

ORIGINAL REPORT

RELATIONSHIP BETWEEN SYMPTOMS AND PSYCHOLOGICAL FACTORS
FIVE YEARS AFTER WHIPLASH INJURY

Britt-Marie Stålnacke, MD, PhD

From the Department of Community Medicine and Rehabilitation, Umeå University, Umeå, Sweden

Objective: The aims of this study were: to describe the frequency of whiplash-related symptoms and psychological factors in persons 5 years after a whiplash injury; to study the relationship between symptoms and psychological factors; to examine gender differences; and to investigate the cause of sick leave.

Methods: Questionnaires addressing neck pain, pain intensity, whiplash-related symptoms, post-traumatic stress, depression, social support and life satisfaction were used.

Results: Neck pain was reported by 59% of subjects, whiplash-related symptoms (Rivermead Post-Concussion Symptoms Questionnaire, RPQ) by 76%, depression (Beck's Depression Inventory, BDI) by 22%, and post-traumatic stress (Impact of Event Scale, IES), by 38%. The scores of pain intensity and RPQ were correlated to BDI, IES and LiSat-11 scores. Men reported a lower level of quality of social support than women. Men reporting many symptoms also reported reduced availability of social interaction, whereas women with many symptoms reported reduced availability of attachment (i.e. lack of intimate partner, close family and friends). A multivariate logistic regression showed an association between sick leave and depression.

Conclusion: These findings indicate the importance of assessing possible relationships between symptoms, depression and post-traumatic stress in persons with long-term problems after whiplash injury, and of treating existing symptoms, especially depression. Because social support may play a role in recovery, social relationships should also be examined.

Key words: whiplash injuries, depression, stress disorders, post-traumatic.

J Rehabil Med 2009; 41: 353–359

Correspondence address: Britt-Marie Stålnacke, Department of Community Medicine and Rehabilitation (Rehabilitation Medicine) Bldg 9A, Umeå University Hospital, Umeå University, SE-901 85 Umeå, Sweden. E-mail: brittmarie.stalnacke@rehabmed.umu.se

Submitted March 26, 2008; accepted November 26, 2008

INTRODUCTION

Whiplash injuries have become a major health problem because of their high frequency and increasing economic costs (1, 2). In Western countries, the incidence is 1.0–3.2/1000 per year (3). The term whiplash describes a mechanism of energy caused by

acceleration being transferred to the neck, which results in soft tissue injury/distortion of the neck (1). Most whiplash trauma is the result of traffic accidents, but other trauma mechanisms have also been described (1, 4). The distortion of the neck usually decreases over subsequent days or weeks, but the injury may lead to a number of clinical symptoms known as whiplash-associated disorder (WAD) (1). The dominating complaints after the injury are neck pain and headache (5, 6). Other symptoms commonly associated with WAD are fatigue, dizziness, irritability, concentration and memory disturbances (1), sleep disturbance and anxiety (7). Although many patients with whiplash trauma recover within a few months after the accident (7), a significant proportion experiences prolonged symptoms (3, 8, 9). The frequency of long-term symptoms after whiplash injuries varies. Mayou et al. (9) reported that 35% of subjects had physical problems 5 years after the injury, and persistent neck pain has been demonstrated in 84–90% of patients 1–2 years after the injury (10) and in as much as 50% of whiplash patients 17 years after the injury (11). Moreover, patients may also have psychological issues after the injury, such as post-traumatic stress or depression, which can influence recovery (12, 13).

Although studies have identified risk factors such as increased age, gender and initial neck pain intensity (6, 10), the literature is inconsistent (14), making it unclear which factors lead to the development of persistent symptoms and related disability after whiplash injuries. During the last years some studies have looked at both physical and psychological aspects (15, 16) as causes of prolonged recovery. However, most studies of long-term outcome after WAD have focused on neck pain (15, 17) after the injury, while the persistence of other symptoms, together with psychosocial and psychological aspects, is less well investigated. Recently, Williamson et al. (14), in a systematic review, identified the need for further research with respect to psychological factors in the development of late symptoms after whiplash injury. Moreover, in several studies attention has been paid to the influence of gender as a potential prognostic factor after whiplash injuries, and female gender has been identified as a factor related to poor recovery (18). In contrast, some studies have failed to show any gender differences regarding long-term symptoms after the injury (15, 17). The inconsistent results may be due to differences in study populations and the investigated variables.

The conditions after whiplash injury may often affect several aspects of daily life, such as work, leisure and the total experience of satisfaction with life (19, 20). Since people live in a

social context with social relationships, the influence of social support after the trauma seems to be important for the injured persons. However, few studies have focused on these factors (21). The consequences of the injury may also be reflected in difficulties with return to usual occupation (3). In a previous study Bylund & Björnstig. (2) found that most people on sick leave due to traffic accidents were injured by whiplash trauma and, recently, Berglund et al. (18) reported increased sick leave several years after motor vehicle injuries. Moreover, attempts have been made to find factors related to sick leave and time off work following a whiplash injury (20), but the underlying causes remain unclear. However, since the follow-up time after whiplash injury differs between studies, and the length of time after injury in most studies has been rather short, it is difficult to compare the long-term outcome (9, 22).

The present study therefore investigates persons with whiplash injuries in a defined population and geographical area 5 years after the trauma in order to address the following aims: (i) to describe the frequency of whiplash-related symptoms and psychological factors; (ii) to study the relationship between symptoms and psychological factors; (iii) to examine gender differences in these frequencies and relationships; and (iv) to investigate the cause of sick leave.

METHODS

Patients and procedures

Information about the trauma history of persons seeking acute medical assessment because of whiplash trauma in the Umeå district of Northern Sweden during the year 2001 was collected from the Umeå University hospital's ongoing injury and trauma register. To be included in the study, the injured patient should have arrived to the emergency department (ED) at the Umeå University hospital within 3 days after the trauma and should have received the diagnosis of whiplash injury based on an examination by the emergency physician or by the general practitioner on call. Exclusion criteria were acute fractures or dislocations of the cervical spine related to a whiplash injury, and these criteria resulted in the inclusion of persons with WAD grades I–III (1).

Out of the 325 subjects injured during the year 2001, a set of questionnaires was sent to 304 subjects who were eligible for the study. These subjects were between 18 and 64 years old 5 years after the injury. (One had died for reasons unrelated to whiplash injury; for 13 subjects, either their addresses could not be obtained or the data was insufficient. Seven persons had moved abroad). After one written reminder, subjects were contacted by telephone if the questionnaires were not returned. In total, 191 persons (88 men (46%) and 103 women (54%)) answered 5 out of 7 questionnaires and participated in the study (Table I) (two questionnaires were answered by 189 and 175 persons), 25 subjects actively declined to participate. Information about demographic and injury characteristics were collected from hospital documents (medical records and the Umeå University hospital's ongoing injury and trauma register) and was completed with some additional questions 5 years after the injury (hospital documents: occupational situation at time of injury, position in vehicle and seat belt; additional questions: education, occupational situation at time of injury and 5 years after injury, marital status) (Table I). The mean age of the participants was 32.7 (standard deviation (SD) 11.4) years at the time of injury. The majority of the participants had been injured in vehicle accidents (81%). The participants were compared with the non-participants (non-responders and the persons who declined to participate). The non-participants had a male dominance (63%), but no significant difference was found in information about external

Table I. Demographic and injury characteristics (n = 191)

Characteristics	n (%)
Gender	
Men	88 (46.0)
Women	103 (54.0)
Age, years, mean (SD)	32.7 (11.4)
Education in years	
9	16 (8.4)
10–12	98 (51.3)
13–21	77 (40.3)
Occupational situation at time of injury	
Working	135 (70.6)
Student	38 (19.9)
Unemployed – seeking work	3 (1.6)
Sick leave	5 (2.6)
Working/sick leave part-time	2 (1.1)
Other	8 (4.2)
Marital status	
Married, cohabitating	132 (69.1)
Single, divorced or widowed	51 (26.7)
Living with parents	8 (4.2)
Non-vehicle accidents	37 (19.4)
Vehicle accidents	154 (80.6)
Position in vehicle:	
Driver	119 (77.3)
Passenger, front	22 (14.3)
Passenger, back	7 (4.5)
Buss passenger	4 (2.6)
Passenger, unknown	2 (1.3)
Seat belt	
Yes	118 (76.6)
No	14 (9.1)
Not applicable	12 (7.8)
Unknown	10 (6.5)
Occupational situation at time of follow-up	
Working	133 (69.6)
Student	22 (11.5)
Unemployed – seeking work	5 (2.6)
Sick leave	21 (11.0)
Working/sick leave part time	2 (1.0)
Other	8 (4.3)

SD: standard deviation.

cause of injury or other information from the medical records or the injury and trauma register.

The study was approved by the ethics committee of Umeå University.

Instruments

Symptoms (pain intensity and whiplash-related symptoms) were assessed using the visual analogue scale (VAS) and the Rivermead Post-Concussion Symptoms Questionnaire (RPQ) (23). The psychological variables (depression, post-traumatic stress and social support) were assessed using the Beck Depression Inventory-II (BDI-II) (24), the Impact of Event Scale (IES) (25), the social support scales: the Availability of Social Interaction (AVSI) and the Availability of Attachment (AVAT) (26). The LiSat-11 was used for assessment of life satisfaction (27). An additional self-constructed questionnaire was used that included questions about education, occupational situation and marital status at time of injury, neck pain, occupational situation, sick leave, compensation and medical care 5 years after injury.

Visual analogue scale

The VAS was used to rate the pain intensity for the previous 7 days. The scale consists of a 100-mm straight line with defined end-points (“no pain” and “worst pain imaginable”) on which the participants

were asked to mark their experienced pain (results in mm). The VAS is considered to have a high degree of reliability and validity (28).

Rivermead Post-Concussion Symptoms Questionnaire

Headache, dizziness, nausea, noise sensitivity, sleep disturbance, fatigue, etc. are symptoms commonly reported after whiplash injuries. These symptoms are also common after concussion. The RPQ (23) is a validated instrument that was used to assess the frequency and severity of 16 symptoms that also are commonly encountered whiplash-related symptoms and asks the participants to rate the extent to which these symptoms have been any more of a problem over the previous 24 h compared with the pre-morbid levels. The RPQ uses a rating scale with values 0–4, from no problem at all to a severe problem. A total symptom score can be calculated as a sum of all scores (possible score 0–72) (23).

Impact of Event Scale

The IES is a widely used self-report scale (25). It is a valid measure of post-traumatic stress reactions and has been suggested as a screening tool for post-traumatic stress disorder (PTSD) (25). The IES comprises 7 statements regarding intrusive symptoms and 8 regarding avoidance symptoms. A total score can vary from 0 to 80 and the score was divided into 4 grades from sub-clinical (0–8), mild (9–25), moderate (26–43) to severe (44–75) stress reactions (29).

Beck Depression Inventory

The BDI-II Manual is a 21-item self-report of depression over a 7-day period (24). The response format ranges from 0 to 3 (with 3 indicating maximal distress). A total score includes all scores and has a range from 0 to 63. The BDI scores can be divided into 4 grades from minimal to severe depression.

Social support scales

Social support was assessed using the social support short-form scales, which consist of 2 subscales: AVSI and AVAT (26). Each subscale comprises 3 items (range 0–3). The scales measure both quantity and quality of social support (26).

LiSat-11

Life satisfaction at follow-up was assessed using the LiSat-11 questionnaire, which comprises 11 items: 1 item addresses life as a whole and 10 other items address vocation, economy, leisure, contacts, sexual life, activities of daily living (ADL), family life, partner, somatic health, and psychological health (27). Levels of satisfaction are estimated on a 6-grade scale (from 1 = very dissatisfied to 6 = very satisfied); higher scores indicate higher levels of life satisfaction. A total score can be calculated (range: 0–66).

Statistical analysis

All statistical analysis was performed with SPSS, version 14.0 for Windows. Data are reported as means with SD, unless indicated otherwise. Comparisons of populations were made using the independent-samples *t*-test. Pearson's correlation coefficient was calculated for the analysis of bivariate correlations. Univariate and multivariate logistic regression were performed to test association between sick leave and variables, both from the background and 5 years after the injury. For the univariate and multivariate statistical analysis, the variables were dichotomized in the following way: sick leave into absence vs presence of sick leave, education levels into university studies vs lower education, whiplash-related symptoms into presence vs absence of symptoms, compensation seeking vs non-compensation seeking, presence vs absence of neck pain, presence vs absence of mild-to severe stress, presence vs absence of mild-to severe depression, and satisfied vs non-satisfied with physical health and psychological health (on the LiSat-11). The results of the logistic regression analysis are presented as odds ratio (OR). The reliability of the OR is expressed as 95% confidence interval (CI). Statistical significance was set at $p < 0.05$.

RESULTS

Pain intensity

Pain intensity on the VAS for all participants 5 years after the injury was 30.2 mm (SD 29.1). Women reported statistically significantly ($p = 0.028$) higher scores (36.4 mm (SD 31.7)) in comparison with men (30.2 mm (SD 29.2)). A majority of the persons (62.7%) rated VAS higher than 10 mm.

Occurrence of whiplash-related symptoms

The frequency of occurrence of whiplash-related symptoms was assessed using the RPQ (see Methods) and the results are displayed in Table II. Five years after the injury, 76% of participants exhibited one or more whiplash-related symptoms and 3 or more symptoms were reported by 66%. The most common symptoms were fatigue (55.4%), irritability (52.2%), poor memory (52.2%), poor concentration (51.1%) and headache (46.2%). No statistically significant differences between men and women were found with respect to total score of RPQ (men: 14.0 (SD 14.6), women: 14.9 (SD 14.7)) or the frequency of occurrence of each symptom except the presence of nausea, which was more frequently reported by women ($p = 0.037$). In an additional question, the frequency of occurrence of neck pain was reported by 59% of all participants. No statistically significant differences were found between genders. The reported frequency of the 2 symptoms neck pain and headache together was 42%.

Depression

The BDI-II was answered by 175 persons (16 persons did not answer the questionnaire). The depression levels according to the BDI scores (30) are shown in Table III; 22% of individuals reported scores that were classified as being mild-to-severe. Presence of depression items (one or more) on the BDI-II was reported by 74%. No statistically significant differences were found between men and women on the total score of BDI.

Table II. Frequency of occurrence of symptoms (Rivermead Post-Concussion Symptoms Questionnaire)

Symptoms	All participants % (n = 191)	Women % (n = 103)	Men % (n = 88)
Headache	46.2	51.0	40.7
Dizziness	37.6	40.0	34.9
Nausea/vomiting	23.7	30.0	16.3
Sleep disturbance	43.5	42.0	45.3
Fatigue	55.4	57.0	53.5
Irritability	52.2	54.0	50.0
Feeling depressed	40.9	41.0	40.7
Feeling frustrated	44.6	40.0	44.5
Poor memory	52.2	51.0	53.5
Poor concentration	51.1	50.0	52.3
Noise sensitivity	40.3	45.0	34.9
Blurred vision	31.7	31.0	32.6
Sensitivity to light	42.5	41.0	44.2
Double vision	14.5	13.0	16.3
Restlessness	41.4	35.0	48.8
Taking longer to think	44.6	41.0	48.8
Total score, mean (SD)	14.5 (14.7)	14.9 (14.7)	14.01 (14.6)

SD: standard deviation.

Table III. Beck Depression Inventory (BDI-II)

	All participants <i>n</i> (%) (<i>n</i> =175)	Women <i>n</i> (%) (<i>n</i> =98)	Men <i>n</i> (%) (<i>n</i> =77)
Level of depression			
Minimal depression	137 (78)	74 (76)	63 (82)
Mild depression	21 (12)	11 (11)	10 (13)
Moderate depression	12 (7)	9 (9)	3 (4)
Severe depression	5 (3)	4 (4)	1 (1)
Total score, mean (SD)	7.59 (8.87)	8.09 (9.25)	6.96 (8.38)

SD: standard deviation.

Post-traumatic stress

The IES was answered by 189 persons (2 persons did not answer the questionnaire). Of these, 70% reported presence of at least one post-traumatic stress reaction. The levels of stress are shown in Table IV; 37.6% of the participants reported mild-to-severe stress. According to the sub-classification by Kongsted et al. (29), mild stress response was observed in 85% (subclinical and mild stress reactions) and distinct stress response was present in 15% (moderate and severe stress reactions). No statistically significant differences were found between the genders with respect to total score of the IES or the subscales Intrusion or Avoidance.

Social support

Table V shows the social support scales. Women reported significantly higher scores (2.8 (SD 0.6)) than men (2.5 (SD 0.9)) on the AVAT scale ($p=0.03$). In contrast, no statistically significant differences on the AVSI were found between genders.

Life satisfaction

Life satisfaction was assessed using the LiSat-11. Table VI shows the relative distribution of the persons with WAD among the 6 different levels of life satisfaction. Only 38% were either very satisfied or satisfied with somatic health, 60% with psychological health, 42% with leisure, and 33% with economy. The mean total LiSat-11 score for all persons was 47.5 (SD 10.6) (range: 17–64). No statistically significant differences were found when the total score of males was compared with that of females.

Correlations between symptoms and psychological factors

To identify the relationships between symptoms (pain intensity and whiplash-related symptoms) and psychological variables

Table IV. Impact of Event Scale

	All participants <i>n</i> (%) (<i>n</i> =189)	Women <i>n</i> (%) (<i>n</i> =102)	Men <i>n</i> (%) (<i>n</i> =87)
Level of stress reaction			
Sub-clinical, <i>n</i> (%)	118 (62.4)	59 (57.8)	59 (67.8)
Mild, <i>n</i> (%)	43 (22.8)	27 (26.5)	16 (18.4)
Moderate, <i>n</i> (%)	21 (11.1)	13 (12.7)	8 (9.2)
Severe, <i>n</i> (%)	7 (3.7)	3 (2.9)	4 (4.6)
Total score, mean (SD)	10.36 (13.59)	10.75 (13.13)	9.78 (14.14)
Intrusion subscale, mean (SD)	5.21 (6.97)	5.40 (7.00)	4.93 (6.96)
Avoidance subscale, mean (SD)	5.16 (7.50)	5.37 (7.34)	4.85 (7.75)

SD: standard deviation.

Table V. Mean social support with standard deviation

	All participants (<i>n</i> =191)	Women (<i>n</i> =103)	Men (<i>n</i> =88)
AVSI	2.9 (0.3)	2.9 (0.3)	2.9 (0.4)
AVAT	2.6 (0.8)	2.8 (0.6)	2.5 (0.9)

AVSI: availability of social integration, 3-item, range 0–3; AVAT: availability of attachment, 3-item, range 0–3.

(depression, post-traumatic stress and social support) and life satisfaction, Pearson's correlate coefficients were calculated. A significant correlation was found between pain intensity (total score of VAS) and whiplash-related symptoms (total score of RPQ, $r=0.708$, $p<0.001$). The total score of VAS was correlated to the IES-score ($r=0.457$, $p<0.001$) and the BDI-score ($r=0.631$, $p<0.001$). The VAS score was negatively correlated to life satisfaction (total LiSat-11-score, $r=-0.452$, $p<0.001$) and weakly negatively correlated to the social support subscale AVAT ($r=-0.186$, $p=0.033$). In contrast, no correlations were found between the total score of VAS and the AVSI. The VAS score was significantly correlated both to neck pain ($r=0.762$, $p<0.001$) and headache ($r=0.606$, $p<0.001$) and there was a significant correlation between these symptoms ($r=0.479$, $p<0.001$). The RPQ was correlated to the IES-score ($r=0.579$, $p<0.001$) and the BDI-score ($r=0.720$, $p<0.001$) and was negatively correlated to the total score of LiSat-11 ($r=-0.541$, $p<0.001$) and to the social support scales AVAT ($r=-0.180$, $p=0.014$) and AVSI ($r=-0.186$, $p=0.011$).

An effect of gender was only found between symptoms and the social support scales. In men, a significant negative correlation was found between the RPQ and the AVSI ($r=-0.250$, $p=0.020$), but not between the RPQ and the AVAT ($r=-0.158$, $p=0.146$). In women there was a significant negative correlation between the RPQ and the AVAT ($r=-0.232$, $p=0.021$), but not between the RPQ and the AVSI ($r=-0.121$, $p=0.234$). Pain intensity on the VAS was weakly significantly correlated to the AVAT ($r=-0.280$, $p=0.019$) in women, but no correlation between VAS and the social support subscales was found in men.

Sick leave, compensation, and medical care

Five years after the injury the participants answered some additional questions. Twenty-three persons were on sick leave (full-time or part-time) and 21 considered their sick leave to be related to the injury. At the time of injury, 7 persons were on sick leave (full-time or part-time) and 2 of these were still on sick leave at follow-up. Out of the 183 subjects who answered the questions about compensation, 31% had received compensation from their insurance companies and 51% were still seeking/waiting for compensation. Fifty-eight persons (32%) reported that they had sought medical care after the acute assessment. Four persons had been on follow-up visits at the hospital or at primary care centres and the others had initiated the contacts by themselves.

Bivariate logistic regression

Logistic regression was used to investigate factors that could be associated with sick leave related to the injury. Persons

Table VI. Self-reported levels (%) of satisfaction with life as a whole and with 10 different life domains for persons with WAD (n = 191); LiSat-11

Satisfied with	Very satisfied	Satisfied	Rather satisfied	Rather dissatisfied	Dissatisfied	Very dissatisfied	Mean (SD)
Life as a whole	17.7	38.6	31.5	7.7	3.9	0.6	4.6 (1.0)
Vocation	13.8	33.1	24.3	14.9	5.1	8.8	4.1 (1.4)
Economy	8.3	24.9	37.5	13.8	8.3	7.2	3.9 (1.3)
Leisure	13.3	28.7	32.0	12.8	8.8	4.4	4.1 (1.3)
Contacts	17.7	35.9	27.5	13.3	5.0	0.6	4.5 (1.1)
Sexual life (n=178)	18.6	29.4	24.9	10.2	8.4	8.5	4.1 (1.5)
ADL	70.7	16.0	8.3	2.2	1.1	1.7	5.5 (1.0)
Family life (n=148)	46.6	34.9	14.4	2.7	0.7	0.7	5.2 (0.9)
Partner relationship (n=148)	49.0	28.7	16.7	3.5	0.7	1.4	5.1 (1.0)
Somatic health	15.5	22.7	26.5	16.5	11.6	7.2	3.9 (1.4)
Psychological health	27.1	33.1	28.2	6.6	3.3	1.7	4.7 (1.1)

WAD: whiplash-associated disorder; ADL: activities of daily living; SD: standard deviation.

with sick leave related to the injury 5 years after the injury were chosen as a dependent variable and coded as a binary variable (1 = presence of sick leave, 0 = absence of sick leave). Univariate logistic regression analysis was performed. No statistically significant associations were shown between sick leave and the independent variables: vehicle accidents, gender, age, education-level, presence of whiplash-related symptoms, the social support subscales, and compensation seeking. Statistically significant associations were obtained between sick leave and the following independent variables: neck pain (OR = 5.58, CI: 1.59–19.54), mild-to-severe stress (OR = 5.07, CI: 1.92–13.34), mild-to-severe depression (OR = 17.14, CI: 5.53–53.13), physical health (OR = 17.55, CI: 2.31–13.51), and psychological health (OR = 5.39, CI: 2.01–14.5). The significant variables in the univariate analysis were analysed in a multivariate logistic regression model that showed a statistically significant association only between presence of sick leave and mild-to-severe depression (OR = 6.39, CI: 1.82–22.46). A *post-hoc* correlation test between presence of sick leave and the total score of depression showed a significant relationship ($r = 0.578$, $p < 0.001$).

DISCUSSION

The present study shows that 5 years after whiplash injury persistent symptoms, post-traumatic stress and depression reactions were frequently reported, together with low levels of life satisfaction and reduced social support. Both the total score of pain intensity and of whiplash-related symptoms were significantly related to depression and post-traumatic stress scores. Although some previous studies have reported pain and some psychological factors a shorter time after whiplash injury, this study is the first to demonstrate high frequencies of physical symptoms and psychological factors that also include different aspects of social support many years after a whiplash event.

In the present study, physical symptoms were assessed using the RPQ. In total, 76% of the participants reported some symptom related to the whiplash injury, which is clearly higher than previously reported 1 year after injury (5). In agreement with other studies (6, 8, 31) neck pain was the most common

symptom, reported by 59%. Pain intensity was rated on the VAS, almost 63% reported VAS-scores higher than 10 mm and were considered symptomatic (10). The percentage of symptomatic persons was somewhat lower than previously reported by Kyhlback et al. (10) (84%) one year after the trauma. Yet, since their study was based on patients referred to an orthopaedic clinic and the time leading up to follow-up was shorter, the results are not strictly comparable. Although the participants were not asked to refer their pain intensity to any specific pain location, it can be assumed that pain intensity in most participants referred to neck pain, since that was the most common symptom. Other participants, however, probably reported their VAS scores of headache or of neck pain and headache together, as many persons experienced both of the symptoms. Moreover, the frequency of cognitive symptoms according to the RPQ was surprisingly high with presence of memory and concentration difficulties in more than half of the participants. The relevance of cognitive impairments in patients with whiplash has been discussed. Some studies have demonstrated neuropsychological dysfunction in persons with chronic symptoms (15, 32), whereas other studies have suggested pre-existent psychological distress or a neurotic development (33) as the underlying cause of cognitive disturbances. However, since cognitive symptoms might be influenced by pain (34), depression and post-traumatic stress (35), these factors may have contributed to the explanation for the present findings.

Among the psychological consequences after whiplash injuries, symptoms of depression are commonly reported (19), but the level of depression is seldom classified. In the present study mild to severe depression was found in 22% of the participants. These findings are in accordance with the previous results reported by Miettinen et al. (17) 3 years after a whiplash injury (23.7% rated their BDI scores as abnormal) and indicate that a considerable proportion suffers depression long after whiplash injury and that the level of depression might persist. Psychological problems may also include post-traumatic stress reactions. In the present study the levels of post-traumatic stress (mild stress in 85% and distinct stress in 15%) were similar to the results documented in the acute phase after whiplash injuries (mild stress in 87%, distinct stress in 13%) by Kongsted et al. (29) who likewise used the IES for assessment. Even though the severity levels of post-traumatic

stress have not previously been assessed in persons long after whiplash injury, post-traumatic stress reactions are described several years after traffic accidents (9). However, since the rate of post-traumatic stress reactions after whiplash injuries might be underestimated, the fairly high post-traumatic stress levels in the present study support the recommendation by the Swedish Society of Medicine and the Whiplash Commission Task Force (36) of diagnosis and treatment of post-traumatic stress early after a whiplash injury in order to reduce the risk of long-lasting symptoms.

In the present study, relationships between physical symptoms and psychological factors were investigated and strong correlations were demonstrated both between pain intensity, whiplash-related symptoms, and the total depression and post-traumatic stress scores. Although there are few studies of the long-term outcome, there are some results of psychological and psychosocial complications in victims up to 2–5 years after motor vehicle accidents (9, 12) and several authors have pointed out that psychological problems should be seen as a consequence of somatic complaints (15).

Social contacts and personal relationships may have influenced perceived health and well-being. Thus, the quantity of social support, (AVSI) and the quality of social support (AVAT) were assessed. These results revealed a significant gender difference on the AVAT; men reported a lower score than women, indicating that they perceived lower quality of support. On the other hand, pain intensity and total score of whiplash-related symptoms were negatively correlated with the AVAT in women but not in men. This finding might suggest that close relationships with strong supportive networks are of greater importance for decreasing pain intensity and symptoms in women. In men, whiplash-related symptoms were weakly negatively correlated with the AVSI, which implies that the size of the social support network may play a role for their experience of symptoms. Although, few studies have focused on the different aspects of social support after whiplash injury, Buitenhuis et al. (21) have shown a negative association between the duration of neck complaints and social support. The authors proposed that the persons who seek social comfort and share their concerns with others have a shorter duration of neck complaints (21), but they did not report any gender differences. In the present study, no difference was shown in the frequency of neck pain between men and women, and there was no association between neck pain and social support. Thus, satisfaction with the quality of support might be of importance for the pain intensity experienced in women, but not for the presence of neck pain.

Consequences in some aspect of quality of life have been described after whiplash injury. In the present study only 38% of subjects were either very satisfied or satisfied with somatic health; other items with low ratings of satisfaction were also economy, leisure, vocation and psychological health. These ratings of life satisfaction were generally lower than those of a large population-based Swedish reference group (27) and seem to correspond with the LiSat-11 scores reported for a group of patients with chronic whiplash seeking hospital care (19). Moreover, the level of life satisfaction was significantly

negatively correlated with the total scores of VAS and RPQ, which seem to depict the fact that decreased life satisfaction reflects increased pain intensity and the level of symptoms experienced.

Some persons might experience difficulties with return to usual occupation after whiplash injury and increased sick leave several years after the accident has been reported (2). The proportion of injury-related sick leave in the present study was somewhat lower than previously reported 2 years after road traffic accidents (12); nevertheless, the number of persons on sick leave had increased in comparison with the sick leave at the time of the injury. Since depression was the only single factor in the multivariate logistic regression model that was associated with being on sick leave 5 years after the injury, symptoms of depression may have influenced the recovery and contributed to lower well-being in the injured persons.

Several limitations of this study should be noted. Although participants reported symptoms at follow-up that they refer to as a whiplash injury, there may be symptoms of other origins that occur during the follow-up period. Therefore, we cannot rule out systematic distortions as other factors might have influenced the patients' results. However, as a considerably higher proportion of patients with neck pain were found in the present study (59%) than previously reported in the general population (23% women, 15% men) (37) and the instruments used in the study are validated (23, 25), the patients' self-experienced situation 5 years after the trauma seems to be reliable. Moreover, even if a majority of the participants answered all the questionnaires, some persons did not answer the instruments BDI-II and IES, and this missing data is a weakness of the study. Several authors have pointed out the problems with selection bias and that the sequelae of whiplash injuries vary with the patient population (38). For example, many studies have included patients seeking medical care because of prolonged symptoms or material from insurance companies or government insurance (39). In contrast to these studies, the sample in the present study was based on a well-defined population and geographical area.

This study has implications for clinicians, since the results indicate that it is of great importance to be aware that various symptoms might be frequent and associated with depression and post-traumatic stress reactions long after a whiplash injury. To optimize the management of persons with long-term problems after whiplash injury, it is crucial to assess possible relationships and to treat existing symptoms, especially depression. The treatment of depression might positively affect other symptoms and could improve the injured person's general well-being. Questionnaires could be used as a brief screening and as a complement to the assessment. Moreover, since social support may play a role (positive or negative) in recovery, the injured person's social relationships should also be examined.

In conclusion, this study demonstrated long-lasting symptoms and psychological consequences, reduced life satisfaction, decline in social support, and difficulties with resuming work after whiplash injury. These aspects should be taken into consideration in the management of persons with WAD.

ACKNOWLEDGEMENTS

The study was supported by the Swedish Association of Survivors of Traffic Accidents and the Polio Cancer and Traffic Injury Fund.

REFERENCES

- Spitzer WO, Skovron ML, Salmi LR, Cassidy JD, Duranceau J, Suissa S, et al. Scientific monograph of the Quebec Task Force on Whiplash-Associated Disorders: redefining "whiplash" and its management. *Spine* 1995; 20: 1S–73S.
- Bylund PO, Björnstig U. Sick leave and disability pension among passenger car occupants injured in urban traffic. *Spine* 1998; 23: 1023–1028.
- Sterner Y, Toolanen G, Gerdle B, Hildingsson C. The incidence of whiplash trauma and the effects of different factors on recovery. *J Spinal Disord Tech* 2003; 16: 195–199.
- Björnstig U, Hildingsson C, Toolanen G. Soft-tissue injury of the neck in a hospital based material. *Scand J Soc Med* 1990; 18: 263–267.
- Herrström P, Lannerbro-Geijer G, Hogstedt B. Whiplash injuries from car accidents in a Swedish middle-sized town during 1993–95. *Scand J Prim Health Care* 2000; 18: 154–158.
- Radanov BP, di Stefano G, Schnidrig A, Ballinari P. Role of psychosocial stress in recovery from common whiplash. *Lancet* 1991; 338: 712–715.
- Hildingsson C, Toolanen G. Outcome after soft-tissue injury of the cervical spine. A prospective study of 93 car-accident victims. *Acta Orthop Scand* 1990; 61: 357–359.
- Haldorsen T, Waterloo K, Dahl A, Mellgren SI, Davidsen PE, Molin PK. Symptoms and cognitive dysfunction in patients with the late whiplash syndrome. *Appl Neuropsychol* 2003; 10: 170–175.
- Mayou R, Tyndel S, Bryant B. Long-term outcome of motor vehicle accident injury. *Psychosom Med* 1997; 59: 578–584.
- Kyhllback M, Thierfelder T, Söderlund A. Prognostic factors in whiplash-associated disorders. *Int J Rehabil Res* 2002; 25: 181–187.
- Bunketorp L, Nordholm L, Carlsson J. A descriptive analysis of disorders in patients 17 years following motor vehicle accidents. *Eur Spine J* 2002; 11: 227–234.
- Andersson AL, Bunketorp O, Allebeck P. High rates of psychosocial complications after road traffic injuries. *Injury* 1997; 28: 539–543.
- Bryant RA, Marosszeky JE, Crooks J, Baguley IJ, Gurka JA. Interaction of posttraumatic stress disorder and chronic pain following traumatic brain injury. *J Head Trauma Rehabil* 1999; 14: 588–594.
- Williamson E, Williams M, Gates S, Lamb SE. A systematic literature review of psychological factors and the development of late whiplash syndrome. *Pain* 2008; 135: 20–30.
- Radanov BP, Sturzenegger M, Di Stefano G. Long-term outcome after whiplash injury. A 2-year follow-up considering features of injury mechanism and somatic, radiologic, and psychosocial findings. *Medicine (Baltimore)* 1995; 74: 281–297.
- Sullivan MJ, Stanish W, Sullivan ME, Tripp D. Differential predictors of pain and disability in patients with whiplash injuries. *Pain Res Manag* 2002; 7: 68–74.
- Miettinen T, Leino E, Airaksinen O, Lindgren KA. Whiplash injuries in Finland: the situation 3 years later. *Eur Spine J* 2004; 13: 415–418.
- Berglund A, Bodin L, Jensen I, Wiklund A, Alfredsson L. The influence of prognostic factors on neck pain intensity, disability, anxiety and depression over a 2-year period in subjects with acute whiplash injury. *Pain* 2006; 125: 244–256.
- Peolsson M, Borsbo B, Gerdle B. Generalized pain is associated with more negative consequences than local or regional pain: a study of chronic whiplash-associated disorders. *J Rehabil Med* 2007; 39: 260–268.
- Hagan KS, Naqui SZ, Lovell ME. Relationship between occupation, social class and time taken off work following a whiplash injury. *Ann R Coll Surg Engl* 2007; 89: 624–626.
- Buitenhuis J, Spanjer J, Fidler V. Recovery from acute whiplash: the role of coping styles. *Spine* 2003; 28: 896–901.
- Sterling M, Jull G, Vicenzino B, Kenardy J, Darnell R. Physical and psychological factors predict outcome following whiplash injury. *Pain* 2005; 114: 141–148.
- King NS, Crawford S, Wenden FJ, Moss NE, Wade DT. The Rivermead Post Concussion Symptoms Questionnaire: a measure of symptoms commonly experienced after head injury and its reliability. *J Neurol* 1995; 242: 587–592.
- Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961; 4: 561–571.
- Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: a measure of subjective stress. *Psychosom Med* 1979; 41: 209–218.
- Karlsson J, Sjöström L, Sullivan M. Swedish Obese Subjects (SOS) – an intervention study of obesity. Measuring psychosocial factors and health by means of short-form questionnaires. Results from a method study. *J Clin Epidemiol* 1995; 48: 817–823.
- Fugl-Meyer AR, Melin R, Fugl-Meyer KS. Life satisfaction in 18- to 64-year-old Swedes: in relation to gender, age, partner and immigrant status. *J Rehabil Med* 2002; 34: 239–246.
- Price DD, Bush FM, Long S, Harkins SW. A comparison of pain measurement characteristics of mechanical visual analogue and simple numerical rating scales. *Pain* 1994; 56: 217–226.
- Kongsted A, Bendix T, Qerama E, Kasch H, Bach FW, Korsholm L, et al. Acute stress response and recovery after whiplash injuries. A one-year prospective study. *Eur J Pain* 2008; 12: 455–461.
- Beck AT, Steer RA, Brown GK, editors. Beck Depression Inventory – second edition Manual, Swedish version. Sandviken: Psykologiförlaget; 2005.
- Miettinen T, Airaksinen O, Lindgren KA, Leino E. Whiplash injuries in Finland – the possibility of some sociodemographic and psychosocial factors to predict the outcome after one year. *Disabil Rehabil* 2004; 26: 1367–1372.
- Kischka U, Ettl T, Heim S, Schmid G. Cerebral symptoms following whiplash injury. *Eur Neurol* 1991; 31: 136–140.
- Berry H. Chronic whiplash syndrome as a functional disorder. *Arch Neurol* 2000; 57: 592–594.
- 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: 485–489.
- Twamley EW, Hami S, Stein MB. Neuropsychological function in college students with and without posttraumatic stress disorder. *Psychiatry Res* 2004; 126: 265–274.
- Jansen GB, Edlund C, Grane P, Hildingsson C, Karlberg M, Link H, et al. Whiplash injuries: diagnosis and early management. The Swedish Society of Medicine and the Whiplash Commission Medical Task Force. Swedish Society of Medicine and the Whiplash Commission Medical Task Force. *Eur Spine J* 2008; 17 Suppl 3: S355–S417.
- Guez M, Hildingsson C, Nilsson M, Toolanen G. The prevalence of neck pain: a population-based study from northern Sweden. *Acta Orthop Scand* 2002; 73: 455–459.
- Mayou R, Bryant B. Outcome of 'whiplash' neck injury. *Injury* 1996; 27: 617–623.
- Holm LW, Carroll LJ, Cassidy JD, Ahlbom A. Factors influencing neck pain intensity in whiplash-associated disorders. *Spine* 2006; 31: E98–E104.