

LETTER TO THE EDITOR-IN-CHIEF

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AUTONOMIC EFFECTS AFTER ANTERIOR-TO-POSTERIOR CERVICAL MOBILIZATION

We read with great interest and would like to congratulate Yung et al¹⁸ for their very interesting study titled “Blood Pressure and Heart Rate Response to Posteriorly Directed Pressure Applied to the Cervical Spine in Young, Pain-Free Individuals: A Randomized, Repeated-Measures, Double-Blind, Placebo-Controlled Study,” published in the August 2014 issue of *JOSPT*. This study contributes to the knowledge of the effects of joint mobilization techniques, especially those applied on the spine, on autonomic nervous system modulation. The trial demonstrated a statistically significant drop in heart rate (HR) after an anterior-to-posterior (AP) cervical mobilization that did not occur in the placebo group. In addition, there was a statistically significant reduction in systolic blood pressure (BP) for both the intervention and placebo groups. However, due to the divergent results between this article and a recently published systematic review,⁴ we would like to add to the discussion.

Due to the anatomical proximity between the stellate ganglion and cervical spine region, it appears to be relevant to explore autonomic repercussions induced by AP cervical mobilization. Anecdotal evidence suggests that this technique may emerge as an alternative in the management of clinical conditions involving unilateral symptoms of the superior quadrant⁸ through sympathetic nervous system activation and subsequent hypoalgesic effects.⁴ However, previous stud-

ies with a similar purpose to that of the study by Yung et al¹⁸ observed statistically significant increases in HR and BP following cervical mobilization.^{9,17} Other articles even showed concurrent effects of sympathetic excitation and an increase of pressure pain threshold after applying different techniques of spinal mobilization.^{7,14} These findings are in contrast to the data published by Yung et al¹⁸ and suggest that the excitation of the sympathetic nervous system may be part of a descending pain-modulation system.

The autonomic nervous system contributes to homeostasis by adjusting the convergence and interaction of a large number of organic and environmental stimuli. It reacts with a broad spectrum of systemic responses that aim to preserve body functions. This implies that many factors can influence autonomic modulation. Thus, rigorous methodological procedures are paramount when investigating how this system is affected by external factors. The conflicting results obtained by Yung et al¹⁸ compared to those of other studies^{4,7,9,14,17} might have occurred as a consequence of different procedures adopted among studies. For example, in the trial by Yung et al,¹⁸ it is unclear whether individuals who were obese, smoked, consumed alcohol, or had systemic disorders such as diabetes were enrolled. Substantial autonomic changes have already been described for these populations.^{3,10,13,16} Moreover, the level of physical activity of the participants was not reported. Sedentary individuals usually demonstrate significantly higher sympathetic activity than their physically active counterparts.^{10,16} Therefore, characteristics of participants enrolled in the study might have influenced the findings. The circadian rhythm can cause significant changes in HR⁵; the type, volume, and composition of food intake can influence autonomic modulation¹; and respiratory rate has a direct effect on HR.² We believe that the authors¹⁸ should have considered the influence of the period of the day of data collection, food intake, and respiratory rate.

Considering one of the main outcomes of the study (HR), we would like to suggest an alternative parameter to assess autonomic nervous system behavior. Heart rate variability (HRV) is a noninvasive marker with good validity and reliability¹¹ that reflects the activity of the sympathetic and vagal components of the autonomic nervous system.¹⁵ It provides more consistent information on either sympathetic or vagal activity. The interest in HRV as a measure of autonomic function, therefore, lies in its clinical importance, because reduced HRV is a powerful and independent predictor of an adverse prognosis in patients with heart disease and in the general population.^{6,12} Among indirect assessment methods of autonomic nervous system activity, HRV appears to be the most affordable and allows recording of data during interventions.

Overall, we would like to emphasize the importance of either a wider description of the Methods section or more controlled procedures for future studies. It would make the investigation easier to reproduce and enhance the internal consistency. Moreover, we believe that incorporating HRV assessments in studies of this nature could yield interesting insights on the neurophysiological effects of joint mobilization techniques on the autonomic nervous system.

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RESPONSE

We are pleased our Brazilian colleagues find our article¹⁰ interesting and appreciate the opportunity to respond to their letter to the editor. First and foremost, the evidence for the effectiveness of AP cervical mobilization is not anecdotal, as claimed by Mr Araujo and colleagues, who cited the study by La Touche et al,⁹ which demonstrated that it is effective in patients with head/neck pain. Another study showed that AP mobilizations achieve the best outcome and/or most efficiently attain analogous effectiveness when compared with 3 other common joint mobilization techniques.⁴

While growing evidence suggests that sympathoexcitatory response is one mechanism explaining why manual therapy may affect pain, the various interactions between the sympathetic nervous system and pain are still not fully characterized.⁵ For example, preoperative blockage of the (sympathetic) stellate ganglion can reduce postoperative pain and the need for tramadol.⁸ When compared to a nonpainful

control condition, experimental acute pain increased HR and mean arterial BP (signs of stress-related sympathoexcitatory response) in young, healthy participants.⁶

If acute pain can induce sympathoexcitatory response and if blockage of the sympathetic nervous system can reduce pain, then it may be reasonable to speculate that sympathoinhibitory response may reduce pain. Although not cited in our article, manual techniques such as soft tissue mobilization, spinal manipulative therapy,^{3,7} and 2-Hz transcutaneous electrical nerve stimulation have been shown to reduce pain via this sympathoinhibitory mechanism. The 1.5-Hz frequency of our AP mobilization technique, applied near the stellate ganglion, is analogous in frequency to the 2-Hz transcutaneous electrical nerve stimulation, which has been shown to reduce systolic BP (sympathoinhibitory response) via an enhanced BP-related hypoalgesia from the endogenous opioid response.¹

Moreover, a recent study using transcutaneous electrical nerve stimulation to stimulate the stellate ganglion showed a reduction in post-coronary artery bypass graft surgery pain, reduced mean arterial pressure (suggesting sympathoinhibitory effects), reduced opiate requirements, and increased circulating beta endorphins.² Due to the proximity of the stellate ganglion to the AP mobilization site, it is possible that the AP mobilization might have stimulated the stellate ganglion, resulting in sympathoinhibitory cardiovascular response.

All studies cited by Mr Araujo and colleagues applied continuous joint mobilization, lasting anywhere from 30 to 120 seconds, for 3 sets, which is approximately 2 to 6 times the total duration of treatment employed in our study. Specifically, in our study, AP oscillations were performed for 10 seconds on and 10 seconds off, repeated over 5 cycles. This is perhaps one reason why our results differed from those of other studies.

The work by La Touche et al⁹ perhaps approximates our AP technique the closest. Their sham group had a decreased HR response that was similar to that of our placebo group. Although their experimental group's HR and respiratory rate went up within session 1, those findings appear to not be statistically significant, whereas our study yielded a statistically significant reduction in HR and systolic BP.

A careful reading of the description of our sample reveals that the body mass index averaged 23.6 kg/m², which is not obese, as defined by the World Health Organization criteria. All the participants in our study were healthy, did not consume alcohol the day of the study, were not smokers, and did not have diabetes.

The concern regarding the influence of the period of the day of data collection (circadian rhythm) would only be pertinent if the data had been collected from more than 1 session. In our study, the subjects were tested during a single session, which lasted approximately 30 minutes and included 2 baseline measurements that have high reliability. It is noteworthy that, similar to our study, all studies cited by Mr Araujo and colleagues did not address food intake, and though respiratory rate was not investigated in our study, HR and BP may be utilized as proxies for sympathetic activity.⁶ In addition, even though La Touche et al⁹ measured respiratory rate, they did not utilize BP as an indicator of sympathetic nervous system activity.

While the suggestion of using HRV is well intended, none of the references cited by Mr Araujo and colleagues used this methodology. Therefore, with the exception of the total procedural dosage duration, our study used similar methodologies, including inclusion and exclusion criteria, to those previously reported by those references. Reproducing our results should not be difficult, as our study was pragmatic in

design and the equipment used is available in every physical therapy practice. Our original manuscript had a more thorough description of the methods, but only limited procedural details could be included within the Brief Report category.

In summary, performing AP mobilizations caused sympathoinhibitory effects. Although contrary to what is popularly accepted in manual therapy, our findings are consistent with published results reported by Knutson,⁷ Delaney et al,³ Campbell and Ditto,¹ and Cipriano et al.² Our disparate outcomes (results derived following comparable methods employed in applicable references mentioned by Mr Araujo and colleagues) suggest that there may be different mechanisms underlying the cardiovascular effects of various manual techniques and/or various dosage regimens.

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The authors certify that they have no affiliations with or financial involvement in any organization or entity with a direct financial interest in the subject matter or materials discussed in this article.

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