EDORIUM Journals

Edorium J Disabil Rehabil 2015;1:16–23.
www.edoriumjournals.com/ej/dr

ORIGINAL ARTICLE PEER REVIEWED | OPEN ACCESS

Is time of neck pain onset a prognostic factor in whiplash-associated disorders?

Rasmus Elrud, Eva Skillgate, Linda J. Carroll, Lena W. Holm

ABSTRACT

Aims: One possible prognostic factor for whiplash-associated disorders which to date has not been investigated, is time of pain onset. We hypothesized that immediate onset of neck pain post-collision may indicate a different origin of the injury, with a prolonged recovery, compared to an injury with delayed onset of neck pain. Therefore, the aim was to investigate this in a prospective cohort study. Methods: Data was collected from insurance claimants (*n* = 1,308). Questionnaires at baseline provided information on time of neck pain onset, and potential confounders. Exposure was time of pain onset, trichotomized into; at the scene of the collision, 1-12 hours, and >12 hours post-collision. At a 6-month follow-up, pain-related disability was assessed with the pain disability index (PDI) and trichotomized into scores based on the median and the 75th percentile; PDI = 0, 1–18 and >18. Results: Twenty-eight percent of persons with pain onset at the scene of collision rated in the PDI >18 category at follow-up, compared to 21% respectively of those with onset 1–12 hours and those with onset >12 hours post collision. Persons with pain onset at the scene were more likely to rate PDI >18 compared to those with onset >12 hours post-collision. When adjusted for confounders, the result was attenuated and not statistically significant or 1.3 (95% CI; 0.8–2.2). Conclusion: Time of neck pain onset is not a prognostic factor in recovery from whiplash-associated disorders in this study. Further studies are warranted to confirm the results.

Keywords: Disability, Neck pain, Prognostic factor, Whiplash-associated

How to cite this article

Elrud R, Skillgate E, Carroll LJ, Holm LW. Is time of neck pain onset a prognostic factor in whiplash-associated disorders? Edorium J Disabil Rehabil 2015;1:16–23.

Article ID: 100004D05RE2015

****

doi:10.5348/D05-2015-4-OA-4

Rasmus Elrud[1], Eva Skillgate[2], Linda J. Carroll[3], Lena W. Holm[4]

Affiliations: [1]Research associate, Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden; [2]Assistant Professor, Institute of Environmental Medicine, Karolinska Institutet, Stockholm, Sweden; [3]Associated Research Scientist, Injury Prevention Centre, Director of Graduate Education, and Professor, School of Public Health, University of Alberta, Edmonton, Canada; [4]Senior Researcher, Institute of Environmental Medicine, Karolinska Institutet, Sweden.

Corresponding Author: Lena W. Holm, Institute of Environmental Medicine, Karolinska Institutet, Box 210, Stockholm, Sweden, 171 77; Ph: +46 704 827479; E-mail: Lena.Holm@ki.se

Received: 26 August 2015
Accepted: 25 September 2015
Published: 23 January 2016

INTRODUCTION

As defined by the Quebec Task Force whiplash is "an acceleration-deceleration mechanism of energy transfer to the neck" which may result in clinical symptoms termed whiplash-associated disorders (WAD) [1]. The cardinal symptom of WAD is neck pain. Other

symptoms may include decreased cervical range of motion, headache, dizziness, and neurological signs [1]. Clinical research with available diagnostic methods, e.g., magnetic resonance imaging and radiography, have not been able to identify any structural injury typical for WAD. In absence of bone fracture, or other injury, visible with modern diagnostic techniques, WAD is considered a "soft tissue injury" [1].

Research on the prognosis of WAD has shown heterogeneous findings, with respect to course of recovery [2, 3]. A number of factors have been identified as prognostic in WAD. Older age [3, 4], female gender [3], low pre-injury general health and pre-injury neck pain, [3] have been associated with poorer prognosis in most studies but the results lack consistency. Also symptom-related factors are of importance for poor prognosis; high neck-pain intensity [3, 4], greater number of symptoms and painful body parts [4], psychological factors such as low expectations of recovery [5, 6], post-traumatic stress [7], depression, anxiety, and fear of movement [3]. To date, there is no evidence that collision factors are of importance for the prognosis, except for some evidence that the crash pulse may play a role in rear-end collisions [3]. Another possible factor to consider is that WAD symptoms may be caused by different injuries to muscles, ligaments, and other tissues which in turns may lead to divergent courses of recovery. Kivioja et al. showed a systemic immune response in acute WAD, which the authors suggest may play a role in the development of WAD symptoms, although it could not explain the course of recovery [8, 9]. Others have suggested that long-lasting pain may be explained by a persistent musculoskeletal inflammatory process in some individuals [4]. There are no published studies with low risk of bias, where possible biomechanics of injury have been addressed, although some hypotheses have been discussed in narrative reviews [10].

In athletes, delayed onset muscle soreness, which occurs after exercise has been completed, is common. It may be due to over stretching or eccentric muscle activity. It increases in intensity in the first 24 hours after exercise, and then subsides within five to seven days [11]. It is possible that similar delayed onset muscle soreness occur within hours after being exposed to a whiplash mechanism. Such muscle soreness with a delayed onset might differ with respect to the natural course from an injury resulting in an immediate pain onset. According to our clinical observations, assessing and treating patients with pain conditions of various origins, we hypothesized that immediate onset of neck pain post-collision may indicate a different origin of the injury, with a prolonged recovery, compared to an injury with delayed onset of neck pain. If so, pain onset may in fact also be an effect modifier in the association between other prognostic factors and recovery. Therefore, the aim of this study was to investigate the association between time of neck pain onset and recovery after a motor vehicle collision.

MATERIALS AND METHODS

Study population

The data was collected prospectively from an inception cohort of claimants at two Swedish insurance companies Trygg-Hansa and Aktsam. These companies had at the time of the data collection approximately 20% of the market share of motor insurances. In Sweden, every person who sustains an injury caused by a motor vehicle collision is entitled to compensation independent of who is at fault for the collision. Litigation following such injury is uncommon and only occurs at a late stage of the claims process (i.e. if the claimant and the insurer do not agree on whether the event has caused the injury or if the work disability is a consequence of the injury). Eligible for the study were claimants 18–74 years of age who reported any bodily injury within 30 days of a passenger car collision during the period January 2004 to January 2005, with exclusion for those injured in a collision with fatal injuries to another passenger in the car. Baseline questionnaires were sent to persons meeting the inclusion criteria (see below) throughout the inception period. Baseline information was collected from the questionnaires and register data from the insurance companies. This included demographic factors, collision and injury related factors, pre-injury health status and psychological factors. A follow-up questionnaire was sent to respondents of the baseline questionnaire six months following inclusion into the study. It included among others information on recovery, measured as disability due to pain. Of the data used in this study, age and sex were retrieved from insurance registers. The remaining information was collected from the questionnaires.

Inclusion criteria for this study were, meeting the operational definition of WAD which was having answered "yes" to the question: "Do you have or have you had pain/ache in the neck due to the accident?" in the baseline questionnaire and having reported absence of cervical fracture. Exclusion criteria were concurrent severe injuries, defined as >2 days of hospitalization post collision, or having reported a new accident during the follow-up period. We also excluded those who had missing values on the exposure measure. The inclusion process of this study is shown in Figure 1.

Exposure

The exposure was defined as time of neck pain onset after a passenger car collision. It was assessed in the baseline questionnaire by the question; "If you had neck pain or ache after the accident, when did the pain start?" The response alternatives was categorized as; "at the

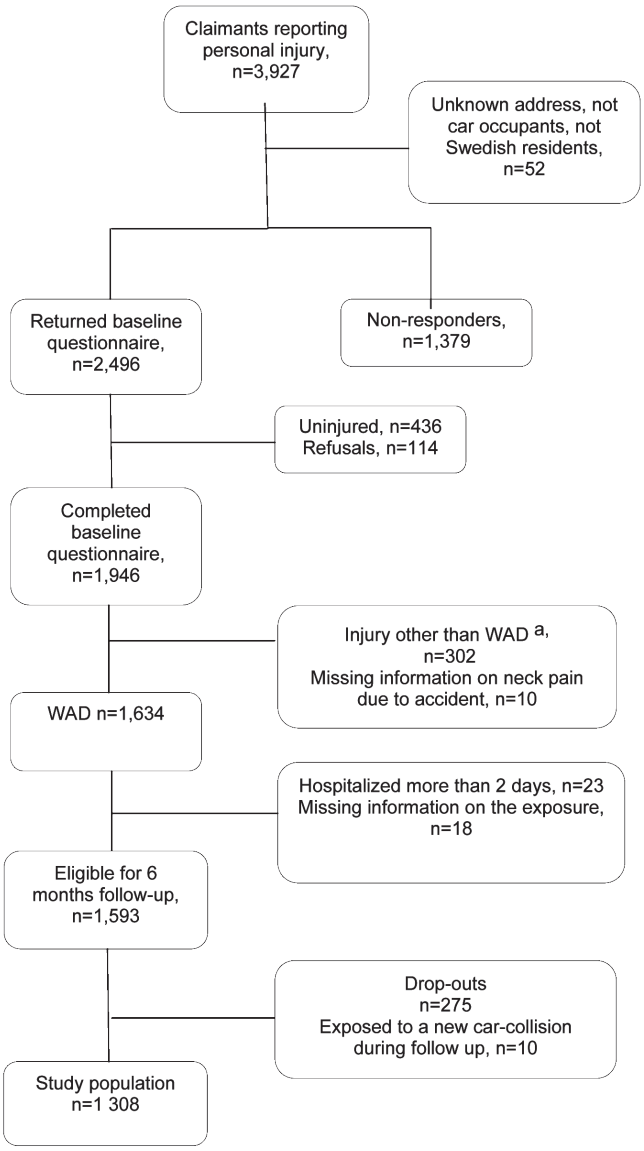

Figure 1: Flowchart of the inclusion process of the cohort study. a whiplash associated disorders.

scene of the accident", "1–12 hours post-accident", "12–24 hours post-accident" and ">24 hours post-accident". Due to the low number of participants with pain onset more than 24 hours after the accident, this category was merged with the 12–24 hours category.

Outcome

The outcome was self-rated disability due to pain. This was measured at follow-up with the pain disability index (PDI) questionnaire, which has been shown to have good psychometric properties and validity [12]. The PDI yields a total disability score of 0–70, with higher scores indicating greater disability. The scale was trichotomized based on the median and the 75th percentile values; PDI = 0, 1–18 and >18.

Potential confounders

Potential confounders were assessed in the baseline questionnaire and chosen based on previous literature on prognostic factors of WAD. Some of the known symptom related prognostic factors may lie in the causal pathway between the exposure and the outcome, and we considered this (see further the statistics section below). Age and sex of the participants were obtained from register data and age was treated as a continuous variable in the analysis. General health the month prior to collision was assessed by the general health item of the Medical Outcome Study Short-Form 36 (SF-36), modified to assess the intended period of time [13]. This variable was dichotomized into categories "poor/fair" and "good/very good/excellent". Neck pain the month prior to collision was assessed by a question recommended by the Quebec Task Force, also modified for the period of one month prior to collision [1]. The response was dichotomized into "very often/every day" and "sometimes/never". Post-traumatic stress was assessed by the impact of event scale (IES), two subscales (intrusion and avoidance) [14]. Depression was assessed by the depression subscale of the Hospital Anxiety and Depression Scale (HAD) [15]. In analysis, the IES and HAD scores were tested as continuous variables. Expectations of recovery were assessed by the question "In your opinion, how likely is it that you will be fully recovered with no persistent sequelae?" The question was answered by a numerical rating scale (NRS 0–10). A 0 was described as "Not at all likely that I will recover" and a 10 was described as "Very likely that I will recover". The variable was treated as continuous in the analysis. Neck pain intensity at baseline (present neck pain) was assessed by a numerical rating scale (NRS 0–10) and was treated as a continuous variable in analysis. Although lack of evidence of being prognostic factors, we also tested two collision related variables as potential confounders; impact direction which was categorized as "front", "rear", "side" or "other/don't know", and head position at the collision, categorized as "straight forward", "turned to the right or left" and "don't know/don't remember".

Statistical analysis

We performed descriptive analysis to describe the baseline characteristics of the study population. To compare follow-up respondents to non-respondents regarding the exposure, we did an attrition analysis by doing independent t-tests and χ^2-tests. For the main analyses we used multinomial regression to calculate odds ratios (OR) with 95% confidence intervals (CI). Since PDI

was highly skewed, it was trichotomized into categories arbitrarily using the median and 75th percentile as cut-off points. The median score was 0 and the 75th percentile had a score of 18. As a method of sensitivity analysis of the outcome categorization, crude models with alternative cut-off points (PDI 0–5, 6–20, 21–70 and PDI 0-10, 11–30, 31–70) were also constructed. We used univariate analysis to assess the crude association between exposure and outcome. To select confounders to adjust for in the final model, the effect of each potential confounder was tested in multivariate regression as described by Rothman [16]. In cases, where the beta estimate of the association between the exposure and the outcome changed more than 10% in any of the outcome category, the factor was considered to be a confounder and was included in the final multivariable model. Since neck pain intensity may or may not lie in the causal pathway between neck pain onset and recovery, we built one multinomial model without this variable as confounder in a secondary analysis.

All analysis was performed with statistical software IBM SPSS Statistics 19.

Ethical considerations

The collection of data with the aim to study prognostic factors has been approved by the Ethical Committee of Karolinska Institutet Stockholm; Dnr: 03–376. An additional ethical approval for including this research question was made Dnr: 2015 /324–32.

RESULTS

Out of 1,593 persons fulfilling the inclusion criteria, 275 (17%) did not respond to the six-month follow-up questionnaire. The attrition analysis revealed statistically significant differences between responders and non-responders to the follow-up questionnaire. Responders were slightly more likely to have reported an early onset of neck pain compared to non-responders (44% versus 37% had pain onset at the scene of the accident, 35% versus 36% had onset 1–12 hours after accident, 21% versus 28% had onset ≥12 hours after accident).

Since ten persons had been exposed to a new car collision during follow-up and were excluded, a total of 1,308 persons were included in the analysis. The mean number of days between collision and completing the baseline questionnaire was 23 (SD 14). Baseline characteristics are presented in Table 1, stratified by the exposure of interest.

The distribution of time of neck pain onset stratified by PDI category at follow-up is given in Table 2. Almost 44% of the participants reported neck pain onset at the scene of the collision, 36% reported onset 1–12 hours after the collision and 21% reported onset later than 12 hours after the collision. At follow-up, a higher proportion of participants with neck pain onset at the scene of the collision (28%) rated the highest disability (PDI >18), compared to those reporting pain onset 1–12 hours after the collision (21%) and those with onset >12 hours after collision (21%).

The crude and adjusted ORs of the associations between time of neck pain onset and pain related disability are presented in Table 3. The crude association show that those with pain onset at the scene of the collision were 1.5 times more likely to report higher disability (PDI >18) at follow-up, compared to those with onset more than 12 hours after the collision. In the sensitivity analysis of the outcome categorization, crude models with the alternative categories show similar effect estimates (≤ ±10%). These estimates, however, lack statistical significance.

In the first and main regression model (Model I), we adjusted for the confounding factors, according to the results of our confounding analysis; neck pain intensity, passive coping strategies, depressive symptoms, expectation of recovery and post-traumatic stress symptoms. When adjusting for these confounders, the association between the exposure and the outcome was attenuated and no longer statistically significant, OR 1.3 (95% CI; 0.8–2.2). In the secondary model (Model II) where we omitted neck pain intensity, all estimates remained similar to the ones in Model I, except for the group with pain onset at the scene of collision, where the OR increased to 1.6 (95% CI; 1.0–2.6), (Table 3). Immediate pain onset was not associated with the intermediate category of pain related disability; neither in the crude nor in the adjusted analysis. The exposure middle category; pain onset 1–12 hours post-collision was likewise not associated with the outcome in any of the models.

DISCUSSION

In this study, time of neck pain onset was not associated with the pain related disability six months after a car collision when neck pain intensity at baseline was included as a confounder in the analysis. Thus the result of the fully adjusted regression model disproves the hypothesis of our study. However, if intensity of neck pain would be considered to lie in the causal pathway between pain onset and recovery, and therefore not be included as a confounder, there is a modest association between pain onset at the scene of collision and higher pain-related disability six months later. The mean values of neck pain intensity for the three exposure categories differed (3.2, 3.0, and 2.8), but not to an extent that would justify the theory, that higher pain intensity would be associated with time of pain onset in a causal way. Another factor that contradicts a “causal pathway theory”, is that we, in previous studies on WAD, have found that rating of pain intensity is associated with pre-injury factors, such as age,

Table 1: Baseline characteristics of the study population, (n=1,308). Numbers are percentages unless otherwise specified

Variables		Time of neck pain onset			
		At the scene of the collision	1–12 hours post collision	>12 hours post collision	Total n a)
Demographic and socioeconomic factors					
Gender	Female	44.1	36.6	19.3	767
	Male	43.3	34.6	22.2	541
Age	18-29	41.2	35.7	23.2	328
	30-39	47.0	35.8	17.3	411
	≥40	42.9	35.9	21.3	569
Education	<High school	49.5	30.8	19.8	182
	High school	40.6	37.9	21.6	663
	University	46.1	34.9	19.0	458
Prior health factors					
General health the month before collision	Excellent, very good or good	43.4	36.4	20.2	1,224
	Fair or poor	49.4	25.9	24.7	81
Neck pain month before collision	Never or sometimes	43.3	36.0	20.8	1,260
	Very often or everyday	56.3	31.3	12.5	48
Collision related factors					
Impact direction	Front	36.0	37.2	26.7	333
	Rear	51.1	33.5	15.5	711
	Side	33.9	42.0	24.1	174
	Other incl. rollover	31.8	37.6	30.6	85
Head position	Straight forward	43.9	34.8	21.3	791
	Turned to the side	43.9	39.0	17.1	328
	Do not know	43.1	34.6	22.3	188
Injury related factors					
Neck pain intensity	NRS b median	3	3	2	1,303
	NRS mean (SD)	3.2 (2.5)	3.0 (2.4)	2.8 (2.3)	
Number of WAD c symptoms	0–2	43.3	34.7	22.0	795
	3–6	44.7	37.6	17.7	492
Psychological factors					
Post-traumatic stress	Yes (IES d ≥26)	38.5	37.6	23.9	213
	No (IES <26)	44.9	35.4	19.7	1,077
Expectations of recovery	NRS median	8	8	9	1,103
Total n		572	468	268	1308

Abbreviations: a) Sum of category count for variables differ due to missing values, b) NRS: Numerical Rating Scale (0–10), c) WAD: Whiplash associated disorders, d) IES: Impact of Event Scale

Table 2: Time of neck pain onset stratified by disability (PDI), (n=1,304 a)

	No disability PDI 0 n (%)	PDI 50th to 75th percentile PDI 1-18 n (%)	PDI >75th percentile PDI >18 n (%)	Total n (%)
At the scene of collision	277 (48.5)	133 (23.3)	161 (28.2)	571 (43.8)
1-12 hours post collision	264 (56.7)	104 (22.3)	98 (21.0)	466 (35.7)
>12 hours post collision	147 (55.1)	63 (23.6)	57 (21.3)	267 (20.5)
Total n	688	300	316	1,304

Abbreviations: PDI Pain disability index, a) sum of n differs from study population due to internal missing values

Table 3: Results of multivariable multinomial regression. Associations between time of neck pain onset and pain related disability at six month follow-up. PDI [a] 0 is the reference category

	Model I (Main model)				Model II (Secondary Model)	
	50th to 75th percentile disability PDI 1-18		>75th percentile disability PDI >18		50th to 75th percentile disability PDI 1-18	>75th percentile disability PDI >18
Neck pain onset	Crude OR [b] (95% CI [c])	Adjusted [d] OR (95% CI)	Crude OR (95% CI)	Adjusted[d] OR (95% CI)	Adjusted [e] OR (95% CI)	Adjusted [e] OR (95% CI)
At the scene of collision	1.1 (0.8-1.6)	1.1 (0.7-1.6)	1.5 (1.0-2.2)	1.3 (0.8-2.2)	1.1 (0.7-1.6)	1.6 (1.0-2.6)
1-12 hours post collision	0.9 (0.6-1.3)	0.9 (0.6-1.5)	1.0 (0.7-1.4)	0.8 (0.5-1.4)	1.0 (0.7-1.5)	1.1 (0.7-1.8)
>12 hours post collision	reference	reference	reference	reference	reference	reference

Abbreviations: a) PDI: Pain Disability Index, b) OR: Odds ratio, c) CI: Confidence interval, d) Confounders adjusted for are; depressive symptoms, passive coping strategies, post-traumatic stress, expectation of recovery and neck pain intensity, e) Confounders adjusted for are; depressive symptoms, passive coping strategies, post-traumatic stress, expectation of recovery but NOT neck pain intensity.

gender, family income, pre-injury neck pain etc., thus not necessarily reflecting severity of injury or a marker for a specific structural injury [17, 18]. To our knowledge, our study is the first study to examine this research question, thus comparison to other studies is not possible.

The strengths of this study include the prospective cohort design in which claimants of the two insurance companies reporting neck pain after car collision were included. This is a less selective group of persons in contrast to studies based on health care settings. Almost 50% of the study population did seek first care at an emergency department, but seeing a general practitioner, an occupational practitioner or a physiotherapist, were also common. Furthermore, 10% had not sought any care by the time the baseline questionnaire was completed. The study participants responded to an extensive baseline questionnaire, which made it possible to also assess the effect of a variety of potential confounding factors. Moreover, the baseline assessment was made early after the injury, where both exposure and potential confounding factors were measured. Misclassification of the exposure is likely to be negligible since it was reported soon after the collision. The participants got clear information that only the researchers involved in data collection would have access to individual answers and that these answers would not be available for the insurers.

Some differences were found between responders and those dropped-out at follow-up, with respect to the prevalence of the exposure, where 44% of the responders had pain onset at the scene of the collision, whereas the corresponding prevalence was seven percent lower among the drop-outs. This may raise a potential selection bias, but only if those who dropped out also differ with respect

to recovery rate and degree of pain related disability. If any, such selection bias may have a minor impact of the point estimate, since the difference in prevalence of the exposure was small and the follow-up rate was relatively large (83%).

Potential limitations of the study include the categorization of exposure and outcome. The three categories of time of neck pain onset may not mirror true differences in pain onset between potential differences in injuries Previous research on this, however, is lacking. The arbitrary classification of the pain disability, using the median and the 75th quartile, may also affect the results. It is possible that the cut-off points are not optimal in distinguishing differences in level of disability, resulting in a dilution of the association especially in the higher PDI category. A PDI score of 20 is far from similar to score of 65, which was the highest rating of PDI in this study. Only 20 persons had a PDI of > 50, which indicate significant disability. The low number of participants with high PDI score make it difficult to use higher scores as cut-offs for the analysis. However, the sensitivity analysis in which crude models with different cut-off points were constructed did show similar effect estimates but lacking statistical significance. Nevertheless, the potential misclassification of the exposure and the outcome are both most likely to be non-differential, thus may to a minor extend have diluted the estimates towards unity.

CONCLUSION

In this study, time of neck pain onset in WAD was not associated with pain related disability at sixth-month follow-up. These results suggest that time of pain onset should not be used in the assessment of prognosis of persons afflicted with WAD, in statistical prediction modeling or in the clinical setting when managing treatment or insurance claims. Future large prospective studies on this topic are warranted to confirm the findings.

****

Acknowledgements
Two Swedish insurers provided computer based person information of the participants eligible for the present study, but did otherwise not have any role in data collection, the objectives of the study, the analysis or the interpretation of the data.

Author Contributions
Rasmus Elrud – Substantial contributions to conception and design, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Eva Skillgate – Substantial contributions to conception and design, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published
Linda J Carroll – Analysis and interpretation of data, Critical revision of the article, Final approval of the version to be published
Lena W Holm – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor
The corresponding author is the guarantor of submission.

Conflict of Interest
Authors declare no conflict of interest.

REFERENCES

1. Spitzer WO, Skovron ML, Salmi LR, et al. Scientific monograph of the Quebec Task Force on Whiplash-Associated Disorders: redefining “whiplash” and its management. Spine (Phila Pa 1976) 1995 Apr 15;20(8 Suppl):1S–73S.
2. Buitenhuis J, de Jong PJ, Jaspers JP, Groothoff JW. Work disability after whiplash: a prospective cohort study. Spine (Phila Pa 1976) 2009 Feb 1;34(3):262–7.
3. Carroll LJ, Holm LW, Hogg-Johnson S, et al. Course and prognostic factors for neck pain in whiplash-associated disorders (WAD): results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine (Phila Pa 1976) 2008 Feb 15;33(4 Suppl):S83–92.
4. Linnman C, Appel L, Fredrikson M, et al. Elevated [11C]-D-deprenyl uptake in chronic Whiplash Associated Disorder suggests persistent musculoskeletal inflammation. PLoS One 2011 Apr 19;6(4):e19182.
5. Holm LW, Carroll LJ, Cassidy JD, Skillgate E, Ahlbom A. Expectations for recovery important in the prognosis of whiplash injuries. PLoS Med 2008 May 13;5(5):e105.
6. Carroll LJ, Holm LW, Ferrari R, Ozegovic D, Cassidy JD. Recovery in whiplash-associated disorders: do you get what you expect? J Rheumatol 2009 May;36(5):1063–70.
7. Kongsted A, Bendix T, Qerama E, et al. Acute stress response and recovery after whiplash injuries. A one-year prospective study. Eur J Pain 2008 May;12(4):455–63.

8. Kivioja J, Ozenci V, Rinaldi L, Kouwenhoven M, Lindgren U, Link H. Systemic immune response in whiplash injury and ankle sprain: elevated IL-6 and IL-10. Clin Immunol 2001 Oct;101(1):106–12.
9. Kivioja J, Rinaldi L, Ozenci V, et al. Chemokines and Their Receptors in Whiplash Injury: Elevated RANTES and CCR-5. J Clin Immunol 2001 Jul;21(4):272–7.
10. Bogduk N, Yoganandan N. Biomechanics of the cervical spine Part 3: minor injuries. Clin Biomech (Bristol, Avon) 2001 May;16(4):267–75.
11. Gulick DT, Kimura IF. Delayed onset muscle soreness: what is it and how do we treat it? J Sport Rehab 1996;5:234–43.
12. Tait RC, Pollard CA, Margolis RB, Duckro PN, Krause SJ. The Pain Disability Index: psychometric and validity data. Arch Phys Med Rehabil 1987 Jul;68(7):438–41.
13. Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Med Care 1992 Jun;30(6):473–83.
14. Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: a measure of subjective stress. Psychosom Med 1979 May;41(3):209–18.
15. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983 Jun;67(6):361–70.
16. Rothman KJ. Epidemiology: An Introduction. 2ed. New York: Oxford University Press Inc; 2012.
17. Holm LW, Carroll LJ, Cassidy JD, Ahlbom A. Factors influencing neck pain intensity in whiplash-associated disorders. Spine (Phila Pa 1976) 2006 Feb 15;31(4):E98–104.
18. Holm LW, Carroll LJ, David Cassidy J, Ahlbom A. Factors influencing neck pain intensity in whiplash-associated disorders in Sweden. Clin J Pain 2007 Sep;23(7):591–7.