Review Article

Use of ketamine for sedation and analgesia in the emergency department : Systematic review

Abstract

Ketamine is a multipurpose substance that has clinical uses as an anesthetic, a pain reliever, and a very fast-acting antidepressant. Due to its ability to induce dissociation, it is also misused as a recreational drug. The neural pathways by which ketamine mediates its complex functions are being revealed by recent rodent research, but the long-term effects of chronic exposure, with their important scientific and clinical consequences, are still poorly understood.

Background: The primary purposes of procedural sedation and analgesia (PSA) in the emergency department (ED) are wound irrigation, fracture reduction, and wound closure. One of the most frequently prescribed medications for PSA in the ED is ketamine. In order to assess the negative effects of ketamine on PSA, a study was carried out in the emergency department of a sizable tertiary care hospital in southern India.
Materials and Methods: This 6-month (October 2019–March 2020) prospective observational research had 151 patients who needed ketamine for PSA. All patients received titrated doses of ketamine; hemodynamic indicators and adverse events were noted at predetermined intervals.
Results: A total of 151 ED patients needed PSA during the study period.
The study cohort's average age was 37 15 years, and 83% of the participants were men. Each person received enough sedative and pain relief. It was discovered that young people (18 to 40 years old) had a higher rate of negative reactions to ketamine (63%). In the study population, 39 cases of hypertension (44.8%) and 25 cases of vomiting ranked as the most frequent adverse reactions.) and delusion in 6 cases (4%).
Conclusion: Ketamine has been demonstrated to have a favorable safety profile with few side events when used as PSA in ED. It also has strong analgesic and sedative qualities. Hypertension was the most prevalent side effect and it was particularly prevalent in the younger adult age group.

Keywords: Analgesia, dissociative anesthesia, emergency department, Ketamine, procedural sedation

Introduction

The best medication for procedural sedation in the emergency department (ED) must start working quickly, have a strong analgesic effect, and have few side effects In the emergency department (ED), procedural sedation and analgesia (PSA) is a standard procedure to ease patients' pain, discomfort, and anxiety during invasive diagnosis and treatment. PSA is made to retain a solid responsiveness to spoken orders while suppressing the level of consciousness.We refer to this condition as moderate sedation.The most typical environments managed by PSA are the critical care unit (ICU), childcare unit, and emergency room. Orthopedic manipulations, abscess incision and drainage, wound cleaning, direct current cardioversion, and other procedures are frequently carried out in the emergency room while under the influence of ketamine. Since its 1970 discovery, ketamine has been utilized as a strong analgesic and dissociative anesthetic. Ketamine's unique capacity to elicit quick sedation, potent analgesia, amnesia, and other favorable effects makes it appealing. The latter include bronchodilation, preservation of sympathetic tone, and maintenance of airway reflexes. Due to its distinctive qualities and adaptability, it is rising in popularity.among anesthesiologists and ED doctors who operate in ED or ICU settings all over the world. Low-dose analgesia, adjuvant therapy of local anesthesia and nerve block, and use in reactive airway illnesses are some of its more recent uses. Despite the drug's potential benefits, it has not yet gained widespread acceptance because of its supposedly problematic "emerging" phenomena, increased salivation, potential for addiction, and the development of additional sedatives and analgesics. This study's primary goal is to assess the negative effects of ketamine on PSA in an emergency department setting. This study, however the first in an Indian ED context, is an addition to the body of literature already in existence.

Materials and Methods

Study Setting: The study was carried out in Vellore's Christian Medical College Emergency Department. The Emergency Department (ED), which has 49 beds, typically sees 300 trauma and non-trauma patients per day.

Study Design: This was a prospective observational study conducted over 6 months from October 2019 to March 2020 on patients requiring PSA in ED.

Inclusion Criteria: Patients with trauma who are older than 16 and need wound cleaning, suturing, screw fixation, or closure reduction with an ASA (American Society of Anesthesiologists) grade 1 or 2.

Exclusion Criteria: Patients who were hesitant to provide their permission for the study or were pregnant or had a history of mental illness were excluded from it.

Sample size calculation:A double-blind randomized controlled trial conducted by Lemon et al. in 2017 indicated that 18% of adverse reactions to ketamine (such as nausea or vomiting) were attributable to the drug. The needed size of the study sample, with a 6% precision and a 95% confidence interval, was around 160 participants.

Statistical Methods and quantitative variables: For regularly distributed values, the mean and standard deviation were used to report quantitative information. Frequency and percentage were used in the reporting of qualitative variables. The Statistical Package for the Social Sciences 21.0 version was used for data analysis.

Results: In the course of our 6-month trial (October 2019 to March 2020), 40,519 individuals sought care at our ED. 2376 of these patients had trauma, and 151 of them needed PSA and were enrolled in our research. [Fig. 1].

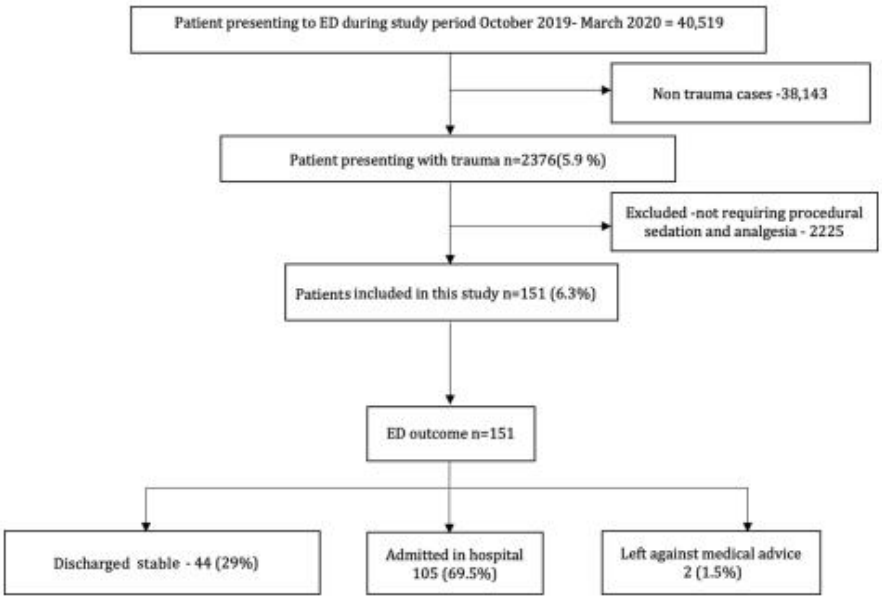

Figure 1: STROBE diagram

ED disposition: Patients from the study population were admitted to the ward/ICU, and the majority of them needed to have significant surgery. The remainder received cautious treatment.

around the ward. After receiving primary care, patients who were not hospitalized were either stably released (44/151: 29%) or left against medical recommendation (2/151: 1.5%). In this research group, no trauma nor PSA-related death were recorded.

Discussion

Ketamine is viewed as a promising drug for a variety of clinical uses, particularly in prehospital and emergency care, as it meets many criteria for an ideal opioid substitute, including potent analgesia, a suitable hemodynamic profile, reduced respiratory depression, and few side effects. Due to its N-methyl-D-aspartate receptor antagonist characteristics, ketamine shows dissociative drowsiness and analgesic effects.[9] One of the most often used medications for PSA, sub dissociated doses of ketamine have been demonstrated to be both effective and safe in emergency rooms in previous trials.[8,9] It has been observed to be useful to use ketamine as an analgesic in the pre-hospital environment, particularly in the case of trauma patients. Trauma patients need to be well sedated for procedures like wound debridement/washing, closure reduction, etc. in order to avoid excruciating pain, agitation, and anxiety.

A total of 590 Ketamine administrations were reported by McGlone et al. and Ellis et al., who also noted a high level of sedative effectiveness, high levels of parental and staff satisfaction, and an adverse effect profile that was easily controlled by skilled ED doctors.

Ketamine usage, however, can potentially result in severe respiratory, cardiovascular, and neuropsychiatric side effects. This investigation was done to investigate negative consequences associated with adult ketamine users. ED in support of a PSA.

In line with a research conducted by Newton et al., the majority of the participants in our study were young adults, with a male preponderance.
In contrast to Newton et al.'s trial, which employed a mean dosage of 0.7 mg/kg (with a range of 0.5-1.0 mg/kg), our study used a mean dose of 0.8 mg/kg-1 mg/kg of ketamine. When compared to the research by Newton et al., the mean starting heart rate and systolic blood pressure for our study sample were 105.6 beats/minute and 112.4 mmHg, respectively. Vomiting and hypertension were the most prevalent negative effects among the study participants, which was in line with previous research. According to older literature, one of the frequent adverse effects is respiratory depression.

However, the patient who was desaturated within the entire research sample (4/87; 4.6%) reacted effectively to extra oxygen. For the same, none of the trial participants needed mechanical ventilation. We had 6.9% (6/87) patients with emergence agitation, of whom two responded to verbal counseling and the remaining required short-acting benzodiazepines, compared to Andolfatto G et al.'s research, which listed emergence delirium as their main adverse impact.At 15 minutes following the IV administration of ketamine, 58.9% (89/151) of the patients had achieved a Ramsay sedation score of higher than 4, and the remainder required a second bolus dosage of 0.45 mg/kg. Unlike the study conducted by Andolfatto G et al., we did not have any sedation failure in our investigation that necessitated the administration of additional sedative medications to reach the desired level of drowsiness.

This might be explained by the fact that the only patients in our research sample were of the adult age range, although laryngospasm often affects children. Traditional sedatives like Midazolam were not delivered in conjunction with PSA since our group solely consisted of trauma patients who needed it, preventing unintended hypotension. None of the research participants' patients had any feared problems, and their surgeries went without incident. The study population did not have any deaths.

Table 1: Baseline characteristics

Variables	Frequency *n*=151 (%)
Demography	
Age, mean (SD) years	37±15
Age 18-40 years	96 (64)
41-60 years	43 (28)
61-80 years	12 (8)
Gender distribution	
Male	126 (83)
Female	25 (17)
Triage priority level	
Priority 1	74 (49)
Priority 2	74 (49)
Priority 3	3 (2)
Time of presentation to ED	
8 am-4 pm	58 (39)
4 pm-12 am	65 (43)
12 am-8 am	28 (18)
Comorbidities	
Diabetes	10 (7)
Hypertension	9 (6)
Smoking	10 (6)
Alcohol	13 (8)
Others*	7 (4)

Others* - Ischemic heart disease, Bronchial Asthma, Chronic obstructive pulmonary disease

Table 2 :Adverse effects of ketamine

Variables	Frequency n=87 (%)
Hypertension	39 (44.8)
Vomiting	25 (28.7)
Nausea	8 (9.2)
Emergence Delirium	6 (6.9%)
Desaturation	4 (4.6)
Confusion, Drowsiness	5 (4.6)

In the emergency department, ketamine is a secure and reliable substitute for opioids in the treatment of acute pain. Our meta-analysis demonstrated LDK was equally effective as opioids in treating acute pain by limiting numerous possible confounding factors with our stringent inclusion criteria and carrying out sensitivity analyses. Since ketamine is frequently used as an adjuvant to opioids, prior studies and comprehensive reviews included patients who were receiving both medications; nevertheless, this confounded their results when directly comparing the two. Although ketamine-related side effects were identified, few of them seemed to be clinically important.

The literature supporting ketamine as an alternative to opioids for the therapy of acute pain is constrained by the low quality of study design and small number of studies, while recent researchs is improving these problems. This is true even though there are several observation trials evaluating ketamine.

Study design is problematic in light of the availability of powerful analgesics. Going forward, researchers should investigate patient and physician satisfaction with ketamine analgesia and side effects in comparison to other opioid options for acute pain, and observational studies examining adverse events should employ comparable outcome metrics and time periods.

Conclusion:

Ketamine has been demonstrated to have strong sedative and analgesic qualities as well as a high safety profile with few side events for PSA in ED. In the young adult age group, hypertension, followed by vomiting and nausea, were the most frequent adverse events. No instances of laryngospasm or airway obstruction.

The use of ketamine for sedation and analgesia has become increasingly popular in clinical practice. Studies have shown that it is a safe and effective option for patients undergoing painful or invasive procedures, particularly those who are unable to tolerate traditional sedatives. While Ketamine has shown great promise in pain management, it is important to recognize that it also carries certain risks and limitations that must be taken into consideration when choosing this drug as an option.

One of the biggest drawbacks of ketamine is the potential for abuse. Because it is a dissociative drug that produces hallucinogenic effects, it can be a tempting target for individuals seeking a recreational high. This risk must be weighed against its benefits in a clinical setting, especially when considering younger individuals. As such, it's important that ketamine only be administered by medical professionals in a controlled setting to minimize the potential for abuse.

Another potential risk of ketamine is the potential for adverse effects when administered in certain situations. For example, it may be less suitable for patients with heart or respiratory problems, as it can cause cardiovascular and respiratory depression at higher doses. Caution must also be exercised when administering ketamine to individuals who are already on other medications or have comorbid medical conditions, which can significantly alter its effects.
In conclusion, while ketamine is a promising drug for the management of pain and sedation, it should be used with care and in accordance with best practices. Its potential risks and limitations must be considered carefully when choosing it as an option for a given patient, and only experienced medical professionals should be tasked with administering the drug. Ultimately, however, when used correctly, ketamine can be an invaluable tool in providing comfort and relief for those undergoing painful or unpleasant procedures.

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