Kurt Pettersson
Sven Brändström
Göran Toolanen
Christer Hildingsson
Per-Olof Nylander

Temperament and character: prognostic factors in whiplash patients?

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K. Pettersson (✉) · G. Toolanen
C. Hildingsson
Department of Orthopedics,
Umeå University, Umeå, Sweden
Fax: +46-19-6025189,
e-mail: kurt.pettersson@orebroll.se

S. Brändström · P.-O. Nylander
Division of Psychiatry,
Department of Neuroscience
and Locomotion, Linköping University,
Linköping, Sweden

P.-O. Nylander
Department of Psychiatry,
Kalmar, Sweden

Present address:
K. Pettersson
Department of Hand Surgery,
Örebro University Hospital,
701 85 Örebro, Sweden

Abstract We studied the relationship between whiplash injury and personality in 40 whiplash patients who admitted the hospital within 8 h from the car accident and 80 age- and gender-matched controls. For this purpose we used the Temperament and Character Inventory (TCI). We found that personality dimensions in whiplash patients both in the acute phase and at follow-up 2 years later showed the same results, i.e., significantly less Harm Avoidant (less anxious; low HA) than controls, but when dividing patients into groups depending on severity of outcome from whiplash injury 2 years after, no differences were found. According to our results personality symptoms related to whiplash injury is probably not a secondary phenomenon. Whiplash patients were normally developed in character, i.e.,

self-directedness (SD), and CO (cooperativeness) and therefore in general are capable of coping with their somatic problems.

Keywords Whiplash · Personality · Temperament · Character · TCI · Harm avoidance

Introduction

The aim of this study was to evaluate if temperament and character differs in whiplash patients compared with controls, and if personality traits interact with recovery or changes within time after whiplash injury.

Our findings indicate that whiplash patients do not differ from normal controls. We found the same results for whiplash patients tested in the acute phase and at follow-up 2 years later and accordingly, personality symptoms related to whiplash injury is probably not a secondary phenomenon. Whiplash patients were normally developed in character and therefore in general are capable of coping with their somatic problems. Most whiplash patients did

not develop persisting symptoms, but a small proportion of patients with WAD had remaining symptoms which could not be explained by personality dimensions.

In an early study presented by Berstad et al. in the mid-1970s [3] whiplash patients were diagnosed as neurotic with moderate to severe symptoms. More recently, Mayou et al. 1993 [28] concluded that whiplash patients scored significantly higher on the neurotic scale of the Eysneck personality inventory. Contrary to this, Gargan et al. [16] and Versteegen et al. [54] stated that whiplash patients' personality profiles do not differ from the population in general. This conclusion was supported by Wallis et al. [51] and Squires et al. [46], who claimed that the psychological profile and pain intensity ratings in whiplash patients did not differ compared with patients with pain of

organic origin, e.g., rheumatoid arthritis, thus reactive to physical pain. Later, Wallis et al. showed that psychological distress resolved following neurosurgical treatment and relieved pain [52].

Radanov et al. [38] have suggested that psychological and cognitive problems are instead a secondary phenomenon correlated to the disease, and that the whiplash injury can initiate a vicious circle, which may explain the secondary neurotic reaction among whiplash patients. But they found no correlation between personality traits and the course of recovery from whiplash, in agreement with a recent study by Borchgrevink et al. [4]. Contrary to this, previous studies [7, 13, 15, 17, 33] have suggested whiplash injuries to be psychogenic in origin and create or contribute to somatic symptoms after whiplash injury.

Materials and methods

The present prospective cohort study included 40 whiplash patients (22 males and 18 females) with a mean age of 34.6 ± 13.2 years (age range 18–64 years). Eighty age- and gender-matched controls (44 males and 36 females) with a mean age of 34.7 ± 13.3 years (age range 20–69 years) were recruited from the normal population in northern Sweden [39]. Informed consent was obtained from all participants and the Ethical Committee approved the study.

All patients were admitted consecutively to the Department of Orthopedic Surgery at the university hospital of northern Sweden because of a whiplash injury resulting from a car accident. The patients had been admitted to our hospital (which serves an area of 110,000 inhabitants) within 8 h of car accident. The university hospital is the only hospital admitting patients from this area. Patients with WAD grades II and III according to the Quebec Task Force Classification on whiplash-associated disorders were included in the study; those with WAD grades I and IV ($\approx 60\%$ of the patients) were excluded. Grade II includes musculoskeletal signs and neck complaints, and grade III includes additional neurological sign(s) such as decreased or absent deep tendon reflexes, weakness, and sensory deficits [45]. Exclusion criteria were unconsciousness, fracture, or dislocation of the cervical spine, head injury, or previous history of neck injury.

An experienced orthopedic surgeon examined the patients the same day as the accident occurred. Initial radiographs, including neutral lateral, flexion, and extension laterals, right and left obliques, as well as anteroposterior and anteroposterior open-mouth views of the cervical spine, were taken on admission in all cases. All radiographs were evaluated by the radiologist on duty. The examinations were performed on initial admission to hospital and clinical follow-ups involving repeated neurological examinations at all follow-up, a standardized questionnaire, covering type of car, impact direction, velocity, clinical symptoms, etc., was used including VAS scales for evaluation of symptoms initially. At the 2-year follow-up, the patients were examined by an independent observer who had no knowledge of the patients' previous clinical status or findings. All patients were examined with oto-neurological tests (pure-tone audiometry, brain/brain-stem audiometry, and oculomotor function tests) within 2 months after injury and repeated at 2-year follow-up to rule out brain/brain-stem dysfunction as a possible cause of cognitive problems. Most whiplash patients had come to an agreement with the insurance companies or social insurance offices within follow-up time. Those patients who had not settled their claims were evenly distributed between the groups according to severity of symptoms. An additional questionnaire comprising 12 items graded 1–6 and ten different VAS scales and pain sketch form were used 6 months, 1 year, and 2 years after injury.

This questionnaire covered various aspects of quality of life, pain, and cognitive disturbances such as lack of concentration, memory disturbances, anxiety, feeling of sickness, and depression.

Cloninger's Temperament and Character Inventory (TCI) were used for measuring personality dimensions. All patients completed the TCI within 8 h after injury. All patients except one who had former drug problems completed TCI at the 2-year follow-up.

The TCI is a 240-item (in Sweden 238-item), self-administered, true-false format, paper-and-pencil test which needs about 30 min to complete. Its high construct validity could be shown in many studies according to established personality theories and in different groups of subjects [12] and with respect to neurobiological parameters [20].

The inventory is based on Cloninger's unified biosocial theory of personality [12]. It measures four higher-order Temperament dimensions and three Character dimensions. The Temperament dimensions are Novelty Seeking (NS) and Harm Avoidance (HA), both composed of four lower-order subscales; Reward Dependence (RD), composed of three subscales; Persistence (PS) as a single-scale dimension. The Character dimensions are Self-Directness (SD) and Cooperativeness (CO), each be composed by five lower-order subscales and Self-Transcendence (ST) consisting of three subscales. Detailed descriptions of each of the seven dimensions are available elsewhere [10, 11, 12].

The control group is a matched sample from a larger study [6, 39] with mean values and standard deviations within 5% difference except for mean values for PS and standard deviations for HA, RD, and SD which are within 10% difference compared with the larger sample. The matched sample is due to the TCI's sensitivity to age and gender [6].

Statistical analysis

The data analyses were performed by using *t* test for independent samples to compare the distributions of the TCI-dimension score between controls and whiplash groups (acute and retest). For the analyses between test-retest in the whiplash group paired sample *t* tests were employed to evaluate differences in scale scores.

Furthermore, the whiplash group was subdivided into three groups (depending on severity of symptoms 2 years after injury) for testing inter-group differences between clinical subgroups. For this purpose we used Kruskal-Wallis test.

Analyses were conducted with SPSS, version PC 11.0.1 (Noru-sis).

Results

The mean scores and standard deviations for the samples of the higher-order dimensions of the TCI are reported in Table 1. Differences occurred between controls and whiplash groups both acute and retest, were the whiplash groups showed significant lower values in HA (Table 2). Differences were also found between the controls and the acute groups in ST where the acute group showed higher values.

We found no significant differences in the higher-order dimensions of temperament and character between whiplash patients tested in the acute phase and at 2 years follow-up (retest; Table 2).

Whiplash patients (retest) were divided into three subgroups depending on outcome (severity of symptoms and oto-neurological findings) 2 years after injury. The same evaluation procedure was performed at intake and at all follow-up, 6 months, 1 year, and 2 years. First group ($n=26$)

Table 1 Dimensions of Temperament and Character Inventory for controls, whiplash patients who tested acute, and after 2 years follow-up (retest; means and standard deviations). Test-retest correlations for whiplash group (using *t* test for paired samples)

	Controls (n=80)		Acute whiplash (n=40)		Whiplash retest (n=39)		Correlations acute-retest (n=39) r_{tt}
	Mean	SD	Mean	SD	Mean	SD	
Age	34.7	13.3	34.6	13.2	36.9	13.2	0.99
Temperament							
Novelty seeking	21.3	5.9	22.7	6.0	22.2	6.3	0.89
Harm avoidance	13.1	5.4	10.0	5.7	10.3	5.0	0.82
Reward dependence	14.9	3.3	15.2	4.4	15.9	3.6	0.82
Persistence	4.2	2.0	4.5	2.2	4.3	2.2	0.86
Character							
Self-directedness	33.1	5.2	32.5	5.7	32.2	5.8	0.75
Cooperativeness	33.4	5.1	34.0	5.5	34.4	5.5	0.89
Self-transcendence	11.9	5.9	14.7	5.1	13.7	5.0	0.76

Table 2 Temperament and Character dimensions: comparison between controls, whiplash patients who tested acute, and after 2 years follow-up (retest; using *t* tests for independent samples: *t* value/*p*)

	Controls/whiplash acute (n=120) df=118		Controls/whiplash retest (n=119) df=117		Whiplash acute vs retest (n=79) df=77	
	<i>t</i> value	<i>p</i>	<i>t</i> value	<i>p</i>	<i>t</i> value	<i>p</i>
Temperament						
Novelty seeking	-1.22	0.227	-0.76	0.447	0.36	0.719
Harm avoidance	2.95	0.004	2.73	0.007	-0.27	0.785
Reward dependence	-0.40	0.689	-1.52	0.132	-0.79	0.429
Persistence	-0.60	0.549	-0.11	0.912	0.39	0.696
Character						
Self-directedness	0.55	0.582	0.87	0.385	0.27	0.789
Cooperativeness	-0.62	0.536	-1.05	0.297	-0.36	0.724
Self-transcendence	-2.56	0.012	-1.70	0.091	0.82	0.417

showed no symptoms after recovery from whiplash injury. Second group ($n=8$) showed mild symptoms, mainly intermittent neck pain and headache. Third group ($n=5$) showed severe symptoms with daily neck pain and/or headache, radiating pain in one or both arms, cognitive disturbances, and pathological oto-neurological findings, neurological deficits (e.g., sensory deficits, weakness, and decreased tendon reflexes) requiring daily analgesics (paracetamol and dextropropoxyphene) and were still on sick leave (Table 3).

According to the results there are some differences, although not significant ones. The group consisting of those with severe symptoms seems to be older and differ mainly in temperament dimensions. Due to the small sample in this subgroup, this is something that needs further investigation.

In summary, The differences found between the whiplash group and controls are that HA were lower in the total whiplash group compared with controls. The acute group showed also higher values in ST compared with controls. No significant differences were found between the subgroups depending on outcome (severity of symptoms and oto-neurological findings) 2 years after injury.

Discussion

Many structures of the cervical spine, including muscles, ligaments, zygapophyseal joints, intervertebral discs, and neural structures, can be damaged by whiplash injury. Although the exact pathophysiology is not known, different hypotheses have been proposed as to whether it is a syndrome arising from neurosis and the desire for compensation or a definite organic disorder [45].

The association between personality and different chronic diseases, such as eating disorders, gastrointestinal diseases, cancer, and coronary heart disease, has previously been studied. For example, type-A behavior has been found to be associated with cardiovascular disease [18]. Certain personality traits are assumed to predispose to the development of particular diseases. If a specific personality profile can be identified which increases the vulnerability for a disease, this information is important for prevention, treatment, and recovery from the disease.

Impaired cognitive functioning after whiplash injury has been documented by several studies [24, 37, 43, 49,

Table 3 VAS scales at 2-year follow-up. *S* severe symptoms, *M* mild symptoms, *N* no symptoms

Patient no./ symptoms	General pain	Feeling of sickness	Depression	Concentration problems	Memory problems	Anxiety	Neck pain	Radiating pain in upper extremity	Neck pain last night	Radiating pain in upper extremity last night
1M	2.5	0.5	0	0	0	0	2.5	0	2	0
2N	0	0	0	0	0	0	0	0	0	0
3M	3.2	2	0.5	0.5	0.5	0	3	0	0	0
4M	0.5	0	0	0	0	1	0.5	0	0	0
5S	1.5	2	0.5	2.5	3	2.5	6.5	9	6	6
6M	3.5	0.5	0	0	0	0	4.3	0.5	4	0
7N	0	0	0	0	0	0	0	0	0	0
8N	0	0	0	0	0	0	0	0	0	0
9N	0	0	0	0	0	0	0	0	0	0
10N	0	0	0	0	0	0	0	0	0	0
11M	3	2.5	2	3	3	0	3	3	0	1
12S	6	1	4.5	4	1	2	6	5	6	2.5
13N	0	0	0	0	0	0	0	0	0	0
14N	0	0	0	0	0	0	0	0	0	0
15N	0	0	0	0	0	0	0	0	0	0
16N	0	0	0	0	0	0	0	0	0	0
17N	0	0	0	0	0	0	0	0	0	0
18S	3.5	0	4.5	0	0	3	4	5	0.5	0
19N	0	0	0	0	0	0	0	0	0	0
20M	5.3	0	0	2	0	2	5.4	0	4	0
21N	0	0	0	0	0	0	0	0	0	0
22M	0.5	0	0	0	0	0	0.5	0	0	0
23N	0	0	0	0	0	0	0	0	0	0
24N	0	0	0	0	0	0	0	0	0	0
25N	0	0	0	0	0	0	0	0	0	0
26N	0	0	0	0	0	0	0	0	0	0
27N	0	0	0	0	0	0	0	0	0	0
28S	4	4	6	4	0	3	5.5	4.5	3	2
29N	0	0	0	0	0	0	0	0	0	0
30M	2	0	0	0	0	0	2	0	0	0
31M	1	0	0	0	0	0	2.5	0	0	0
32M	2	0	0	0	0	0	2.5	0	0	0
33N	0	0	0	0	0	0	0	0	0	0
34S	3.5	0	0	3	3	1.5	5.7	5	4	2
35N	0	0	0	0	0	0	0	0	0	0
36N	0	0	0	0	0	0	0	0	0	0
37N	0	0	0	0	0	0	0	0	0	0
38N	0	0	0	0	0	0	0	0	0	0
39N	0	0	0	0	0	0	0	0	0	0

55], whereas others have failed to reproduce these findings [21, 44, 50]. Symptoms such as emotional lability, fatigue, insomnia, and impairment of attention, concentration and memory have been reported to become chronic in 15–50% of the whiplash patients [45].

Psychiatric illness sometimes produces pain, especially headache [47]. Pain might be related to serotonin deficiency [40], which also is common in depression. Furthermore, an affective disorder or other psychological circumstances [2, 5] could enhance an existing pain. Persistent pain may cause psychiatric symptoms as a secondary phenomenon and therefore the reason for psychiatric symptoms can be

the injury itself [30]; however, Mayou and Bryant [29], found no correlation between psychological and physical outcome but, psychological variables were found to be of importance of social disability and psychological outcome.

It is also widely accepted that psychosocial factors are related to illness behavior; however, Radanov et al. [36] concluded that psychosocial factors have little validity in explaining the recovery from whiplash injury, even though they found a relation between neuroticism and initial neck pain intensity and subjective cognitive impairment.

In order to identify whiplash patients in the acute phase and investigate the relation between initial symptoms and

signs, personality traits, and outcome, the inclusion criteria was patients with musculoskeletal and neurological signs and symptoms, e.g., WAD II–III. These patients can easily be identified and are believed to have a longer recovery period [49].

Our study is comparable with previous whiplash studies concerning age, gender, and type of car accidents [45]. The frequency of residual symptoms in our study is equivalent to that in reports [14, 31]. We found no significant differences between the three subgroups depending on severity of symptoms at follow-up and temperament and character. In this study, no data were found indicating that litigation could influence outcome. These findings are in agreement with the study recently published by Sapir and Group [41] and Schlesinger et al. [42], but contrary to findings presented by Cassidy et al. [8].

We found significant differences in the higher-order dimensions of temperament HA (less anxious) but only in ST for the character dimensions in the acute whiplash group compared with controls. We found the same results for whiplash patients tested at follow-up 2 years later (chronic phase), except for ST. Although these findings are significant, taken together the other results from the personality inventory, we do not attach any clinical importance to the findings.

In contrary to our findings Castro et al. showed that subjects with symptoms immediately after an experimental placebo collision had a higher score on the psychosomatic disorder scale [9]. Even when whiplash patients in our study were divided into groups depending on outcome at follow-up, we found the same results regardless of persistent whiplash symptoms or not. Therefore, the time aspect seems not to be an important factor and personality symptoms related to whiplash injury is probably not a secondary phenomenon, contrary to previous results [34].

Cloninger's model integrates concepts and research from neuroanatomy, neurophysiology of behavior and learning, and from developmental and clinical psychology [11, 12]. The distinction between temperament and character is assumed to be related to differences in the major brain systems for procedural learning, which involves perception-based differences in habits and skills vs propositional learning which involves individual differences in self-concepts about goals and values in relation to experience [12].

The Temperament dimensions are defined as genetically homogenous and independently inherited. These processes influence tendencies to activate (NS), maintain (RD), or inhibit (HA) behavior and influence the perception of the environment and society. Character is defined as individual differences in self-concepts which vary in the extent to which persons identify the self as an autonomous individual (SD) and as an integrated part of the humanity (CO), and as an integral part of the whole universe (ST). The observed phenotypic expression of personality does not represent directly the underlying genetic structure. Its

phenotype is the result of interactions between Temperament dimensions, Character dimensions, social, environmental, and other genetically determined influences during the whole life span.

It is possible that this personality inventory (TCI) is not sensitive enough to detect small differences in Temperament and Character as well as structural neuroimaging and functional brain studies seldom demonstrate organic origin [22] with few exceptions [26]. But in contrast to this, previous studies with TCI of other patient groups, such as migraine [32] and fibromyalgia [1], which can be suspected to be psychosomatic diseases, show opposite results with higher and significantly higher HA (Harm avoidance), respectively, compared with controls; however, in recent studies neuropsychological findings correlated with cognitive dysfunction have been demonstrated after whiplash injury [19, 23]. Still, our findings indicate that whiplash patients do not differ from normal controls, contrary to other studies which have described whiplash patients as neurasthenic [3], anxious, and depressed [25], and more neurotic [28], whereas another study [16] found no differences between whiplash patients and normal controls.

As pointed out by several authors neuropsychological problems after whiplash injury is often misinterpreted [27], and a watchful interpretation of neuropsychological test results is necessary [53]. Furthermore, it is possible, although not likely, that our findings could be an effect of selection bias: that patients less anxious are more common to attend the emergency hospital care which were one of the inclusion criteria. But this is contrary to the well-known fact that anxious patients are more likely to attend emergency hospital care than others; therefore, one reason for our results might be just the fact that our study was based on a consecutive, prospective, non-selected whiplash patient group.

When we divided whiplash patients into groups depending on outcome (no, mild, or severe symptoms) at follow-up 2 years later we found no correlation between personality traits and recovery after whiplash injury, in agreement with previous studies [4, 29, 35, 38]; however, the subgroups were small and further investigation is advocated.

We found no differences in character, i.e., Self-directedness or Cooperativeness, between the controls and the whiplash patients at the acute phase, at follow-up 2 years later, or depending of severity of outcome (recovery) after whiplash injury. This indicates that whiplash patients in general have normal mature personalities and are therefore capable of coping with their somatic problems as well as others.

According to our results a small proportion of patients with WAD develop persisting symptoms which could not be explained by personality dimensions; therefore, it seems reasonable that personality symptoms related to whiplash injury is not a secondary phenomenon.

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