Therapeutic Applications of Ketamine in Emergency Medicine: Systematic Review

Suraj Gyawali[1], MD; Rajeeb Raj Thapaliya[1], MD; Olita Shilpakar[1], MD; Shreeram Shrestha[1],MD; Prasanna Rajbhandari[1], MD; Prajjwal Malla[1], MD; Bikash Shrestha[1], MD; Shreeya Pathak[1], RN

[1] Department of Emergency Medicine, Grande International Hospital, Dhapasi, Kathmandu, Nepal

ABSTRACT

Ketamine is a dissociative anesthetic widely used in emergency medicine due to its preservation of airway reflexes and cardiovascular stability. A systematic review of studies published between 2000 and 2024 identified 18 relevant articles evaluating ketamine use in emergency settings. Sub-dissociative doses provide effective analgesia with opioid-sparing effects, while procedural sedation, especially in children, shows high success rates. Ketamine offers hemodynamic stability during rapid sequence intubation and is effective in refractory asthma and acute agitation, often avoiding intubation. Its affordability and stability make it valuable in resource-limited settings. Ketamine remains a versatile and evidence-based option in emergency care.

Keywords: Ketamine; Emergency Medicine; Analgesia; Procedural Sedation; Rapid Sequence Intubation

Introduction

Ketamine, first synthesized in the 1960s, is widely recognized for its role as a dissociative anesthetic. Unlike other sedative agents, ketamine preserves airway reflexes, spontaneous respiration, and cardiovascular stability, making it especially valuable in emergency medicine[1]. Its mechanism of action involves NMDA receptor antagonism, opioid receptor activity, and catecholamine release, contributing to both analgesic and anesthetic effects[2]. It provides analgesia for polytrauma, sedation for agitated patients with head injuries or metabolic encephalopathy, and stability during transports like helicopter transfers, often preferred over agents like propofol or fentanyl due to reduced cardiovascular depression[3]. Beyond traditional applications, ketamine has gained attention for off-label use in treating major depressive disorder (MDD) and treatment-resistant depression (TRD), offering rapid symptom relief[4]. This review aims to systematically evaluate ketamine's therapeutic roles particularly in resource-limited settings like Nepal.

This review systematically examines the therapeutic uses of ketamine in emergency medicine, emphasizing its efficacy, safety, and advantages over traditional alternatives.

Methods

A systematic review was conducted to assess ketamine's therapeutic applications in emergency medicine, focusing on its efficacy and safety across diverse clinical scenarios. We searched PubMed, Cochrane Library, and Google Scholar for studies published from January 2000 to June 2024. Inclusion criteria comprised randomized controlled trials, observational studies, systematic reviews, and meta-analyses evaluating ketamine's use in emergency settings, including analgesia for acute pain, procedural sedation, rapid sequence intubation, severe asthma management, and agitation or excited delirium control. Studies related to recreational or abuse-related use, veterinary applications, or non-emergency contexts were excluded to maintain relevance. The search identified 178 articles. After screening

Correspondace:
Suraj Gyawali, MD
Email: gyawalisuraj2671@gmail.com
Received: 20/September/2025
Accepted:12/December/2025
DOI: https://doi.org/10.3126/gmj.v5i2.87591

titles and abstracts, 32 studies were selected for full-text review. Following rigorous application of eligibility criteria, 18 studies were included in the final analysis, forming a robust evidence base. This meticulous selection process ensured a comprehensive evaluation of ketamine's role in emergency care, with a particular emphasis on its feasibility in resource-limited settings like Nepal, where access to advanced medical resources may be constrained.

Results

Therapeutic Use	Clinical Setting	Dose/Route	Key Findings (with statistical info where available)	References
Analgesia in Acute Pain	Trauma, burns, sickle cell crisis	0.1–0.3 mg/kg IV (sub-dissociative)	Cuts pain as well as opioids, spares opioid use, keeps vitals stable (noninferior to morphine; MD 0.28 in pain reduction, 95% CI -0.18 to 0.73, p>0.05)	5, 6, 7
Procedural Sedation	Fracture reduction, abscess drainage, wound repair, pediatrics	1–2 mg/kg IV, 4–5 mg/kg IM	Maintains airway reflexes; safe in children; emergence reactions manageable	8, 9
Rapid Sequence Intubation	Shock, trauma, hemodynamic instability	1–2 mg/kg IV	Preserves BP, increases sympathetic tone, safer than propofol/ thiopental in shock	10
Acute Severe Asthma	Refractory status asthmaticus	0.5–2 mg/kg IV bolus/infusion	Bronchodilation, useful when conventional therapy fails	11, 12
Agitation & Excited Delirium	Prehospital, ED psychiatric emergencies	4–5 mg/kg IM	Rapid sedation, faster than haloperidol/Benzos; risk of oversedation.	13

Discussion

This systematic review underscores ketamine's pivotal role as a versatile therapeutic agent in emergency medicine, offering rapid onset, hemodynamic stability, and a robust safety profile across diverse acute care scenarios. Its utility is particularly pronounced in resource-limited settings like Nepal, where access to advanced analgesics, sedatives, or ventilatory support may be constrained, and ketamine's low cost, long shelf life, and ease of administration enhance its feasibility[7]. Evidence from randomized controlled trials (RCTs), systematic reviews, and clinical guidelines supports its role in analgesia, procedural sedation, rapid sequence intubation (RSI), severe asthma, and management of agitation, making it indispensable in both emergency departments (EDs) and prehospital care.

At sub-dissociative doses (0.1–0.5 mg/kg IV), ketamine has proven to be a potent opioid-sparing agent for acute pain. Meta-analyses indicate that low-dose ketamine provides pain relief comparable or superior to opioids while minimizing risks of respiratory depression, nausea, and dependence[5, 6, 14]. In polytrauma, it reduces pain scores while preserving respiratory drive, which is critical in EDs with limited monitoring resources[15]. Given opioid shortages and misuse risks in Nepal, ketamine emerges as a practical alternative for both ED and prehospital use, including ambulances and rural clinics[7]. However, transient dissociative effects necessitate short-term monitoring to ensure patient comfort[8].

For procedural sedation, ketamine remains a preferred agent due to preservation of protective airway reflexes and cardiovascular stability, particularly in pediatric populations. Clinical guidelines endorse its use for procedures such as fracture reduction and laceration repair, with success rates exceeding 80–90% and low adverse event rates[8]. Intranasal administration offers a non-invasive, effective option, reducing the need for intravenous access and making it especially suitable in high-volume or resource-constrained EDs[9]. Reports of laryngospasm or vomiting are rare, reinforcing its reliability[9].

In RSI, ketamine provides hemodynamic stability through sympathetic stimulation, making it advantageous for patients with shock or trauma compared with etomidate or propofol[9, 16]. An RCT demonstrated superior cardiovascular outcomes with ketamine during intubation, though mortality benefits remain inconclusive[10]. In prehospital care, including aeromedical retrievals, ketamine's stability and minimal monitoring needs make it an optimal induction agent[17]. This is especially significant in Nepal, where trauma burden is high and transport conditions are often challenging[17].

Ketamine also demonstrates promise in status asthmaticus. By reducing airway resistance via beta-2 adrenergic activity, it improves ventilation in refractory cases[12, 18]. Although current evidence is limited by small sample sizes and inconsistent dosing protocols, reviews suggest benefit as an adjunct, particularly in ventilated patients in settings lacking advanced respiratory support [12].

For severe agitation and excited delirium, ketamine enables rapid sedation within minutes, proving highly effective in both ED and prehospital environments. Systematic reviews report success rates exceeding 90% without requiring intubation[13,19]. In aeromedical retrievals, it improves safety for both patients and staff[17]. This is vital in Nepal, where psychiatric emergencies and overcrowded EDs present ongoing challenges[19].

Despite its broad utility, ketamine carries risks. Dissociative effects and potential for misuse highlight the need for strict regulation to prevent diversion, particularly given the increasing incidence of ketamine-related ED visits worldwide[20]. Limitations of existing studies include heterogeneous dosing, variable outcome measures, and limited long-term safety data on repeated use. Future research should prioritize standardized protocols, long-term outcomes, and strategies for misuse prevention to optimize ketamine's integration into emergency care, particularly in resource-constrained regions.

Conclusion

Ketamine remains a versatile agent in emergency medicine, with well-established roles in analgesia, sedation, intubation, asthma management, and psychiatric emergencies. While evidence supports its safety and efficacy, ongoing research is needed to optimize dosing protocols and expand its applications.

References

1. Domino EF. Taming the ketamine tiger. Anesthesiology. 2010; 113(3): 678–84.
2. Persson J. Ketamine in pain management. CNS Neuroscience & Therapeutics. 2013 June; 19(19): 396–402.
3. Green SM RMKRKB. Clinical practice guideline for emergency department ketamine dissociative sedation: 2011 update. Annals of Emergency Medicine (abbreviated as Ann Emerg Med). 2011 May; 57(5): 449–461.
4. Bahji A VGZCJ. Comparative efficacy of racemic ketamine and esketamine for depression: A systematic review and meta-analysis. Journal of Affective Disorders (abbreviated as J Affect Disord). 2021 January; 278: 542–555.
5. Motov S ea. Sub-dissociative dose ketamine for acute pain in the ED: a systematic review. American Journal of Emergency Medicine. 2018 April; 36(4): 694–701.
6. Sin B ea. The use of low-dose ketamine for acute pain in the ED. Journal of Emergency Medicine. 2015 June; 48(6): 712–725.
7. Jennings PA ea. Morphine and ketamine is superior to morphine alone for prehospital analgesia: randomized trial. Annals of Emergency Medicine. 2012 June; 59(6): 497–503.
8. Green SM ea. Clinical practice guideline for ED ketamine sedation in children. Annals of Emergency Medicine. 2011 May; 57(5): 449–461.
9. Andolfatto G ea. Intranasal ketamine for procedural sedation in children: randomized controlled trial. Annals of Emergency Medicine. 2013 June; 61(6): 547–555.
10. Jabre P ea. Etomidate versus ketamine for rapid sequence intubation in acutely ill patients: randomised controlled trial. The Lancet. 2009 July; 374(9686): 293–300.
11. Howton JC ea. The use of ketamine in status asthmaticus. Annals of Emergency Medicine. 1996 February; 27(2): 170–175.
12. Goyal S AA. Ketamine in status asthmaticus: a review. Indian Journal of Critical Care Medicine. 2013 May-June; 17(3): 154–161.

13. Cole JB ea. Rapid sedation with ketamine in ED patients with severe agitation. Annals of Emergency Medicine. 2016 May; 67(5): 490–498.

14. Karlow N, SCH, SCRT,ea. A systematic review and meta-analysis of ketamine as an alternative to opioids for acute pain in the emergency department. Academic Emergency Medicine. 2018 October; 25(10): 1086–1097.

15. Sleigh J, HM, DB, ea. Ketamine versus fentanyl for prehospital trauma analgesia: A systematic review. Prehospital Emergency Care. 2020 March/April; 24(2): 181–189.

16. Merelman AH PMSR. Alternatives to rapid sequence intubation: contemporary airway management with ketamine. West J Emerg Med (Western Journal of Emergency Medicine). 2019 May ; 20(3): 466–471.

17. Le Cong M GBHESP. Ketamine sedation for patients with acute agitation and psychiatric illness requiring aeromedical retrieval. Emerg Med J (Emergency Medicine Journal). 2012 April; 29(4): 335–337.

18. Howton JC RJDSZTLM. The use of ketamine in status asthmaticus. Ann Emerg Med (Annals of Emergency Medicine). 1996 February; 27(2): 170–175.

19. Riddell J TABRHGAP. Ketamine as a first-line treatment for severely agitated emergency department patients. Am J Emerg Med (American Journal of Emergency Medicine). 2017 July; 35(7): 1000–1004.

20. Schak KM VVJJEKSLJRKea. Ketamine-related emergency department visits and hospitalizations: A retrospective analysis. Am J Emerg Med (American Journal of Emergency Medicine). 2019 July; 37(7): 1346–1350.