



APP ABSTRACT- APP 2026-002

Unlocking the Power of Nano-medicine, Revolutionizing Opioid Therapy: A review

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Abstract

Objective: Opioids represent one of the oldest classes of drugs in medicine and remain central to pain management. The aim of this literature review is to summarize the latest research on opioid nano formulations and their ability to increase analgesic efficacy while minimizing associated risks. Preclinical studies have already demonstrated that both liposomal and dendrimer-based opioid formulations allow for extended release and, consequently, more prolonged and stable analgesia.

Methodology: This narrative review was conducted to evaluate the role of NPs in opioid-based analgesia and in mitigating the harms associated with opioid use. Key methodologies include formulation of nanocarriers, surface functionalization for targeted delivery, and stimuli responsive release systems.

Results: Nano medicine improves opioid therapy by optimizing pharmacokinetics and drug delivery system, which is helpful in maintaining analgesia and reducing the adverse effect. Nanoformulations such as liposomes and dendrimer based opioid formulations allow sustained, controlled drug release and have higher rate of bioavailability.

Conclusion: Nano medicine-based delivery systems represent promising tools for providing effective analgesia for patients. Interdisciplinary collaboration among materials scientists, pharmacologists, anesthesiologists, and regulatory authorities is essential for the establishment of standardized evaluation pipelines for opioid nanoformulations. Only through such coordinated efforts will nanomedicine evolve into a clinically reliable and widely accessible tool for both effective and safe pain management. Keywords Nanoparticle, liposomes, dendrimers, nanoemulsions, opioids.