

THE ASSOCIATION BETWEEN CERVICAL SPINE MANIPULATION AND CAROTID ARTERY DISSECTION: A SYSTEMATIC REVIEW OF THE LITERATURE



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ABSTRACT

Objective: Controversy surrounds the safety of cervical spine manipulation. Ischemic stroke secondary to cervical spine manipulation is a hypothesized adverse event. In Canada, the seriousness of these events and their perceived association to cervical spine manipulation has led some members of the public to call for a ban of the procedure. The primary objective of this study was to determine the incidence of internal carotid artery (ICA) dissection after cervical spine manipulation in patients who experience neck pain and its associated disorders. The secondary objective was to determine whether cervical spine manipulation is associated with an increased risk of ICA dissection in patients with neck pain, upper back pain, or headaches.

Methods: We systematically searched MEDLINE, CINAHL, Alternative Health, AMED, Index to Chiropractic Literature, and EMBASE from 1970 to November 2012. Two independent reviewers used standardized criteria to screen the eligibility of articles. We considered cohort studies, case-control studies, and randomized clinical trials that addressed our objectives. We planned to critically appraise eligible articles using the Scottish Intercollegiate Guideline Network methodology.

Results: We did not find any epidemiologic studies that measured the incidence of cervical spine manipulation and ICA dissection. Similarly, we did not find any studies that determined whether cervical spine manipulation is associated with ICA dissection.

Conclusions: The incidence of ICA dissection after cervical spine manipulation is unknown. The relative risk of ICA dissection after cervical spine manipulation compared with other health care interventions for neck pain, back pain, or headache is also unknown. Although several case reports and case series raise the hypothesis of an association, we found no epidemiologic studies that validate this hypothesis. (*J Manipulative Physiol Ther* 2015;38:672-676)

Key Indexing Terms: *Manipulation, Spinal; Chiropractic; Carotid Artery, Injuries*

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Paper submitted April 15, 2013; in revised form September 18, 2013; accepted September 20, 2013.

0161-4754

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<http://dx.doi.org/10.1016/j.jmpt.2013.09.005>

Internal carotid artery (ICA) dissection is a rare cause of ischemic stroke. Epidemiologic studies suggest that most dissections of the ICA are spontaneous.^{1,2} In the United States and in France, the annual incidence of spontaneous ICA dissection varies from 1.72 to 1.89 per 100 000 residents in Minnesota³ to 2.9 per 100 000 residents in Dijon.⁴

Internal carotid artery dissections result from tearing of the internal lining of the artery followed by displacement of the internal lining due to the pulsatile blood flow between the internal and medial layers.⁵ The separation of the arterial layers usually occurs in the direction of blood flow and leads to an obstruction of blood flow in the distal carotid artery with secondary ischemia in the anterior and/or middle cerebral artery territories in the brain. Little is known about the etiology of spontaneous ICA dissection. It is more common in women and individuals in their fifth decade of life.^{3,4} The hypothesized risk factors include the

following: collagen vascular disease^{6–10}; blunt trauma such as in motor vehicle collisions^{11,12}; mild traumas such as childbirth, vomiting, coughing, and rhythmic neck movements^{13–15}; and cervical spine manipulation.^{16,17} Some examples of other risk factors hypothesized to be involved in the etiology of cervical artery dissections include infection, elevated plasma homocysteine, aortic diameter greater than 34 mm, atherosclerosis, diabetes mellitus, hypercholesterolemia, hypertension, tobacco use, and migraine headaches.^{18–25}

To our knowledge, only one review has investigated the association between cervical spine manipulation and ICA dissection.²⁶ However, the review was not systematic, and it relied on case reports and case series to comment on the association between cervical spine manipulation and ICA dissection. Therefore, the results of this review lack validity because case reports and case series cannot be used to determine whether cervical spine manipulation is associated with ICA dissection. To date, no systematic review has investigated the association between cervical spine manipulation and ICA dissection.

Our primary objective was to determine the incidence of ICA dissection after cervical spine manipulation in patients who experience neck-related complaints. Our secondary objective was to determine whether cervical spine manipulation is associated with an increased risk of ICA dissection in patients with neck pain, upper back pain, or headaches.

METHODS

Protocol and Registration

Our systematic review was registered with PROSPERO, the international prospective register of systematic reviews (CRD42012003289) and can be accessed at http://www.crd.york.ac.uk/prospero/display_record.asp?ID=CRD42012003289.

Eligibility Criteria

Articles eligible for the review met the following inclusion criteria: (1) English or French language; (2) studies of human subjects; (3) published in a peer-reviewed journal; (4) randomized controlled trial, cohort study, case-crossover, or case-control study; (5) cervical spine manipulation was explicitly stated as the treatment or exposure under investigation; and (6) carotid artery dissection was a primary or secondary outcome. We excluded studies that combined carotid and vertebral arteries into one category (cervical arteries), unless a stratified analysis was conducted for carotid artery dissections. We also excluded cross-sectional studies, biomechanical studies, case reports, case series, reviews, opinions, editorials, and conference proceedings.

Information Sources

We systematically searched 6 electronic databases (MEDLINE, CINAHL, Alternative Health, AMED, Index to Chiropractic Literature [ICL], EMBASE) from 1970 to November 2012. The search strategy combined terms relevant to manipulation and the carotid artery (Musculoskeletal Manipulations [Mesh], Chiropractic [Mesh], Carotid Artery Injuries [Mesh], Chiroprac* [All Terms], Manipulat* [All Terms], Carotid Artery [All Terms], Spinal Manipulation [All Terms]). The outlined search strategy can be viewed in [Appendix A](#). The ICL was searched using search terms in “All Fields” and limited to peer-reviewed journals. All identified abstracts were retrieved and reviewed for relevance by at least 2 of the authors, and upon consensus, full-text articles were retrieved for critical appraisal. The references of the retrieved articles were hand searched for further articles that may have been missed in the systematic search.

Study Selection

We used a 2-phase screening process to select eligible studies. In phase 1, random pairs of independent reviewers screened citation titles and abstracts to determine the eligibility of studies. Phase 1 screening resulted in studies being classified as relevant, possibly relevant, or irrelevant. In phase 2, the same paired reviewers independently reviewed the articles of possibly relevant studies to make a final determination of eligibility. Reviewers met to resolve disagreements and reach consensus on the eligibility of studies. If consensus could not be reached, then a third reviewer was used.

Risk of Bias Assessment

We had planned to critically appraise the eligible articles using the Scottish Intercollegiate Guidelines Network criteria.²⁷ The Scottish Intercollegiate Guidelines Network criteria assist with the evaluation of selection bias, measurement bias, and confounding in epidemiologic and clinical studies.

Data Collection

We planned for one reviewer to independently extract data from scientifically admissible studies. Similarly, we had planned for a second reviewer to validate the data extracted by the first reviewer. However, these steps were not undertaken because we did not identify studies relevant to our purpose.

Synthesis

We planned to qualitatively synthesize results from scientifically admissible studies according to principles of best-evidence synthesis.²⁸ Specifically, we planned to build

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