ORIGINAL ARTICLE

Whiplash associated disorder: incidence and natural history over the first month for patients presenting to a UK emergency department

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An appendix to this paper has been posted online at <http://www.emjonline.com/supplemental/>

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Objectives: To describe the epidemiology, process of care, and outcomes at 4–6 weeks after injury among patients with whiplash associated disorder attending a UK emergency department.

Methods: All patients presenting during the study period with neck pain following a road traffic accident who met the inclusion criteria were assessed. Patients were followed up with a telephone interview at 4–6 weeks after attendance using the Neck Disability Index (NDI). The patient's general practitioner (GP) was contacted post attendance to ascertain subsequent healthcare use.

Results: A total of 200 patients were recruited to the study, of which 30 were lost to follow up. Four variables, midline tenderness ($p=0.008$; 95% CI 0.9 to 6.1), x ray request ($p=0.004$; 0.9 to 6.1), wearing a seat belt ($p=0.038$; 0.2 to 6.2), and having seen their GP post injury ($p=0.001$; CI –10.5 to 6.6), were found to be associated with a higher NDI score at follow up. Significant correlation was identified with a high pain score and an increasing age of patient and high NDI scores. No correlation was found between the impact speed, speed of vehicle struck, or time since incident with the NDI. Two thirds of patients had some disability at 4–6 weeks after injury; 91 patients (54.5%) saw their GP in the intervening period between attending the department and telephone follow up, and 87/170 patients had no idea about their prognosis.

Conclusions: This study identifies that there is significant disability associated with whiplash associated disorder. Clear prognostic information would be a useful development.

Whiplash associated disorder is a common, disabling, and expensive condition. It is estimated that 300 000 road traffic accidents (RTAs) per year result in whiplash injuries, with a cost to the UK economy of £3 billion.¹ UK figures indicate that around 50% of participants do not recover by three months.²

The term whiplash has suffered from a lack of definition. We adopted the term 'whiplash associated disorder' as defined by Spitzer *et al.*³ This disorder is caused by an acceleration and deceleration mechanism of energy transferred to the neck. It may result from rear-end or side impact motor vehicle collisions, but can also occur during diving and/or other mishaps. The impact may result in bony or soft tissue injuries (whiplash injury), which in turn may lead to a variety of clinical manifestations.

It was evident from the literature that no sizeable prospective study had been undertaken in the UK of people suffering from whiplash associated disorder who present to the emergency department. We decided to study a cohort of patients who could be easily defined, treated in a standardised way (based on the best available evidence at the time of this study) and followed up using a combination of standardised assessment tool, open questions, and general practice surveys. We wished to establish the following:

- Epidemiology of whiplash
 - Description of the patients in terms of age, sex, and frequency
 - Neck symptoms prior to injury
 - Details of the accident

- Process of care
- Service delivery by the emergency department in terms of (a) time in the department, (b) numbers of patients immobilised, and (c) numbers of patients undergoing x ray
 - Patients' perspective in terms of their experience in the emergency department
- Outcomes of care
 - Assessment of residual symptoms at four to six weeks after injury using the Neck Disability Index (NDI), and use of general practice and other health service providers
 - Patients' expectation of the duration of their neck symptoms

We hope this information would give a greater understanding of whiplash associated disorder as it presents to UK emergency departments (ED) and provide a baseline description which will also inform future studies.

METHOD

Setting

We conducted this study in the Emergency Department, Southampton General Hospital, Southampton, UK, which serves a population in excess of 0.5 million living in a mixed urban and rural setting. At the time of the study the annual

Abbreviations: ADL, activities of daily living; GP, general practitioner; NDI, Neck Disability Index; RTA, road traffic accident

attendance rate at this department was 70 000 new patients per annum.

Patients

Inclusion criteria

- Patients with neck pain at the time of presentation
- Involved in RTAs
- Over 18 years of age
- Glasgow Coma Scale (GCS) score of 15
- No distracting injuries
- Clinically stable (not shocked or in respiratory distress)
- Not under the influence of alcohol or drugs

Exclusion criteria

- Patients who had no neck pain
- Thought to be multiply injured
- Motor or pedal cyclists or pedestrians involved in RTAs

We described our study population in terms of the whiplash associated disorder classification (table 1).

Recruitment

All patients who were involved in an RTA and had neck pain at the time of their emergency department presentation were invited to participate in the study and consented to telephone follow up. Epidemiological data and data relating to the RTA were recorded using a specially designed data collection form, while the patient was in the emergency department (see appendix 1; <http://www.emjonline.com/supplemental/>).

The notes of every patient who was coded on arrival as involved in an RTA by the receptionist were reviewed to identify those patients who were eligible to be recruited, and thus identify those who were missed. The staff associated with this latter group were reminded of the importance of this study. The treatment for whiplash associated disorder was given in a standardised way (see appendix 1; <http://www.emjonline.com/supplemental/>) and supplemented by a patient advice sheet.

Patients were sent a reminder letter at three weeks after the accident that they were going to receive a telephone call the following week. At telephone follow up four to six weeks after their attendance, specially designed data collection forms were used to ensure consistency in eliciting and recording patient responses. The questionnaire was specifically designed for this study and included the NDI.^{5,6} We chose the NDI to establish the degree of disability experienced by patients with whiplash associated disorder, given that whiplash-type injuries create more morbidity than mortality. The NDI (a revised form of the Oswestry Low Back Pain Index) is an instrument designed to assess the ability of an individual with neck pain to carry out activities of daily living (ADLs).⁶ The NDI covers pain intensity and

headaches, and ADLs such as personal care, lifting, reading, concentration, work, driving, sleeping, and recreation.

The telephone follow up at four to six weeks following the injury provided an opportunity for qualitative questions about a patient's experience in the department and their thoughts about prognosis, as well as administration of the NDI questionnaire. Staff were trained to ensure consistency in the application of the telephone questionnaires. Two nurses were seconded to the role of research nurse (RW/PW). They familiarised themselves with the questionnaire and carried out two to three mock follow up interviews, which were tape-recorded. Both nurse reviewed the tapes and areas of inconsistency or where elements could be improved were highlighted. Training of both nurses and doctors in how to use and complete the assessment proforma and data collection form was carried out repeatedly by the research nurses over the six month period both formally and informally, telling about the study and the importance of recruitment. General practitioners (GPs) were sent letters asking about patient usage of health care for their whiplash associated disorder for the month following their presentation in the emergency department.

The Southampton and South West Hampshire Joint Local Research Ethics Committee gave approval for all elements of this study. The study was undertaken before the introduction of the National Institute for Clinical Excellence guideline for imaging the cervical spine and the four hour waiting time target.

Data analysis

Simple descriptive statistics were used to describe the epidemiology and outcomes of the patients based on the data collected in the department and during the follow up telephone calls which were made four to six weeks later.

The NDI score is the sum of scores from the 10 components of the scale. Each component has a maximum possible score of 5; 0 indicates no degree of difficulty with the ADL and 5 the greatest degree of difficulty with that ADL. Therefore the higher the NDI score the greater the difficulty with ADLs. Where the respondent did not give a score for one of the components (such as for difficulty driving—because they had not been able to drive a car before the accident, or difficulty working when they had not been in paid employment before the accident), an average score of the rest of the components was added to give an overall NDI score. This enabled such individuals to be included in the analysis without systematically underestimating their score.

Continuous variables such as the pain score on arrival in the department, estimated speed of impacting vehicle, time since incident and attendance at the ED, estimated speed of patient's vehicle at the time of incident, and age of patient were correlated with the NDI score using Pearson's correlation coefficient and used as predictor variables. Relations between these dichotomous predictor variables collected using the clinical proforma and the NDI were explored using independent samples *t* tests with equal variances assumed unless Levene's test for equality of variance was significant. Data were analysed using SPSS (version 10) taking a 0.05 level of statistical significance.

RESULTS

Study duration

Recruitment ran from 31 May to 16 October 2001, the time for which funding was available. During this time 24 943 patients attended the department. A flow diagram of recruitment numbers is shown in fig 1. The figure also gives the reasons for the loss of 30 patients, despite two attempts to follow up.

Table 1 The Quebec classification of whiplash associated disorders⁴

Grade	Clinical presentation
0	No complaint about the neck—no physical signs (excluded)
1	Neck complaint of pain, stiffness, or tenderness only. No physical signs
2	Neck complaint and musculoskeletal sign(s)
3	Neck complaint and neurological sign(s)
4	Neck complaint and fracture/dislocation

Figure 1 Flow diagram of study recruitment.

Epidemiology

Of a total of 170 patients, 104 (61%) were female. The mean age was 32 years. Pain score on arrival in the department was recorded in 160/170 patients, with a mean score of 4.91. After attendance in the department 91 (54.5%) of 167 patients had seen their GP.

Past history of neck problems

A previous history of neck problems was present in 28 patients (16.5%). All patients were noted to be alert on arrival and only seven (4.1%) had any neurological signs or symptoms at presentation. A limitation in the amount of movement in their neck was reported by 19 patients (11.2%), whereas 59 (34.7%) patients had midline tenderness at presentation and 70 (41.2%) were referred for x rays of the cervical spine.

Accident data

Speed of vehicle

The estimated average speed ($n = 165$) of the vehicle that was struck was 14 mph. The estimated average speed of the impacting vehicle was 27 mph ($n = 143$). There was significant variation in the time since the accident to attendance at the department, and the mean was 541 minutes ($n = 163$).

Vehicle type and state, position of patient, and direction of impacting vehicle

In 159 (93.5%) cases, the victims were driving a car (van = 11 (6.5%)). In 139 cases (81.8%) the vehicle was struck by another car, in 18 (10.6%) by a van, in 8 (4.7%) by an HGV, and in 5 (2.9%) by another type of vehicle. The vehicle was driveable after the incident in 98 cases (61.6% $n = 159$). In the majority of cases ($n = 117$; 68.8%) the vehicle was struck from behind.

Seatbelt and airbag usage

A seatbelt was reported as being worn by vehicle occupants in 162 cases (95.3%). The air bag was deployed in only two cases (1%).

Outcomes at one month

The NDI was the principal outcome measure. The mean (SD) NDI score was 9 (8) and the median score was 7.5 (25th and

Table 2 Results of the data analysis

Variable (Neck Disability Index)	No.	Mean (SD)	Equal variance not assumed	Mean difference	95% CI	Significance (2-tailed)
Seatbelt worn						
Yes	162	9.2 (8.2)				
No	8	6.0 (3.4)	Yes	3.2	0.2 to 6.2	0.038
X ray						
Yes	70	11.2 (8.2)				
No	100	7.6 (7.7)		3.6	0.9 to 6.1	0.004
Midline tenderness						
Yes	59	11.3 (8.9)				
No	111	7.9 (7.4)		3.4	0.9 to 6.1	0.008
Seen GP						
No	76	4.3 (5.5)				
Yes	91	12.8 (7.6)	Yes	-8.5	-10.5 to -6.6	0.001
Impact area						
Rear	117	9.6 (8.2)				
Other	53	7.8 (7.8)		1.8	-0.8 to 4.4	0.176
Limit movement						
Yes	19	9.6 (7.5)				
No	151	8.9 (8.1)		0.591	3.3 to 4.5	0.764
Neurological signs						
Yes	7	13.4 (7.0)				
No	163	8.9 (8.1)		4.5	-1.6 to 10.7	0.145
Previous neck problems						
Yes	28	10.7 (7.7)				
No	142	8.7 (8.1)		-1.9	-5.2 to 1.4	0.251
Vehicle driveable						
Yes	98	8.8 (8.0)				
No	61	8.6 (7.3)		0.143	-2.4 to 2.6	0.910
Sex						
Male	66	7.9 (7.1)				
Female	104	9.7 (8.6)		-1.8	-4.3 to 0.7	0.164

75th percentiles were 2 and 15, respectively). Following the classification used by Vernon and Mior,⁵ 37.1% of patients had no disability (scores 0–4), 37.6% had a mild disability (scores 5–14), 21.2% had a moderate disability, and 4.1% had a severe disability (scores 25–34).

Independent samples *t* tests were performed with Levene's test for equality of variances. Where equal variance has not been assumed this is indicated in table 2. On analysis of variables obtained using the clinical proforma and the NDI, four variables—midline tenderness, x ray request, wearing a seat belt, and having seen the GP after injury—were found to be associated with a higher NDI score at follow up (see table 2). Midline tenderness and x ray request are linked as midline tenderness was an indicator for referral for x ray. No association was found within the confines of this study between the other variables: impact area (rear end), limitation in movement, neurological signs, past neck problems, whether the vehicle was driveable, sex, and the NDI. The distribution of the NDI was somewhat skewed to the right, but the *p* values were similar when we used the Mann–Whitney U test instead of the *t* test. The exception was for seatbelts where the Mann–Whitney U test gave *p* = 0.51.

Significant correlation (Pearson's correlation) was identified with a high pain score ($r = 0.305$, $p < 0.01$; two tailed) and an increasing age of patient ($r = 0.251$, $p < 0.01$; two tailed) and high NDI scores. No correlation was found between the estimated impact speed ($r = 0.147$, $p = 0.080$), speed of vehicle struck ($r = -0.117$, $p = 0.135$), or time since incident ($r = 0.078$, $p = 0.319$) with the NDI.

Service implications

By reviewing patient notes and through the information gained in the additional questions during telephone follow up (*n* = 200) we found that 95 patients (47%) had triple immobilisation while in the department. The average time of immobilisation was 3 hours and 20 minutes (range 1–8 hours); 70 had cervical spine radiology and one patient had a CT scan.

Patient experience expressed at time of follow up

Enquires of the patients' perspective of their experience showed that most felt they received good care and that they felt it could not be improved (102/170); 44 patients felt the wait was too long and 18 reported being uncomfortable being immobilised. The exploration of anxieties revealed that 87 patients had no idea how long their symptoms would last and 43 were apprehensive about future neck problems.

GP follow up

From the follow up phone calls and data from the GP follow up questionnaires (*n* = 170) we identified that 93 patients (54.7%) saw their GP in the intervening period between attending the department and telephone follow up. The frequency of attendance at the GP surgery is shown in table 3.

We asked GPs to document the outcomes from the visit to the GP (NB: more than one outcome may have been recorded for the consultation—that is, physiotherapy and analgesia)

Table 3 Number of times people saw GP following injury during the month following injury (*n* = 93)

Number of times	Frequency
5–6	1
3	6
2	22
1	64

Table 4 Outcomes of GP visits

Outcome	Frequency
Analgesia	45
Physiotherapist	19
Time off work	17
Mobilisation/exercise	7
Muscle relaxants	3
Osteopath/chiropractor	2
Collar	1
Self-referral to chiropractor	1
Sent to the emergency department	1
Insurance company referral to physiotherapist	1
Referred to fracture clinic	1
Walk-in centre	1

(*n* = 93). The most frequent outcome was the prescription of analgesia followed by referral to physiotherapy (table 4).

DISCUSSION

The study demonstrated that approximately 1 in 125 new patients attending our emergency department will have whiplash associated disorder. This compares with an estimate of 1 in 200 people having minor neck injury of whiplash each year.⁷ Our study identifies that there is significant disability associated with whiplash. Two thirds of patients in this study has some disability at four to six weeks after the injury as measured by the NDI. More than half visited their GP in the month following their visit to the emergency department. This is in line with research which shows that 50% of patients do not recover by three months.² The association of the NDI score with midline tenderness, pain scores on presentation, and age is consistent with previous studies.⁸

Patients want to understand prognosis; the review by McClune *et al* and this study clearly demonstrates that a large number of patients had no idea about their prognosis.⁸ Clear prognostic information would be a useful development. Interestingly, *The Whiplash Book* does not contain much detail on prognosis except to say that if patients are still off work at three to six weeks, there is a 10% risk that they will be off work in one year's time.⁷

By standardising the approach to the patient in terms of assessment, diagnostic testing, treatment, and advice, a baseline approach has been described. The use of the *Whiplash Associated Disorder Training Pack*, *The Whiplash Book* or other evidence based advice leaflets should be of help.^{1 7}

Conclusion

Findings from this study suggest that two thirds of patients presenting with whiplash associated disorder are likely to have some degree of disability four to six weeks after injury. Patients have a limited understanding of their prognosis. If they are better informed of this it may help manage expectations and reduce unnecessary and unplanned follow up.

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AUTHORS' CONTRIBUTIONS

MC was the study collaborator with Hope Hospital Salford. MC and RC modified the study design, and managed the research within

SUHT. RW and PW were the research nurses who conducted the data collection and patient follow up. PT advised and assisted with data analysis. RC and MC drafted the paper. RC and MC act as guarantors.

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Competing interests: none declared

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