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"EFFECT OF ADDING LOW-DOSE KETAMINE TO TRAMADOL INFUSION IN PCA PUMP ON POST-OPERATIVE PAIN FOLLOWING MAJOR LUMBAR SPINE SURGERIES: A PROSPECTIVE OBSERVATIONAL STUDY"

Anaesthesiology

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ABSTRACT

Background: Effective post-operative pain management is crucial following major lumbar spine surgery. This prospective observational study evaluated the effect of adding low-dose ketamine to tramadol patient-controlled analgesia (PCA) on post-operative pain, tramadol consumption and patient satisfaction. **Methods:** Forty patients (ASA I-III, aged 18-65 years) undergoing major lumbar spine surgery were assigned to receive either tramadol alone (Group T, n=20) or tramadol plus ketamine (Group TK, n=20) via PCA pump. Pain scores (VRS), hemodynamic variables, oxygen saturation, tramadol consumption, rescue analgesic requirements and patient satisfaction were assessed at various time points post-operatively. **Results:** VRS scores at 2, 4, 8, 12, and 16 hours post-operatively were significantly lower in Group TK ($p<0.05$). Cumulative tramadol consumption at 24 hours was also significantly lower in Group TK ($p<0.05$). Rescue analgesic requirements were significantly less in Group TK ($p<0.05$). Patient satisfaction was significantly higher in Group TK ($p<0.05$). Hemodynamic variables and oxygen saturation remained comparable between groups. The incidence of nausea was similar between groups ($p>0.05$). **Conclusions:** The addition of low-dose ketamine to tramadol PCA provided superior analgesia, reduced tramadol consumption, decreased rescue analgesic needs and improved patient satisfaction following major lumbar spine surgery, without significant hemodynamic or respiratory side effects.

KEYWORDS

Post-operative pain, patient-controlled analgesia, tramadol, ketamine, lumbar spine surgery.

INTRODUCTION

Effective post-operative pain management is essential after major lumbar spine surgery to facilitate early mobilization, reduce complications and improve patient satisfaction. Opioids are commonly used for post-operative analgesia, but their use can be associated with side effects such as nausea, vomiting, and respiratory depression. Patient-controlled analgesia (PCA) allows patients to self-administer analgesics, potentially leading to better pain control and reduced opioid consumption.

Tramadol, a centrally acting analgesic, is often used in PCA regimens. However, its efficacy may be limited in some patients. Ketamine, an N-methyl-D-aspartate (NMDA) receptor antagonist, has been shown to have analgesic properties and may potentiate the effects of opioids. The addition of low-dose ketamine to opioid-based PCA has been investigated in various surgical settings, with promising results.

This prospective observational study aimed to evaluate the effect of adding low-dose ketamine to tramadol PCA on post-operative pain, tramadol consumption, and patient satisfaction following major lumbar spine surgery.

METHODS

This prospective observational study was approved by the Institutional Ethics Committee of Government medical college & New civil hospital, Surat and registered with the Clinical Trial Registry of India (CTRI/2017/05/008555). Forty patients (ASA physical status I-III, aged 18-65 years) scheduled for major lumbar spine surgery at New civil hospital, Surat were enrolled after obtaining informed written consent. Patients with allergies to study drugs, inability to use a PCA pump, long-term opioid use, chronic pain, hepatic or renal dysfunction, chronic hypertension, ischemic heart disease, history of post-operative nausea and vomiting or motion sickness were excluded.

Patients were pre-operatively instructed on PCA use and the verbal rating scale (VRS, 0-10). Patients were assigned to one of two groups based on the consultant anaesthesiologist's choice:

Group T (n=20): Tramadol PCA
Group TK (n=20): Tramadol plus Ketamine PCA

Premedication consisted of glycopyrrolate 0.2 mg IV, midazolam 1 mg IV, ondansetron 4 mg IV, and tramadol 100 mg IV. General anaesthesia was administered and the choice of induction and maintenance agents was at the discretion of the consultant anaesthesiologist.

Post-operatively, patients in Group T received a tramadol loading dose of 0.5 mg/kg IV followed by a continuous infusion of 0.2 mg/kg/hr. Patients in Group TK received a tramadol 0.5 mg/kg IV plus ketamine 0.5 mg/kg IV loading dose, followed by a continuous infusion of tramadol 0.2 mg/kg/hr plus ketamine 0.03 mg/kg/hr (calculated based on a 75mg/50ml concentration). The PCA pump was set to deliver 1 ml bolus with 10 minutes lockout period.

VRS scores, heart rate, blood pressure, and oxygen saturation were recorded at 1, 2, 4, 8, 12, 16, and 24 hours post-operatively. Total PCA demands, successful demands and total drug delivered were recorded from the PCA pump. Rescue analgesia (diclofenac 75 mg IV) was administered for VRS ≥3 despite PCA use. Side effects were assessed using a four-grade scale (0-3). Patient satisfaction was assessed as poor, good or excellent.

Statistical analysis was performed using OpenEpi 2000 software. Continuous variables were analyzed using Student's t-test and categorical variables were analyzed using Fisher's exact or Chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

Demographic data, duration of surgery and duration of anaesthesia were comparable between the two groups (Table 1). The types of surgery performed were also similar between groups (Table 2).

VRS scores were significantly lower in Group TK at 2, 4, 8, 12, and 16 hours post-operatively ($p<0.05$) (Table 3, Graph 1). At 1 hour and 24 hours, the differences were not statistically significant.

Heart rate, systolic blood pressure, diastolic blood pressure, and oxygen saturation were comparable between the two groups at all time points.

Total PCA demands and good demands were significantly lower in Group TK at 2, 4, 8, 12, 16, and 24 hours ($p<0.05$) (Tables 4-5, Graph 2-3).

Cumulative tramadol consumption (mg and ml) was significantly lower in Group TK at 4, 8, 12, 16, and 24 hours ($p<0.05$)

The incidence of nausea was similar between the two groups. No patients experienced severe side effects.

The need for rescue analgesia was significantly lower in Group TK ($p<0.05$) (Table 6, Graph 4).

Patient satisfaction was significantly higher in Group TK. ($p<0.05$)

Table 1 : Demographic Data

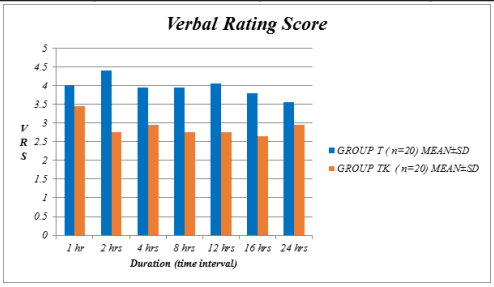
PARAMETERS		GROUP T (n=20)	GROUP TK (n=20)	P VALUE
AGE(years)		40.4±10.28	44.3±13.34	p>0.05
WEIGHT(kg)		62.6±9.92	58.65±12.57	p>0.05
SEX	MALE	14	12	–
	FEMALE	6	8	
Duration of Surgery (min)		200.95±27.03	201.85±28.18	p>0.05
Duration of Anaesthesia (min)		247.4±34.26	245.8±30.72	p>0.05

Table 2 : Type Of Surgery

SURGERY	GROUP T (n=20)	GROUP TK (n=20)	P VALUE
FIXATION	15	17	p>0.05
DISCECTOMY	5	3	p>0.05

Table- 3 : Vrs For Pain At Various Time Intervals (mean±sd)

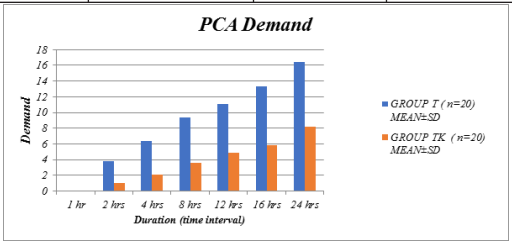
DURATION (time interval)	GROUP T (n=20) MEAN±SD	GROUP TK (n=20) MEAN±SD	P VALUE
1 hr	4±1.25	3.45±0.82	P>0.05
2 hrs	4.4±1.64	2.75±0.96	P<0.05
4 hrs	3.95±1.64	2.95±1.19	P<0.05
8 hrs	3.95±1.61	2.75±1.29	P<0.05
12 hrs	4.05±1.90	2.75±1.44	P<0.05
16 hrs	3.8±1.61	2.65±1.30	P<0.05
24 hrs	3.55±1.35	2.95±1.35	P>0.05



Graph 1 : VRS for pain at various time intervals

Table- 4 : Demand At Various Time Intervals (mean±sd)

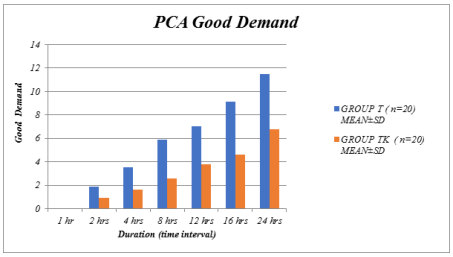
DURATION (time interval)	GROUP T (n=20) MEAN±SD	GROUP TK (n=20) MEAN±SD	P VALUE
1 hr	0±0	0.05±0.22	P>0.05
2 hrs	3.8±5.47	1.05±1.93	P<0.05
4 hrs	6.4±6.84	2.1±3.43	P<0.05
8 hrs	9.35±8.17	3.6±4.0	P<0.05
12 hrs	11.05±8.59	4.85±4.94	P<0.05
16 hrs	13.35±9.42	5.8±5.49	P<0.05
24 hrs	16.4±10.62	8.2±6.65	P<0.05



Graph 2 : PCA Demand at various time intervals

Table- 5 : Good Demand At Various Time Intervals (mean±sd)

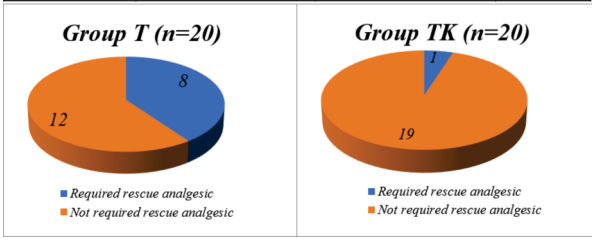
DURATION (time interval)	GROUP T (n=20) MEAN±SD	GROUP TK (n=20) MEAN±SD	P VALUE
1 hr	0±0	0.05±0.22	P>0.05
2 hrs	1.85±1.63	0.9±1.61	P<0.05
4 hrs	3.55±2.64	1.6±2.32	P<0.05
8 hrs	5.9±4.06	2.6±2.70	P<0.05
12 hrs	7.05±4.46	3.8±3.45	P<0.05
16 hrs	9.1±5.59	4.6±3.73	P<0.05
24 hrs	11.45±6.85	6.8±5.01	P<0.05



Graph 3 : PCA Good Demand at various time intervals

Table-6 : Need For Rescue Analgesic (inj. Diclofenac 75mg I.v.)

	Group T (n=20) (no. of patients)	Group TK (n=20) (no. of patients)	P value
Required	8	1	p <0.05
Not required	12	19	



Graph 4 : comparison of need for rescue analgesic

DISCUSSION

This study demonstrates that the addition of low-dose ketamine to tramadol PCA provides superior post-operative analgesia compared to tramadol alone following major lumbar spine surgery. Patients in the ketamine group experienced lower pain scores, reduced tramadol consumption, and decreased need for rescue analgesia. Furthermore, patient satisfaction was significantly higher in the ketamine group.

The lower VRS scores observed in the ketamine group suggest that ketamine potentiates the analgesic effects of tramadol. This is consistent with previous studies that have shown the benefits of adding ketamine to opioid-based PCA regimens. The reduced tramadol consumption in the ketamine group further supports this finding.

The comparable hemodynamic and respiratory parameters between the two groups indicate that the addition of low-dose ketamine to tramadol PCA is safe and does not increase the risk of adverse events. The similar incidence of nausea suggests that the addition of ketamine at this dose does not increase this particular side effect.

Limitations

This study has some limitations. The sample size was relatively small, which may have limited the power to detect small differences in side effects. Post-operative assessment was limited to 24 hours and longer-term follow-up would be beneficial. Pain was assessed at rest, and assessment during movement would have been valuable. The study design was observational, and a randomized controlled trial would provide more robust evidence.

CONCLUSION

The addition of low-dose ketamine to tramadol PCA provides superior post-operative analgesia, reduces tramadol consumption and improves patient satisfaction following major lumbar spine surgery, without significant side effects.

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