The Burden and Determinants of Neck Pain in Whiplash-Associated Disorders After Traffic Collisions

Results of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders

Lena W. Holm, DrMedSc,* Linda J. Carroll, PhD,† J. David Cassidy, DC, PhD, DrMedSc,‡ Sheilah Hogg-Johnson, PhD,§ Pierre Côté, DC, PhD,¶ Jamie Guzman, MD, MSc, FRCP(C),¶¶ Paul Peloso, MD, MSc, FRCP(C),*** Margareta Nordin, PT, DrMedSc,†† Eric Hurwitz, DC, PhD,‡‡ Gabrielle van der Velde, DC,§§ Eugene Carragee, MD, FACS,¶¶ and Scott Haldeman, MD, PhD\\n
Study Design. Best evidence synthesis.

Objective. To undertake a best evidence synthesis on the burden and determinants of whiplash-associated disorders (WAD) after traffic collisions.

Summary of Background Data. Previous best evidence synthesis on WAD has noted a lack of evidence regarding incidence of and risk factors for WAD. Therefore there was a warrant of a reanalysis of this body of research.

Methods. A systematic search of Medline was conducted. The reviewers looked for studies on neck pain and its associated disorders published 1980–2006. Each relevant study was independently and critically reviewed by rotating pairs of reviewers. Data from studies judged to have acceptable internal validity (scientifically admissible) were abstracted into evidence tables, and provide the body of the best evidence synthesis.

Results. The authors found 32 scientifically admissible studies related to the burden and determinants of WAD. In the Western world, visits to emergency rooms due to WAD have increased over the past 30 years. The annual cumulative incidence of WAD differed substantially between countries. They found that occupant seat position and collision impact direction were associated with WAD in one study. Eliminating insurance payments for pain and suffering were associated with a lower incidence of WAD injury claims in one study. Younger ages and being a female were both associated with filing claims or seeking care for WAD, although the evidence is not consistent. Preliminary evidence suggested that headrests/car seats, aimed to limiting head extension during rear-end collisions had a preventive effect on reporting WAD, especially in females.

Conclusion. WAD after traffic collisions affects many people. Despite many years of research, the evidence regarding risk factors for WAD is sparse but seems to include personal, societal, and environmental factors. More research including, well-defined studies with accurate denominators for calculating risk, and better consideration of confounding factors, are needed.

Key words: neck injury, whiplash-associated disorders, traffic collision, systematic review, epidemiology.

Whiplashes injuries occur primarily after motor vehicle collisions, although they can also occur in other settings, such as work and sports. The Québec Task Force on Whiplash-Associated Disorders defined whiplash as “an acceleration-deceleration mechanism of energy transferred to the neck that results in soft tissue injury that may lead to clinical manifestations including neck pain and associated symptoms.”¹ That task force also coined the term “whiplash-associated disorders” (WAD) to describe the clinical entities related to the injury, and to distinguish them from the injury mechanism. It is likely that WAD results from cervical sprain or strain. The exact pathophysiology is not known, and there may or may not be damage to soft tissue, including
the joints, ligaments and/or the muscles in the neck, posterior shoulder and upper thoracic regions. Cervical fractures are generally excluded from WAD, even though they sometimes occur as a result of a whiplash acceleration-deceleration mechanism. Although traffic collision is the most common cause of WAD, the disorder can also occur as a result of falls or other mishaps.²

A range of biomechanical research has been published exploring possible mechanisms of injury to the neck. One key area of interest is to determine the minimum threshold of force during an impact that is required to produce WAD. That literature includes experimental studies of crash tests using dummies, animals or human cadavers, and volunteers.¹⁻⁵ The experimental literature using dummies, animals or human cadavers was outside of the mandate of the Neck Pain Task Force, and we did not include those studies in our best evidence synthesis.

The occurrence of WAD is based on a combination of factors, including exposure to a whiplash mechanism, followed by the appearance of symptoms or clinical signs. However, there is no gold standard diagnostic test, such as radiograph, computerized tomography (CT) or magnetic resonance imaging (MRI), to detect WAD. The clinical diagnosis is also confused by the high prevalence of neck pain and other WAD-like symptoms in the general population and in the working population.²⁻⁶

In the introductory paragraphs of this report of the Bone and Joint Decade 2000–2010 Task Force on Neck Pain and Its Associated Disorders, details of the background of the Task Force and its purpose are presented.⁴⁻⁶ The overall objective was to conduct a systematic search and a critical review of the literature to produce a body of the best evidence on neck pain and its associated disorders. This includes findings on incidence, prevalence, risk, diagnosis, prognosis, treatment, and prevention. This article reports a best evidence synthesis on incidence, prevalence and risk factors of WAD after traffic collisions, i.e., for neck pain after traffic collisions. Other results of the best evidence on neck pain and its associated disorders are reported elsewhere.⁷⁻¹⁰c,¹⁷⁻¹⁹

Materials and Methods

Design and Data Collection

The literature search and critical review strategy are outlined in detail elsewhere.⁷ Briefly, we systematically searched the electronic library database Medline for literature published from 1980 through 2005 on neck pain and its associated disorders (including neck pain after traffic collisions); we updated our search with key articles published in 2006 and early 2007, and we also systematically checked reference lists for other potentially relevant articles. Our electronic search strategy is described in more detail elsewhere,⁷ and is available in detail online.

Each citation was screened for relevance to the Neck Pain Task Force mandate, using a priori inclusion and exclusion criteria. However, we made no attempt to assess the scientific quality of studies when establishing this level of relevance. Studies were considered relevant if they pertained to neck pain assessment, diagnosis, incidence, prevalence, determinants, risk factors, prevention, course, prognosis, treatment and rehabilitation; if they pertained to the economic costs of neck pain; if they contained data and findings specific to neck pain and/or disorders associated with neck pain; if they included at least 20 persons with neck pain or at risk for neck pain; or if they described a systematic review of the literature on neck pain.

We included neck pain resulting from traffic-related whiplash injuries, and work-related injuries and strains, and neck pain from sports injuries and of unknown etiology in the general population. Clinical case series were included if they were judged to be of special relevance to the Neck Pain Task Force report, for example, if they were frequently cited in the literature, or if they focused on a topic for which there was little or no information available. We excluded studies on neck pain that was associated with serious local pathology or systemic disease, such as neck pain from fractures or dislocations (except for studies on assessment, where such studies can inform differential diagnosis), infections, myelopathy; rheumatoid arthritis and other inflammatory joint diseases; or tumors.

Quality Assessment

Rotating pairs of clinician/scientist reviewers (members of the Scientific Secretariat) performed independent, in-depth, critical reviews of each article, identifying methodologic strengths, and weaknesses. After a full discussion of each article, the reviewers then made decisions about the article’s scientific and clinical merit. Criteria used in the methodologic appraisal of the studies are available on the following internet site (address of our web-version). Our appraisal focused on sources of potential selection bias, information bias, and confounding; we also considered whether these biases would likely result in erroneous or misleading conclusions.

Studies judged to have adequate internal validity were included in our best evidence synthesis. We divided our syntheses of evidence regarding incidence, prevalence, risk factors, and prevention based on the following source populations: workers; people involved in traffic collisions; and finally, the general population (which included people with sports-related neck pain).

Analysis

To better delineate risk factors and evidence strength from cohort studies where risk factors were assessed, we adapted a ranking method used in previous studies and systematic reviews.⁸⁻¹² The methodology acknowledges three types of analytic approach when assessing associations between determinants and an outcome:

- Phase I studies are hypothesis-generating, descriptive investigations that explore crude associations between single factors and outcome.
- Phase II studies are exploratory, but use stratified or multivariable analyses to identify sets of predictors.
- Phase III studies are hypothesis-driven and confirmatory. The goal is to confirm or refute hypotheses about the apparent relationship between a particular risk factor and the outcome of interest (in this case, onset of neck pain), after adjusting for confounding.

Organization of the Findings

We have organized our results for incidence of WAD based on study settings (i.e., emergency room visits and insurance injury claims). We classified the studies identifying prognostic factors into Phase I, II, or III studies (described earlier).