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The long-term prognosis of whiplash-associated disorders (WAD)

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Abstract Somatic and mental symptoms in 22 patients (16 women and 6 men) 22–73 months after a whiplash injury are described. The results of the present study are compared with the corresponding results of a previous study on the same patients. According to the Quebec Classification System, the whiplash injuries of 15 patients were classified as grade 2 and those of 7 patients as grade 3. Pain intensity was evaluated by means of a visual analogue scale and muscular tenderness was assessed by pressure algometry. Algometry was also used to measure the pain tolerance level. The Mood Adjective Check List was used as a measure of mental well-being. During the 2 years that had passed since the previous study, the patients had improved regarding pain intensity, pain tolerance level and mental well-being. The results show that patients

with prolonged disability after a whiplash injury can improve even after a long time.

Key words Whiplash-associated disorders · Whiplash-associated disorders, mental well-being · Whiplash-associated disorders, muscle tenderness · Whiplash-associated disorders, pain tolerance

Introduction

A distinction is generally made between an acute and a chronic state of whiplash. The most common acute symptoms are neck pain and restricted mobility in the cervical spine. A number of associated disorders are often included in the symptomatology, such as headache, pain in the thoracic spine, radiating pain, paraesthesiae and/or weakness in the arms, vertigo, visual and auditory disturbances and dysphagia [1, 2]. Clinical examination may reveal tense and tender cervical muscles, restricted cervical mobility and sometimes sensory and motor disturbances.

“Late whiplash syndrome” is present by definition when patients still have symptoms after 6 months [10]. In addition to the acute symptoms, the chronic state includes depression, anxiety, difficulty in concentrating, fatigue and irritability [1, 7]. The persistent symptoms have been attributed to underlying organic pathology, psychological factors or financial gain [3].

Most patients who develop chronic symptoms are in the 21- to 50-year age group and the majority are women [1].

An international committee in Quebec recently presented a standardised classification system of whiplash injuries in the form of a three-point scale grading the severity of the clinical symptoms with a time axis for each grade [14].

At the Department of Neurology, Sahlgrenska University Hospital in Gothenburg, a previous study looked at patients with somatic and mental symptoms at a mean of 1 year after a whiplash injury [5]. The aim of the present study was to describe the somatic and mental symptoms of the same patients after a further 2 years and to compare the patients' current impairments with those documented in the previous study.

Materials and methods

Subjects

The patients taking part in the previous study [5] consisted of 30 consecutive patients (22 women and 8 men) who were diagnosed as having whiplash injuries at the Department of Neurology, Sahlgrenska University Hospital in Gothenburg, Sweden. Twenty-two (16 women and 6 men) of these 30 patients agreed to enter the present study and the results obtained are based upon their previous and present symptoms. Their mean age was 37 years (range 22–66 years).

Twenty patients had sustained injuries in car accidents (75% rear, 25% frontal) and two patients had been exposed to other types of acceleration/deceleration injuries. One patient had suffered a previous whiplash injury, but had no sequelae at the time of the second accident.

The neck pain had appeared immediately or on the same day as the accident in 18 patients (82%). The other four patients reported a pain-free interval of varying length after the accident; in two patients the delay exceeded 3 months.

The patients were categorised according to the Quebec three-point scale [14]:

1. General, nonspecific complaints or symptoms about the neck without objective signs
2. Neck complaints plus signs limited to musculoskeletal structures
3. Neck complaints with neurological signs

Fifteen of the 22 patients were assigned to grade 2 and the remaining 7 patients to grade 3.

Radiological examination of the cervical spine had revealed no fractures or dislocations. Magnetic resonance tomography (MRT) had been performed on 18 of the 22 patients. Twelve patients presented degenerative changes with osteophytes with or without bulging discs.

At the time of the present study an average of 3 years (range 22–73 months) had passed since the accident and approximately 2 years (range 16–41 months) had passed since the previous study. Fourteen patients worked now 50% or more, as compared to 7 patients in the previous study [5]. Twelve patients were still dependent on some kind of sickness benefit. Further data are given in Table 1. Fifteen patients (68%) were still involved in litigation, as compared to 95% in the previous study (Table 1).

Most patients had tried many different treatments, but only with short-term pain relief. A control group comprising 30 healthy individuals (20 women and 10 men) with a mean age of 32 years (range 19–63 years) was used for comparisons.

A reference group representing the population of Gothenburg (Persson, unpublished data) served as age- and sex-matched controls in the evaluation of mental well-being.

All participants gave their informed consent prior to inclusion in the study. The study was approved by the Ethics Committee at Sahlgrenska University Hospital in Gothenburg.

Table 1 Source of income and litigation involvement in the present and in the previous study

Source of income	Number (%)	
	Present study (n = 22)	Previous study (n = 22)
Litigation involvement		
Full-time work	7 (32%)	4 (18%)
Part-time work ≥ 50%	4 (18%) ^a	3 (14%)
Part-time disability pension ≤ 50%	3 (14%)	–
Sick leave >50%	5 (23%)	12 (55%)
Full-time disability pension	1 (5%)	1 (5%)
Unemployment	1 (5%)	2 (9%)
Retirement pension	1 (5%)	–
No negotiations with insurance company are going on	7 (32%)	1 (5%)
Negotiations with insurance com- pany are going on	15 (68%)	21 (95%)

^a Three patients are still dependent on sickness benefit

Drop-outs

Eight patients (six women and two men) from the previous study [5] did not take part in the present study. Four of these worked full-time, one 75% and two had begun s. c. working training. None of these seven patients considered that they could spare the necessary time away from their present work. In response to a direct question about their pain problems, they reported insignificant pain that did not hinder them from working. In the previous study [5], their mean VAS score had been 25 mm (SD 25) as compared to 48 mm (SD 25) for the rest of the group. One patient, who had left the town, could not be reached. Of the eight patients from the first study who did not take part in the present one, the whiplash injuries of seven were classified as grade 2 and those of one as grade 3 according to the Quebec classification [14].

Assessment instruments

The patients were asked to stop their intake of analgesics and sedatives the day before the examination. The investigators had no access to the previous results.

Pain intensity

Pain intensity was assessed by means of a visual analogue scale (VAS) [4]. The patients were instructed to rate their pain at the time of examination.

Pain location and characteristics (pain drawing)

Instructions for the pain drawing were: draw your pain on the figure; include all areas where you feel pain or other sensations; use symbols to indicate the types of pain or other sensations. Symbols could be selected from a fixed set of symbols describing different pain types, such as aching, burning, throbbing, cutting, numbing or pressing.

Cervical mobility

Neck mobility was measured with an inclinometer (Myrin, LIC, Solna, Sweden) [9]. All movements, including flexion, extension,

side flexion and rotation, were measured with the participants seated. For each movement, the participants were instructed to move their heads actively as far as they could. Care was taken to make sure that a pure movement of the head took place and movements of the shoulders or the back were minimised. Each movement was repeated twice and the best of the two was recorded.

Handgrip strength

Grip strength was measured by means of maximal manual compression of a rubber balloon (Vigorimeter, Modema, Bromma, Sweden). The pressures were registered in bars. During the test, the participants were sitting in a chair with an elbow angle of 90° and with the wrist in a neutral functional position, i.e. with a slight ulnar and dorsal flexion. Three measurements were performed with an interval of 30 s and the mean value was registered [15].

Muscular tenderness

Muscular tenderness was assessed by pressure algometry. The measurements were performed at 14 points which were selected because they corresponded to the location of pain and were easy to identify. The muscle sites chosen were:

1. The origin of the extensor carpi radialis longus muscles at the lateral epicondyle
2. The insertion of the deltoid muscles at the deltoid tuberosity of the humerus
3. The passage of the proximal tendon of the long head of the biceps brachii muscles in the intertubercular sulcus of the humerus
4. The insertion of the levator scapulae muscles at the superior angle of the scapulae
5. The insertion of the sternocleidomastoid muscles at the mastoid process
6. The middle part of the trapezius muscles
7. The origin of the trapezius muscles at the occipital protuberance

The Pressure pain threshold (PPT) was measured by means of a pressure algometer (Somedic, Farsta, Sweden), which consists of an acrylic handle with a pressure-sensitive strain gauge at the tip connected to an amplifier. The tip of the algometer was provided with a probe 0.5 cm² in area, covered with 1-mm-thick soft polypropylene material. The pressure is given in kilopascals [6, 8]. Before the measurements, the patients were informed about the procedure and told that their pain threshold was to be tested. They were asked to press a button, which they held in the hand opposite to the tested side, as soon as the sensation changed from pressure to pain. It was stressed that the pain threshold and not the tolerance was to be tested. The test was performed with the patients in relaxed lying and sitting positions.

Pain tolerance

The pain tolerance level was measured on the distal phalanx of digit II before the PPT test [8]. The difference between pain threshold and pain tolerance was carefully explained to each participant.

Mental well-being

Patients' mental well-being was measured by the Mood Adjective Check List (MACL) [13]. The MACL consists of 71 adjectives describing mood and related feelings. The patients indicate their current emotional states by marking a series of scale from 1–4; higher scores indicate more positive emotional states.

The adjectives are clustered in six bipolar dimensions:

1. Pleasantness/unpleasantness
2. Activation/deactivation
3. Calmness/tension
4. Extroversion/introversion
5. Positive/negative social orientation
6. Confidence/lack of confidence

An overall mood index was also calculated.

Statistical methods

For comparison between the 22 patients' previous and present measurements the *t*-test for paired observations was used. For comparison with the control groups the *t*-test for group comparison was used. The tests were considered significant at the 5% level.

Results

Pain intensity

The mean VAS score of the patient group was 30 mm (SD 22 mm), with a range of 1–78 mm. This is significantly lower ($P < 0.01$) compared with the previous study [5], in which the mean score was 48 mm (SD 25 mm), with a range of 5–85 mm. Five patients of 15 in grade 2 and 4 patients of 7 in grade 3 (Quebec Classification System) reached a "clinically significant improvement level", which corresponds to an improvement of 50% or more.

Pain location

As in the previous study, all patients had neck pain. Headache and pain in the shoulder, arm/hand and thoracic spine were also common in the present study, which is in accordance with the previous study (Table 2).

Pain characteristics

In this study, neck and shoulder pain was usually described as aching, arm/hand pain as aching and/or numbing, while headaches had pressing and/or aching characteristics. Thir-

Table 2 Pain location of the patients in the present study

Pain location	Number (%) (<i>n</i> = 22)
Neck	22 (100%)
Shoulder	9 (41%)
Arm/hand	9 (41%)
Thoracic spine	8 (36%)
Head	7 (32%)
Chest	5 (23%)
Lower back	2 (9%)
Face	2 (9%)

teen patients (59%) occasionally had pain-free periods, compared to nine patients (45%) in the previous study.

the previous study, the patient group had a significantly lower PPT compared with controls.

Cervical mobility

The results of all movements show that there is no significant difference between the present and the previous study. The mobility of all tested movements was significantly lower ($P < 0.001$) in the patient group compared with controls.

Pain tolerance level

The patients' tolerance to pain showed a remarkable increase ($P < 0.001$), from a mean value of 356 kPa (SD 90 kPa) in the previous study to 633 kPa (SD 261 kPa) at the time of this study. The present value was higher, although not significantly, than the mean value of the controls, which was 568 kPa (SD 184 kPa).

Handgrip strength

The mean value of the patients' grip strength was 0.79 bar (SD 0.22 bar), which does not differ significantly from the 0.75 bar (SD 0.34 bar) in the previous study. The grip strength showed a significantly lower value ($P < 0.01$) compared with the controls.

Mental well-being

Only 15 of the 22 patients participating in this study performed the MACL in the previous study. Comparison between previous and present results is therefore based upon these 15 patients' values. Mental well-being shows a considerable improvement on all dimensions as compared to the previous study (Table 4). In spite of the improvement of the patient group, they still presented significantly lower scores on four out of six dimensions compared with the reference group (Table 4). On one dimension, "confidence/lack of confidence", there was, similarly to the pre-

Muscular tenderness by algometry

There was no significant difference between the patients' previous and present values for muscle tenderness except for two muscle sites (Table 3). In this study as well as in

Table 3 Muscle tenderness: mean value (SD) of pressure pain threshold (PPT) in kilopascals

Muscle	Pressure pain threshold				
	Present study ($n = 22$)		Previous study ($n = 22$)		P
	Mean	(SD)	Mean	(SD)	
M. extensor carpi radialis longus	229	(147)	149	(47)	*
M. deltoideus	214	(135)	200	(81)	n.s.
M. biceps brachii	174	(98)	150	(61)	n.s.
M. levator scapulae	181	(106)	176	(57)	n.s.
M. sternocleidomastoideus	106	(58)	113	(37)	n.s.
M. trapezius	139	(79)	106	(46)	**
M. trapezius (occipital protub)	138	(87)	136	(50)	n.s.
All muscles	169	(89)	147	(44)	n.s.

* $P < 0.05$; ** $P < 0.01$

Table 4 The Mood Adjective Check List (MACL): mean (SD) score (range 1–4) of the patient group and reference subjects

MACL items	Previous study ($n = 15$)			Present study ($n = 15$)			Reference subjects ($n = 112$)	
	Mean	(SD)	P	Mean	(SD)	P	Mean	(SD)
Overall MACL	2.49	(0.53)	***	3.02	(0.50)	*	3.30	(0.39)
Pleasantness/unpleasantness	2.35	(0.72)	***	3.00	(0.67)	**	3.38	(0.50)
Activation/deactivation	2.31	(0.66)	***	2.89	(0.65)	***	3.43	(0.45)
Calmness/tension	2.30	(0.53)	***	2.77	(0.67)	**	3.24	(0.64)
Extroversion/introversion	2.53	(0.54)	**	3.02	(0.42)	n.s.	3.05	(0.49)
Positive/negative social orientation	2.71	(0.68)	***	3.35	(0.41)	**	3.65	(0.34)
Confidence/lack of confidence	2.73	(0.53)	**	3.08	(0.55)	n.s.	3.07	(0.54)

* $P < 0.05$; ** $P < 0.01$;
*** $P < 0.001$

vious study, no difference between the patient group and the reference group. Regarding the dimension "extroversion/introversion", the present patient group and the reference group did not differ significantly, while in the previous study the patient group presented a significantly lower score on this dimension.

Discussion

In the present study, which is a follow-up 2 years after the previous study [5], the results show a clear improvement regarding many of the patients' somatic and mental symptoms. Thus, the patients find their pain less intensive and now have more pain-free periods. The tolerance to pain has also increased. The rating on the MACL indicates an improved mental well-being, but still not reaching that of the healthy controls. The neck mobility and the handgrip strength in the patient group are almost unchanged since the previous study and significantly lower than in the controls.

In the present study, the patients had no access to their previous VAS assessments. This has been shown to be the best course of action when comparing pain intensity from one time to another [4].

The present study has shown that the long-term prognosis of WAD is relatively good. The most pronounced

improvement occurred in mental well-being. This would probably not have been the case if the patients had experienced psychological problems before the accident. It supports the hypotheses that the patients' psychological problems are rather a consequence than a cause of somatic symptoms in whiplash injuries [12]. In the present study pain intensity also improved significantly. It has been reported that recovery from physical symptoms often leads to improved mental well-being [11]. It is also possible that patients who have long-term symptoms, as in the present study, might improve their mental well-being by rational adaptation to the situation [11].

An analysis of the drop-outs (27%) revealed that the vast majority had improved. This implies that the drop-outs will not have influenced the results negatively and supports the general findings of the study that most patients with WAD improve with time.

Conclusions

The results of the study show improvement with time in many patients suffering from prolonged disability after a whiplash injury.

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