

# Ketamine: Perioperative Pain Management And Chronic Relief

Rakesh Sharma\*

Department of Anesthesiology and Pain Medicine, Himalayan Institute of Medical Sciences, Dehradun, India

## Introduction

Ketamine's expanding role in perioperative pain management offers significant acute and chronic benefits, leveraging its dissociative anesthetic properties and neuromodulatory effects, particularly on the N-methyl-D-aspartate (NMDA) receptor. This mechanism makes it a valuable tool for managing opioid tolerance and reducing postoperative opioid consumption, with sub-anesthetic doses increasingly explored for chronic pain conditions like complex regional pain syndrome and neuropathic pain. However, careful patient selection and vigilant monitoring are essential due to potential psychotomimetic and cardiovascular side effects [1].

Recent investigations into the efficacy of low-dose ketamine infusions for refractory chronic pain syndromes highlight its potential to desensitize hyperactive pain pathways. This research often presents data on patient outcomes, adverse events, and the impact on quality of life, particularly in individuals experiencing substantial pain relief and a reduction in opioid reliance [2].

The utilization of ketamine as an adjunct for acute postoperative pain is also gaining traction, with a focus on its opioid-sparing effects. This application details the mechanisms by which ketamine reduces opioid requirements, primarily through NMDA receptor antagonism, and consolidates evidence from clinical trials demonstrating its effectiveness across various surgical settings [3].

Complex regional pain syndrome (CRPS), a particularly challenging chronic pain condition, is a focus of research examining ketamine's therapeutic potential. Studies in this area report on the efficacy of different ketamine administration protocols, such as intravenous infusions, and investigate predictive factors for successful treatment response in CRPS patients [4].

Delving deeper into the therapeutic actions of ketamine, research explores the neurobiological mechanisms underlying its analgesic effects. This often centers on its interaction with the NMDA receptor and downstream signaling pathways, providing a more profound understanding of ketamine's efficacy in both acute and chronic pain states, including its role in mitigating central sensitization [5].

The impact of perioperative ketamine on patient-reported outcomes following major surgery is a critical area of study. Prospective evaluations assess metrics such as pain intensity, functional status, and psychological well-being, offering insights into the broader benefits of ketamine beyond immediate analgesia [6].

For opioid-tolerant patients undergoing surgery, where conventional analgesia can be less effective, ketamine presents a viable option. Research in this domain provides evidence for ketamine's role in achieving adequate pain control and facilitating recovery in this particularly challenging patient population [7].

A thorough examination of ketamine's safety profile in perioperative settings is

crucial for its widespread adoption. This includes discussing potential side effects such as hallucinations, cardiovascular changes, and urinary tract issues, alongside guidance on patient selection, monitoring, and adverse event management [8].

Beyond CRPS, ketamine's application extends to other specific chronic pain conditions, including fibromyalgia and neuropathic pain. Reviews in this area often highlight emerging evidence and discuss the observed heterogeneity in treatment responses among different patient groups [9].

Optimizing ketamine's therapeutic utility necessitates a focus on dosing strategies and administration techniques. Research addresses challenges in titrating ketamine, managing dose-related side effects, and comparing the effectiveness of various administration routes for both acute and chronic pain management [10].

## Description

The evolving landscape of perioperative pain management prominently features ketamine, a compound offering a spectrum of acute and chronic therapeutic benefits. Its unique dissociative anesthetic properties and potent neuromodulatory actions, particularly its interaction with the N-methyl-D-aspartate (NMDA) receptor, establish it as a valuable agent for addressing opioid tolerance and significantly reducing postoperative opioid requirements. Furthermore, the administration of sub-anesthetic doses of ketamine is increasingly being investigated and utilized for a variety of chronic pain conditions, demonstrating considerable promise in managing complex regional pain syndrome and neuropathic pain, although stringent patient selection and meticulous monitoring remain paramount due to the potential for psychotomimetic and cardiovascular adverse effects [1].

Contemporary research actively investigates the efficacy of low-dose ketamine infusions for managing recalcitrant chronic pain syndromes, underscoring its capacity to modulate and potentially desensitize overactive pain pathways. The findings from such studies typically encompass detailed data on patient outcomes, the incidence and nature of adverse events, and the tangible impact on patients' overall quality of life, especially within cohorts experiencing substantial pain relief and a consequent reduction in their reliance on opioid medications [2].

Within the realm of acute postoperative pain management, ketamine is being explored as an adjunct therapy, with a particular emphasis on its capacity to reduce opioid consumption. This application thoroughly examines the physiological mechanisms through which ketamine exerts its opioid-sparing effects, primarily revolving around NMDA receptor antagonism. Comprehensive evidence from rigorous clinical trials is presented, illustrating its demonstrable effectiveness across a diverse array of surgical scenarios and patient populations [3].

Complex regional pain syndrome (CRPS), a notoriously debilitating and challenging chronic pain condition, is a specific focus for research evaluating ketamine's therapeutic utility. Investigations in this area often delineate the effectiveness of various ketamine administration protocols, including but not limited to intravenous infusions, and seek to identify predictive factors that may indicate a successful treatment response in patients afflicted with CRPS [4].

A deeper understanding of ketamine's therapeutic impact is being elucidated through research into its fundamental neurobiological mechanisms of analgesia. These studies predominantly concentrate on ketamine's intricate interactions with the NMDA receptor and its subsequent downstream signaling cascades. Such explorations aim to provide a more robust scientific foundation for ketamine's efficacy in managing both acute and chronic pain states, including its crucial role in attenuating the development and persistence of central sensitization [5].

The broader implications of perioperative ketamine use are being assessed through prospective studies that meticulously evaluate patient-reported outcomes. These assessments encompass critical domains such as the intensity of pain experienced, the restoration of functional capacity, and the overall state of psychological well-being following major surgical interventions, thereby offering a more holistic view of ketamine's benefits beyond mere nociception control [6].

In the context of perioperative care for opioid-tolerant patients, a group for whom conventional analgesic strategies may prove insufficient, ketamine emerges as a significant therapeutic option. Evidence presented in this area supports ketamine's role in ensuring adequate pain management and facilitating a smoother recovery trajectory for this particularly challenging patient demographic [7].

The safe and effective implementation of ketamine in perioperative settings hinges on a comprehensive understanding of its safety profile. This involves a detailed discussion of potential adverse events, including but not limited to hallucinations, transient cardiovascular alterations, and potential urinary tract sequelae. Crucially, this research also aims to provide practical guidance on optimal patient selection criteria, essential monitoring parameters, and effective strategies for managing any emergent adverse events to maximize ketamine's therapeutic utility while minimizing risk [8].

Ketamine's therapeutic applications extend beyond CRPS to encompass other challenging chronic pain conditions, such as fibromyalgia and various forms of neuropathic pain. Reviews focusing on these indications often synthesize emerging research findings and address the considerable heterogeneity in patient response that is frequently observed within these diverse clinical populations [9].

Maximizing the benefits of ketamine therapy for pain management necessitates meticulous attention to optimal dosing strategies and precise administration techniques. Current research endeavors aim to address the inherent challenges associated with titrating ketamine effectively, managing dose-dependent side effects, and comparatively evaluating the efficacy of different routes of administration in both acute and chronic pain contexts [10].

## Conclusion

Ketamine is increasingly utilized in perioperative pain management for its acute and chronic benefits, primarily through NMDA receptor antagonism. It effectively

manages opioid tolerance and reduces postoperative opioid consumption. Sub-anesthetic doses show promise for chronic pain conditions like CRPS and neuropathic pain, though careful monitoring is crucial due to potential side effects. Research highlights ketamine's efficacy in refractory chronic pain, its opioid-sparing effects in acute settings, and its potential in opioid-tolerant patients. Safety profiles and optimal dosing strategies are actively being investigated.

## Acknowledgement

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## Conflict of Interest

None.

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**\*Address for Correspondence:** Rakesh, Sharma, Department of Anesthesiology and Pain Medicine, Himalayan Institute of Medical Sciences, Dehradun, India, E-mail: rakesh.sharma@hims.edu

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