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A descriptive analysis of disorders in patients 17 years following motor vehicle accidents

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Abstract Whiplash-associated disorders (WAD) are described and analysed 17 years after involvement in a motor vehicle accident. A self-report questionnaire was mailed to 121 patients registered at emergency departments in Gothenburg in 1983 because of neck complaints following a car collision. The questionnaire contained items on symptoms referred to WAD, treatment, work disability, involvement in settlement of claims, medical disability and the Neck Disability Index (NDI). Of the 121 patients, 108 (89%) chose to participate in the present study. Fifty-nine (55%) had residual disorders referable to the original accident. Neck pain, radiating pain and headache were the most common symptoms. One-third of the patients with residual symptoms suffered from work disability, compared to 6% in the group of patients without residual disorders. All 25 patients who had reached a final claim settlement (42%) had a poor outcome, and 15 of the claiming patients had been assigned a medical disability ranging from 5 to 30%. Patients with WAD reported a significantly higher score on the NDI than those without residual disorders. There was no significant correlation between the patients' degree of medical disability and the scores on the NDI. The results of the study show that approximately half of the patients with neck complaints following motor vehicle accidents in Gothenburg in 1983 suffered frequent residual symptoms 17 years after the accident, mostly comprising neck pain, radiating pain, and headache. The residual disorders contributed to the patients' overall disability.

Keywords Whiplash injury · Whiplash-associated disorder · Medical disability · Neck pain

Introduction

Neck pain arising from motor vehicle accidents is an increasing problem to society, and frequently the cause of prolonged physical complaints, disability and litigation [18]. There have been several accounts of the symptomatology and prevalence of residual symptoms [13, 17, 19, 26], but there is little specific information in the literature regarding exposure to motor vehicle accidents and future whiplash-associated disorders.

The cardinal manifestation of whiplash injury is neck pain [1, 3]. Prolonged pain varies. Late whiplash syndrome is present by definition when patients still have symptoms after 6 months [23]. The term "whiplash-associated disorder" (WAD) was introduced by the Quebec Task Force in 1995 to designate a number of clinical manifestations [27]. Symptoms associated with WAD are: neck pain, stiffness, radiating pain in the shoulder/arm/hand, headache, fatigue, concentration difficulties, dizziness, visual and auditory symptoms, emotional disturbances such as anxiety and depression, and general irritability [13, 19, 26]. After neck pain, headache is the most frequently reported complaint following whiplash injury [2, 19].

It is unclear which factors start the vicious circle leading to late whiplash syndrome. Residual symptoms are

more prevalent among women and older patients [11, 25, 27], and have been attributed to underlying organic pathology, psychological factors or financial gain [9]. The etiology is still unknown and controversial.

The Quebec Task Force found over 10,000 articles on WAD [27], but the length of the follow-up is generally short and the study populations are often small, based on selected groups of patients [14] and not presenting a clear picture of the long-term consequences of WAD. To our knowledge, the literature only provides one long-term follow-up study presenting the symptoms and signs as late as 15 years after the initial accident [28].

The aim of the present study is to describe and analyze whiplash-associated disorders 17 years after exposure to a motor vehicle accident.

Materials and methods

Study population

The study included 154 patients (89 women and 65 men) with neck complaints following motor vehicle accidents in 1983, treated at the two main hospitals in Gothenburg. The patients were initially assessed in the emergency department, and plain radiographs and, in certain cases, magnetic resonance imaging (MRI) were performed. The patients were further assessed at the Traffic Injury Register, which is a hospital-based organization. The diagnosis of whiplash injury was based on anamnestic and radiological information, and on the presence of neck pain and stiffness. The standard initial treatment was analgesics and a soft cervical collar.

Seven patients had a skeletal injury or a significant dislocation (>3 mm) of a cervical vertebra with or without a spinal cord or cervical root injury. These patients were excluded from the present study. The remaining 147 patients were classified as having whiplash injuries, defined as soft tissue injuries with no skeletal injury or significant dislocation of a cervical vertebra.

The inclusion criteria of the present study were as follows:

- No unrelated disease or additional injury that precluded completion of the questionnaire or would make evaluation difficult
- No previous severe neck pain causing more than 1 month of sick leave or disablement pension during the year preceding the accident
- No involvement in a second traffic accident with whiplash trauma

Excluded patients

Six patients were excluded because of unrelated diseases, four due to sick leave or disablement pension the year preceding the accident and six patients because of an additional car accident. A further ten patients had died since the accident, leaving a total study population of 121 patients.

Drop-outs

Thirteen patients (11%) did not take part in the present study. Among these, two refused to participate and five patients were not found in the national register – four of those five had been in Sweden only temporarily at the time of the accident, and could not be traced. A further six patients could not be reached because of secret or unknown phone numbers.

Table 1 Selected demographic data, type of collision and safety equipment

	Total (*N*=108)	Women (*N*=66)	Men (*N*=42)
Age (years): mean (SD)	52 (13)	53 (13)	50 (14)
Collision with: *n* (%)			
Another car	79 (73)	48 (73)	31 (74)
Bus	1 (1)	1 (2)	0 (0)
Truck	9 (8)	6 (9)	3 (7)
Accident involving one vehicle only	19 (18)	11 (17)	8 (19)
Safety equipment: *n* (%)			
Wearing seat belt	73 (68)	43 (65)	30 (71)
Not wearing seat belt	21 (19)	15 (23)	6 (14)
Unknown	14 (13)	8 (12)	6 (14)

Patients

A total of 108 patients (89%) completed the present study. The patients who did not return the questionnaire after two written reminders were interviewed over the phone. Seventy-six patients (70%) returned the completed questionnaire and 32 patients (30%) were interviewed over the phone. Selected demographic data, the type of collision, and safety equipment used are given in Table 1. The study was approved by the Ethics Committee of Gothenburg University.

Assessments

Whiplash-associated disorders (WAD) were assessed by means of a questionnaire consisting of three parts. A self-constructed questionnaire was used to assess symptoms referred to WAD. It consisted of eight questions concerning neck pain intensity, neck pain frequency, pain location and characteristics, further whiplash-associated symptoms and treatment. The questionnaire was first tested on five patients (non-participants) and was shown to be valid.

Neck pain intensity. Two modes of rating the neck pain intensity were applied. Firstly, a scale from 0 to 3 was used to describe distinct levels of spontaneous neck pain and neck pain aggravated by cervical motion, classified as: none, mild, moderate or severe. Secondly, a visual analog scale (VAS) was used, consisting of a 100-mm straight line on which the patients marked their pain intensity on three occasions: at present, at its worst, and at its least during the past week. The VAS is considered to have a high degree of reliability and validity [10].

The patients interviewed over the phone were asked to estimate their neck pain verbally on a scale graded from 0 to 100, like the VAS.

Frequency of spontaneous neck pain and neck pain aggravated by cervical motion. This was assessed on a scale from 1 to 3, classified into: several times a month, several times a week or daily.

Pain location and characteristics were assessed by means of a pain drawing. The drawing was divided into three regions describing neck pain in (1) the upper part of the neck, (2) the middle and caudal part of the neck, and (3) the neck/shoulder-angle and/or interscapular regions. The drawing was vertically divided into right, left and central regions.

Patients were also able to describe the nature of the pain by using seven different symbols describing aching, burning, stabbing, cramp-like, and numbing pain, as well as deep or superficial pain.

Intensity of radiating pain was assessed on a scale of 0 to 3: none, mild, moderate, or severe.

Frequency of radiating pain was assessed on a scale of 1 to 3: several times a month, several times a week or daily.

Intensity of headache was assessed on a scale of 0 to 3: none, mild, moderate or severe.

Frequency of headache was assessed on a scale of 1 to 3: several times a month, several times a week or daily.

Headache location and characteristics were assessed by means of a pain drawing. Patients were asked to describe the character of the headache in the drawing by using three different symbols (1) stabbing, (2) aching/pressing, and (3) throbbing/pulsating pain. They were asked whether the headache was bilateral/symmetric or unilateral, intermittent, related to stress, superficial or deep, of tension-type, or of other type.

The patients were also asked to report the occurrence of any *further whiplash-associated symptoms*, such as concentration difficulties, fatigue, dizziness, visual disturbances and tinnitus.

Treatments over the last 5 years. The patients were asked to report any intake of analgesics and frequency of consumption. They were also asked to report all methods of treatment they had received and to evaluate their effect.

A self-constructed questionnaire was used to assess *work disability, claim settlement and assignment of medical disability (MD)* due to the neck injury.

Sick leave during the past year was assessed on a scale of 0 to 4: 0 days, 1–7 days, 1–3 months, 3–6 months or 6–12 months.

Disablement pension/sickness benefit was assessed on a scale of 0 to 4: 0%, 25%, 50%, 75% or 100%.

Retirement pension preceded by disablement pension was reported by answering "yes" or "no".

Patients who had reached a final claim settlement reported the *percentage **MD*** they had been assigned.

MD is graded from 0 to 100%, in accordance with the degree of disability caused by the injuries. It is determined by specially trained insurance physicians at each insurance company, who judge each case on the basis of information from relevant medical sources. This information is assessed according to a priori criteria laid down in guidelines common to all insurers [6]. The assessment includes consideration of causality, that is, the probability that the symptoms really were caused by the accident [14].

The Neck Disability Index (NDI) was used to assess *neck-related disability*. The NDI is a 10-item scaled questionnaire used to assess to what extent the patient is affected in daily activities with respect to pain intensity, pain frequency, personal care, lifting, reading, headaches, concentration, work, driving, sleep, and recreation. The NDI has been shown to be valid and reliable, and useful for patients with WAD [29]. It has been modified into a Swedish version.

Each item consists of six alternatives, scored from 0 (good function) to 5 (poor function). The total NDI score can vary from 0 to 50. To calculate the patient's degree of disability as a percentage, the scores on each question are summed and the final score is divided by the maximum score of 50. To provide a strategy for dealing with questions that are left blank by the participants, a method similar to that described for the Oswestry questionnaire was used [12]. By dividing a patient's score by the maximum possible score for the number of questions answered, a percentage score was obtained.

Statistical method

Analyses were done using the Statistical Package for Social Sciences (SPSS 10.0). Fisher's Exact Test was used to compare gender differences with respect to the occurrence, intensity and frequency of spontaneous neck pain and neck pain aggravated by cervical motion, radiating pain, and headache.

Mann Whitney's U-test was used to compare gender differences with respect to the neck pain intensity according to the VAS. To provide a strategy for the analysis with respect to occurrence, each variable was recoded into two new categories: occurrence present, and occurrence not present. Fisher's Exact Test was used to compare gender differences with respect to the occurrence of further WAD.

The Chi-square test was used to compare sex differences with respect to the extent of work disability. To perform the analysis, each variable was recoded into two new categories: work disability present, and work disability not present. Moreover, Chi-square analysis was used to compare differences between the two groups of patients with and without residual disorders regarding the extent of work disability. Analyses were also done using Mann Whitney's U-test, to compare the scores on the NDI between the patients with WAD and the group of patients who considered themselves fully recovered. Finally, the Chi-Square test was used to compare the intensity of spontaneous neck pain and neck pain aggravated by motion, radiating pain and headache between the claiming group and the non-litigants.

Bivariate correlations were calculated between the intensity of radiating pain and the patients' scores on the NDI. Furthermore, bivariate correlations were calculated between the patients' scores on the NDI and their degree of MD. For this purpose, Spearman's correlation coefficient was chosen, and two-tailed tests were performed. For all statistical tests, a *P*-value of less than 0.05 was considered significant.

Results

Fifty-nine patients (55%), mean age 54 (range: 36–83 years), answered "yes" to the first question, thus considering themselves as having residual symptoms linked to the motor vehicle accident. This group included 55% of the women (*n*=36, mean age 53, range: 37–76) and 55% of the men (*n*=23, mean age 55, range: 36–83). These patients are classified, in the present study, as having WAD. Forty-nine patients (45%) considered themselves fully recovered, and are referred to as patients without WAD.

Spontaneous neck pain and pain radiating into the upper extremities were the most common symptoms, closely followed by neck pain aggravated by cervical motion and headache.

Other associated symptoms comprised difficulties in concentrating, fatigue, dizziness, tinnitus and visual disturbances.

Neck pain intensity

Spontaneous neck pain was present in 52 patients (88%), being the most common symptom. Neck pain aggravated by cervical motion was reported by 47 patients (80%).

The mean and median VAS score of the neck pain intensity at the present time was 31 mm and 24 mm (SD 28 mm), respectively, with a range of 0–90 mm.

Neck pain frequency

Twenty-one patients (36%) reported spontaneous neck pain daily, 20 (34%) several times a week and 11 (19%) several times a month. Twenty-seven patients (46%) re-

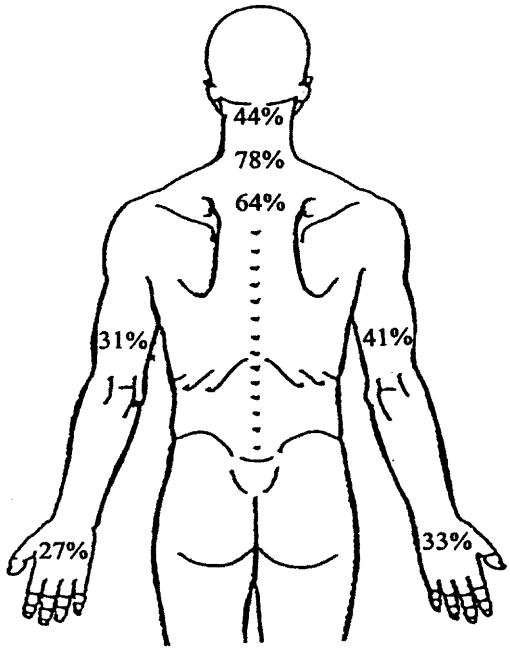

Fig. 1 Pain location

ported neck pain aggravated by cervical motion daily, 11 (19%) several times a week and 9 (15%) several times a month.

Fisher's Exact Test indicated that no significant difference existed between women and men in the occurrence of spontaneous neck pain (P=1.00) or occurrence of neck pain aggravated by cervical motion (P=0.334). Furthermore, there was no significant sex difference regarding the intensity of spontaneous neck pain or intensity of neck pain aggravated by cervical motion.

However, women reported a significantly higher frequency of neck pain aggravated by cervical motion than men (P=0.035).

Radiating pain

Forty-nine (83%) of the patients with residual WAD reported radiating pain in the upper extremities. The pain was reported to be mild in 17 patients (29%), moderate in 20 (34%) and severe in 12 (20%). Twenty-four patients (41%) reported radiating pain daily, 15 (25%) several times a week and 10 (17%) several times a month.

There was no significant sex difference with respect to the occurrence of radiating pain (P=0.490), or the intensity (P=0.211). However, the women reported a significantly higher frequency of radiating pain than the men (P=0.033).

Table 2 Characteristics of neck pain and radiating pain[a]

Characteristics	Neck pain (N=49) n (%)	Radiating pain (N=28) n (%)
Aching	36 (73)	10 (4)
Burning	17 (35)	9 (25)
Deep	13 (27)	2 (7)
Stabbing	7 (14)	1 (4)
Cramp-like	5 (10)	2 (7)
Numbing	2 (4)	20 (54)
Superficial	2 (4)	0 (0)

[a] Each characteristic was assigned a symbol; several symbols could be used on the map

Pain location and characteristics

Forty-nine of the patients (83%) with residual WAD completed the pain drawing, which showed two distinct distributions: central in the neck alone, and radiating into the shoulder, arm and hand (Fig. 1). There was a dominance of central and/or bilateral neck pain in the middle and caudal parts of the cervical spine, which was reported by 38 patients (78%). Forty-four patients (90%) reported neck pain on the right side of the neck, and 38 (78%) on the left side. The neck pain was described as unilateral in 11 patients (22%).

Twenty-eight patients (57%) marked the location of radiating pain in the upper extremities (Fig. 1). Thirteen patients (27%) reported radiating pain in the right arm and hand, seven patients (14%) in the right arm only and three patients (6%) in the right hand only. Ten patients (20%) were experiencing radiating pain in the left arm and hand, five patients (10%) in the left arm only, and three patients (6%) in the left hand only. The characteristics of neck pain and radiating pain are given in Table 2.

Headache

Headache was reported by 41 of the patients with WAD (69%) (Table 3).

Location and characteristics

Thirty-nine of the patients (95%) with headache marked the location and character of the headache on the pain drawing. Occipital headache was the most common location, being reported by 25 patients (64%). In 21 patients (54%), the headache was located in the forehead or the orbital regions. Thirteen patients (33%) reported both frontal and occipital headaches. Headache located in the right temporal region was reported by 15 patients (38%), and temporal headache on the left side by 13 patients (33%). Eleven patients (28%) reported bilateral temporal headache.

Table 3 Intensity and frequency of headache, and differences between the sexes

	Total (*N*=59) *n* (%)	Women (*N*=36) *n* (%)	Men (*N*=23) *n* (%)	Sex differences *P*-value*
Intensity				
Not present	18 (31)	11 (31)	7 (30)	0.529
Mild	8 (14)	3 (8)	5 (22)	
Moderate	24 (41)	16 (44)	8 (35)	
Severe	9 (15)	6 (17)	3 (13)	
Frequency				
Not present	18 (31)	11 (31)	7 (30)	0.910
Several times a month	17 (29)	11 (31)	6 (26)	
Several times a week	18 (31)	10 (28)	8 (35)	
Daily	6 (10)	4 (11)	2 (9)	

* *P*-value obtained by Fisher's Exact Test, after collapsing categories into "present" and "not present"

The character of the headache was described as aching and pressing by 31 patients (79%) and throbbing and pulsating by 19 patients (49%).

Fisher's Exact Test indicated that there were no significant sex differences with respect to the occurrence of headache (*P*=1.000), or the intensity or frequency (Table 3).

Other whiplash-associated disorders

Other whiplash-associated disorders are listed in Table 4. There were no significant sex differences with respect to the report of any of these symptoms.

Treatments during the past 5 years

Thirty-one of the patients with WAD (53%) used analgesics to relieve the pain. Twenty-four patients (77%) answered the question regarding the frequency of consumption. Two patients (8%) reported using analgesics occasionally, 7 patients (29%) 2–6 times a week, 11 patients (46%) 7–30 times a week and 4 patients (17%) more than 30 times a week. Patients with a higher frequency of consumption more often relied on strong analgesics than the patients with a lower intake. In the group of patients without WAD, 28 subjects (57%) answered the question regarding analgesics, and only one (4%) reported frequent intake.

Table 4 Other whiplash-associated disorders (WAD) and differences between the sexes

Other WAD	Total (*N*=59) *n* (%)	Women (*N*=36) *n* (%)	Men (N=23) *n* (%)	Sex differences *P*-value*
Fatigue	29 (49)	18 (50)	11 (48)	0.384
Concentration difficulties	23 (39)	16 (44)	7 (30)	0.459
Dizziness	21 (36)	16 (44)	5 (22)	0.139
Visual disturbances	19 (32)	15 (42)	4 (17)	0.075
Tinnitus	11 (19)	8 (22)	3 (13)	0.705

Thirty-three patients with WAD (56%) had sought some kind of treatment during the past 5 years, compared to 16 (31%) in the group without WAD. Twenty-six (44%) had relied on physiotherapy and 22 (37%) had tried other therapeutic interventions, compared to 13 (25%) and 5 (10%), respectively, in the group of patients without WAD. Massage and heat treatment were considered the most helpful among the patients with WAD.

Neck Disability Index

Table 5 shows the scores on the NDI. There was a significant difference regarding the score on the NDI between the group with and those without WAD (*P*=0.000). Within the two groups, the item analysis revealed that two items were the most prominent: headache and lifting. In the group of patients with WAD, there was no significant sex difference on the NDI (*P*=0.560).

Within the group of patients with WAD, there was a significant correlation between the patients' evaluation of intensity of radiating pain in the upper extremities and their scores on the NDI (*r*=0.61, *P*=0.01).

Work disability, final claim settlement and MD

Twenty patients (34%) reported having either been on sick leave, relying on partial or full disablement pension/sickness benefit, or being on a retirement pension preceded by a disablement pension in the past year due to

Table 5 Neck Disability Index (NDI) scores

NDI score	Patients with WAD (*N*=58) Mean (SD) median	Patients without WAD (*N*=41) Mean (SD) median	*P*-value*
Total score (0–100)	32.0 (20.0) 28.0	8.5 (16.0) 2.0	0.000
Items (0–5)			
Headache	2.0 (2.0) 1.6	0.8 (1.3) 0.0	
Lifting	1.9 (1.0) 1.6	0.8 (1.4) 0.0	
Pain intensity	1.9 (2.0) 1.2	0.4 (1.0) 0.0	
Sleep	1.7 (1.0) 1.4	0.4 (0.9) 0.0	
Work	1.7 (1.0) 1.5	0.5 (1.1) 0.0	
Reading	1.6 (1.0) 1.4	0.2 (0.7) 0.0	
Recreation	1.5 (1.0) 1.5	0.3 (0.9) 0.0	
Driving	1.4 (1.0) 1.3	0.3 (0.8) 0.0	
Concentration	1.2 (1.0) 1.3	0.2 (0.5) 0.0	
Personal care	0.7 (2.0) 1.1	0.2 (0.6) 0.0	

WAD. In the group of patients without WAD, 35 subjects (71%) answered the question regarding work disability and two (6%) reported being partly or fully work disabled due to reasons other than WAD.

To analyze differences within the sexes with respect to the extent of work disability, each variable was recoded into two new categories: work disability present, and work disability not present. Women with WAD were more likely than men to be work disabled, but the difference was not statistically significant (P=0.115).

Twenty-five patients (42%) with residual disorders had been involved in settlement of claims, compared to seven subjects (14%) in the group without WAD. Eighteen of the patients with residual disorders had been assigned a MD because of their injuries. The degree of MD ranged from 5% to 30%, with a mean MD of 14% (SD 8%), among the 15 of these patients who knew what MD grade they had been assigned. The remaining seven patients had not been assigned a MD.

Thirteen patients (87%) were dissatisfied with the degree of MD they had been assigned, and with the outcome of the claim settlement. In the group of patients without residual disorders, no-one had been assigned a MD.

Claim settlement and residual symptoms

Twenty-five patients (42%) with residual disorders had been involved in settlement of claims, compared with seven subjects (14%) in the group without WAD.

Among the patients with WAD, there was a statistically significant difference between the claiming group and the non-claiming patients regarding the intensity of spontaneous neck pain (P=0.023), radiating pain (P=0.017) and headache (P=0.012), with the claiming patients reporting a higher intensity. It is notable that all 25 patients (100%) continued to have residual WAD subsequent to the settlement of claims for damages. No significant correlation could be found between the patients' scores on the NDI and their degree of MD (r=0.017, P=0.952).

Discussion

This study was set up to describe and analyze the long-term consequences of WAD following motor vehicle accidents among 154 patients. All patients who had attended the two major emergency departments in Gothenburg in 1983 were included in the study. This suggests that the study population is a representative sample of patients with neck complaints following traffic accidents in Gothenburg in 1983.

Residual symptoms were present in 55%, approximately half of the women and half of the men. The figures reported in the available whiplash literature on prognosis vary considerably. In a 15-year follow-up, Squires et al. [25] reported that 70% of the patients continued to complain of symptoms, compared to 18% in the study by Radanov et al. [26]. It has been suggested that persistent symptoms are more prevalent among women and older patients [11, 25, 27]. The results in the present study suggest that women more frequently report neck complaints after motor vehicle accidents or are more inclined to seek medical care than men are. In addition, women have a higher frequency of WAD. However, sex appeared to have no influence on residual symptoms in the long term, which is consistent with the findings in the literature [26].

Analyses of the disorders in the present study show that neck pain and radiating pain are most common. This is in accordance with the findings reported by Squires et al. [28], where the most common symptoms appeared to be neck pain and radiating pain in the arms. In the present study, headache was a frequent problem among the patients, which is in line with other studies on WAD [2, 15, 19]. Other associated disorders comprised fatigue, difficulties in concentrating, dizziness, visual disturbances and tinnitus, as also found in the literature [27].

Neck pain constitutes a major health problem in the general population. The prevalence of chronic neck pain in a large random sample from the general population in Norway was reported to be 13.8% [7]. In Finland, "chronic neck syndrome" was identified in 9.5% of men and 13.5% of women [16]. These prevalence studies give no information regarding the degree of disability caused by the pain. Both the intensity and the character of pain may be influenced by a whiplash trauma. The possible causal relationship between neck complaints following motor vehicle accidents and persistent neck pain may be difficult to obtain as long as one is dependent on the evaluation of subjective symptoms.

In a Swedish cohort study, Berglund et al. [4] concluded that in drivers with reported whiplash injury, the risk of neck or shoulder pain 7 years after the collision was increased nearly three-fold compared with that in patients without reported whiplash injury. The patients with reported whiplash injury also seem to have an increased relative risk, in the range of 1.6–3.7, for headache, thoracic and low back pain, as well as for fatigue, sleep disturbances and ill health, compared to the unexposed comparison group [5].

The method of measuring the outcome of residual disorders with a self-report questionnaire may have different degrees of validity. The method is not wholly reliable, due to recall bias of the self-report and the link between the symptoms and the accident. However, it is not likely that the patients exposed to motor vehicle accidents would over-report or simulate their neck complaint at follow-up 17 years after the accident, as all compensation claims will have been settled. However, secondary gain due to having neck pain can occur for reasons other than compensation. Taking these methodological considerations into account, it would be crucial to include an unexposed com-

parison group when evaluating the outcome of symptoms and associated disability after a motor vehicle accident.

In the present study, the pain drawings showed two distinct distributions: central in the neck alone, and radiating into the shoulder/arm/hand. There was a significant correlation between the intensity of radiating pain and the patient's score on the NDI. In the previous 15-year follow-up by Squires et al. [28], radiating pain was associated with more severe disability.

In the present study, the headache was mostly reported as aching and located in the occipital region, sometimes together with headache located in the forehead or the orbital regions, which is in accordance with the literature [2, 19].

There was a significant difference in NDI score between the groups of patients with and those without residual disorders.

In the present study, one-third of the patients with residual WAD were not working full time or were fully work disabled due to neck problems related to the accident, compared to 6% in the group without WAD. Women were more likely to suffer from work disability due to neck problems than men, but the difference was not significant. Squires et al. [28] reported in their 15-year follow-up that 18% of the symptomatic individuals had taken early retirement due to health problems, which they related to the whiplash injury. In a previous Swedish study, 55% of the whiplash injuries accounted for 82% of all sick leave taken within 2.5 years after the injury event. In 16 of 18 patients, the injury to the cervical spine resulted in long-term sick leave or dependence on a disablement pension [8].

The association between claim settlement and residual symptoms is not clearly defined [19, 21, 22, 24, 27]. In the present study, 25 patients (42%) with WAD had filed for claim settlement, and in all cases the claims were finally settled. Among the patients with residual disorders, the claiming group reported more severe symptoms than the non-claiming patients. This result supports the findings in the literature, where the rate of litigation can be almost twice as great in patients with severe as compared with mild symptoms [19]. Those who had settled had a poor outcome. Trends towards a poor outcome in claimants may be due to their having more serious disorders.

Among the patients with residual WAD in the present study, 25% had a medical disability ranging from 5 to 30% because of the disorders. The degree of MD due to WAD usually ranges from 1 to 15%. In some cases it might be judged as high as 50% [14]. In a study of car occupants based on a Swedish insurance material, Nygren et al. [20] found that patients with WAD judged to have a permanent MD of 10% or more accounted for 50% of the total amount of MD among injured car occupants in 1990–1992.

According to the guidelines, the degree of disability should determine the percentage of MD settled by the insurance company [6]. In the present study, there was no significant correlation between the degree of medical disability and the scores on the NDI.

Additional medicolegal aspects may contribute to the presentation of persistent symptoms and associated disability in patients exposed to motor vehicle accidents.

Conclusions

Approximately half of the patients with neck complaints following motor vehicle accidents in Gothenburg in 1983 frequently had residual symptoms 17 years after the accident, mostly comprising neck pain, radiating pain, and headache. The residual disorders contributed to the patients' overall disability.

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