

Changes in vertebral artery blood-flow following various head positions and cervical spine manipulation.

Journal of Manipulative and Physiological Therapeutics 2014 Vol 37 Issue 1: pp22-31

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ABSTRACT:

Objective

The objective of the study was to investigate the cerebrovascular hemodynamic response of cervical spine positions including rotation and cervical spine manipulation in vivo using magnetic resonance imaging technology on the vertebral artery (VA).

Methods

This pilot study was conducted as a blinded examiner cohort with 4 randomized clinical tasks. Ten healthy male participants aged 24 to 30 years (mean, 26.8 years) volunteered to participate in the study. None of the participants had a history of disabling neck, arm, or headache pain within the last 6 months. They did not have any current or history of neurologic symptoms. In a neutral head position, physiologic measures of VA blood flow and velocity at the C1-2 spinal level were obtained using phase-contrast magnetic resonance imaging after 3 different head positions and a chiropractic upper cervical spinal manipulation. A total of 30 flow-encoded phase-contrast images were collected over the cardiac cycle, in each of the 4 conditions, and were used to provide a blood flow profile for one complete cardiac cycle. Differences between flow (in milliliters per second) and velocity (in centimeters per second) variables were evaluated using repeated-measures analysis of variance.

Results

The side-to-side difference between ipsilateral and contralateral VA velocities was not significant for either velocities ($P = .14$) or flows ($P = .19$) throughout the conditions. There were no other interactions or trends toward a difference for any of the other blood flow or velocity variables.

Conclusions

There were no significant changes in blood flow or velocity in the vertebral arteries of healthy young male adults after various head positions and cervical spine manipulations.

ANALYSIS

Evidence of any bias from, say, funding source influence/author's affiliations

An appropriate methodology for original research has been conducted (see below). Acknowledgements of specific funding and author affiliations with the funders have been reported including the Canadian Chiropractic Protective Association and NCMIC Research Foundation and Canadian Memorial Chiropractic College. While two authors have affiliations with two funders, the methods (blinded RCT) and conclusions are appropriate as such no evidence of intentional bias is present. However, as with all research funded by governing bodies or where conflicts may be present, caution should be taken when examining or reporting the findings in isolation and reading the wider literature is recommended.

Summary of the research methods

A blinded randomised control trial (RCT) methodology has been performed with ethical approval and informed consent sought. Inclusion/exclusion criteria (healthy males, no specific pathology, humans only), and appropriate statistical analyses have been performed. This is a rigorous system commonly used for original research.

Strengths or weaknesses in the research methods

The RCT methodology is an obvious strength of the article as this is a rigorous methodology (considered the 'gold standard') and the blinded assessor approach limits the possibility of bias. A strong rationale for the use of MRI rather than ultrasonography is provided and a strength given the reported limitations of ultrasonography on blood flow in this region. However, limitations (acknowledged by the authors) exist: (1) carotid blood flow cannot be visualised using the current methodology thus total flow is unable to be determined (2) time course from manipulation to measurement may result in short-term or transient alterations in blood flow to be missed, (3) only 10 subjects were recruited and no power analyses conducted, the sample size does appear to be small which risks a type II error (failing to detect a significant difference). Finally, healthy males were used, blood flow in patients with specific conditions may influence the data thus while the conclusions are appropriate, further research is needed on specific demographics.

Appropriateness of the statistical analysis

Repeated measured ANOVAs (analysis of variance) have been performed on blood flow and velocity in four head positions. As these measures are somewhat related, a single repeated measures MANOVA (multiple analyses) may be more appropriate. However, as the MANOVA is an even more robust statistical test, the outcome of this test would likely be identical in that no difference would be detected.

Whether the quality of the research supports the authors' conclusions

The authors' draw 2 appropriate conclusions:

- 'Phase-contrast MRI measure of blood velocity and flow through the V3 segment of the VA showed no significant changes in association with either head rotations or chiropractic CSM procedure.

This conclusion is appropriate as no difference was detected; however in their own limitations section they report trends for reductions in rotated positions, and with a small sample size the risk of a type II error is possible.

- No evidence of cerebrovascular hemodynamic effects as a result of mechanical interactions with the VA during head motions was identified.

Again appropriate based on the previous conclusions but with the same limitation as the 1st conclusion.

Overall

The article is very well written and is an award winning paper from 2013 from both WFC and ACCRAC organisations. Despite some methodological limitations, the conclusions are appropriate and it is published in a moderately high-impact journal (1.8), which all supports the quality of the research. The main conclusion that therapist-guided strengthening exercises are superior to advice and could be prescribed for within patients that suffer PFPS is appropriate however more research needs to be undertaken with a larger sample size and methodologies that attempt to remove some of the limitations stated by the authors.