

Effects of experimentally induced lumbar nociception on trunk motor control in the rat during locomotion

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Summary

Experimentally induced lumbar nociception did not affect lumbar kinematics or back muscle activation during locomotion in the rat, except for localized decreased peak EMG amplitude and variability.

Introduction

Nociception resulting in pain perception might be one of the factors contributing to the motor control changes in people with low-back pain [1]. However, limited evidence exists regarding the effects of acute pain on trunk motor control during locomotion [2]. This study aimed to evaluate the effects of hypertonic saline induced nociception on trunk movement and back muscle activity during locomotion in a rat model.

Methods

Twelve adult male Wistar rats (*Rattus norvegicus domestica*, 330  34 gram prior to surgery) were used in this study. Spine and pelvis kinematics, EMG signals from bilateral multifidus (MF) and medial longissimus (ML) muscles of the rats were collected during treadmill locomotion before and after hypertonic saline (5.8%, 100  l) injection into the lumbar MF.

Results and Discussion

Both kinematics and EMG patterns during locomotion remained unchanged after hypertonic saline injection. No significant changes were found in stride duration, pelvic, lumbar and spine angle changes (Figure 1), variability, or movement asymmetry. Also, the overall EMG patterns and intermuscular coordination were unaffected (Figure 2). For the MF muscles, we found synchronized bilateral activation with two peaks per stride cycle. In contrast, alternating activation of left and right ML was observed. The only significant effects of hypertonic saline injection were a decrease in normalized peak amplitude of the left MF

($p=0.041$, $t=2.50$, effect size=0.88) and EMG variability ($p=0.038$, $t=2.81$, effect size=1.15) of the right ML.

These findings suggest that the central nervous system maintains the functional movement under nociceptive conditions.

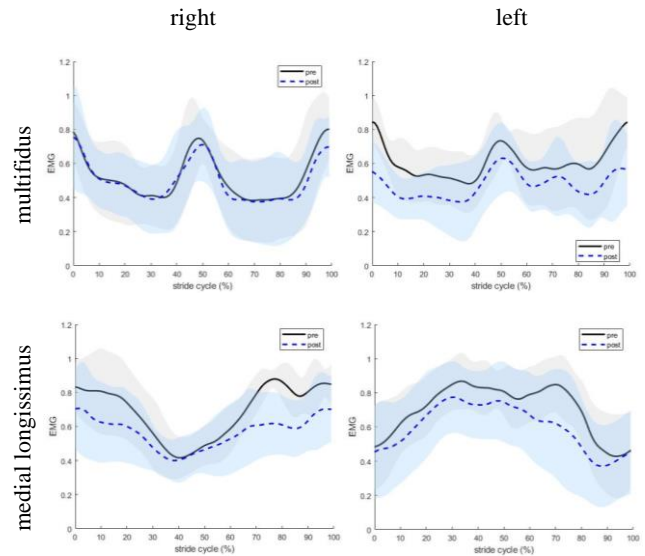


Figure 2: Mean (\pm SD) of the filtered rectified EMG envelopes of right and left multifidus (MF) and medial longissimus (ML) muscles during locomotion pre- (black solid line) and post- (blue dashed line) hypertonic saline injection. EMG amplitudes were normalized to peak amplitude measured before hypertonic saline injection and plotted as a function of normalized stride cycle duration.

Conclusions

Hypertonic saline injection induced nociception had minimal impact on motor control, with overall consistent kinematic and muscle activation patterns.

Acknowledgments

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References

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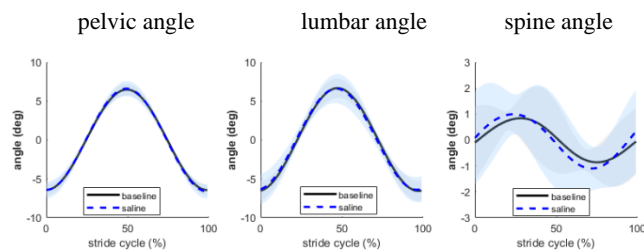


Figure 1: Joint angle changes during locomotion pre- (black solid line) and post- (blue dashed line) hypertonic saline injection.