

# Efficacy of Preemptive Analgesia in Reducing Postoperative Pain Scores

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## ABSTRACT

**Background:** Post-operative pain is one of the more frequent post-operative complaints following surgery and can further hinder recovery, make the patient feel uncomfortable and may lead to the need for further pain medications. The preemptive analgesic approach involves preemptively treating the pain pathway with analgesic drugs to prevent central sensitization. This approach could be helpful for postoperative pain management and reduce the need for rescue analgesics.

**Objective:** To determine the efficacy of preemptive analgesia in reducing postoperative pain scores among patients undergoing elective surgical procedures.

**Methods:** This comparative study was conducted at the Department of Surgery/ Anaesthesia Mirpur Divisional Headquarters Teaching Hospital Mirpur AJK from July 2022 to July 2023. All 92 were patients who were undergoing elective surgery and were split evenly into two groups. Forty-six patients were put into Group A and 46 patients into Group B, each group having patients who were given preemptive analgesia prior to surgical incision and conventional postoperative analgesia respectively. Visual Analogue Scale (VAS) was used for the assessment of postoperative pain at 1, 2, 4, 6, 12 and 24 hours after surgery. Analgesic requirement for rescue, time to first rescue analgesic, total analgesia consumption, patient satisfaction and adverse effects were also documented. The data were analyzed using SPSS version 25, with a p value < 0.05 was regarded as statistically significant.

**Results:** Patients in the preemptive analgesia group had significantly lower mean postoperative pain scores at all observed time intervals compared with the control group. At 1 hour, the mean pain score was  $3.1 \pm 1.0$  in Group A and  $5.2 \pm 1.3$  in Group B. At 24 hours, the mean pain score was  $2.1 \pm 0.8$  in Group A and  $3.0 \pm 1.0$  in Group B. Rescue analgesia was required in 16 (34.8%) patients in Group A compared with 31 (67.4%) patients in Group B. The time to first rescue analgesia was also longer in the preemptive analgesia group. Patient satisfaction was higher in Group A, while adverse effects were comparable between both groups.

**Conclusion:** Preemptive analgesia was effective in reducing postoperative pain scores and rescue analgesic requirement during the first 24 hours after surgery. It also improved patient satisfaction without increasing major adverse effects. Preemptive analgesia should be considered as part of a planned multimodal strategy for postoperative pain management.

**Keywords:** Preemptive analgesia, postoperative pain, Visual Analogue Scale, rescue analgesia, pain management, elective surgery.

## INTRODUCTION

Postoperative pain is a frequent and important clinical problem following surgical procedures. While simple pain after tissue injury is normal, inadequate pain management will impact patient comfort, delay mobilization, affect breathing/coughing, lengthen hospital stays, and increase the need for further pain relief drugs. Managing pain after surgery and during anesthesia is therefore critical to the care of the patient. It gives quicker recovery, lesser stress response and better post-surgical satisfaction<sup>1-3</sup>.

Post-operative pain is a result of tissue damage, inflammation and peripheral nociceptor activation. These painful impulses are sent to the higher centres and spinal cord where they can cause heightened sensitivity to pain. In the absence of appropriate control of nociceptive stimulation, central sensitization can take place. Increased nervous system responsiveness to pain can lead to increased postoperative pain and sometimes to a prolonged postoperative pain is what is meant by central sensitization. This has led to the employment of analgesic techniques that start pre-emption, before the onset of the pain, rather than after<sup>4,5</sup>.

Preemptive analgesia is the use of analgesic drugs prior to surgical incision or prior to the painful stimulus. This is to block/potentiate pain signals before they become intense enough to trigger peripheral and central sensitisation. These can include non-steroidal anti-inflammatory drugs (NSAIDs), paracetamol, local anaesthetic, opioids, gabapentinoids or regional anaesthetic, depending on the surgery and patient. The administration of the drug and the dosage used may differ, but in essence: pain should

not become unbearable and should be prevented or minimized<sup>6-8</sup>.

Clinically, the concept of preemptive analgesia is important because, in most cases, postoperative pain is treated later after the patient complains of pain. By this point, pain pathways might already be engaged and a higher dose or multiple doses of pain medication may be necessary. Preemptive analgesia, on the other hand, can decrease the intensity of early postoperative pain, the time to first analgesic request and subsequent analgesic consumption. It can also help to minimize complications associated with drug use, such as the requirement for multiple postoperative doses of painkillers<sup>9,10</sup>.

A number of studies and reviews have demonstrated the benefits of planned perioperative pain management on postoperative outcomes. Multimodal analgesia techniques, which combine various different methods of analgesia, are also supported by modern guidelines for pain management, and are used to achieve more effective pain relief with reduced side effects. Preemptive analgesia may be an important part of this multimodal approach. Its efficacy could be different depending on the surgery, the analgesic used, when it was administered and how its pain was assessed. In this regard local evidence is required to assess its practical value in normal surgical patients<sup>11,12</sup>.

The present study was conducted to determine the efficacy of preemptive analgesia in reducing postoperative pain scores among patients undergoing elective surgical procedures. The study also assessed rescue analgesic requirement, time to first rescue analgesia, patient satisfaction, and adverse effects during the first 24 hours after surgery. This will help in understanding whether preemptive analgesia provides better postoperative pain control compared with conventional postoperative analgesia alone.

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**METHODOLOGY**

This comparative study was conducted at Department of Surgery/ Anaesthesia Mirpur Divisional Headquarters Teaching Hospital Mirpur AJK from July 2022 to July 2023 to evaluate the efficacy of preemptive analgesia in reducing postoperative pain scores. A total of 92 patients undergoing elective surgical procedures were included in the study. Patients were divided into two equal groups, with 46 patients in the preemptive analgesia group and 46 patients in the control group. Patients in the preemptive analgesia group received analgesic medication before surgical incision, while patients in the control group received routine postoperative analgesia according to the standard hospital protocol. The purpose of this comparison was to determine whether administration of analgesia before the onset of surgical tissue injury could reduce postoperative pain intensity and decrease the need for rescue analgesics.

Patients both male and female, aged 18-years and older, scheduled for elective surgery under anesthesia and willing to participate in the study were included. Patients who were at risk for infection with the study drug, had chronic pain conditions, long-term usage of opioids or analgesics, psychiatric disorders that may affect pain assessment, severe renal or hepatic disease, bleeding diseases, were pregnant or could not understand the pain scoring system were excluded. Detailed history, clinical examination and review of relevant investigations were used to assess all eligible patients preoperatively. The following demographic data were collected on a proforma: age, gender, BMI, ASA physical status, type of surgery, length of surgery, relevant comorbidities.

After enrollment, patients were allocated into two groups. Pre-operative (before surgical incision) analgesia was administered to Group A according to departmental protocol and conventional analgesia (after surgery or after the pain was reported) to Group B. To minimize bias, the same anesthesia and intraoperative monitoring were used for both groups. The following parameters were recorded intraoperatively: duration of surgery, type of anesthesia, and requirement of additional analgesics. All patients were observed in the postoperative recovery room and then in the ward following the standard procedure of postoperative care.

Visual Analogue Scale (VAS) was used to assess postoperative pain. Patients were informed of the pain scoring system prior to surgery, with a score of 0 being no pain and 10 being the worst pain possible. Pain scores were obtained at 1, 2, 4, 6, 12 and 24 hours post surgery. The main result of the study was the difference between the mean postoperative pain score in the preemptive analgesia group and the control group. Secondary outcomes were the number of patients who needed rescue analgesics, the time to first rescue analgesic dose, total requirement of rescue analgesics in the first 24 hours, patient satisfaction and the occurrence of adverse effects in the postoperative period, including nausea, vomiting, dizziness, sedation, respiratory depression, gastritis or allergic reaction.

If the patient reported moderate to severe pain or the Visual Analogue Scale (VAS) score went beyond the institutional threshold, this was administered as rescue analgesia. The time from completion of surgery to first rescue analgesic administration was recorded. The total amount of analgesics used in the first 24 hours after surgery was also recorded. Any drug related complications were observed as well as any adverse events after surgery. Patient satisfaction with pain control was measured at 24 hours and reported as good, fair or poor, depending on the patient's overall level of comfort and requirement for further analgesia.

Data were entered and analyzed using SPSS version 25. Quantitative variables such as age, body mass index, duration of surgery, pain scores, time to first rescue analgesia, and total analgesic requirement were expressed as mean and standard deviation. Qualitative variables such as gender, ASA status, need for rescue analgesia, adverse effects, and patient satisfaction were presented as frequency and percentage. Mean pain scores

between the two groups were compared using the independent sample t-test. Categorical variables were compared using the chi-square test or Fisher's exact test where appropriate. A p-value of less than 0.05 was considered statistically significant.

**RESULTS**

A total of 92 patients were included in the study and were divided into two equal groups. A total of 46 patients received preemptive analgesia before cutting (Group A) and 46 patients received conventional postoperative analgesia (Group B). The mean age of patients in Group A was 38.6 ± 10.4 years, whereas in Group B it was 39.8 ± 11.2 years. There was no significant difference between the ages of the two groups. There was a slight predominance of men in both groups. The baseline characteristics such as age, gender, body mass index, ASA status and duration of surgery were found to be similar between the two groups indicating that both groups were similar at baseline.

Visual Analogue Scale was used to assess postoperative pain at various time intervals after the surgery. Group A had reduced pain scores at all postoperative time points when compared with Group B. The difference was greater in the early postoperative period. The mean pain scores at 1 hour after surgery were 3.1 ± 1.0 in Group A and 5.2 ± 1.3 in Group B, statistically significant difference. The same was true at 2, 4, 6, 12 and 24 hours after the surgery.

Also, patients who received preemptive analgesia had less need for rescue analgesia. In Group A, 16 patients had to be given rescue analgesia and in Group B, 31 patients had to be given extra analgesia after surgery. There was also a significant difference in mean time to first rescue dose of analgesic between the two groups, with Group A having a longer delay, as well as a significant difference in total postoperative analgesic consumption during the first 24 hours between the two groups, with Group A consuming less.

Adverse effects after surgery were noted for both groups. The control group experienced slightly more nausea/ vomiting but this difference was not significant. There were no cases of respiratory depression, severe sedation or allergic reaction. Of all the patients, 34 in Group A were satisfied with the results while 21 in Group B were satisfied with the results.

Patients who received preemptive analgesia had significantly lower postoperative pain scores, longer time before needing to take a rescue dose of analgesia and less total requirement for postoperative analgesia, as well as increased satisfaction with their postoperative treatment when compared with patients who received postoperative analgesia alone. Based on these results, preemptive analgesia has been shown to be effective for better postoperative pain control within 24 hours following surgery.

Table 1: Baseline Demographic and Clinical Characteristics of Patients

Variable	Group A: Preemptive Analgesia n=46	Group B: Control n=46	p-value
Age, years	38.6 ± 10.4	39.8 ± 11.2	0.596
Male	25 (54.3%)	24 (52.2%)	0.835
Female	21 (45.7%)	22 (47.8%)	0.835
BMI, kg/m <sup>2</sup>	25.8 ± 3.4	26.1 ± 3.7	0.686
ASA I	29 (63.0%)	27 (58.7%)	0.667
ASA II	17 (37.0%)	19 (41.3%)	0.667
Duration of surgery, minutes	58.4 ± 14.6	60.1 ± 15.2	0.586

Table 2: Comparison of Postoperative Pain Scores Between Groups

Time After Surgery	Group A: Preemptive Analgesia	Group B: Control	p-value
1 hour	3.1 ± 1.0	5.2 ± 1.3	<0.001
2 hours	3.4 ± 1.1	5.6 ± 1.2	<0.001
4 hours	3.6 ± 1.2	5.4 ± 1.4	<0.001
6 hours	3.2 ± 1.0	4.8 ± 1.3	<0.001
12 hours	2.7 ± 0.9	3.9 ± 1.1	<0.001
24 hours	2.1 ± 0.8	3.0 ± 1.0	<0.001

Table 3: Rescue Analgesic Requirement During First 24 Hours

Variable	Group A: Preemptive Analgesia n=46	Group B: Control n=46	p-value
Patients requiring rescue analgesia	16 (34.8%)	31 (67.4%)	0.002
Time to first rescue analgesia, hours	7.8 ± 2.4	3.9 ± 1.8	<0.001
Total rescue analgesic doses in 24 hours	1.2 ± 0.7	2.4 ± 0.9	<0.001

Table 4: Postoperative Adverse Effects and Patient Satisfaction

Variable	Group A: Preemptive Analgesia n=46	Group B: Control n=46	p-value
Nausea	5 (10.9%)	9 (19.6%)	0.244
Vomiting	3 (6.5%)	6 (13.0%)	0.295
Dizziness	4 (8.7%)	5 (10.9%)	0.725
Sedation	2 (4.3%)	3 (6.5%)	0.646
Respiratory depression	0 (0.0%)	0 (0.0%)	—
Good patient satisfaction	34 (73.9%)	21 (45.7%)	0.006

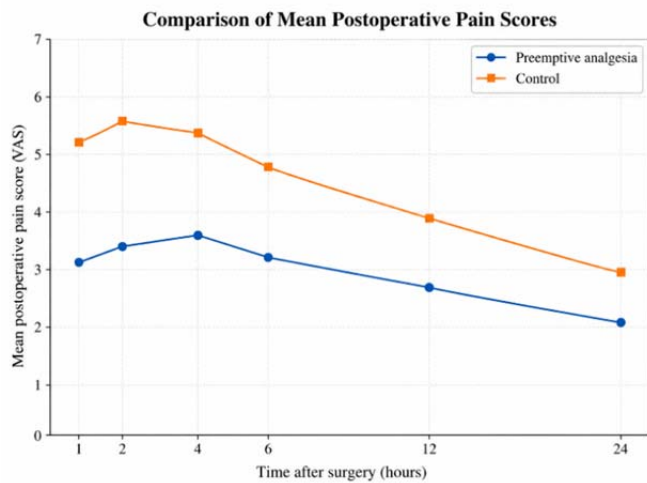


Figure 1. Comparison of mean postoperative pain scores between the preemptive analgesia group and control group during the first 24 hours after surgery.

The graph shows that patients who received preemptive analgesia had consistently lower Visual Analogue Scale pain scores at 1, 2, 4, 6, 12, and 24 hours postoperatively compared with the control group, indicating better postoperative pain control.

**DISCUSSION**

The present study evaluated the efficacy of preemptive analgesia in reducing postoperative pain scores among 92 patients. The findings showed that patients who received preemptive analgesia before surgical incision had significantly lower postoperative pain scores at 1, 2, 4, 6, 12, and 24 hours compared with patients who received conventional postoperative analgesia. This difference was most prominent during the early postoperative period, suggesting that administration of analgesia before surgical tissue injury may reduce the initial pain response after surgery. The lower Visual Analogue Scale scores in the preemptive analgesia group support the concept that early control of nociceptive stimulation can improve postoperative comfort and reduce the intensity of acute postoperative pain<sup>13-15</sup>.

The biological hypothesis behind these results is that peripheral and central sensitization are prevented. Surgical incision and handling of tissue stimulates nociceptors and helps to conduct painful impulses more strongly to the spinal cord. The administration of an analgesic agent prior to the onset of this painful stimulus can decrease the amplification of pain pathways and thus postoperative hyperalgesia. Preemptive analgesia has

been described as a strategy to prevent the establishment of central sensitization. Likewise, other reviews have detailed how preventive and preemptive analgesic techniques can help to decrease postoperative pain by managing pain pathways prior to or during the initial stages of wound healing. The decreased pain scores reported in the current study are thus in line with the concept of preemptive analgesia<sup>16, 17</sup>.

The use of rescue analgesia was also less in the preemptive analgesia group in this study. Only 34.8% of patients in the preemptive analgesia group required rescue analgesia compared with 67.4% in the control group. Furthermore, the time to the first administration of a rescue dose of analgesic was longer among patients receiving preemptive analgesia. This is clinically significant as postoperative pain management is not just about lowering pain scores, but also reducing repeated analgesic administration, enhancing comfort and minimizing adverse effects from analgesic use. Previous studies have also demonstrated that optimal perioperative pain management can decrease the amount of analgesics used and enhance patient recovery. The findings of this study indicate that preemptive analgesia might be beneficial in a multimodal pain management approach<sup>18</sup>.

The current results also corroborate clinical practices regarding postoperative pain management such as pain assessment, multimodal analgesia and personalized pain plans. Research suggest a proactive approach to post operative care of pain over waiting for pain to become excessive. In the present study, patients receiving analgesia prior to the incision experienced less pain for the first 24 hours. This reinforces the utility of being able to predict post-operative pain and manage it early. Patients can enjoy improved pain control which will allow them to take deep breaths, cough, move sooner and be more active in their post-op recovery<sup>19</sup>.

However, the preemptive analgesia group had higher patient satisfaction which may be linked to lower pain intensity and the need for less additional analgesics. Nausea, vomiting, dizziness and sedation were slightly more common in the control group, but the difference was not statistically significant. No serious adverse events were noted (respiratory depression or allergic reaction). This suggests that preemptive analgesia was not associated with adverse responses in the current study. These findings are corroborated by previous research and reviews that used preemptive/preventive analgesia methods to achieve better postoperative pain outcomes without a significant increase in complications when appropriate drugs and doses were administered<sup>20</sup>.

However, some limitations should be considered. The study was limited to 92 patients within a set timeframe of one year (January 2022 to January 2023). The effect of preemptive analgesia on persistent or chronic postoperative pain could not be evaluated, as pain was only assessed during the first 24 postoperative hours. No analysis of the efficacy or route of administration of various analgesics was performed. In addition, there are a number of factors that can influence the perception of pain, such as anxiety, surgical procedure, person's pain tolerance and previous exposure to analgesics. Further research, using larger sample sizes, greater follow-up and comparison of various preemptive analgesic approaches should be undertaken to determine which is most effective and safe for various surgical patient groups.

**CONCLUSION**

Preemptive analgesia was effective in reducing postoperative pain scores during the first 24 hours after surgery. Patients who received analgesia before surgical incision had significantly lower Visual Analogue Scale scores, delayed requirement for rescue analgesia, reduced total analgesic need, and higher satisfaction compared with the control group. The findings suggest that preemptive analgesia is a useful and safe strategy for improving postoperative pain control. It should be considered as part of a

planned multimodal analgesic approach in suitable surgical patients.

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