Subjective health complaints in patients with chronic Whiplash Associated Disorders (WAD). Relationships with physical, psychological, and collision associated factors

Camilla Ihlebæk[1], Arit Ødegaard[2], John Vikne[2], Hege R. Eriksen[1,3] and Even Lærum[4]

[1]*The Research Unit, The Norwegian Back Pain Network, Unifob helse, University of Bergen, Norway*
[2]*Friskvernklinikken, Asker, Norway*
[3]*Department of Education and Health promotion, University of Bergen, Norway*
[4]*The Communication Unit, The Norwegian Back Pain Network; Ullevål University Hospital, Norway*

Correspondence: Camilla Ihlebæk, Section of Occupational Health and Social Insurance Medicine, Department of General Practice and Community Medicine, University of Oslo, P.O. Box 1130 Blindern, NO-0317 Oslo, Norway
Telephone: +47 22850608 Telefax: +47 22850590 E-mail: Camilla.ihlebaek@psych.uib.no

ABSTRACT

Aims: Investigate subjective health complaints (SHC) in chronic whiplash associated disorder (WAD, grade I & II) patients, and to identify physical, psychological, and collision associated factors that might be associated with high levels of comorbidity. ***Method***: During the years 2000-2002 171 chronic WAD patients filled in questionnaires and underwent physical examination. The prevalence of SHC was recorded and compared with a representative sample of the Norwegian population (n=1014). ***Results***: The chronic WAD patients reported higher number of subjective health complaints (median: 9) than the general population (median: 5). They showed significantly higher risk of reporting all musculoskeletal complaints, palpitation, heat flushes, sleep problems, tiredness, dizziness, anxiety, depression, breathing difficulties, chest pain, coughing, heartburn, gas discomfort, and obstipation. The patients with the highest level of comorbid subjective health complaints also reported more function loss, reading difficulties, poorer quality of life, higher psychological distress, higher use of medication, and less optimism about their situation. There were no differences however, in any collision factors or physical meassures recorded by physiotherapists between the high, medium and low comorbidity groups. ***Conclusion***: The high comorbidity of other complaints, the strong relationships between degree of comorbidity and psychological factors, and the lack of relationships between degree of comorbidity and collision factors and physical tests, suggest that chronic WAD is best understood as a syndrome and not simply as a neck injury. Sensitization is suggested as a possible psychobiological mechanism.

INTRODUCTION

Whiplash was defined in 1995 by the Quebec Task Force as an acceleration-deceleration mechanism of energy transfer to the neck. It may result in bony or soft tissue injuries (whiplash injury), which in turn may lead to a wide variety of clinical manifestations (whiplash-associated disorders) (WAD) graded 0 (none) I-II (symptoms with unknown pathology), III (symptoms and neurological signs), and IV (symptoms and cervical fracture and/or dislocation) (1). Grade I and II patients represent up to 90% of "whiplash injury claims" (2). The annual incidence of acute WAD is reported to vary from 0.8 to 4.2 per 1000 inhabitants, depending on the populations studied, type of accidents, and inclusions and exclusions criteria of studies (3). The proportion that report pain and disability 6 months after the accident (i.e. chronic WAD) varies substantially between studies and countries (4-6).

Pain in neck, head and shoulders are prevalent in chronic WAD patients, together with related symptoms like neck stiffness, dizziness, fatigue, sleeping and concentration problems (3,7), and impairment in cognitive performance (8). A higher prevalence of allergy, breathing disorders, hypertension, cardiovascular disorders and digestive disorders with moderate or severe impact on health has also been reported (9). There have also been reported higher prevalence of depression and anxiety in chronic WAD patients (10), and a history of psychiatric disease have been found to be associated with chronic WAD, and might suggest that development of chronic symptoms after a whiplash injury might be associated with psychiatric vulnerability (11). Psychological factors are suggested to be more important than collision severity in predicting the severity of complaints in collision victims with WAD grade I and II (12), and several studies have suggested that a psychosomatic or psychosocial approach is

necessary to understand the development of chronic WAD (12,13). As with other functional somatic syndromes, it is a problem that the complaints involved are very common in the general population and that there often are no specific symptoms or findings that are specific for chronic WAD. Comorbidity is a common feature of functional somatic syndromes, although the prevalence of comorbid complaints in patients seems to vary considerable within the different syndromes (14,15).

The aim of this study was to investigate subjective health complaints in chronic WAD patients, and to identify physical measures, and psychological and collision factors that might be associated with high levels of comorbidity.

METHODS

Material

General population

In spring 2003 the opinion poll firm Norwegian Gallup collected data during the monthly national omnibus registrations. A standard procedure of computer assisted telephone interviewing was followed: A sample was drawn randomly, using telephone numbers in proportion to the population in each small municipally, to ensure a representative sample of the adult population (≥15 yrs). The respondent in each household was selected by interviewing the one who had the most recent birthday, with five recalls if not reached. The procedure was repeated until the needed sample of approximately 1000 was obtained (N=1014). Classic response rates for quota sample surveys are not quantifiable; however it is indicated that 30 to 55% of eligible subjects responded at each survey. The main reasons for not participating is usually lack of time, objections to telephone interview, or no particular reason.

WAD patients

Patients were recruited through a large insurance company from 2000 to 2002 requesting their participation in a large intervention study at Friskvernklinikken, Asker. Patients of both genders (18-60 years) that had experienced a traffic accident 6-12 months earlier and with symptoms according to WAD grade I-II (1) were selected. Patients that were pregnant, had known abuse of alcohol and drugs, serious illness, or pronounced language difficulties were excluded. Based on the executive officers registrations from the insurance company, approximately 85% of the persons asked were included in the study, resulting in 171 patients from all five health regions of Norway. All patients had unsettled insurance claims. Included patients were referred for a physical examination by a specialist in manual therapy and a physiotherapist at Friskvernklinikken, an out-patient clinic for physical medicine and rehabilitation in Norway. Here they also answered a questionnaire.

Ethics

Informed and written consent was obtained from all patients. The study was approved by the Regional Committee for Medical Research Ethics.

Measurements

The questionnaire contained questions about current quality of life (worst possible=1, best possible=10), use of medication (1=never, 2=weekly or more seldom, 3=daily), and two statements regarding optimism concerning their neck pain (no/yes).

Subjective health complaints

The Subjective Health Complaints Inventory, SHC, consists of a list of 29 common health complaints, such as different musculoskeletal, gastrointestinal, and allergic complaints, breathing difficulties, palpitation, dizziness, tiredness, sleep problems, anxiety, depression, and flu related complaints (16). Responders are asked to grade intensity of each complaint on a four-point scale (0=not at all; 1=a little; 2=some; 3=severe) as experienced last month.

Education

Education was measured by a variable consisting of 6 categories: 1=no education, 2=1-6 years of elementary school, 3=7-9 years of elementary school, 4=high school, 5=1-4 years of education at university level, and 6=more than 4 years of education at university level. For the purpose of this study the variable was recoded into three categories: 1+2+3=elementary school, 4=high school, and 5+6=university.

Marital status

Marital status was measured by 5 categories: 1=single, 2=married, 3=living together, 4=widower, 5=divorced. For the purpose of this study marital status was dichotomized to single (1+4+5) and married (2+3).

Collision factors

All information on collision factors was based on self-report. The patients were asked about position in vehicle (driver, front seat passenger, back seat passenger), type of accident (rear end, side on, head on, or other), if the car was condemned after the accident (no/yes), and speed of own vehicle at the time of the accident. In addition they were asked what immediate actions that were taken in terms of X-ray and MR, and if they were sent to an emergency centre, emergency room at a hospital, to their general practitioner, or both emergency centre and hospital.

Physical activity

The patients were asked to indicate in the questionnaire if they had been physically active during the last year on a regular basis. Physical activity was defined as doing sports, walking etc. for more than 45 minutes, and the categorized answers were 1=no, 2=once a

week, 3=twice a week, and 4=three or more times per week. For the purpose of this study physical activity was dichotomized to < twice a week (1+2) and ≥ twice a week (3+4).

Self-reported disability

A modified version of the Roland & Morris disability questionnaire (17) was applied, using "neck" instead of "back" in describing symptom localization. The Roland & Morris disability questionnaire consists of 24 statements regarding activity restrictions in daily life, and the respondents are asked to indicate which statements describe best their current status. A sum score was calculated (range 0-24); a sum score above 14 is usually regarded as having severe activity limitations.

Sickness absence

Patients were asked to report if they were on current sick leave (no/yes).

Psychological distress

The HSCL-25-item questionnaire was used to register psychological distress with the sub-dimensions anxiety, depression and somatisation during the last week (18,19). A mean total-score equal to or above 1.75 is usually regarded as a psychiatric case (20).

Physical measures

BMI
The specialist measured weight and height of each patient, and BMI was calculated.

The physiotherapist recorded several physical measures and tests:

Aerobic capacity
Aerobic capacity was measured using the Aastrand's test (21). This is an indirect method of calculating the maximal oxygen consumption using large muscle groups on an ergometer-bicycle. The patient is brought into a steady state of pulse at a fixed working load. The value is compared with a table concerning the patient's sex and age. The result is used as an indicator of VO_2 max.

Neck stability
Neck stability testing was registered as the patients' ability to hold (in seconds) his head in a fixed position (22). The patient was lying supine, holding his head in a mid position slightly elevated from the surface. The patient was instructed to slightly withdraw his cheek to achieve a mid position.

Cervical range of motion
Cervical range of motion (ROM) was measured using the Cervical Measurement System (CMS) (23) with the patient in a sitting position. By using a device formed as a helmet and mounted with compasses on top, side and front, one is able to read the range of motion in degrees.

Statistics

SPSS 12.0.1 for Windows was used for the statistical analyses. Logistic regression was used to analyze differences between WAD patients and the general population in risk of reporting complaints. Gender, age and educational level were included in the analysis to control for potential confounding effects. Odds ratios and 95% confidence intervals were calculated for WAD patients vs. the general population both for reporting any complaints (score above 0) and for reporting substantial complaints (score above 1) for each of the 29 complaints. A score of number of subjective health complaints was constructed, excluding neck pain (0-28). Frequencies of having 0 to 28 complaints were calculated. Percentiles (33.3 and 66.7) were used to divide the patients into low (≤ 7 other complaints), medium (8-11 other complaints), and high comorbidity groups (12-28 other complaints). Differences between groups were tested by chi-square and ANOVA, and tests for trends were conducted by linear-by-linear associations (categorical variables) and linear regressions (continuous variables).

RESULTS

The WAD patients had a significantly higher proprtion (67%) of women than the general population sample (51%) (p<.001). The WAD patients were also significantly younger (mean (95% CI): 36.2 (34.4-37.9)) than the general population sample (46.3 (45.3-47.4), p<.001). There were no significant educational differences.

Chronic WAD patients vs general population

The chronic WAD patients reported higher number of subjective health complaints (median: 9) than the general population (median: 5) (figure 1).

The most common complaints in WAD patients were headache, tiredness, sleep problems, shoulder pain, and back pain, and as much as 65 to 96% reported such complaints (table 1). The chronic WAD patients showed significantly higher risk of reporting musculoskeletal pain (table 1). They also showed significantly higher risk of reporting palpitation, heat flushes, sleep problems, tiredness, dizziness, anxiety, depression, breathing difficulties, chest pain, coughing, heartburn, gas discomfort, and obstipation. The same pattern was true for substantial complaints, except for migraine, heartburn, breathing difficulties, and chest pain where there were no significant differences between the two groups. The WAD patients showed higher risk of reporting substantial complaints with diarrhoea and allergy.

Differences between low, medium, and high comorbidity groups

There was a significantly higher proportion of the high morbidity group that were women and single (table 2).

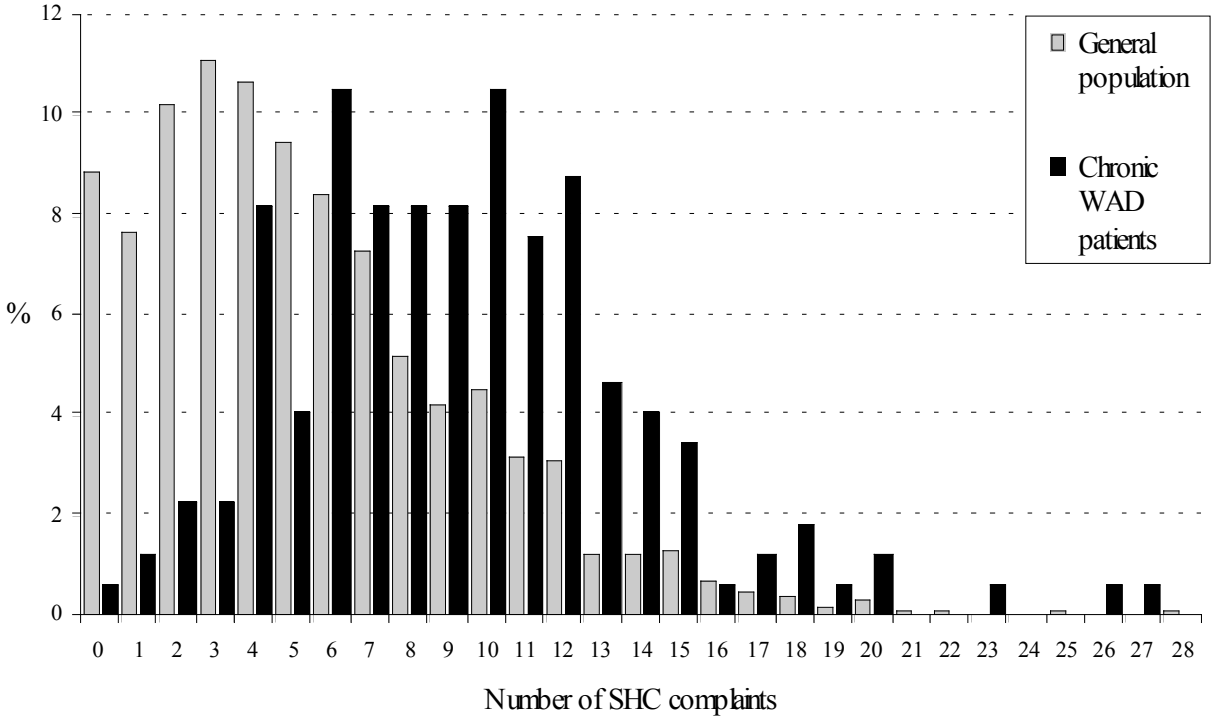

Figure 1. Distribution of number of subjective health complaints (SHC) for the general population and patients with chronic whiplash associated disorders (WAD).

Table 1. Prevalence of any subjective health complaints (score>0) and substantial subjective health complaints (score>1) in the normal population and in patients with chronic Whiplash Associated Disorder (WAD). Odds ratio (OR) and 95 % Confidence interval (CI) for reporting complaints in WAD patients vs. normal population, controlled for gender, age and education.

	Prevalence, any complaints (score >0)				**Prevalence, substantial complaints (score >1)**			
	Normal population	WAD patients	OR (95% CI)	p-value	Normal population	WAD patients	OR (95% CI)	p-value
Headache	35.7	96.3	35.2 (15.3-80.9)	<.001	13.1	77.4	17.7 (11.6-27.0)	<.001
Neck pain	34.3	98.2	97.8 (30.9-310.1)	<.001	14.4	87.6	38.7 (23.4-64.1)	<.001
Upper back pain	25.7	72.1	7.5 (5.0-11.1)	<.001	11.6	51.3	8.3 (5.5-12.4)	<.001
Low back pain	40.1	64.7	2.8 (1.9-4.1)	<.001	20.8	38.0	2.4 (1.6-3.6)	<.001
Arm pain	27.4	58.1	4.6 (3.1-6.7)	<.001	12.0	34.8	5.3 (3.4-8.2)	<.001
Shoulder pain	35.4	81.7	7.8 (5.0-12.1)	<.001	15.9	56.7	7.4 (5.0-10.8)	<.001
Migraine	7.6	17.9	2.0 (1.2-3.4)	.008	4.7	10.0	1.7 (0.9-3.3)	.115
Palpitation	11.4	19.9	2.5 (1.5-4.1)	<.001	3.0	5.5	2.7 (1.0-6.7)	.040
Heat flushes	8.6	23.8	3.6 (2.2-5.9)	<.001	2.8	6.3	2.9 (1.2-7.0)	.017
Sleep problems	30.7	74.1	6.6 (4.5-9.8)	<.001	11.9	47.5	6.9 (4.6-10.2)	<.001
Tiredness	52.2	90.7	7.2 (4.1-12.5)	<.001	16.8	67.9	9.0 (6.1-13.3)	<.001
Dizziness	15.8	60.4	9.0 (6.0-13.4)	<.001	4.3	33.1	13.1 (7.7-22.3)	<.001
Anxiety	9.9	23.1	3.4 (2.1-5.6)	<.001	3.0	7.5	3.4 (1.6-7.6)	.002
Depressed	17.4	47.9	4.2 (2.9-6.2)	<.001	5.6	13.7	2.6 (1.4-4.7)	.001
Heartburn	21.2	28.5	1.5 (1.0-2.3)	.043	7.7	9.9	1.4 (0.8-2.7)	.278
Gas discomfort	24.0	36.6	1.8 (1.3-2.7)	.002	6.4	11.1	2.5 (1.4-4.7)	.003
Diarrhoea	16.3	19.5	1.3 (0.8-2.1)	.250	4.5	8.7	2.4 (1.2-4.8)	.013
Obstipation	7.2	14.5	3.2 (1.8-5.7)	<.001	2.3	5.5	3.7 (1.4-9.3)	.006
Breathing difficulties	11.5	15.9	2.0 (1.2-3.4)	.013	5.3	4.8	1.5 (0.6-3.7)	.420
Allergies	15.3	21.6	1.5 (0.9-2.3)	.087	6.4	12.8	2.1 (1.1-3.7)	.018
Chest pain	9.1	16.0	2.8 (1.6-4.9)	<.001	3.4	4.2	2.1 (0.8-5.5)	.131
Cough	18.3	25.0	1.8 (1.1-2.7)	.010	7.9	12.5	2.0 (1.1-3.6)	.021

Table 2. Demographic, functioning and behavioural/psychological characteristics of the low, medium, and high comorbidity groups of chronic WAD Patients. Differences between groups of continuous variables tested with ANOVA, differences between groups of categorical variables tested with Chi-square tests. CI = Confidence Interval.

	Low Comorbidity N=64	Medium comorbidity N=59	High comorbidity N=48	p-value	Test for trend p-value
Gender; % women	53.1	72.9	77.1	.013	.006
Age; mean (95% CI)	34.8 (31.9-37.7)	38.1 (34.9-41.3)	35.4 (32.3-38.8)	.269	.643
Education:					
Elementary %	10.9	12.1	19.1		
High school %	50.0	46.6	53.2	.522	.152
University %	39.1	41.4	27.7		
Marital status; % single	27.6	27.6	50.0	.025	.022
Function in daily life (Roland Morris) mean (95% CI)	4.0 (3.3-4.7)	6.1 (5.2-7.0)	6.9 (5.8-7.9)	<.001	<.001
Sick listed % yes	35.6	37.5	46.7	.487	.267
Physical activity % ≥2 times per week	45.0	70.2	55.6	.022	.197
Quality of life, mean (95% CI)	6.6 (6.1-7.1)	6.4 (5.8-6.9)	5.7 (5.2-6.3)	.074	.028
Reading/writing difficulties after accident % yes	29.3	35.1	55.8	.020	.009
Daily use of painkillers %					
Never	31.7	23.7	6.5		
Weekly or more seldom	61.9	64.4	65.2	.002	<.001
Daily	6.3	11.9	28.3		
Daily use of tranquilizers %					
Never	78.0	80.4	53.7		
Weekly or more seldom	16.9	14.3	36.6	.039	.026
Daily	5.1	5.4	9.8		
Psychological distress, HSCL-case %	21.9	42.4	79.2	<.001	<.001
Somatization, HSCL, mean (95% CI)	1.8 (1.6-1.9)	2.2 (2.1-2.4)	2.7 (2.5-2.8)	<.001	<.001
Depression, HSCL, mean (95% CI)	1.3 (1.2-1.4)	1.5 (1.4-1.6)	1.9 (1.7-2.0)	<.001	<.001
Anxiety, HSCL, mean (95% CI)	1.3 (1.2-1.4)	1.5 (1.4-1.6)	1.9 (1.8-2.1)	<.001	<.001
Optimism, % yes					
'I think I can decrease my complaints by myself'	74.6	72.4	54.3	.057	.032
'I believe I will get rid of my complaints'	58.8	41.8	26.7	.005	.001

There were no differences in age and education between the groups. Neither were there any significant trends in proportion that were sick listed or that reported physical activity two or more times per week between the comorbidity groups.

The high comorbidity group had sigificantly poorer quality of life, and more problems with reading difficulties and daily functioning compaired with the low comorbidity group. They also reported significantly higher use of painkillers and tranquilizers. In the high comorbidity group, 79% scored above 1.75 on psychological distress scale and could be regarded as a SHCL case, however, only 22% in the low comorbidity group scored over this limit. There were significantly higher scores in the high comorbidity group on SHCL somatization, SHCL depression, and SHCL anxiety score. The two statements reflecting optimism showed that significantly less individuals in the high comorbidity group reported that they believed they could decrease the complaints themselves or that their complaints would disappear (table 2).

There were no significant differences between the groups in any of the collision factors investigated, such as position in vehicle, type of accident, damage of car, or self-reported speed (table 3). There was significantly more patients in the high comorbidity group that reported to have been sent to X-ray immediatly after the accident, otherwise there were no differences in immediate initiative after accident.

The high comorbidity group did not differ significantly from the other groups on any of the physical measures taken by the physiotherapists (table 4).

DISCUSSION

The chronic WAD patients reported a higher prevalence than the general population on the majority of subjective health complaints. The exceptions were pain in feet after strain, stomach pain and discomfort, ulcer and non ulcer dyspepsia, diarrhea, asthma, eczema, and cold/flu. The WAD patients with the highest level of comorbid complaints reported poorer function

Table 3. Collision associated factors of the low, medium, and high comorbidity groups of chronic WAD Patients. Differences between groups of continuous variables tested with ANOVA, differences between groups of categorical variables tested with Chi-square tests. CI = Confidence Interval.

	Low Comorbidity N=64	Medium comorbidity N=59	High comorbidity N=48	p-value	Test for trend p-value
Position in vehicle:					
Driver %	77.0	73.2	83.0		
Front seat passenger %	23.0	21.4	17.0	.273[a]	.514
Back seat passenger %	0	5.4	0		
Type of accident:					
Rear end %	52.5	62.3	71.1		
Side on %	8.5	3.8	6.7	.376[a]	.285
Head on %	35.6	26.4	17.8		
Other %	3.4	7.5	4.4		
Car condemn; % yes	39.3	34.5	52.2	.185	.222
Self reported speed, own vehicle; mean (95% CI)	23.1 (15.3-30.9)	17.6 (10.3-24.8)	17.0 (8.5-25.4)	.461	.257
Immediate initiative after accident:					
X-ray %	85.0	82.5	97.9	.024[a]	.056
MR %	18.2	27.3	32.5	.313	.134
Emergency primary health care centre %	47.5	43.6	33.3		
Emergency room, hospital %	30.5	29.1	37.8	.640[a]	.142
General practitioner %	20.3	25.5	22.2		
Emergency primary health care centre and hospital %	1.7	1.8	6.7		

[a]Fisher's Exact Test

Table 4. Results of physical tests of the low, medium, and high comorbidity groups of chronic WAD Patients. Differences between groups tested with ANOVA. CI = Confidence Interval.

	Low Comorbidity N=64	Medium comorbidity N=59	High comorbidity N=48	p-value	Test for trend p-value
BMI; mean (95% CI)	25.4 (24.1-26.7)	24.7 (23.5-25.8)	25.4 (24.1-26.7)	.589	.941
Aerobe capacity, O_2, mean (95% CI)	33.8 (31.5-36.1)	33.6 (30.9-36.2)	31.8 (28.8-34.7)	.501	.286
Aerobe capacity, %, mean (95% CI)	84.6 (78.7-90.5)	89.3 (83.2-95.3)	84.5 (77.6-91.5)	.480	.912
Neck stability, seconds, mean (95% CI)	29.0 (25.6-32.4)	25.2 (21.5-28.9)	24.5 (20.8-28.2)	.146	.067
Cervical range of motion, mean (95% CI)					
Flexion, degrees	55.3 (52.2-58.4)	54.7 (50.5-58.8)	53.3 (49.7-56.9)	.738	.447
Extension, degrees	58.6 (54.4-62.8)	62.0 (57.2-66.7)	56.1 (51.7-60.5)	.204	.550
Flexion right, degrees	39.1 (37.4-40.9)	40.5 (37.4-43.6)	38.5 (36.2-40.8)	.519	.816
Flexion left, degrees	39.2 (36.9-41.5)	41.0 (38.0-43.9)	39.4 (37.0-41.7)	.549	.818
Rotation right, degrees	70.9 (67.3-74.4)	68.6 (64.6-72.6)	67.8 (63.9-71.7)	.493	.252
Rotation left, degrees	67.9 (64.7-71.0)	65.0 (61.2-68.7)	68.0 (64.5-71.6)	.380	.943

in daily life, more reading difficulties, poorer quality of life, higher psychological distress, higher use of medication, and less optimism about their situation. There were no differences however, in any collision factors or physical meassures recorded by manueltherapists between the comorbidity groups.

The broad spectrum of comorbid complaints found are in concordance with other studies (3,5,7,9,10), and support that chronic WAD is best understood by a psychobiological or psychosomatic approach, and extending beyond what can be simply labeled as a neck injury (7). High comorbidity is reported for several functional somatic disorders, and patients diagnosed with e.g. irritable bowel syndrome or food hypersensitivity, have a higher risk of reporting musculoskeletal pain than the general population or even low back pain patients, but approximately the same risk as the chronic WAD patients in this study (14,15,24). In this cross-sectional study however, it is impossible to conclude on causal relationships. Despite this, there are some additional findings in our study that seems to further support a psychobiological or psychosomatic appr-

oach. First, even though the high comorbidity group reported poorer physical function in daily life, they did not show significantly poorer performance on the physical tests. Second, we found no differences between the comorbidity groups in self-reported collision factors or severity of accident. Some collision-related factors such as non-rear-end impact, lack of seat belt use, and rotated head position at the time of impact, have been suggested to influence prognosis of WAD (25), although this is contradicted by other studies showing that damage of vehicle had no predictive value for disability in WAD patients (26). Psychological factors seem to be more important than collision severity in predicting the duration and intensity of symptoms in WAD patients (12). This is in accordance with our study where we found higher levels of psychological distress and lower optimism in the high comorbidity group. A score of 1.75 or higher on the total HSCL score is considered as a symptom of depression (20), and in our study 79% of the participants in the high comorbidity group reported such a score. In the general population in Norway, about 10% have a mean value of 1.75 or higher on the total HSCL score (27).

All patients included in our study were having ongoing compensation claims and where initially recruited to participate in an intervention study to treat WAD. The sample is therefore highly selected, and the prevalence and findings might therefore not be representative for whiplash patients without or with settled insurance claims. Eliminating compensation for pain and suffering is associated with a decrease in incidence and improved prognosis of whiplash injury (28). In general, insurance and compensation systems may have a large impact on recovery from acute whiplash injuries (5,29).

Some authors have suggested that allthough physical injury might contribute to some initiative symptoms of whiplash pain, psychological factors might contribute to the persistance of symptoms (8). Despite this being a cross-sectional study giving us no possibility to conclude about causal mechanisms, it is tempting to speculate. First of all, the consequences of a physical injury persisting over time may lead to a number of additional complaints. It is not surprising that individuals seeking help for their WAD in addition to being involved in an insurance claim to get additional complaints including depressive symptoms. A possible psychobiological explanation of the high degree of comorbidity is sensitization. Some of these individuals may in general be more sensitive than others, and therefore being more vulnerable for developing more complaints after e.g. a car accident. Sensitization have been suggested as a psychobiological mechanism for several syndroms characterized by a multitude of subjective health complaints. It is possible to become sensitized after an initial pain episode. Repeated use of the synapses in the nervous system may lead to change in the synaptic efficiency for long time periods, and sensitization is an increased efficency in the synapses. Sensitization processes may be present at several levels of the organism from cellular level, at the psychological level, and at interpersonal level (30). The spinal cord do „remember pain“ and it is possible to develop a cognitive sensitization. Anxious persons have a cognitive processing priority for information related to their fears and will detect fear related information earlier. Their normal cognitive performance is interrupted and their cognitive capacity is absorbed in enhanced processing of information that is related to their concerns (31). Sensitization may therefore be the mechanism explaining the high number of different pain and complaints from different organ systems in the high comorbidity WAD patients.

CONCLUSION

The high comorbidity of other complaints, the strong relationships between degree of comorbidity and psychological factors, and the lack of relationships between degree of comorbidity and collision factors and physical tests, suggest that chronic WAD is best understood as a syndrome and not as a neck injury. Sensitization is suggested as a possible psychobiological mechanism.

REFERANSER

1. Spitzer WO, Skovron ML, Salmi LR, et al. Scientific monograph of the Quebec Task Force on Whiplash-Associated Disorders: redefining „whiplash“ and its management. *Spine* 1995; **20** (suppl): 2S-73S.
2. Hartling L, Brison RJ, Ardern C, Pickett W. Prognostic value of the Quebec classification of Whiplash-Associated Disorders. *Spine* 2001; **26** (1): 36-41.
3. Sterner Y, Gerdle B. acute and chronic Whiplash disorders – a review. *J Rehabil Med* 2004; **36**: 193-210.
4. Scholten-Peeters GGM, Bekkering GE, Verhagen AP, van der Windt DAWM, Lanser K, Hendriks EJM, Oostendorp RAB. Clinical practice guideline for the physiotherapy of patients with Whiplash-Associated Disorders. *Spine* 2002; **27** (4): 412-22.
5. Schrader H, Stovner LJ, Ferrari R. Kronisk nakkeslengsyndrom – en oversikt (Chronic whiplash syndrome – an overview). *Tidsskr Nor Lægeforen* 2002; **122**: 1296-9.
6. Ferrari R, Lang C. A cross-cultural comparison between Canada and Germany of symptom expectation for whiplash injury. *J Spinal Disord Tech* 2005; **18** (1): 92-7.

7. Ferrari R, Russell AS, Caroll LJ, Cassidy JD. A re-examination of the Whiplash-Associated Disorders (WAD) as a systemic illness. *Ann Rheum Dis* 2005; **64** (9): 1337-42.
8. Radanov BP, Bicik I, Dvorak J, Antinnes J, von Schulthess GK, Buck A. Relation between neuropsychological and neuroimaging findings in patients with late whiplash syndrome. *J Neurol Neurosurg Psychiatry* 1999; **66**: 485-9.
9. Côté P, Cassidy JD, Caroll L. Is a lifetime history of neck injury in a traffic collision associated with prevalent neck pain, headache and depressive symptomatology? *Accid Anal Prev* 2000; **32**: 151-9.
10. Wenzel HG, Haug TT, Mykletun A, Dahl AA. A population study of anxiety and depression amongst persons who report whiplash traumas. *J Psychosom Res* 2002; **53**: 831-5.
11. Kivioja J, Själin M, Lindgren U. Psychiatric morbidity in patients with chronic Whiplash-Associated Disorder. *Spine* 2004; **29** (11): 1235-9.
12. Richter M, Ferrari R, Otte D, Kuensebeck HW, Blauth M, Krettek C. Correlation of clinical findings, collision parameters, and psychological factors in the outcome of whiplash associated disorders. *J Neurol Neurosurg Psychiarty* 2004; **75**: 758-64.
13. Malt EA, Sundet K. Nakkeskader med whiplashmekanisme – et psykosomatisk perspektiv (A psychosomatic approach to the understanding of whiplash-associated disorders). *Tidsskr Nor Lægeforen* 2002; **122**: 1291-5.
14. Vandvik PO, Wilhelmsen I, Ihlebæk C, Farup PG. Comorbidity of irritable bowel syndrome in general practice: a striking feature with clinical implications. *Aliment Pharmacol Ther* 2004; **20**: 1195-1203.
15. Hagen EM, Svensen E, Eriksen HR, Ihlebæk C, Ursin H. Comorbid subjective health complaints in low back pain. *Spine* 2006; **31** (13): 1491-5.
16. Eriksen HR, Ihlebæk C, Ursin H. A scoring system for subjective health complaints (SHC). *Scand J Public Health* 1999; **27** (1): 63-72.
17. Roland M, Morris R. A study of the natural history of low back pain. Part 1: Development of a reliable and sensitive measure of disability in low back pain. *Spine* 1983; **8**: 141-4.
18. Derogatis LR, Lipman RS, Rickels K. The Hopkins Symptom Checklist (HSCL): a measure of primary symptom dimensions. In: Pichot P, ed. *Psychological measurements in psychopharmacology – modern problems in pharmacopsychiatry*. Karger, Basel, 1974.
19. Derogatis LR, Lipman RS, Rickels K, Uhlenhuth E, Cori L. The Hopkins Symptom Checklist (HSCL): a self-report symptom inventory. *Behav Sci* 1974; **19**: 1-15.
20. Winokur A, Winokur DF, Rickels K. Symptoms of emotional stress in family planning cervice: stability over four-week period. *Br J Psychiatr* 1984; **144**: 395-9.
21. Åstrand PO, Ryhming I. A Nomogram for calculation of aerobic capacity (physical fitness) from pulse rate during submaximal work. *J Appl Physiol* 1954; **7**: 218-21.
22. Jull G, Kristjansson E, Dall'Alba P. Impairment in the cervical flexors: a comparison of whiplash and insidious onset neck pain patients. *Manual Therapy* 2004; **9**: 89-94.
23. Denner I, Denner A, Agnischock A. Retest reliability study on the CMS: Deutsche Sporthochschule, Köln, 1992.
24. Lind R, Arslan G, Eriksen HR, Kahrs G, Haug TT, Florvaag E, Berstad A. Subjective health complaints and modern health worries in patients with subjective food hypersensitivity. *Dig Dis Sci* 2005; **50** (7): 1245-51.
25. Rodriquez AA, Barr Kp, Burns SP. Whiplash: Pathophysiology, diagnosis, treatment, and prognosis. *Muscle Nerve* 2004; **29**: 768-81.
26. Gun RT, Osti OL, O'Riordan A, Mpelasoka F, Eckerwall CGM, Smyth JF. Risk factors for prolonged disability after whiplash injury: A prospective study. *Spine* 2005; **30** (4): 386-91.
27. Svalund J, Kjevik J. Health (Helse). Samfunnsspeilet 2004; 4. Statistics Norway (http://www.ssb.no/vis/samfunnsspeilet/utg/200404/04/art-2004-09-15-01.html).
28. Cassidy JD, Carroll LJ, Côté P, Lemstra M, Berglund A, Nygren A. Effect of eliminating compensation for pain and suffering on the outcome of insurance claims for whiplash injury. *N Engl J Med* 2000; **342** (16): 1179-86.
29. Côté P, Hogg-Johnson S, Cassidy JD, Carroll L, Frank JW. The association between neck pain intensity, physical functioning, depressive symptomatology and time-to-claim-closure after whiplash. *J Clin Epidemiol* 2001; **54** (3): 275-86.
30. Eriksen HR, Ursin H. Subjective health complaints, sensitization, and sustained cognitive activation (stress). *J Psychosom Res* 2004; **56** (4): 445-8.
31. Brosschot JF. Cognitive-emotional sensitization and somatic health complaints. *Scand J Psychol* 2002; **43** (2):113-21.