Innovations

Clinical Outcomes and Comparison of Effects of Melatonin and Gabapentin on Postoperative Pain and Anxiety Following Lumbar Spinal Surgery

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Abstract

Background: *Significant pain and discomfort following spinal surgery are common and may delay recovery and prolong hospital stays. This study compared the effects of melatonin and gabapentin on pain and anxiety in patients undergoing spinal spinal surgery.* ***Methods:*** *This prospective comparative study was conducted between Jan 2025 and April 2025 in a tertiary care hospital in Kolar, Karnataka. Patients aged 25 and 60 who underwent elective lumbar spine surgery were included. Exclusion criteria included BMI >35, previous spine surgery, tumour-related surgery, and allergy to study drugs. During the pre-operative period, group B was given 600 mg gabapentin and group A 10 mg melatonin. The Visual Analogue Scale (VAS) was used to measure pain, and the Hospital Anxiety and Depression Scale (HADS) was used to measure anxiety at 6, 12 and 24 hours. Statistical analysis was performed using SPSS v21 with a significance of $p < 0.05$.* ***Results:*** *According to the results, the demographic and comorbidity profiles of the gabapentin and melatonin groups were similar. Gabapentin significantly reduced mean VAS scores at all time points ($p=0.001$), indicating better pain relief. Melatonin showed improved control over anxiety.* ***Conclusion:*** *Melatonin provides a better anxiolytic effect in patients undergoing lumbar spine surgery, while gabapentin is more effective in treating postoperative pain. These results highlight the importance of tailored treatment plans for maximising postoperative outcomes. Future studies should examine long-term functional recovery and combined therapies.*

Keywords: *Lumbar Spinal Surgery, Melatonin, Gabapentin, Anxiety Management*

Introduction

Patients undergoing lumbar spinal surgery have severe pain in the post-operative period, which may delay recovery and hospitalisation. Pain associated with peripheral mechano-receptor stimulation is nociceptive pain that occurs after surgery.[1,2]Neurogenic, visceral, and inflammatory processes also influence acute pain symptoms. As a result, we must take the required actions to lessen postoperative discomfort.[3]Morphine, fentanyl, corticosteroids, Nonsteroidal Anti-inflammatory Drugs (NSAIDs), morphine, fentanyl, and N-methyl-D-aspartate (NMDA) receptor antagonists are among the medications used to treat post-laminectomy pain. These drugs work through different mechanisms and have several potential side effects.[4]This study compares the effects of melatonin and gabapentin in postoperative patients following lumbar spine surgery. Melatonin is mainly excreted by the suprachiasmatic core from the pineal gland. In addition to controlling the biological clock, this neurohormone has a circadian secretion pattern. It also possesses analgesic, anxiolytic, and antiemetic properties.[4]Melatonin is beneficial in lowering postoperative pain and anxiety following lumbar spine surgery because of its effects on both acute and chronic pain. In humans, there are three subtypes of melatonin cell membrane receptors: MT1, MT2, and MT3. The G-protein-coupled MT1 and MT2 receptors convey most biological functions of melatonin.[5]By activating MT2R, melatonin produces an analgesic effect. Gabapentin is an anti-epileptic medication that is well tolerated and has few side effects. It has analgesic, anticonvulsant, and anxiolytic properties. Neuropathic pain and chronic pain can both be effectively treated with gabapentin.[6]Postoperative anxiety was measured using the Hospital Anxiety and Depression Scale (HADS).[7]Patients' satisfaction with postoperative pain management was assessed using the Visual Analogue Scale (VAS), which has a five-point rating system: 1 for very poor, 2 for poor, 3 for satisfactory, 4 for good, and 5 for very good. Normal anxiety scores ranged from 0 to 7, borderline cases ranged from 8 to 10, and abnormal anxiety ranged from 11 to 21.[8]Existing literature on melatonin and gabapentin in postoperative pain management highlights their efficacy, yet direct comparisons in lumbar spinal surgery remain limited.[9]In this context, this study aims to determine the clinical outcomes and the comparison of the effects of melatonin and gabapentin on postoperative pain and anxiety in patients in whom a lumbar spinal surgery has undergone.

Materials & Methods:

This prospective comparative study was carried out betweenJan 2025 to March 2025 after obtaining the necessary IEC approval, in a tertiary care hospital-RLJH Hospital Kolar, Karnataka. In this prospective comparative study, the study population were included using convenience sampling method, comprised patients aged 25 to 60 years undergoing elective lumbar spine surgery, including laminectomy, discectomy, or posterior spinal stabilization at one or two levels. Patients who met the inclusion criteria and did not have any of the following

exclusions surgery for tumours, emergency procedures, body mass index greater than 35, anxiety disorders, autoimmune diseases, history of drug abuse, known allergies to melatonin or gabapentin, or previous spinal surgeries were enrolled in the study. Eligible participants were allocated to either Group A or Group B using a simple random sampling method after obtaining the informed consent. All enrolled patients, received a standard dose of intramuscular Diclofenac 75 mg. Group A received 10 mg of melatonin (two 5 mg tablets), while Group B received 600 mg of gabapentin (two 300 mg tablets) post operatively. Postoperative anxiety was assessed using the Hospital Anxiety and Depression Scale, and pain intensity along with patient satisfaction was evaluated at 6, 12, and 24 hours after surgery using the Visual Analogue Scale.The sample size was calculated based on an assumed effect size (Cohen's *d*) of 0.5, which corresponds to a clinically meaningful moderate difference in postoperative pain scores between the melatonin and gabapentin groups. Assuming a mean difference of 5 units and a pooled standard deviation of 10 units (yielding an effect size of 0.5), with a two-sided significance level (alpha) of 0.05 and 80% power (beta = 0.2), the required sample size was 19 participants in one group. Hence total sample size required for the study was determined to be38 subjects in total, with 19 participants per group.

Analysis & Statistical Methods:

For continuous and categorical variables, all results were shown as mean (± SD) and frequency (percent), respectively. The Kolmogorov-Smirnov calculated deviation from the abnormal distribution, and the two-tailed type I error of 0.05 was set as the statistical significance level. The distribution of the categorical variables among the groups was compared using the Chi-Square test. The continuous variables were compared between the groups using the Independent Student t-test and the Mann-Whitney U-test based on normality.A p-value of less than 0.05 was considered Statistically significant. SPSS Version 21 will be used for data analysis after MS Excel 2017 was used for data entry

Results:

Table 1 shows the age, gender, and comorbid conditions were compared between the melatonin and gabapentin groups. Most patients were 46–60 years old (63.2% in the melatonin group and 42.1% in the gabapentin group). Gender distribution was identical, with 52.6% females and 47.4% males in both groups (p=1.00). Most patients reported no comorbidities, with a higher proportion in the gabapentin group (78.9%) compared to the melatonin group (57.9%). The slight differences in the distribution of diabetes and hypertension were not statistically significant. Table 2 shows theVAS Scores where Gabapentin demonstrated superior pain relief compared to melatonin at 6, 12, and 24 hours postoperatively. Participants in the gabapentin group exhibited lower median VAS scores, recording 2 at 6 hours, 2 at 12 hours, and 3 at 24 hours, compared to the melatonin group, which had scores of 3, 4, and 4 at those times. These differences were statistically significant

(p=0.001), indicating gabapentin's effectiveness in managing postoperative pain. Table 3 shows HADS Scores where Melatonin showed significantly better control of postoperative anxiety. The HADS scores were lower in the melatonin group at all time points (6, 12, and 24 hours), with significant differences observed (p=0.001). At 24 hours, the scores dropped to 7.74 ± 1.59 for melatonin versus 11.63 ± 1.80 for gabapentin, highlighting melatonin's anxiolytic efficacy.

Table 1: Demographic Characteristics and Comorbidities

Parameter	Melatonin Group (n=19)	Gabapentin Group (n=19)	p-value
Age Category			
<30	2 (10.5%)	1 (5.3%)	0.25
31-45	5 (26.3%)	10 (52.6%)	
46-60	12 (63.2%)	8 (42.1%)	
Gender			
Female	10 (52.6%)	10 (52.6%)	1.00
Male	9 (47.4%)	9 (47.4%)	
Comorbidities			
DM	2 (10.5%)	2 (10.5%)	0.455
DM/HTN	3 (15.8%)	1 (5.3%)	
HTN	3 (15.8%)	1 (5.3%)	
NIL	11 (57.9%)	15 (78.9%)	

Table 2: Comparison of Visual Analogue ScaleScores between two groups

Time	Melatonin Group (Median, IQR)	Gabapentin Group (Median, IQR)	Mann-Whitney U testp-value
6 hrs	3 (3-3)	2 (1-2)	0.001
12 hrs	4 (3-4)	2 (2-3)	0.001
24 hrs	4 (4-5)	3 (2-3)	0.001
Friedman Test	0.001	0.001	

Table 3: Comparison of Hospital Anxiety and Depression ScaleScores between two groups

Time	Melatonin Group (Mean ± SD)	Gabapentin Group (Mean ± SD)	Independent t tp-value
6 hrs	12.63 ± 2.11	16.42 ± 2.24	0.001
12 hrs	10.11 ± 1.79	14.0 ± 1.67	0.001
24 hrs	7.74 ± 1.59	11.63 ± 1.80	0.001
Repeated Measures ANOVA	0.001	0.001	

Discussion

Our study sheds light on the demographics, comorbidities, and clinical outcomes of patients undergoing lumbar spine surgery by examining the effects of gabapentin and melatonin on postoperative pain and anxiety.

The majority of our study Participants in our study were between 46-60 years old, with 63.2 percent in the melatonin group and 42.1% in the gabapentin group falling within this age range. This aligns with other studies on degenerative lumbar conditions, such as the research by Stefani et al. on the analgesic effects of melatonin in adults.[10] The gender distribution in our study was the same for both groups, consisting of 52.6% females and 47.4% males. This balanced distribution may have helped control for potential gender-related differences in postoperative outcomes since some research indicates that being female can be a predictor of inadequate postoperative pain control.

However, our findings differ from those of some earlier research. Gautschi and colleagues. found that, in comparison to male patients, female patients with lumbar degenerative disease frequently experience worse pain, disability, and health-related quality of life outcomes.[11]Alternatively, Triebel et al. discovered that compared to male patients , female patients might see more notable improvements in pain, health-related quality of life from baseline to follow up.[12]These contradictory findings demonstrate the intricate connection between surgical outcomes and gender in lumbar spine surgery. The results of our study imply that there is a complex relationship between gender and surgical outcomes that could be impacted by several variables. To completely comprehend this intricate relationship, more investigation is required. With a higher percentage in the gabapentin group (78.9 percent) than in the melatonin group (57.9 percent), most patients in our study did not report any comorbidities (**Table 1**).This finding contrasts with some other research, such as a study on full-endoscopic spine surgery that reported higher numbers of comorbidities in frail patients. The lower prevalence of comorbidities in our study population may have influenced the outcomes, potentially resulting in better overall pain management and fewer complications. The slight differences in the distribution of

diabetes and hypertension in our study, though not statistically significant, align with common comorbidities in spine surgery patients. However, other research has highlighted the importance of specific comorbidities in spine surgery outcomes. For instance, obesity has been identified as a challenge in postoperative pain management, and psychological disorders have been linked to higher rates of postoperative delirium, readmission, and more extended hospital stays.

Our study employed the Hospital Anxiety and Depression Scale (HADS) to assess anxiety and the Visual Analogue Scale (VAS) to assess pain. According to the findings, gabapentin consistently had lower median VAS scores and provided better pain relief than melatonin at 6, 12, and 24 hours after surgery (**Table 2**). The results of other studies, like those of Javaherforooshzadeh et al., are consistent. who found that gabapentin was superior to melatonin in the treatment of postoperative pain following lumbar spine surgery.[9]

Regarding anxiety, our study revealed that melatonin showed significantly better control of postoperative anxiety compared to gabapentin. This finding is supported by other research, including a systematic review by Hansen et al., which found that melatonin reduced preoperative anxiety compared to placebo.[13] The use of HADS in our study is particularly noteworthy, as it is a reliable tool for assessing anxiety and depression in patients undergoing spine surgery (**Table 3**). A survey conducted by Carreon LY and colleagues, discovered that among patients with lumbar degenerative disorders slated for spine surgery, lower HADS scores were linked to lower preoperative health-related quality of life scores.[14]Similarly, Rorarius et al. observed significantly lower median VAS scores in patients who received gabapentin compared to placebo after surgery.[15]However, a meta-analysis by Kong et al. contrasts with our findings of analgesic effects that last for up to 24 hours after surgery. found that the analgesic effects of gabapentin were strongest during the first four hours following surgery.[16]Regarding anxiety management, our results are consistent with a systematic review by Hansen et al., which found that melatonin reduced preoperative anxiety compared to placebo.[13]the superior anxiolytic effect of melatonin observed in our study suggests its potential as an adjunct therapy in surgical patients with high preoperative anxiety levels. Furthermore, gabapentin's long-lasting pain-relieving properties highlight how useful it is in conventional postoperative pain management procedures. These results add to the increasing data demonstrating the benefits of individualised postoperative care strategies, which may enhance patient satisfaction and results. This study's use of validated measures (VAS and HADS) to measure anxiety and pain is one of its strengths; it improves the validity of our conclusions. Nevertheless, the limited sample size and single-center design may limit the results' generalizability. Furthermore, our study population's lower prevalence of comorbidities than in some other studies

might have affected the results, possibly leading to better overall pain management and fewer complications.

Conclusion: Our study's findings on the demographic characteristics, comorbidities, and clinical outcomes of patients undergoing lumbar spinal surgery contribute to the growing body of evidence in this field. The results highlight the complex interplay between patient characteristics, comorbidities, and surgical outcomes, emphasising the need for personalised approaches to postoperative care in lumbar spinal surgery.

Conflict of Interest: Nil
Source of Funding: None.

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