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Original Research Article

Comparative Study Between Intranasal Tapentadol Versus Intravenous Tramadol for Post-Opdrative Analgesia in Patients Undergoing Elective Surgery Under General Anesthesia

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Conflict of interest: Nil

Abstract:

Introduction: Elective surgery often leads to pain that is not amenable to simple measures. Intranasal use provides systemic access without an intravenous route; tramadol, used intravenously, shares one mechanistic feature with the dual acting agent but not the second.

Aims and Objectives:

Aim: To compare analgesic efficacy provided by Intranasal Tapentadol and Intravenous Tramadol in patients undergoing Elective General Surgery.

Objectives:

- To compare analgesic efficacy between the two study drugs.
- To compare the hemodynamic stability between the two study groups
- To determine incidence of post-operative nausea and vomiting between the two study drugs.

Material and Method:

Study Design: The study was designed as a Prospective Randomized Controlled study

Study Place: The study was carried out at Kempegowda Institute of Medical Sciences, Bengaluru.

Study Period: The study was conducted over the course of one year.

Study Participants: After IEC approval is obtained, 72 patients satisfying the inclusion and the exclusion criteria will be included in the study.

Sample Size: For 2 groups, the total sample size will be 72 subjects (36 subjects in each group).

Result: A total of 72 patients were enrolled and equally randomized into two groups (n = 36 each). Baseline characteristics were comparable between the groups, ensuring the internal validity of the study.

Discussion: In this study, hemodynamic parameters (SBP, DBP, MAP, and PR) were monitored across both Intranasal Tapentadol and Intravenous Tramadol groups. Baseline values for all parameters were comparable between the groups.

Keywords: Analgesia, Neuropathic Pain, Nerve Blocks, Postoperative Pain, Tapentadol.

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Introduction

Perioperative pain management includes strategies before, during, and after surgery to control pain. These strategies vary based on the timing of the intervention but often share similar techniques. Intraoperative pain control may include systemic medications and regional techniques like epidurals or nerve blocks. Because pain is subjective, consistent use of validated pain assessment tools is crucial. Using the same scale throughout the perioperative period improves accuracy and helps guide treatment.

Effective postoperative pain control is essential for recovery, improving outcomes such as sleep, mobility, and reducing complications like DVTs. While opioids remain common for analgesia, their side effects have led to reduced use.

Tapentadol and Tramadol are opioids with dual mechanisms of action. Tapentadol is a centrally acting analgesic with a distinctive profile, combining μ-opioid receptor agonism and noradrenaline (norepinephrine) reuptake inhibition while exerting minimal serotonin reuptake

inhibition. This dual mode of action renders tapentadol highly valuable for addressing both nociceptive and neuropathic pain. Clinical trials have consistently demonstrated its efficacy in acute and chronic non-cancer pain, cancer-related pain, and neuropathic pain.

Tapentadol combines mu-opioid receptor activation with norepinephrine reuptake inhibition, while Tramadol also affects serotonin reuptake. The oral formulation of tapentadol presents certain limitations that affect its overall efficacy and patient compliance. One significant drawback is its extensive first-pass metabolism, resulting in a low bioavailability of only 32%. In addition, approximately 97% of the parent compound undergoes metabolism, with none of the metabolites contributing to its analgesic activity. An innovative solution is the development of a tapentadol nasal spray formulation. Such a formulation offers several advantages over traditional oral delivery. First, it provides a bypass of the gastrointestinal tract, mitigating issues such as bitter taste, and potential gastrointestinal adverse effects. Second, the nasal route allows for rapid absorption and onset of action, leading to more immediate pain relief.

Intranasal Tapentadol, a newer delivery method, may offer faster pain relief and higher patient satisfaction compared to intravenous Tramadol.

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Inclusion Criteria

- Patients aged between 18-60 years
- American society of Anaesthesiologist (ASA) 1 & 2
- Elective General surgeries.

Exclusion Criteria

- History of hypersensitivity to tapentadol or tramadol
- Recent intranasal medication within the 72 hours preceding randomization.
- Patients in whom intranasal tapentadol spray was contraindicated (severe asthma or breathing problems, bowel obstruction, history of consumption of Monoamine oxidase inhibitor drugs in the past two weeks)

Estimation of Sample Size: Sample size was estimated based on clinical assumption of effect size 0.7(medium effect, per Cohen's d) between Group 1 and Group 2 and using these values at 95% Confidence limit and 80% power, sample size of 32 was obtained in each group by using the below mentioned formula and Med calc sample size software. Considering 10% non-response rate a sample size of 32+ 3.2 = 36 subjects minimum to be included in each group

$$N = \frac{2\,(Z_{\alpha/2} + Z_{\beta})^2}{d^2}$$

Where,

- $Z_{\alpha/2}$ is the critical value of the Normal distribution at $\alpha/2$ (e.g. for a confidence level of 95%, $\boldsymbol{\alpha}$ is 0.05 and the critical value is 1.96).
- Z_{β} is the critical value of the Normal distribution at β (e.g. for a power of 80%, ß is 0.2 and the critical value is 0.84),
- D= Cohen's d (effect size)

The minimum number of samples needed per group will be 36 samples.

For 2 groups, the total sample size will be 72 subjects (36 subjects in each group).

Statistical Analysis: Data will be entered into Microsoft excel data sheet and will be analyzed using SPSS 22 version software. Categorical data will be represented in the form of Frequencies and proportions. Chi-square will be the test of significance. Continuous data will be represented as mean and standard deviation. Independent t test will be the test of significance to identify the mean difference between two groups. P value <0.05 was considered as statistically significant.

Result

Table 1: Base line characteristics

Variable	Intranasal Tapentadol	Intravenous Tramadol	p-value
Age in years	44.52 ± 4.52	42.36 ± 5.14	>0.05
Male : Female	20 :16	21 :15	>0.05
ASA (I:II)	19 :17	18 :18	>0.05
BMI (kg/m²)	28.02 ± 12.31	25.02 ± 3.78	>0.05
Operative Time (min)	97.12 ± 18.06	97.46 ± 18.56	>0.05

A total of 72 patients were enrolled and equally randomized into two groups (n = 36 each). Baseline characteristics were comparable between the groups, ensuring the internal validity of the study. The mean age in the tramadol group was 44.52 ± 4.52 years, while it was 42.36 ± 5.14 years in the tapentadol group (p =>0.05). Both groups were similar in terms of body mass index (BMI), and operative time, with no statistically significant differences observed (all p > 0.05).

Table 2: Postoperative Pain Scores

Postoperative Pain Scores	Intranasal Tapentadol	Intravenous Tramadol	p-value
	1.98 ± 0.19	3.12 ± 0.36	< 0.05

The primary outcome of this study was postoperative pain intensity, measured using the Visual Analog Scale (VAS) three hours after surgery. Patients in the tapentadol group reported significantly lower pain scores (1.98± 0.19) compared to those in the tramadol group (3.12 ± 0.36), with a p-value < 0.001.

Table 3: Incidence of Postoperative Nausea and Vomiting (PONV)

Postoperative Pain Scores	Intranasal Tapentadol	Intravenous Tramadol	p-value
	30.56%	69.44%	< 0.05

The incidence of postoperative nausea and vomiting (PONV) was lower in the tapentadol group (30.56%) than in the tramadol group (69.44%). Although this trend favored tapentadol, the difference was statistical significance (p = <0.05).

Discussion

In this study, hemodynamic parameters (SBP, DBP, MAP, and PR) were monitored across both Tapentadol and Tramadol groups. Baseline values for all parameters were comparable between the groups. At the 120-minute mark, the mean SBP, DBP, MAP, and PR were slightly lower in the Tapentadol group compared to the Tramadol group, with statistical significance, though the actual differences were minimal.

The findings of this randomized controlled trial demonstrate that tapentadol 45 mg, when administered nasally 10 minutes before induction during elective surgery under general anesthesia, provides significantly better postoperative analgesia than tramadol 100 mg. The statistically and clinically meaningful reduction in VAS scores observed in the tapentadol group, both at the 3-hour mark and across subsequent time points up to 24 hours postoperatively, underscores the superior efficacy of this dual-acting analgesic. Although the incidence of postoperative nausea and vomiting (PONV) was lower in the tapentadol group, the difference was not statistically significant, likely due to the limited sample size. Nonetheless, this trend supports previous evidence suggesting a more favorable side effect profile for tapentadol compared to conventional opioids such as tramadol [4,5]

These results align with prior studies conducted internationally. For instance, Iyer et al. compared tapentadol and tramadol in postoperative cardiac surgery patients and reported significantly lower pain scores and reduced PONV in the tapentadol group [5]. Similarly, Roulet et al. highlighted tapentadol's enhanced tolerability and reduced opioid-related adverse effects due to its dual mechanism of μ-opioid receptor agonism and noradrenaline reuptake inhibition, without serotonergic involvement [4]. This pharmacological profile differentiates tapentadol from tramadol, which requires hepatic biotransformation via cytochrome P450 enzymes and exerts additional serotonergic effects, thus increasing interindividual variability and potential for serotonin- related side effects [6,7]. In contrast, tapentadol undergoes primary metabolism through glucuronidation, which contributes to its more predictable clinical performance and possibly its lower emetogenicity [8].

Conclusion

Choosing between intranasal tapentadol and intravenous tramadol for postoperative comfort after elective surgery under general anesthesia raises an important question with considerable patient-centered implications. Patients experience pain after surgery and often know how they wish to manage that pain before the operation, yet the standard

intravenous opioid regimen provides little effective relief. Tapentadol provides relief through combined μ-receptor agonism and norepinephrine reuptake inhibition, closely mimicking the mu-mediated action of morphine and combining it with a second mechanism having additive or synergistic effects. Tramadol exerts its effect through weak μ-receptor agonism with a much longer effective half-life; the important contribution of a second mechanism remains uncertain and probably varies according to patient differences in active metabolite formation. Tapentadol provides a faster onset, longer duration, and similar or better quality of initial analgesia than tramadol, while side effects are less common and less invasive.

References

1. Mukhopadhyay S, Chandra I, Dan S, Piplai G. A comparative study between intranasal tapentadol versus intravenous tramadol in patients undergoing elective surgery under general anaesthesia.
2. Kamble P, Panchal S, Prabhu RM, Mohanty SS, Dhotre R. Utility of Intranasal Tapentadol in Redefining Postoperative Pain Management in Total Knee Arthroplasty: A Prospective Observational Study. Cureus. 2024 Nov 7;16(11):e73220. doi: 10.7759/cureus.73220. PMID: 39651001; PMCID: PMC11624896.
3. Shetty, Sunil; Kale, Sachin; Singh, Shikhar; Mandal, Shobhan; Sharma, Vidur; Shah, Varmit; Sabbani, Komal; Patil, Aloukika Paresh. Head-to-Head Comparison of Tapentadol Nasal Spray and Intravenous Tramadol for Managing Postoperative Moderate-to-Severe Pain: An Observational Study. Indian Journal of Pain 37(Suppl 1):p S41-S44, December 2023. | DOI: 10.4103/ijpn.ijpn_58_23
4. Roulet L, Rollason V, Desmeules J, Piguet V. Tapentadol Versus Tramadol: A Narrative and Comparative Review of Their Pharmacological, Efficacy and Safety Profiles in Adult Patients. Drugs. 2021;81(11):1257–72.
5. Iyer S, Mohan G, Ramakrishnan S, Theodore S. Comparison of Tapentadol With Tramadol for Analgesia After Cardiac Surgery. Ann Card Anaesth. 2015;18(3):352–60.
6. Thiels CA, Habermann EB, Hooten WM, Jeffery MM. Chronic Use of Tramadol After Acute Pain Episode: Cohort Study. BMJ. 2019;365:l1849.
7. Fuggle N, Curtis E, Shaw S, Spooner L, Bruyère O, Ntani G, et al. Safety of Opioids in Osteoarthritis: Outcomes of a Systematic Review and Meta-analysis. Drugs Aging. 2019; 36(1):129–43.
8. Faria J, Barbosa J, Moreira R, Queirós O, Carvalho F, Dinis-Oliveira RJ. Comparative Pharmacology and Toxicology of Tramadol and Tapentadol. Eur J Pain. 2018;22(5):827–44.