Effects of Post Trauma Morphine On Dorsal Horn Neuron Excitability: Studies using cFOS and RNAscope

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The following is an excerpt from a longer piece. For full text, please visit https://scholar.colorado.edu/concern/undergraduate_honors_theses/0k225c53t

Abstract

Previous research has shown that a 5-day course of morphine enhances nociceptive sensitivity and allodynia when given 10 days after chronic constriction injury (CCI) as measured by the Von Frey test, a test where the hindpaw is poked with force (measured in grams) calibrated filament. This increased sensitivity to touch suggests that post trauma morphine makes second order sensory dorsal horn neurons more excitable. Therefore, it is hypothesized that during morphine enhanced allodynia, dorsal horn neurons will be more excitable to nociceptive stimulus. It was found that morphine enhanced allodynia causes more excitable neurons across a larger spatial range of the spinal cord, both rostral-caudal and dorsal-ventral along the dorsal horn. Mechanisms for the increased excitability of the dorsal horn are proposed and explored. These findings add to a robust literature which has detailed the paradoxical pain amplifying effects of morphine. Further, this study predicts that hyperexcitability of pain and touch pathways may occur as a clinically unintended side effect of morphine when administered to treat ongoing neuropathic pain.

Lay Summary

When working on the body, opioids take effect on various cells- including cells of the nervous system known as Glia. These glial cells produce various inflammatory responses that are typically known to decrease inflammation in the body. However, prior literature has revealed that following an activated state, these cells enter a "primed" form. If a second immunological activation occurs during this primed state, glial cells have been shown to release proteins that actually potentiate the state of pain. This study examines this hypothesis through the context of peripheral nerve injury (modeling injury, surgery, or trauma), followed by an administration of morphine. Using advanced imaging techniques, we are able to visualize exactly what modulators are inducing this potentiated pain response, as well as where in the nervous system these cells are found. Morphine has a potent effect on various aspects of the nervous system which may be alleviated by other treatment routes that focus specifically on the cell type and location that release the molecules that initiate the healing process. By unveiling the details of this mechanism, we can better understand how to treat patients following injury or surgery without inducing a higher pain response that can be caused by a short-term administration of morphine.