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Does Hypersensitivity Occur After Axillary Brachial Plexus Block in Healthy Volunteers? A Mechanistic Study of Rebound Pain

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Introduction

Rebound pain after single-injection peripheral nerve block resolution is a phenomenon where patients may experience a severe and rapid increase in pain.1,2 One unanswered mechanistic question that remains is whether “rebound pain” represents a true hyperalgesic state, or simply reflects an unmasking of residual surgical pain. This healthy volunteer study aimed to determine whether hypersensitivity occurs after block resolution by comparing changes in pain sensitivity between participant’s previously blocked and contralateral (unblocked) arms.

Materials and Methods

IRB committee approval was obtained for the study. Healthy volunteers were recruited to receive an axillary brachial plexus block with 15cc mepivacaine 1.5%, without a surgical incision. Participants were randomized to the arm that received a block, while the contralateral arm received no intervention. Sensory and motor function were tested throughout the study to determine the onset and resolution of the block. Participants underwent repeated, bilateral forearm/hand quantitative sensory testing (QST) to assess heat, pressure and punctate pain, and central sensitization at baseline, post-block onset, and every 20-minutes for 3-hours after motor resolution. The primary outcome was change in heat pain threshold from baseline between block and control arms, measured 60-minutes after motor resolution. Given the block resolution timeline variability, we extracted the maximally sensitized value for both block and control arms during the 3-hours after resolution, and compared these between arms, using paired t- or Wilcoxon signed rank tests.

Results/Case Report

40 participants completed the study. The mean age was 35.9±14.9 years, with 60% being female. There was a significant difference between the block and control arms in heat pain threshold 1/10 pain at 60 minutes after motor resolution, after adjusting for baseline (change from baseline in block arm:-0.09±2.39°C vs. control arm:-0.93±2.35°C ; p=0.028), such that the block arm was less sensitive than the control arm (Figure 1). Comparing maximally sensitized values, we similarly saw less sensitization in the block than the control arm, for heat pain threshold to 1/10-pain (block:-1.86±2.24°C, control:-3.27±2.05°C; p< 0.001), 5/10-pain (block:-1.38±1.78°C, control:-3.21±2.49°C; p< 0.001), and 10/10-pain (block:-2.17±1.36°C, control:-3.02±1.92°C; p=0.004). The block arm also had lower maximally sensitized values for punctate pain (block:-0.05±1.71, control:0.56±1.48; p=0.005) and less reduction of forearm pain tolerance (block:-3.70±3.70, control:-5.08±2.91; p=0.006) compared to the control arm. There was no difference between blocked and control arms for temporal summation of pain, forearm pressure pain threshold, or cuff pressure pain threshold.

Discussion

This study provided no evidence for increased nociceptive sensitivity following resolution of an axillary brachial plexus block. Conversely, there was evidence that the presence of a block may be protective against sensitization that occurs with repeated pain testing, as the control arm exhibited more sensitization compared to the block arm. Therefore, rebound pain may reflect the simple return of surgical pain, in the absence of adequate regional duration, education, realistic expectations, and multimodal analgesic regimens.

References

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