

# Neither the WAD-classification nor the Quebec Task Force follow-up regimen seems to be important for the outcome after a whiplash injury. A prospective study on 186 consecutive patients

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**Abstract** A classification of injury and a follow-up schedule were proposed by the Quebec Task Force (QTF) in 1995. No general agreement about the clinical usefulness of the WAD-classification or of the suggested follow-up regimen exists. A series of 186 consecutive cases seen in the emergency room during the acute phase after a whiplash injury was prospectively studied for 1 year. All findings including history and physical findings were recorded using standardized QTF protocols. In one group follow-up visits were done according to the QTF regimen: at 1, 3, 6, 12 weeks and 1 year after the accident; in a control group no visit was scheduled. The outcome variable was neck pain at 1 year after the accident. After 1 year, 18% of the total number of patients had significant neck pain. Risk factors for chronic neck pain at 1 year after whiplash injury were: neck pain before the accident and a high degree of emotional distress at the time of the accident; both factors independently associated with a tenfold increased risk of developing chronic neck pain. Neither the WAD classification nor the QTF follow-up regimen could be linked to a better outcome. In this study the outcome was associated with patient-specific characteristics and not with physical signs of injury, the depth of the initial evaluation or the follow-up regimen.

**Keywords** QTF classification · Follow-up plan · Multivariate analysis · Neck sprain · Outcome · Predictors · WAD · Whiplash injury

## Introduction

Forces acting on the neck at a motor vehicle accident (MVA) can result in soft tissue injuries (whiplash injuries), with different clinical manifestations, (Whiplash Associated Disorders; WAD). A classification of injury severity and a follow-up schedule were proposed by the Quebec Task Force (QTF) in 1995 [20]. Whiplash injuries are common and troublesome; they lead to a large portion of the total impairment and disability that result from traffic injuries.

The pathogenesis of WAD is obscure; the diagnosis is solely based on symptoms and physical findings since all today clinically available imaging methods have failed to convincingly show injuries to muscle, bone, discs, ligaments, spinal cord or brain stem in these cases. There is no effective treatment, thus the risk of unnecessary suffering and intolerable socioeconomic costs are obvious.

Previously, certain factors associated with chronic symptoms have been identified: female gender, neck pain before the accident, neck pain and emotional distress at the time of the MVA. In addition the QTF-group has suggested several factors [20]. This report has been criticized partially on formal grounds [11]. No general agreement about the clinical usefulness of the WAD-classification or of the follow-up regimen suggested by the QTF exists.

The aim of this study was to investigate the predictive value of the WAD-classification as well as several other factors assessed in the QTF regimen. A further aim was to investigate if the follow-up program proposed by the QTF

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improves the outcome. The Ethical Committee of the Karolinska University Hospital, Huddinge, approved the study protocol.

## Patients and methods

A consecutive series of 186 patients who were seen in the emergency room within a week from the injury were studied prospectively for 1 year. After that a fracture of the cervical spine had been ruled out by the physician on call, the patients were given an appointment to see an orthopedic surgeon (J.K.) in the next morning clinic for whiplash injuries. The inclusion criteria for the study were: age 18–65, a car accident followed by neck pain less than one week ago, and fluency in the Swedish language. All kinds of car impact directions were included. The exclusion criteria were: previous neck injury, other obvious simultaneous injuries or neurological disease – 65 patients were excluded. The study was designed as a longitudinal controlled study.

Formal randomization was not possible since the controls patients were not to be made aware of the study design. They were informed about the nature of the injury and that no further examination or office visit was necessary.

At the first visit, between November 1996 and June 1997, the 186 study subjects were allocated into two groups. The emergency room nurse on duty listed all new cases in chronological order and the allocation was done prior to the clinic by consecutively marking the listed cases alternately as one or two (by J.K.). In case several persons in the same car were injured they were all allocated to the same group. The allocation was done before any information about the patient was available. In group 1 ( $n = 96$ ) all patients filled questionnaires about pain intensity, quality of life, disability, details about the car accident, employment and education. Orthopedic and neurological physical examination was done and findings were recorded using a special protocol. The follow-up in group 1 ( $n = 96$ ) was done according to the proposed regimen by the QTF in 1995 [20] at 1, 3, 6, 12 weeks and 1 year after the accident by same doctor (J.K.). They were given symptomatic treatment including analgesics when necessary and physical therapy in case of discomfort associated with perceived stiffness. In group 2 ( $n = 90$ ) only one questionnaire was used which included a pain drawing and a visual analog scale (VAS), 0–100 for neck pain. No follow-up was mentioned at this stage and the patients in this group were not made aware of any ongoing study. All patients (in both groups) were encouraged to continue with normal activities. After 1 year all patients in both groups ( $n = 186$ ) were called to a follow-up and were seen by one of the

authors (J.K.). The outcome parameter was self-reported neck pain at 1 year after the MVA.

The following questionnaires were used in the study

1. *Physical and emotional symptoms*: At the first visit, a self administered Quebec Protocol (QP) was filled by all patients. One item regarding emotional distress was added to the original QP. The patients were asked about emotional distress: “Are you emotionally worse off than is normal for you”? Yes/No. The kappa coefficient was calculated between dichotomized HAD (Hospital Anxiety and Depression Scale) [23] depression scale (cut off >7) and the emotional distress item. The kappa coefficient was 0.46, which indicates a moderate level of agreement.

*Pain intensity*: At the first visit, the patients were asked to indicate the severity of the current neck pain on a VAS [14, 15]. They were also asked about neck and shoulder pain during the month preceding the accident: “Did you have neck or shoulder pain last month”. Answers were categorized as one: never, two: sometimes, three: often, four: always. One year after the MVA, neck pain was assessed by a single item: “Do you have neck pain now”, VAS-scale 0–100.

## Statistical analysis

Odds ratios resulting from logistic regression analysis were used to estimate relative risk (RR) and the results are presented as RR.

No a priori hypothesis was formulated about the predictive power of any factor as this study is an association study. The logistic regression analyses were performed in two steps. In order to validate the study group we performed a univariate testing of factors previously known to be associated with chronic symptoms: female gender, neck pain before the accident, neck pain and emotional distress at the time of the MVA in addition to clinically important factors as suggested by the QTF. (Age, education, headache, neck stiffness, nausea, low back pain and WAD-classification [20]). These previously known factors together with other factors that also proved to be equally important ( $P$ -value < 0.05) were then entered simultaneously in the logistic regression analysis (enter method). The dependent variable was self-reported neck pain at the 1-year follow-up. Neck pain before the MVA was recorded from four categories (1) never, (2) sometimes, (3) often and (4) always into a dichotomous variable with never/sometimes as one category (0) and often/always as another (1). The continuous parameter initial neck pain (VAS) was categorized into two categories; 1, severe neck pain (>30 VAS-scale) or 2, recovered (<30 VAS). The cutoff score

was based on the study of Jensen et al. [15] where pain above 30 (VAS) was found to be of moderate to high intensity.

Fisher's exact test was used for dichotomous variables; gender and previous neck pain (Yes/No) in the QTF-follow-up group comparisons between the group with persistent neck pain and recovered group. In all analyses,  $p < 0.05$  was considered to be statistically significant.

## Results

### Attrition rates

There were a total of 170 cases (91%) available for statistical analysis. Sixteen (six men and ten women) of the 186 patients included in the study were lost to the 1-year follow-up. Five cases were lost in group 1 and 11 in group 2; this difference was not statistically significant. At the follow-up a physical examination was done on 136 patients and 34 were interviewed by telephone (J.K.) because they would not come to the clinic. These 34 patients all stated that they were free of neck pain. Socioeconomic data are shown in Table 1. The mean interval between the accident and the initial examination was  $3 \pm 2$  (SD) days; the final follow-up was done at  $360 \pm 3$  (SD) days after the injury. In total there were 83 men (49 %) and 87 women (51%). The distribution according to the Quebec classification was: 15 WAD grade I (9%), 139 grade II (82%) and 16 grade III (9%). Descriptive data concerning initial symptoms are listed in Table 2. Self reported emotional distress at the time of the accident was noted in a total of 29 of 91 cases (34%) (two cases missing data).

### Prediction analysis

In the first analysis data from group 1 (QTF) was used. Univariate analysis in the QTF follow-up group ( $n = 91$ ) (Table 3) showed that female gender, pain in neck/shoulder before the accident, or back pain at the time of the accident and self-reported high degree of emotional distress at the time of the accident were statistically significant predictors of persistent neck pain at 1 year. Of the 91 cases in the QTF follow-up group; 3 of 42 men (7%) had persistent neck pain at the 1 year follow-up as compared to 12 of 49 women (24%). The results from the multivariate regression analysis showed a significantly lower risk (RR = 0.13. CI = 0.02–0.87) for men to experience neck pain at 1 year after the accident (Table 4). Ten of 15 cases (66%) with neck pain at the follow-up reported neck or shoulder pain during the last month before the MVA as compared to 20 of 71 (28%) cases who reported no neck pain at follow-up. Both the univariate and multivariate analyses showed a

statistically significant increased risk for experiencing neck pain 1 year post accident for subjects reporting neck pain before the accident (Tables 3, 4).

The number of cases in the group with persistent neck pain at the 1 year follow-up who reported “high degree of emotional distress” at the time of the accident was significantly higher [11 of 15 cases (73%)] as compared to cases who reported no neck pain at follow-up [18 of 74 cases (24%)], (data missing for two cases). The results from the multivariate regression analysis showed a statistically significant increased risk for experiencing neck pain at 1 year after the accident for subjects who reported emotional distress at the initial visit (Table 4).

At the first examination 26 of the 89 cases (29%) were unable to work (data missing for two cases). At the 1 year follow-up only 4 of 91 cases in the QTF follow-up group were on sick leave, (one woman and three men), reporting an average neck pain intensity of 82 (VAS) at the follow-up.

### Comparison of outcome between groups

At 1 year, 31 cases (18%) in total; 15 cases (16%) in the QTF-follow-up group and 16 cases (20%) in the no follow-up group reported neck pain (>30 VAS-scale). The difference in reported neck pain at 1 year between the groups was not statistically significant ( $n = 170$ , Fischer exact test,  $P > 0.05$ ). In the analysis of the WAD classification, WAD-group I, 1 of 15 cases (7%) had neck pain at the 1 year follow-up, in WAD-group II, 26 of 139 cases (19%) had neck pain, and in WAD group III, 4 of 16 cases (25%) had neck pain at 1 year. We also studied the data dichotomized into grade 1/higher grades (Table 3). In the multivariate logistic regression analysis there was no statistically significant differences between the WAD classification groups.

## Discussion

There are relatively few studies concerning the incidence of WAD, however in western countries it has been estimated to be about 1/1,000/year [1, 5, 6]. Studies on the recovery rate in WAD has shown variable results; 13–66% of recovery [13, 18–20]. The QTF-cohort study [20] found chronic symptoms in 13%, 6 months after MVA. In another study [19], 18% of WAD cases still had complaints after 2 years, while yet another study [18] reported a recovery rate at 66% after 18 months. Female gender was a risk factor for injury to the neck in two studies [9, 16]. Neck pain, stiffness in the neck and headache have been the most commonly reported complaints associated with whiplash injury, but numbness and arm pain, dysphagia,

**Table 1** Demographic data on the 170 cases included in study

	QTF-follow-up (n = 91) n (%)	Non QTF-follow-up (n = 79) n (%)	All cases (n = 170) n (%)
Sex			
Men	42 (46)	41(51)	83 (49)
Women	49 (54)	38 (48)	87 (51)
Marital status			
Single/living alone	36 (40)	19 (30) <sup>a</sup>	55 (32)
Married/living together	55(60)	44 (60) <sup>a</sup>	99 (68)
Education			
Secondary school	64 (58)	50 (71) <sup>b</sup>	114 (67)
University level	27 (42)	20 (29) <sup>b</sup>	47 (28)
Accident type			
Rear end	45 (49)	39 (51) <sup>c</sup>	84 (49)
Other	46 (51)	38 (49) <sup>c</sup>	84 (49)

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<sup>a</sup> Data missing on 16 cases

<sup>b</sup> Data missing on 9 cases

<sup>c</sup> Data missing on 2 cases

**Table 2** Self reported initial symptoms of the 91 patients in the QTF-follow-up group (descriptive data)

	Recovered (n = 76) <sup>a</sup> n (%)	Significant pain (n = 15) <sup>a</sup> n (%)	All patients (n = 91) n (%)
Neck pain intensity VAS > 30	30 (39)	11 (73)	41 (45)
Neck stiffness	69 (91)	15 (100)	84 (92)
Headache	41 (54)	11 (73)	52 (57)
Arm/hand numbness	17 (22)	5 (33)	22 (24)
Leg/foot numbness	5 (7)	2 (13)	7 (8)
Dizziness	14 (18)	4 (26)	18 (20)
Nausea	11 (14)	5 (33)	16 (18)
Difficulties in swallowing	5 (7)	3 (20)	8 (9)
Blurred vision	9 (12)	0 (0)	9 (10)
Difficulties in concentration	10 (13)	6(40)	16 (18)
Low back pain	20 (26)	8 (53)	28 (31)
Physical condition worsened	33 (43)	9 (60)	42 (46)
Emotional distress	18 (23)	11 (73)	29 (32)

<sup>a</sup> Neck pain at 1 year follow-up was used as outcome measurement, categorized into two groups: (1) VAS < 30 (recovered group) and (2) VAS > 30 (significant neck pain) group

visual disturbances and dizziness have also been mentioned [1, 18]. Berglund et al. [3] recently studied prognostic factors for pain and disability after a whiplash injury and could confirm that in particular initial neck pain was a prognostic factor.

Other factors such as the psychological construct helplessness was also noted as a negative factor.

There is no consensus about the follow-up regimen after a whiplash injury. The current study used protocols proposed by the Quebec group and investigated whether the QTF follow-up regimen could prevent chronic neck pain better than no follow-up.

The present study includes consecutively treated cases from the emergency department. All cases were examined and treated by the same doctor (J.K.) in a standardized fashion. In a report by Hartling et al. [12] on 380 cases from two emergency departments in Ontario, Canada it was concluded that the Quebec classification was useful for predicting chronic WAD. In their study, the outcome was a

non-validated pain score questionnaire based on a telephone interviews. The score was equally based on pain from three different anatomical regions; (1) neck- and/or (2) upper back and/or (3) shoulder pain. The initial WAD classification, which was based on physical examinations made by different physicians on call, was retrospectively determined from the medical records. WAD grade 0 was included (10% of the total study sample). However, Berglund et al. [2] concluded in their prospective study that cases without symptoms after rear end collisions (i.e., WAD grade 0) do not have an increased risk of developing chronic WAD. There was a high number of cases missing in the study by Hartling et al. [12], increasing from 12% at the 6 month follow-up to 25% at 24 months.

Furthermore, the WAD-grade was treated as a continuous variable in the statistical analysis all of which makes their conclusions questionable.

Sterner et al. [21] found female gender, low educational level, pretraumatic neck pain and WAD grades 2–3 to be

**Table 3** Univariate predictors (as noted at the initial examination) for chronic neck pain ( $n = 91$ ; logistic regression)

Predictor	Relative risk (RR)	95% CI
Age	1.0	0.9–1.1
Gender (0 = male 1 = female)	0.2	0.6–0.9*
Education	1.6	0.4–6.3
Neck/shoulder pain before acc.	5.6	1.7–18.4**
Headache before acc.	1.1	0.3–3.5
Accident type	0.5	0.2–1.2
WAD grade I-III	1.0	0.1–9.7
WAD grade I versus II + III	0.2	0.02–1.4
Neck pain intensity (VAS)	1.1	1.0–1.1*
Headache	1.0	0.3–3.5
Low back pain	3.1	1.0–9.8**
Nausea	2.8	0.8–9.9
Physical condition	1.9	0.6–5.9
Emotional distress	8.4	2.4–29.6**

Neck pain at 1 year follow-up was used as outcome measurement, categorized into two groups: (1) VAS < 30 (recovered group) and (2) VAS > 30 (chronic neck pain group)

\*  $P < 0.05$ , \*\*  $P < 0.005$

**Table 4** Multivariate predictors for chronic neck pain in the QTF group ( $n = 91$ )

	Relative risk (RR)	95% CI
Gender (0 = male 1 = female)	0.13	0.02–0.9*
Neck/shoulder pain before	9.7	1.1–18.8*
Emotional distress at the time of the accident	11	2.1–57.2**

Neck pain at 1 year follow-up was used as outcome measurement, categorized into two groups: (1) VAS < 30 (recovered group) and (2) VAS > 30 (chronic neck pain group)

Only variables significant in univariate analysis considered in the logistic regression  $P < 0.05$  Nagelkerke  $R^2 = 0.37$ , \*  $P < 0.05$ , \*\*  $P < 0.005$

associated with persistent disability. The predictive power of female gender and pretraumatic neck pain is in accordance with our study; however, we found that the educational level and WAD grade had no predictive power. Their study is not directly comparable to the present because of different outcome measurements (our study used chronic neck pain as outcome whereas Sterner et al. studied disability). The geographical difference (i.e., a major city area in our study vs. a rural area) may also have impact on the socioeconomic status for the two populations under study. Blue collar workers had a higher prevalence of neck-shoulder disorders than white collar workers in a Finnish study [16] a factor which might also have influenced their results. Furthermore Sterner et al. [21] included

WAD grade 0 (no symptoms, 21% of total) and only 1% of their patients had WAD grade 3. The numbers in the WAD-categories found in our study are in better agreement with larger epidemiological studies than the study by Sterner et al. [21] who furthermore, might have had difficulties in classifying cases from the medical records. In a Finnish study based on patient records the WAD classification was found to be important for the sick leave; however, this was not based on statistical analysis [17]. Côté et al. [7, 8] studied the prognostic impact of the intensity of medical care after a whiplash injury. Their data did not support the theory that aggressive treatment promotes faster recovery; in fact their data suggested the opposite. Their studies were not based on a randomized population. Government insurance data and mailed questionnaires were used for the analysis.

Previous symptoms have been found to be risk factors for subsequent disorders of the low back in other studies [4, 22]. Earlier episodes of neck/shoulder pain are known to have a considerable impact on the risk for new episodes of neck/shoulder pain. Neck symptoms in 1969 were risk factors of neck disorders 24 years later [10]. This is in agreement with our finding that previous neck pain was a prognostic factor. Their finding that especially in women psychosocial factors were associated with neck/shoulder disorders may also be relevant to the situation after a whiplash injury.

## Conclusions

The WAD-classification could not predict persistent neck pain after a whiplash injury in this hospital emergency department based population. Nor was there a statistically significant difference in the rate of chronic neck pain between the no-follow-up regimen and the multiple-follow-up regimen proposed by the QTF.

The multiple-follow-up regimen is both time consuming and costly and appears not to be justified in a routine clinical setting. At the first visit we recommend a careful history, physical examination and information about the nature of the condition. Patients with a high risk of developing chronic pain may be selected for studies of prophylactic treatment programs when available. In this study cases with neck pain before the accident and a high degree of emotional distress from the accident had a tenfold increased risk of developing chronic neck pain.

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