



Original Article

Long-term Follow-up of Whiplash Injury of the Neck

頸椎過度屈伸(揮鞭式)損傷的長期隨訪

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ARTICLE INFO

Article history:

Accepted October 2012

Keywords:

neck injury
whiplash

ABSTRACT

Background: Whiplash injury has long-term sequelae, although little has been written about its long-term follow-up. The aim of the present study was to establish the factors affecting long-term outcome of whiplash injury.

Methods: This was a retrospective study in the public Russells Hall Hospital (Dudley, UK). Sixty-four patients who had whiplash injury of the neck due to road traffic accidents in 1995, 1996, and 1997 were recruited. All were treated with conservative means. Fifty-four patients replied. They were assessed using the Short Form 36 Health Survey (SF-36) and Whiplash Disability Questionnaire Score (WDQS).

Results: Twenty-two patients (40.7%) were still symptomatic 10 years after injury. Eighteen patients (33.3%) had pins and needles sensation in their limbs; 13 (24.1%) had frontal headache; and seven (13%) had occipital headache. The mean WDQS in patients with low back pain was 29.23 and 12.53 for those without back pain. In smokers, the mean WDQS was 32.2 compared with 17.93 in non-smokers. The mean WDQS in those who did not drink alcohol was 26.73 compared with 16.58 in those who drank alcohol.

Conclusion: Whiplash injury patients have long-term residual symptoms; mainly pins and needles sensation in their limbs, headache, and dizziness. Increasing age and low back pain are bad prognostic factors. Claiming compensation prolongs the time for recovery. Sex, body mass index, type of treatment, smoking, and alcohol have no association with the incidence of persistent symptoms. However, smoking had a significant worsening effect on the severity of the symptoms in patients with high WDQS. WDQS, SF-36 and time to symptom relief are sensitive outcome measures of these injuries.

中文摘要

背景: 頸椎過度屈伸損傷是有長期的後遺症，然而很少文獻涉及它的長期跟進情況。這個研究之目的是要找出那些因素能影響頸椎過度屈伸損傷的長期結果

方法: 這是一個在公立醫院進行的回顧性之研究。在這項研究中，有64例患者頸部有頸椎過度屈伸損傷，都是因發生在1995年，1996年和1997年的交通事故而引致，全部皆予以保守治療，有54名患者回覆問卷調查。我們使用SF-36及頸椎過度屈伸損傷問卷(WDQS)作評估

結果: 有22例患者受傷10年後仍然是有症候的。其中18例患者有肢體的針刺感覺。13例有前額頭痛及7例枕部頭痛。有腰痛患者的平均WDQS分別為29.23；沒有背部疼痛的是12.53。在吸煙者中，平均WDQS為32.2；但非吸煙者是17.93。在不喝酒患者的平均WDQS為26.73；喝酒者是16.58。

結論: 頸椎過度屈伸損傷的患者，有長期的後遺症，症狀主要是肢體的針刺感覺，頭痛，頭暈。年齡的加增和腰痛都是不良的影響因素。涉及追討賠償問題，所需恢復的時間較長。性別，身體質量指數(BMI)，所接受的治療類型，吸煙和喝酒對持續性症狀的發生率沒有任何關聯。但是，吸煙卻能顯著地惡化症狀，並有較高WDQS。頸椎過度屈伸損傷問卷評分，SF-36和緩解症狀所需的時間，都是對這創傷的高靈敏度之測量方法。

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Introduction

Whiplash describes a neck injury caused by a sudden movement of the head forwards, backwards, or sideways leading to injury of the soft tissues of the neck (specifically ligaments, tendons, and muscles). Whiplash-associated disorder typically causes pain, stiffness, and a loss of movement in the neck. Headaches, muscle spasms, and pain in the shoulders or arms are also possible symptoms. It happens in motor vehicle accidents, sports activities, accidental falls, and assaults. Whiplash injury has long-term sequelae, however, little has been written about its long-term outcome.

Its annual incidence has varied between 70 per 100,000 in Quebec^{1,2} to 106 per 100,000 in Australia.³ Whiplash injury accounts for 85% of all claims for personal injury in motor accidents in the UK, costing over 3 billion pounds each year.⁴ Each case costs around 2500 dollars in Canada.² In South Australia with a population of 1.3 million aged > 15 years, approximately 4000 claims were made, with a cost of 70 million dollars.⁵

According to the National Accident Sample System in the UK, there are an estimated 300,000 new cases every year of neck injuries of occupants of motor vehicles that are involved in road traffic accidents: 73% of those wearing seatbelts developed neck pain as compared with 53% not wearing seatbelts. It might be due to the front seat occupants not wearing seatbelts being propelled towards the steering wheel, dashboard, or windshield, or out of the car completely. They could sustain more severe head injuries and other major trauma or even death.⁶ A study from Denmark found that about 67% of the patients who presented with whiplash injuries were either drivers or front-seat passengers.⁷

The aim of the present study was to establish the factors affecting long-term outcome of whiplash injury.

Materials and Methods

We recruited 64 patients who had whiplash injuries in road traffic accidents and presented to the accident and emergency department at our hospital from 1995 to 1997. Our hospital covers 400,000 of the population in the UK. Their names and details were identified from their accident and emergency case notes. Approval was acquired from the Institutional Review Board and informed consent was obtained from each patient or candidate. The initial examination was performed 5.6 ± 4.5 days after the accident and follow-up examinations at 3 months, 6 months, 1 years, and 2 years later. Exclusion criteria were the presence of bony injuries of the cervical spine, associated head injury, and polytrauma patients. The questionnaires were sent to the 64 patients but only 54 replied. Possible prognostic factors such as age, sex, body weight, body height, low back pain, compensation claims, type of treatment, smoking habit, and amount of alcohol consumption at the time of injury were recorded. The outcomes were assessed using the Short Form 36 Health Survey (SF-36) (body pain and emotional role); Whiplash Disability Questionnaire Score (WDQS); Quebec Task Force Clinical Classification of Whiplash Associated Disorders; time off work; time for symptoms to resolve completely; and residual symptoms such as headache, dizziness, neck pain, tingling sensation, and interscapular pain. They were asked if they were still receiving treatment and what type of treatment, such as soft collars, physiotherapy, and analgesics. The patients were asked whether the work they did at that moment was different from that before the injury.

Results

Twelve patients were male and 42 were female. The mean age of the female patients was 40.9 years (range: 25–61 years) and the

Table 1

Time taken for the patients' symptoms to resolve and correlation with Quebec Task Force classification

Time for the patients' symptoms to resolve	No. of patients	Quebec Task Force Clinical Classification of Whiplash Associated Disorders
<6 wk	4	2 Grade I, 2 Grade II
6 wk to 3 mo	10	4 Grade I, 6 Grade II
6 mo to 1 y	15	14 Grade II, 1 Grade III
>1 y	3	2 Grade II, 1 Grade III
≥ 10 y	22	19 Grade II, 3 Grade III

mean age of the male patients was 47.3 years (range: 30–70 years). Body mass index (BMI) was calculated in 48 patients: 32 had a BMI ≤ 25 , nine 25–30, and seven > 30.

The time taken for the patients' symptoms to resolve varied (Table 1). The average follow-up time was 10.3 years (range: 11.6–9.4 years).

Headache was one of the symptoms that hindered whiplash injury patients during long-term follow-up. Headaches following whiplash injuries were occipital, frontal, or generalised (Table 2), usually of muscular contraction type and often associated with greater occipital neuralgia. Eighteen patients were still complaining of pins and needles sensation in their limbs. WDQS was <20 in 38 patients. There was no correlation between BMI and WDQS or the other outcome measures.

The mean WDQS in patients with low back pain at the time of injury was 29.23 and for those who did not complain of back pain, it was 12.53 (Table 3). That means that patients with low back pain had worse prognosis than those without back pain at the time of injury. The WDQS, SF-36, and the time for symptoms to resolve showed that the patients with low back pain had significantly worse prognosis ($p = 0.005$).

Forty-four patients were non-smokers, and 18 (41%) had persistent symptoms at 10 years, and four (40%) out of 10 smokers had symptoms. There was no correlation between smoking and time to resolution of symptoms. However, smoking had a significant effect on symptom severity. The mean WDQS in the smokers was 32.2 compared with 17.93 in non-smokers. Twenty-four patients drank alcohol. There was no correlation between alcohol consumption and time to relief of symptoms. The mean WDQS in those who did not drink alcohol (26.73) was not significantly different from those who did drink alcohol (16.58), also the SF-36 score did not show any significant difference between drinking alcohol and non drinking alcohol groups.

Thirty-nine patients claimed compensation for their injuries; 17 (43.6%) had persistent symptoms, whereas four out of 15 (26.7%) patients who did not claim compensation had persistent symptoms. Concerning working history, 22 (40.7%) patients were working before their injury and still doing the same job, 22 (40.7%) were still working but had changed their job. Four (7.4%) patients were working before their injury but had retired, and four (7.4%) patients were working before their injury but not working at present. Two (3.7%) patients were not working before the accident and still not working at present.

Table 2

Headaches following whiplash injuries

Type of headache following whiplash injury	No. of patients
Frontal headache	13
Occipital headache	7
Frontal and occipital headache	17
No headache	17

Table 3

WDQS in patients with low back pain, smoking, and alcohol consumption

Whiplash Disability Questionnaire Score		<i>p</i> value
Low back pain = 29.23	Without low back pain = 12.53	0.005*
Smokers = 32.2	Non-smokers = 17.93	0.045*
Alcohol consumption = 16.58	Without alcohol consumption = 26.73	0.071

**p*-value ≤ 0.05 as significant.

The patients were treated with soft neck collars, physiotherapy, and analgesics in the early phase of their injuries. Sixteen (29.6%) patients were still receiving some sort of treatment in the form of analgesics and/or physiotherapy about 10 years later.

Statistical Analysis

SPSS version 15 software was used for statistical analysis. The risk factors included age, sex, low back pain, compensation claim, and treatment. The outcome measures were WDQS, body pain score, emotional role score, time off work due to injury, and length of time for symptoms to resolve. The correlations between each item are shown in Table 4.

Discussion

We looked for different risk factors and their impact on the long-term outcome of whiplash injury patients. Whiplash patients with several specific musculoskeletal and neurological signs and symptoms can have a long recovery period.² Other patients with few symptoms can be expected to recover fully within a few weeks.² Bannister et al have concluded that most patients who are symptomatic after 3 months will remain so indefinitely.⁸

Whiplash injury has long-term associated disability. One study showed that at 22–73 months, whiplash injury patients with

prolonged disability could improve after a longer period of time.^{9,12} In a study in Quebec in 2001² about the relation between initial symptoms and prognosis of whiplash, the median time for recovery was 32 days, and 12% of patients did not recover after 6 months. Drottning et al¹³ reported that 3% of the patients had still not recovered after 12 months and 35% of these patients would not recover after a further 5 years. In our study, 22 (40.7%) patients were still symptomatic 10 years after injury.

The Quebec Task Force Clinical Classification of Whiplash Associated Disorders has a prognostic value and its routine use is recommended.¹⁰ However, the Quebec Task Force study was self-limiting and ended by the time the compensation claims were settled. Hartling et al¹⁰ showed that the median time to recovery was 31 days, and 10% of patients were unable to resume normal activity 200 days post-injury. One of the disadvantages of the Quebec study was that the time to recovery was not the same as the time for compensation to be settled.¹¹ In our study, we found that claiming compensation delayed the time for recovery, to the extent that 21 patients (17 of whom had compensation claims) were still symptomatic 10 years after their injury. We found that the patients who claimed compensation took longer for their symptoms to resolve. Also, we found that 43% of the patients who claimed compensation were still symptomatic 10 years after their injury.

The disability after whiplash injury was not related to the severity of the injury.¹² Inclusion of pain as a disability item in the insurance system would increase the patients' morbidity.¹⁴ In the countries where pain is not considered as a disability in the insurance system, such as Singapore, New Zealand, and Lithuania, the incidence of chronic whiplash is low or nonexistent. These findings support the implementation of insurance systems designed to minimise litigation.¹⁴ The best predictors of outcomes of whiplash injuries were the SF-36 scores for body pain. Higher role emotional scores are associated with better outcome.⁵ In our study, we found that the body pain section of SF-36 was the best

Table 4

Correlation between risk factors and outcomes

Risk factors	Outcome measures				
	WDQS	Body pain score	Emotional role score	Time off work due to injury	Length of time for symptoms to resolve
Age	SC = 0.38, <i>p</i> = 0.005 (older age associated with higher WDQS)	SC = -0.39 <i>p</i> = 0.004 (older age associated with lower body pain score)	No	No	SC = 0.40 <i>p</i> = 0.003 (older age associated with longer times to resolve symptoms)
Sex	No	No	No	No	No
Low back pain	No	Low back pain associated with lower body pain scores (<i>p</i> = 0.005 MUT)	No	No	No
Compensation claim	No	No	No	No	Those who claimed compensation had longer times to resolve symptoms: Ktb = 0.26, <i>p</i> = 0.044. It did not affect the final outcome measure.
Treatment given					
Heat therapy				Longer time off work (Ktb = 0.34, <i>p</i> = 0.005)	
Physiotherapy	Higher WDQS (<i>p</i> = 0.019 MUT)			Longer off work (Ktb = 0.28, <i>p</i> = 0.024)	Longer time to resolve symptoms (Ktb = 0.32, <i>p</i> = 0.012)
Exercises					Longer time to resolve symptoms (Ktb = 0.26, <i>p</i> = 0.041)
Analgesics	Higher WDQS (<i>p</i> = 0.029 MUT)				Longer time to resolve symptoms (Ktb = 0.33, <i>p</i> = 0.007)

Ktb = Kendall's τ -b; MUT = Mann–Whitney U test; No = no significant correlation; SC = Spearman correlation; WDQS = Whiplash Disability Questionnaire Score.

outcome predictor. We also found that time for symptoms to resolve is a good outcome predictor in evaluating whiplash injury.

One study found no association between sex and outcome of whiplash injury.⁵ Other studies have reported that women and older patients have worse outcome.^{15,16} A study in Finland in 2004 found no difference between sex and age and the perceived change in health at 3 years after injury.¹⁷ They reported that classification of whiplash-associated disability was significantly reflected in health impairment. In a study in South Australia in 2005, there was no consistent association between age and outcome of whiplash injury.⁵ In our study, we found a significant association between age and outcome of whiplash injury, and increasing age was a bad prognostic risk factor for the disability of persistent symptoms. There was a correlation in the outcome measures WDQS, body pain score, and time for symptoms to resolve. We found that sex had no long-term effect on the outcome of whiplash injury. The Toronto study in 2001 found that female patients did badly after whiplash injury.¹⁵

We found that patients with back pain had poor prognosis after whiplash injury. They showed lower scores in SF-36 and longer time for resolution of symptoms. This has also been reported by Lankester et al¹⁸ who showed that pre-injury back pain was associated with poor outcome. Guez et al¹⁹ evaluated the prevalence of chronic low back pain in individuals with chronic neck pain of traumatic and nontraumatic origin, with special emphasis on whiplash injury. They reported that there was no difference in the prevalence of chronic low back pain between whiplash injury and other types of neck trauma. The prevalence of chronic low back pain was three times higher in individuals with chronic neck pain than in the general population.

It has been discussed if the high rate of low back pain after whiplash injuries in patients with seatbelts is caused by distortion of the lumbar spine simultaneously with the neck trauma.²⁰ However, Guez et al¹⁹ disagreed with this theory, because they found that other types of trauma to the cervical spine led to an equal frequency of chronic low back pain. This was further supported by the fact that individuals with chronic neck pain after whiplash injury had the same prevalence of chronic low back pain as those without a neck injury. Chronic musculoskeletal pain, which is common in the general population, was characterised by pain appearing at different sites in the body.²¹ These symptoms are probably due to several factors such as those of a psychosocial and sociodemographic nature, the nature of compensation systems, and cultural background. Individuals with persistent regional pain are more prone to report persistent pain elsewhere, as well as several other symptoms.²²

In conclusion, whiplash injury patients have long-term residual symptoms: mainly pins and needles sensation in their limbs, headache, and dizziness. Claiming compensation is associated with longer time to resolution of symptoms in whiplash injury patients. Drinking alcohol, sex, BMI, and type of treatment after the initial injury have no significant effect on the long-term outcome of these injuries. Smoking has no significant effect on the time to symptom resolution, but has a significant effect on symptom severity. Increasing age and low back pain are bad prognostic factors. WDQS, SF-36 (body pain), and time for symptom resolution are sensitive outcome measures to assess those injuries.

WHIPLASH DISABILITY QUESTIONNAIRE

This questionnaire has been designed to provide information on the impact that your whiplash injury and symptoms have upon your lifestyle. Please circle a number in each section to indicate how you have been affected by the whiplash injury and symptoms. If

NAME:..... DATE:...../...../.....

1. How much **pain** do you have today?
0 1 2 3 4 5 6 7 8 9 10
No Pain ----- Worst pain imaginable
2. Do your whiplash symptoms interfere with your **personal care** (washing, dressing, etc.)?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Unable to perform
3. Do your whiplash symptoms interfere with your **work/home/study duties**?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Unable to perform
4. Do your whiplash symptoms interfere with **driving or using public transport**?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Unable to travel in car/use public transport
5. Do your whiplash symptoms interfere with **sleep**?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Cannot sleep
6. Do you feel more **tired/fatigued** than usual since your injury?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Always
7. Do your whiplash symptoms interfere with **social activity**?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Unable to socialise
8. Do your whiplash symptoms interfere with **sporting activity**?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Unable to participate
9. Do your whiplash symptoms interfere with **non-sporting leisure activity**?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Unable to participate
10. Do you experience **sadness/depression** as a result of your whiplash injury/symptoms?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Always
11. Do you experience **anger** as a result of your whiplash injury/symptoms?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Always
12. Do you experience **anxiety** as a result of your whiplash injury/symptoms?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Always
13. Do you have difficulty **concentrating** as a result of your whiplash injury/symptoms?
0 1 2 3 4 5 6 7 8 9 10
Not at all ----- Unable to concentrate

one or more questions are not relevant to you (e.g., you don't participate in sporting activities), please leave the question blank.

Source: Pinfold M, Niere KR, O'Leary EF, et al. Validity and internal consistency of a whiplash-specific disability measure. *Spine* 2004;**29**:263–8.

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