Sustained Regional Anesthesia for Post-operative Pain Management

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2018

Abstract

Acute post-operative pain is inevitable, yet current treatment strategies do not provide sufficient pain relief. While local anesthetics are widely used to achieve a regional block, they are currently delivered as a bolus liquid injection and, thus, quickly clear the injection site. Subsequently, pain relief is short-lived, and quick distribution of the drug throughout the body leads to systemic side effects. Post-operative pain management can be improved by a local, controlled and sustained drug delivery system that increases the duration of local anesthetic efficacy while minimizing side effects. Herein, a hyaluronan-methylcellulose hydrogel (HAMC) was investigated as a drug delivery vehicle to locally deliver pain medication over an extended period. By distributing particulates of a local anesthetic within HAMC, the hydrogel serves as a local drug depot and prevents fast clearance of the drug. The anesthetic-loaded HAMC system was optimized for minimal swelling, ease of injection and sustained release in vitro, and then evaluated in rat models of nerve block where sustained release was achieved with increased anesthetic dose. The anesthetic-loaded HAMC formulation outperformed currently used bolus injection of anesthetic in the rat model of nerve block based on pharmacokinetic and pharmacodynamic evaluation.