine, and neck function including isometric muscle strength and passive range of motion were evaluated. All subjects completed self-report questionnaires including questions about neck pain and disability.

Results: Fifty-nine percent of the women presented degenerative changes and they were older than women without the changes ($p = 0.001$). Neck pain and disability were comparable when the patients were put into subgroups according to the radiological cervical changes. Neck mobility and muscle strength were comparable in women with or without degenerative changes, except for a lower rotational range of motion in women with degenerative changes ($p = 0.009$).

Conclusion: The results suggest that the degenerative changes in cervical plain films are poorly related to the severity of symptoms or neck function in women with chronic neck pain working in sedentary occupations.

Key words: cervical spine degeneration, mobility testing, isometric force, musculoskeletal pain, disability.

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INTRODUCTION

Neck pain is a common complaint among women of working age. Plain film radiography is widely used in the diagnostic evaluation of cervical complaints, although the role of the degenerative changes as a cause of cervical pain is unclear.

Degenerative changes in the cervical vertebrae and discs are common and it is well known that the incidence and severity of spinal degeneration increases with advancing age even in asymptomatic people (1). Peterson et al. (2) found that the number of levels and the severity of degeneration in the

discs, facets and uncovertebral joints on the radiographs are not related to the levels of pain and disability. Even magnetic resonance imaging (MRI) does not elucidate the aetiology of pain in most cases (3–6). However, Marchiori & Henderson (7) found a significant correlation between higher disability ratings in women and increased levels of disc degeneration in radiographs.

Patients with chronic neck pain have been reported to have decreased strength in the neck muscles and decreased cervical range of motion (ROM) compared with healthy unmatched controls (8–11). This was shown in a recent study in which patients and controls were matched according to gender, age, height and occupation (12).

The objective of the present study was to compare neck pain and disability, isometric muscle strength and cervical ROM in women with chronic neck pain with and without degenerative changes.

METHODS

Patients

Patients were recruited by occupational healthcare services, which were informed about the study and the inclusion and exclusion criteria.

Inclusion criteria. Female gender; age 25–53 years; office worker; permanently employed; motivated to continue working; motivated for rehabilitation; and having chronic neck pain (> 6 months).

Exclusion criteria. Specific neck diseases; frequent migraine; peripheral nerve entrapment; fibromyalgia; shoulder diseases; inflammatory rheumatic diseases; severe psychiatric illness; other diseases preventing physical loading; and pregnancy.

On the basis of clinical examination, physicians working in the occupational healthcare services referred 347 potential participants, who completed a questionnaire on their current health and symptoms. Before inclusion in the study, the questionnaires were checked by a specialist in physical medicine and rehabilitation (MN) to ensure that the subjects fulfilled the inclusion and exclusion criteria. After exclusion of 168 applicants who did not meet the criteria, a total of 179 females were enrolled in the study (13).

Assessment of cervical X-rays

An antero-posterior view, a lateral view, an odontoid view and 2 oblique views of cervical plain films were marked as either intact or degenerated (showing one or more of the following: vertebral osteophytes, uncovertebral or facet joint arthrosis) by a physician experienced in assessing degenerative changes in cervical radiographs (MN). Assessment of the X-rays was performed prior to the measurements of neck function or assessment of pain and disability. The physician who

read the radiographs was blinded for the symptoms and neck function results of the subjects.

Measurement of neck function

The isometric neck strength measurement system (Kuntoväline Ltd, Helsinki, Finland) was used to assess maximal neck strength. The tests were performed 3 times in each direction and the best results were used in data analysis (12). The reproducibility of the neck strength measurements in chronic neck pain has been shown to be good (12).

A three-dimensional motion-testing device for the cervical spine (Kuntoväline Ltd) was used to measure passive ROM in the sitting position towards flexion, extension, lateral flexion and rotation (14).

All the strength and mobility tests were performed blind by the same experienced physical therapist without being aware of the results of the X-rays.

Assessment of pain and disability

Subjectively perceived neck pain during the previous week was assessed by visual analogue scale (15) and functional deficits were measured by modified neck and shoulder pain and disability index (16) and Vernon neck disability index (17)

Statistics

Results were expressed as means with standard deviations (SD) or medians with interquartile range (IQR). Statistical comparison between groups was made by using *t*-test, Mann-Whitney *U* test (Monte Carlo *p*-value) and analysis of covariance (ANCOVA). Multivariate approach was made using Hotelling's T^2 or rank-based Hotelling's T^2 (Monte Carlo *p*-value), where appropriate.

RESULTS

Degenerative changes were present in 59% of patients with chronic neck pain. Women with degenerative changes in the cervical spine were older than women without changes ($p < 0.001$), but no difference was found between the groups for the variables height, weight, body mass index or duration of symptoms (Table I).

Neck pain and disability did not differ between the women with or without the degenerative changes (Table I). Women

Table I. Demographic and clinical data (mean with SD within parentheses) and pain and disability ratings (median with IQR within parentheses) for women with or without spondylosis of the cervical spine.

	Spondylosis		<i>p</i> -value
	Not present (<i>n</i> = 73)	Present (<i>n</i> = 106)	
<i>Demographic</i>			
Age, years	43 (6)	47 (4)	< 0.001
Height, cm	165 (5)	164 (5)	0.11
Weight, kg	69 (11)	68 (11)	0.58
Body mass index, kg/m ²	25 (4)	25 (3)	0.94
<i>Clinical</i>			
Duration of neck pain, years	8.4 (5.7)	8.1 (6.1)	0.77
<i>Ratings</i>			
Neck pain (VAS)	58 (43, 73)	58 (43, 70)	0.58
Vernon neck disability index	22 (16, 28)	20 (16, 28)	0.69
Neck and shoulder pain and disability index	35 (27, 43)	37 (26, 48)	0.28

Rank-based multivariate *p*-value (Hotelling T^2): $p = 0.33$.

SD: standard deviation; IQR: interquartile range; VAS: visual analogue scale.

with degenerative changes had significantly smaller ROM in rotation ($p = 0.009$), but not in lateral flexion and from flexion to extension compared with the other women (Table II). In multivariate analysis after adjustment for age and duration of the symptoms the overall mobility of the cervical spine was lower in women with degenerative changes (Hotelling's T^2 $p = 0.002$). Isometric neck muscle strength towards all directions tested was comparable between the groups (Table II).

DISCUSSION

Despite long-standing neck pain, only 59% of women with chronic neck pain had degenerative changes in cervical plain radiographs. They were older than women without the changes. Furthermore, degenerative changes could not be found by utilizing neck disability indices. From neck function measurements rotational ROM and the overall mobility of cervical spine were lower in women with degenerative changes.

This is partially in line with the earlier studies: the cervical ROM decreases with increasing age (18, 19), while the degenerative changes increase with age (1). Dvorak et al. (18) studied age- and gender-related cervical ROM using passive movements, as in our study, and thus their results are more comparable with ours than those of Castro et al. (19) who used active movements. The results of Dvorak's group (18) showed a significant reduction in both flexion-extension, lateral bending and axial rotation from age group 30–39 years to age group 40–49 years in asymptomatic females. In our study only axial rotation reduced significantly, although the other movements also decreased. The attempted maximal passive rotation used in the testing procedure may cause pain in a degenerated cervical spine, resulting in a reflexory muscular contraction that limits the ROM. Another possibility is that the degeneration mechanically limits the ROM in rotation earlier than it limits movements in other directions.

Most studies have failed to show a link between degenerative changes in the cervical spine imaging and neck pain (2–6) and

Table II. Passive range of motion (mean with SD) and isometric neck strength (mean with 95% CI) of the cervical spine in women with or without spondylosis of the cervical spine.

Variables	Spondylosis		<i>p</i> -value‡
	Not present (<i>n</i> = 73)	Present (<i>n</i> = 106)	
<i>Passive range of motion</i>			
Rotation, deg.	165 (15)	156 (15)	0.009*
Lateral flexion, deg.	86 (11)	81 (12)	0.26*
Flexion to extension, deg.	124 (13)	124 (14)	0.25*
<i>Isometric neck strength</i>			
Flexion, N	57 (21)	57 (17)	0.40†
Extension, N	132 (42)	133 (34)	0.36†
Rotation, right, Nm	6.0 (1.7)	5.9 (1.5)	0.80†
Rotation, left, Nm	6.6 (1.7)	6.4 (1.6)	0.82†

* $p = 0.002$; † $p = 0.85$.

‡Analysis of covariance (ANCOVA), age values as covariate.

Multivariate *p*-value (Hotelling T^2).

SD: standard deviation; CI: confidence interval.

the same is true of the present study. For extremity joints, it is known that pain may be present years before any degeneration can be seen on plain films (20). The pain may be due to the synovial irritation caused by the degradation products of a very early phase of the cartilage degeneration. The facet joints are synovial, and thus prone to this same chemical synovitis and pain, even though plain films may show no degenerative changes. Likewise, pain may arise from inter-vertebral discs with normal appearance, not only in plain radiographs but also in MRI, as shown in the discography studies by Shellhas et al. (4). The nociceptors and mechanoreceptors in the annulus fibrosus mediate nociception from structural disruption of the inter-vertebral disc itself or from the chemically mediated inflammatory effect of, for example, phospholipase A2 (21, 22). Conversely, even grossly deformed joints, such as knee joints, may be painless, in addition to a spine with advanced degeneration of the inter-vertebral discs. In conclusion, non-invasive imaging shows structural changes in the spine, but may not be able to reveal the pain generator, if present.

It is also likely that the spinal skeletal structures are of minor importance, while the more important sources of non-specific cervical pain and decreased ROM are related to soft tissue. This is supported by a recent study showing that active muscle training is an effective treatment for chronic neck pain and disability, including restricted ROM (13).

Epidemiological studies have shown that women experience chronic neck pain more often than men, and thus study populations have commonly consisted of women, as in this study. Detailed exclusion criteria for the subjects were established in order to minimize confounding factors. These included specific reasons for neck pain and conditions that may interfere with successful and safe testing or radiological investigation.

Our results demonstrate that women with radiological degenerative changes cannot be identified on the basis of symptoms. The functional measurements suggest that degenerative changes may affect the mobility of the cervical spine, but not the isometric neck muscle strength. From a clinical viewpoint, the present study suggests that, among working-age women in sedentary occupations, plain radiographs of the cervical spine provide very little clinically relevant information. This study therefore supports the clinical guidelines recommending medical imaging of the cervical spine only if signs or symptoms of a severe disease are observed (23).

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