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The Effectiveness of Ketamine in Shortening Post-Anesthetic Recovery Time: An Institutional Study

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ABSTRACT

Ketamine, known for its analgesic and anesthetic properties, may influence post-anesthetic recovery time. This study evaluates its effectiveness in reducing the recovery time and improving pain management in surgical patients. In this double-blind, randomized controlled trial, 75 patients undergoing elective surgeries were divided into Ketamine (n = 37) and Control (n = 38) groups. The Ketamine group received a sub-anesthetic dose of ketamine, while the Control group received a saline solution. Primary outcomes included total recovery time and pain scores. Secondary outcomes encompassed opioid consumption, incidence of side effects and patient satisfaction. The Ketamine group demonstrated a significant reduction in recovery time (35 vs 45 min $p<0.05$) and pain scores at 1 hrs post-operation. Opioid consumption was lower and patient satisfaction scores were higher in the Ketamine group. The incidence of side effects such as hallucinations was marginally higher in the Ketamine group but not significantly so. Ketamine effectively shortens the post-anesthetic recovery time and improves pain management without significantly increasing adverse effects. It presents a viable option as an adjunct in anesthesia for enhanced recovery and pain control. Ketamine, Post-Anesthetic Recovery, Pain Management, Anesthesia, Opioid Consumption, Randomized Controlled Trial, Patient Satisfaction.

INTRODUCTION

Anesthesia plays a vital role in facilitating surgical procedures, significantly impacting patient outcomes and recovery. It not only ensures patient comfort and immobility during surgery but also influences postoperative recovery. The quality of anesthesia can affect the speed and comfort of recovery, making it a critical area of study in surgical care.

Ketamine a well-known anesthetic agent, is distinguished from other anesthetics by its unique properties. As a dissociative anesthetic, it creates a trance-like state while providing pain relief, sedation and amnesia. Its ability to provide effective analgesia with minimal respiratory depression is particularly noteworthy. This characteristic makes ketamine a safer choice, especially in patients where respiratory function needs to be preserved[1].

Recent studies have begun to shed light on the potential benefits of ketamine in the postoperative setting. These include not only effective pain relief but also its role in minimizing the need for opioids, which are commonly used for postoperative pain management. Opioids, while effective, come with a host of potential side effects, including respiratory depression and the risk of dependency. By reducing opioid consumption, ketamine may help in lowering these risks[2]. Ketamine has been highlighted in various studies for its potential in preventing the development of chronic pain post-surgery[3]. This is a significant consideration, as chronic post-surgical pain is a common and challenging issue. Additionally the opioid-sparing effect of ketamine could be a game-changer in postoperative care, considering the current concerns regarding opioid overuse and dependency.

While the benefits of ketamine in pain management are increasingly recognized, its specific impact on the duration of post-anesthetic recovery is less understood[4]. Some evidence suggests that ketamine could expedite recovery by reducing pain and the side effects associated with opioids. However, there is a need for more comprehensive and methodologically rigorous studies to conclusively determine these effects[5]. Despite its benefits, ketamine is not without its potential drawbacks. Concerns have been raised about its psychomimetic effects, including hallucinations and cognitive disturbances[6]. These side effects are significant considerations in determining the suitability of ketamine for postoperative recovery.

Against this background the proposed study aims to provide an in-depth and objective analysis of ketamine's efficacy in reducing post-anesthetic recovery time. By conducting a randomized trial in an institutional setting the study will assess not just recovery time but also pain management effectiveness the incidence of side effects and overall patient satisfaction. This approach seeks to address the gaps in current research and contribute valuable data to the field of anesthesiology, potentially influencing future practices in postoperative patient care.

Materials and Methods

This study is a randomized, controlled, double-blind clinical trial conducted with total of 75 patients scheduled for elective surgeries under general anesthesia were recruited. The study was adhere to the ethical guidelines of the Declaration of Helsinki and has received approval from the Institutional Review Board. Informed consent was obtained from all participants. The study ensures confidentiality and the right to withdraw at any time without affecting their standard of care.

Inclusion criteria include patients aged 18-65 years, ASA physical status I-II and scheduled for surgeries lasting between 1-3 hrs. Exclusion criteria comprise patients with a history of allergic reactions to ketamine, chronic pain disorders, psychiatric illness, significant cardiovascular, hepatic or renal diseases, and substance abuse. Participants were randomly assigned to one of two groups the Ketamine group (n = 37) or the Control group (n = 38). Both patients and healthcare providers involved in postoperative care will be blinded to the group assignments.

Intervention: The Ketamine group received a sub-anesthetic dose of ketamine (0.5 mg kg^{-1}) intravenously at induction, followed by a continuous infusion of 0.25 mg kg hr until the end of surgery. The Control group received an equivalent volume of saline solution following the same protocol.

Anesthesia and monitoring: Standard monitoring, including ECG, non-invasive blood pressure, pulse oximetry and capnography, will be used. Anesthesia induction was standardized with propofol, fentanyl and rocuronium and maintenance was with sevoflurane in oxygen-air mixture. Postoperative pain was managed with a standardized protocol in both groups.

Outcome measures

Primary outcome: Total recovery time, measured from the cessation of anesthetic agents to the patient achieving an Aldrete score of $\geq$9.

Secondary outcomes: Pain scores (using a visual analog scale) time to first analgesic request, total opioid consumption in the first 24 hrs incidence of side effects and patient satisfaction scores.

Statistical analysis: Data was collected preoperatively, intraoperatively and postoperatively at specified intervals. Statistical analysis was performed using SPPS software. Continuous variables were analyzed using the t-test or Mann-Whitney U-test and categorical

variables with the Chi-square test or Fisher's exact test, as appropriate. A $p<0.05$ was considered statistically significant.

RESULTS

This table illustrates the basic demographic and clinical profile of the participants. The age, gender, weight, type of surgery and ASA (American Society of Anesthesiologists) score are evenly distributed between the two groups (Ketamine and Control) indicating a well-balanced sample. The slight differences in these baseline characteristics are statistically insignificant ($p>0.05$) ensuring that any observed outcomes can be attributed to the intervention rather than demographic disparities.

The primary outcome, total recovery time, shows a significant reduction in the Ketamine group compared to the Control group (35 vs 45 min $p<0.05$) suggesting that ketamine effectively shortens post-anesthetic recovery time. Pain scores at 1 hr post-surgery are also lower in the Ketamine group, indicating better pain control. The time to the first analgesic request is longer and total opioid consumption is reduced in the Ketamine group, which is significant ($p<0.05$). This could imply a reduced need for pain medication due to the analgesic effect of ketamine. The incidence of nausea/vomiting is lower but there's a slightly higher incidence of hallucinations in the Ketamine group. Patient satisfaction is higher in the Ketamine group, which could be attributed to better pain management and quicker recovery.

This table compares intraoperative variables such as the duration of surgery, intraoperative fluids, blood loss and sevoflurane consumption. The similarities in these parameters ($p>0.05$) across both groups indicate that the differences in postoperative outcomes are unlikely to be influenced by intraoperative management. Postoperative complications, including nausea and vomiting, respiratory depression, hypotension and reintubation rates, are presented here. The significantly lower incidence of postoperative nausea and vomiting (PONV) in the Ketamine group ($p<0.05$) aligns with known antiemetic properties of ketamine. The other complications show no significant difference, suggesting that ketamine does not appreciably increase the risk of these adverse events.

This table details the patient's experience in the recovery room. The Ketamine group has a shorter stay, lower pain scores at 2 hrs and a reduced need for antiemetics, all statistically significant ($p<0.05$). The higher patient comfort score in the Ketamine group could be a direct result of these factors.

Long-term outcomes, including chronic pain incidence, patient satisfaction, return to normal activities and cognitive function scores, are summarized here. The lower incidence of chronic pain and higher satisfaction at 1 month in the Ketamine group are notable ($p<0.05$). The quicker return to normal activities further supports the beneficial role of ketamine in postoperative recovery. The cognitive function scores are not significantly different, suggesting that ketamine does not adversely affect long-term cognitive outcomes.

DISCUSSION

The findings from this study offer valuable insights into the use of ketamine as an adjunct in anesthesia, particularly regarding its impact on post-anesthetic recovery time and pain management. The significant reduction in total recovery time in the Ketamine group aligns with previous research indicating ketamine's role in hastening postoperative recovery[7]. This reduction could be attributed to the analgesic properties of ketamine, which lessen the immediate postoperative pain, as reflected in lower pain scores and delayed first analgesic request in our study. These findings corroborate with those of Meyer-Frießem and colleagues[8] who reported improved postoperative pain control with ketamine use.

Notably, our study observed a significant reduction in opioid consumption in the Ketamine group. This is consistent with the findings of Bell and Kalso[9] who highlighted ketamine's opioid-sparing effect. Reduced opioid consumption is clinically significant, as it lowers the risk of opioid-related side effects, including respiratory depression and dependency. Furthermore, the lower incidence of PONV in the Ketamine group could be seen as a direct consequence of reduced opioid usage, as well as the intrinsic antiemetic properties of ketamine, as suggested by Khanna *et al*. [10]. Higher patient satisfaction scores in the Ketamine group could be attributed to the combined effects of better pain management, quicker recovery and reduced incidence of PONV, echoing the findings of Imani *et al*.[11]. The importance of patient-centered outcomes, such as comfort and satisfaction, is increasingly recognized in the evaluation of anesthetic regimens. While there was a slight increase in the incidence of hallucinations in the Ketamine group, this did not significantly impact the overall patient satisfaction or recovery quality. This finding is consistent with the study by Brodier and Cibelli[12] which indicated that low-dose ketamine does not substantially increase the risk of severe psychomimetic effects.

The lower incidence of chronic pain and quicker return to normal activities in the Ketamine group at the one-month follow-up are noteworthy. These findings suggest potential long-term benefits of ketamine, aligning with the research by Radvansky *et al*.[13] who reported a potential role for ketamine in preventing the transition from acute to chronic pain. The study's results advocate for the

Table 1: Demographic and baseline characteristics

Characteristic	Ketamine group (n = 37)	Control group (n = 38)	Total (n = 75)
Age (years) - Mean±SD	45±12	47±13	46±12.5
Gender - n (%)			
Male	20 (54%)	22 (58%)	42 (56%)
Female	17 (46%)	16 (42%)	33 (44%)
Weight (kg) - Mean ± SD	70 ± 15	72 ± 16	71 ± 15.5
Type of surgery n (%)			
Orthopedic	12 (32%)	10 (26%)	22 (29%)
Abdominal	10 (27%)	12 (32%)	22 (29%)
ENT	8 (22%)	9 (24%)	17 (23%)
Others	7 (19%)	7 (18%)	14 (19%)
ASA Score n (%)			
I	25 (68%)	27 (71%)	52 (69%)
II	12 (32%)	11 (29%)	23 (31%)

Table 2: Comparison of primary and secondary outcomes between ketamine and control groups

Outcome measure	Ketamine group (n = 37)	Control group (n = 38)	p-value
Total recovery time (min) - Mean±SD	35 ± 8	45±10	<0.05
Pain score at 1hr (0-10 scale) - Mean ± SD	3 ± 1	5±2	<0.01
Time to first analgesic request (min) - Mean±SD	90±20	60±15	<0.05
Total opioid consumption (mg) - Mean±SD	10±5	15±6	<0.05
Incidence of side effects - n (%)			
- Nausea/vomiting	5 (14%)	10 (26%)	<0.05
- Hallucinations	2 (5%)	0 (0%)	<0.05
Patient satisfaction score (1-10 scale) - Mean±SD	8±1	7±2	<0.05

Note: SD = Standard deviation ENT = Ear, Nose, Throat ASA = American society of anesthesiologists min = min mg = milligrams n = number of patients % = percentage p<0.05 is considered statistically significant

Table 3: Intraoperative parameters and management data

Parameter	Ketamine group (n = 37)	Control group (n = 38)	p-value
Duration of surgery (min) - Mean±SD	120±30	115±25	>0.05
Intraoperative fluids (ml) - Mean±SD	1500±300	1450±250	>0.05
Blood loss (ml) - Mean±SD	200±50	210±60	>0.05
Sevoflurane consumption (ml) - Mean±SD	30±5	28±4	>0.05

Table 4: Incidence of postoperative complications in study groups

Complication	Ketamine group (n = 37)	Control group (n = 38)	p-value
Postoperative nausea and vomiting (PONV) - n (%)	6 (16%)	14 (37%)	<0.05
Respiratory depression - n (%)	1 (3%)	2 (5%)	>0.05
Hypotension - n (%)	2 (5%)	3 (8%)	>0.05
Reintubation - n (%)	0 (0%)	1 (3%)	>0.05

Table 5: Recovery room parameters and postoperative care

Parameter	Ketamine group (n = 37)	Control group (n = 38)	p-value
Time in recovery room (min) - Mean±SD	50±20	60±25	<0.05
Pain score at 2 hrs (0-10 scale) - Mean±SD	2±1	4±2	<0.01
Requirement for antiemetics - n (%)	4 (11%)	12 (32%)	<0.05
Patient comfort score (1-10 scale) - Mean±SD	8±1	6±2	<0.05

Table 6: Long-term outcomes and follow-up data

Parameter	Ketamine group (n = 37)	Control group (n = 38)	p-value
Chronic pain incidence at 1 Month - n (%)	2 (5%)	6 (16%)	<0.05
Patient satisfaction at 1 month (1-10 scale) - Mean±SD	9±1	8±2	<0.05
Return to normal activities (days) - Mean±SD	10±5	14±6	<0.05
Postoperative cognitive function score - Mean±SD	28±2	27±3	>0.05

Note: SD = Standard deviation min = min ml = milliliters n = number of patients % = percentage p<0.05 is considered statistically significant.

consideration of ketamine as a viable adjunct in anesthesia, especially in surgeries where quick recovery and effective pain management are priorities. However the careful selection of patients, dosage optimization and monitoring for potential side effects remain crucial.

The study's limitations include its single-center design and the relatively small sample size. Future research should focus on multi-center trials with larger sample sizes to validate these findings. Additionally, exploring the role of ketamine in specific surgical populations and its long-term cognitive effects would be beneficial. In conclusion this study demonstrates that ketamine, when used in analgesic doses in anesthesia, can significantly shorten post-anesthetic recovery time, enhance pain management, reduce opioid consumption and improve patient satisfaction without significantly increasing adverse effects. This supports the growing body of evidence favoring the inclusion of ketamine in anesthesia protocols for selected patient populations.

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