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ORIGINAL ARTICLE

Prospective Evaluation of Pain Control Strategies in Patients Undergoing Hernia Repair

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ABSTRACT:
Aim: This study aimed to evaluate and compare the effectiveness of different pain control strategies in patients undergoing elective hernia repair, focusing on pain relief, opioid consumption, patient satisfaction, and adverse effects. **Materials and Methods:** A prospective study was conducted on 100 patients undergoing elective inguinal or ventral hernia repair at a tertiary care hospital. Patients were divided into three groups: Group A (NSAIDs alone), Group B (NSAIDs + Acetaminophen), and Group C (Multimodal Analgesia including NSAIDs, Acetaminophen, and Low-Dose Opioids). Pain levels were assessed using the Visual Analog Scale (VAS) at 6, 12, 24, and 48 hours postoperatively, with follow-up at 1 week and 1 month. Opioid consumption, patient satisfaction, and the incidence of adverse effects such as nausea, vomiting, and sedation were recorded. Statistical analysis was performed using ANOVA and chi-square tests. **Results:** Multimodal analgesia (Group C) provided significantly lower pain scores at all time points ($p < 0.05$) compared to Groups A and B. At 6 hours postoperatively, the mean VAS score was 6.2 ± 1.1 in Group A, 5.5 ± 1.0 in Group B, and 4.8 ± 0.9 in Group C ($p = 0.001$). Group C also had significantly lower opioid consumption at all time points ($p < 0.005$), with the lowest mean opioid use at 48 hours (1.0 ± 0.5 mg vs. 3.2 ± 1.2 mg in Group A and 2.4 ± 1.0 mg in Group B, $p = 0.005$). Patient satisfaction scores were highest in Group C ($p < 0.01$), with the 1-month score at 9.6 ± 0.7 in Group C, compared to 8.7 ± 0.8 in Group B and 8.0 ± 0.9 in Group A. The incidence of adverse effects was comparable across groups ($p > 0.05$), with Group C showing fewer opioid-related complications such as nausea and sedation. **Conclusion:** Multimodal analgesia significantly improves postoperative pain control, reduces opioid consumption, and enhances patient satisfaction without increasing adverse effects. These findings support the routine implementation of multimodal analgesia in hernia repair surgery to improve patient outcomes, promote early recovery, and minimize opioid reliance.
Keywords: Multimodal analgesia, Postoperative pain, Hernia repair, NSAIDs, Opioid consumption.

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INTRODUCTION

Hernia repair is one of the most common surgical procedures performed worldwide, with millions of cases being conducted annually. While the procedure itself is often straightforward and associated with high success rates, pain management remains a significant concern for both patients and healthcare providers. Effective pain control strategies are crucial for ensuring patient comfort, facilitating early recovery, and minimizing the risk of complications such as chronic pain, delayed mobility, and opioid dependence. Given the increasing emphasis on enhanced recovery protocols, evaluating the effectiveness of different pain management techniques has become a priority in surgical practice.[1]Pain following hernia repair varies depending on multiple factors, including the type of hernia, surgical approach, patient characteristics, and individual pain thresholds. The most common types of hernias requiring surgical intervention include inguinal, umbilical, femoral, and incisional hernias, with inguinal hernia repair being the most frequently performed. These surgeries can be conducted using open techniques or minimally invasive laparoscopic and robotic-assisted approaches. While laparoscopic procedures are often associated with reduced postoperative pain and quicker recovery times, open techniques remain widely used, particularly in cases of large or recurrent hernias.[2]Pain experienced after hernia repair can be categorized into acute and chronic pain. Acute pain occurs in the immediate postoperative period and is typically the result of tissue trauma, inflammation, and nerve irritation. Chronic postoperative pain, on the other hand, persists beyond the expected healing period, usually defined as lasting more than three months. The incidence of chronic pain following hernia repair can range significantly, with some studies indicating that up to 30% of patients may experience persistent discomfort. This highlights the need for effective pain management strategies not only to address acute pain but also to mitigate the risk of chronic pain development.Traditionally, pain control following hernia repair has relied heavily on opioid analgesics, given their potent efficacy in managing moderate to severe pain. However, the ongoing opioid crisis has

necessitated a shift toward multimodal analgesia to reduce opioid consumption and its associated risks, including dependence, respiratory depression, and gastrointestinal side effects. Multimodal pain management involves the use of various pharmacologic and non-pharmacologic strategies to optimize pain relief while minimizing adverse effects.[3]Pharmacologic interventions for pain control in hernia repair include nonsteroidal anti-inflammatory drugs (NSAIDs), acetaminophen, local anesthetics, and nerve blocks. NSAIDs and acetaminophen are commonly used as first-line agents due to their effectiveness in reducing inflammation and providing baseline analgesia. Local anesthetics, including long-acting agents such as bupivacaine and liposomal bupivacaine, are frequently administered via infiltration at the surgical site or through peripheral nerve blocks. Nerve blocks, such as the transversus abdominis plane (TAP) block and ilioinguinal/iliohypogastric nerve blocks, have gained popularity for their ability to provide targeted pain relief with minimal systemic effects.[4]Non-pharmacologic approaches also play a vital role in pain management and have gained recognition as valuable adjuncts to traditional analgesic regimens. Techniques such as transcutaneous electrical nerve stimulation (TENS), acupuncture, guided imagery, and cognitive-behavioral therapy have been explored as complementary methods to enhance pain control. Additionally, early mobilization and physical therapy are emphasized in enhanced recovery after surgery (ERAS) protocols to prevent stiffness, improve circulation, and expedite functional recovery.The choice of pain management strategy is influenced by various patient-related and surgical factors. Individual pain thresholds, preexisting medical conditions, history of chronic pain, and psychological factors such as anxiety and depression can significantly impact pain perception and response to treatment. Furthermore, the type of surgical approach—open versus laparoscopic—affects the selection of analgesic modalities, with laparoscopic surgery generally associated with reduced postoperative pain intensity.[5]Given the diversity of available pain management strategies, evaluating their effectiveness in different patient populations is essential for optimizing postoperative outcomes. Comparative studies examining the efficacy of opioid-sparing regimens, nerve blocks, and multimodal analgesia protocols are necessary to establish evidence-based guidelines for pain control in hernia repair. The goal is to achieve a balance between effective pain relief and minimal side effects, ensuring a smooth recovery and reducing the risk of long-term complications.[6] Pain management in hernia repair remains a critical aspect of perioperative care, directly influencing patient satisfaction, recovery speed, and overall surgical success. With evolving pain control strategies and an increasing emphasis on opioid-free regimens, ongoing research and clinical evaluations are essential to determine the most effective approaches. By integrating multimodal analgesia and personalized pain management plans, healthcare providers can enhance patient outcomes while addressing the challenges associated with postoperative pain following hernia repair.

MATERIALS AND METHODS

This prospective study was conducted on 100 patients undergoing elective hernia repair at tertiary care hospital. Patients aged 18–75 years, diagnosed with inguinal or ventral hernia, and scheduled for surgical repair were included. Exclusion criteria comprised patients with chronic pain conditions, opioid dependence, and those undergoing emergency hernia repair. Preoperative assessment included demographic data, comorbidities, and baseline pain scores measured using the Visual Analog Scale (VAS). Patients were stratified into three groups based on different postoperative pain management strategies: Group A received nonsteroidal anti-inflammatory drugs (NSAIDs) alone, Group B received a combination of NSAIDs and acetaminophen, and Group C received multimodal analgesia, including NSAIDs, acetaminophen, and low-dose opioids.

All surgeries were performed under standardized anesthesia protocols by experienced surgeons. Postoperative pain levels were assessed at 6, 12, 24, and 48 hours post-surgery using VAS, with additional assessments at one week and one month for long-term pain outcomes. Opioid consumption, patient-reported satisfaction, and incidence of adverse effects such as nausea, vomiting, or sedation were recorded. Statistical analysis was conducted using SPSS version16.0, with comparisons between groups performed using ANOVA for continuous variables and chi-square tests for categorical data. Ethical approval was obtained from the Institutional Review Board, and all participants provided informed consent before enrollment.

RESULTS

Table 1: Demographic and Baseline Characteristics of Patients

The demographic characteristics of the patients were comparable across the three groups, with no statistically significant differences. The mean age of the participants ranged between 51.8 to 53.1 years, with a slightly higher proportion of males in all groups (ranging from 67.65% to 72.73%). The distribution of hernia types was also similar, with inguinal hernia being more prevalent than ventral hernia in all groups (60.61%–63.64% for inguinal and 36.36%–39.39% for ventral). The baseline pain score (VAS) before surgery was similar across groups, ranging from 6.5 ± 1.0 to 6.8 ± 1.2, indicating no significant preoperative differences ($p = 0.67$). This ensures that the observed differences in pain control outcomes were not influenced by baseline variations.

Table 2: Postoperative Pain Scores (VAS Score) ± SD

Postoperative pain scores were significantly lower in the multimodal analgesia group (Group C) at all time points compared to the other two groups ($p < 0.05$ at all time points). At 6 hours post-surgery, the mean VAS score was 6.2 ± 1.1 in Group A, 5.5 ± 1.0 in Group B, and 4.8 ± 0.9 in Group C ($p = 0.001$). This trend continued at later time points, with Group C consistently reporting the lowest pain scores at 12 hours, 24 hours, 48 hours, 1 week, and 1 month. By the 1-month follow-up, patients in Group C had the lowest pain levels (0.5 ± 0.3), followed by Group B (0.9 ± 0.4) and Group A (1.3 ± 0.5) ($p = 0.05$). This demonstrates that multimodal analgesia provides superior pain control compared to NSAIDs alone or NSAIDs with acetaminophen.

Table 3: Opioid Consumption (Mean Morphine Equivalent Dose ± SD in mg)

The use of opioids was significantly reduced in Group C, reflecting better pain control with multimodal analgesia. At 6 hours postoperatively, Group A had the highest mean opioid consumption (10.2 ± 2.1 mg), followed by Group B (8.1 ± 1.8 mg) and Group C (5.0 ± 1.5 mg) ($p < 0.001$). This statistically significant reduction continued at all time points, with Group C consistently using the least amount of opioids (1.0 ± 0.5 mg at 48 hours vs. 3.2 ± 1.2 mg in Group A and 2.4 ± 1.0 mg in Group B, $p = 0.005$). This result indicates that multimodal analgesia significantly reduces opioid consumption, potentially lowering the risk of opioid-related side effects and dependency.

Table 4: Patient Satisfaction Scores (Mean ± SD on 1-10 scale)

Patient satisfaction scores were highest in the multimodal analgesia group (Group C) at all time points. At 24 hours postoperatively, Group C had a mean satisfaction score of 8.0 ± 1.0, compared to 6.8 ± 1.1 in Group B and 6.0 ± 1.2 in Group A ($p = 0.001$). This trend continued at 48 hours, 1 week, and 1 month, with Group C showing the highest levels of satisfaction (9.6 ± 0.7 at 1 month vs. 8.7 ± 0.8 in Group B and 8.0 ± 0.9 in Group A, $p = 0.01$). This suggests that better pain control directly translates to improved patient satisfaction with postoperative care.

Table 5: Incidence of Adverse Effects (%)

The incidence of adverse effects was comparable across all groups, with no statistically significant differences ($p > 0.05$ for all adverse effects). The most common side effect was nausea, occurring in 15.15% of patients in Group A, 18.18% in Group B, and 11.76% in Group C ($p = 0.76$). Vomiting was slightly more frequent in Groups A and B compared to Group C (12.12%, 15.15%, and 8.82%, respectively, $p = 0.82$). Sedation and dizziness were least common in Group C, likely due to lower opioid use, with only 5.88% experiencing sedation and 2.94% experiencing dizziness. This suggests that multimodal analgesia may reduce opioid-related side effects without significantly increasing other complications.

Table 1: Demographic and Baseline Characteristics of Patients

Characteristic	Group A (NSAIDs)	Group B (NSAIDs + Acetaminophen)	Group C (Multimodal Analgesia)	p-value
Total Patients (n)	33	33	34	-
Mean Age (years) ± SD	52.3 ± 5.4	51.8 ± 4.9	53.1 ± 5.7	0.85
Male (%)	23 (69.70%)	24 (72.73%)	23 (67.65%)	0.90
Female (%)	10 (30.30%)	9 (27.27%)	11 (32.35%)	0.88
Inguinal Hernia (%)	21 (63.64%)	20 (60.61%)	21 (61.76%)	0.76
Ventral Hernia (%)	12 (36.36%)	13 (39.39%)	13 (38.24%)	0.81
Mean Baseline VAS Score ± SD	6.8 ± 1.2	6.7 ± 1.1	6.5 ± 1.0	0.67

Table 2: Postoperative Pain Scores (VAS Score) ± SD

Time Point	Group A (NSAIDs)	Group B (NSAIDs + Acetaminophen)	Group C (Multimodal Analgesia)	p-value
6 Hours	6.2 ± 1.1	5.5 ± 1.0	4.8 ± 0.9	0.001
12 Hours	5.5 ± 1.0	4.8 ± 0.9	4.1 ± 0.8	0.002
24 Hours	4.8 ± 0.9	4.2 ± 0.8	3.5 ± 0.7	0.003
48 Hours	3.5 ± 0.8	2.9 ± 0.7	2.5 ± 0.6	0.01
1 Week	2.2 ± 0.7	1.8 ± 0.6	1.2 ± 0.5	0.02
1 Month	1.3 ± 0.5	0.9 ± 0.4	0.5 ± 0.3	0.05

Table 3: Opioid Consumption (Mean Morphine Equivalent Dose ± SD in mg)

Time Point	Group A (NSAIDs)	Group B (NSAIDs + Acetaminophen)	Group C (Multimodal Analgesia)	p-value
6 Hours	10.2 ± 2.1	8.1 ± 1.8	5.0 ± 1.5	<0.001
12 Hours	8.0 ± 1.9	6.5 ± 1.5	3.6 ± 1.2	0.001

24 Hours	6.1 ± 1.7	4.6 ± 1.3	2.1 ± 0.8	0.002
48 Hours	3.2 ± 1.2	2.4 ± 1.0	1.0 ± 0.5	0.005

Table 4: Patient Satisfaction Scores (Mean ± SD on 1-10 scale)

Time Point	Group A (NSAIDs)	Group B (NSAIDs + Acetaminophen)	Group C (Multimodal Analgesia)	p-value
24 Hours	6.0 ± 1.2	6.8 ± 1.1	8.0 ± 1.0	0.001
48 Hours	7.0 ± 1.1	7.6 ± 1.0	8.8 ± 0.9	0.002
1 Week	7.5 ± 1.0	8.2 ± 0.9	9.2 ± 0.8	0.005
1 Month	8.0 ± 0.9	8.7 ± 0.8	9.6 ± 0.7	0.01

Table 5: Incidence of Adverse Effects (%)

Adverse Effect	Group A (NSAIDs)	Group B (NSAIDs + Acetaminophen)	Group C (Multimodal Analgesia)	p-value
Nausea	5 (15.15%)	6 (18.18%)	4 (11.76%)	0.76
Vomiting	4 (12.12%)	5 (15.15%)	3 (8.82%)	0.82
Sedation	2 (6.06%)	3 (9.09%)	2 (5.88%)	0.64
Dizziness	3 (9.09%)	2 (6.06%)	1 (2.94%)	0.88

DISCUSSION

The findings of this study align with existing literature supporting the efficacy of multimodal analgesia in postoperative pain management. In this study, patients receiving multimodal analgesia (Group C) reported significantly lower postoperative pain scores at all time points compared to those receiving NSAIDs alone (Group A) or NSAIDs combined with acetaminophen (Group B). For instance, at 6 hours post-surgery, the mean VAS score was 4.8 ± 0.9 in Group C, compared to 6.2 ± 1.1 in Group A and 5.5 ± 1.0 in Group B ($p = 0.001$). This trend continued through the 1-month follow-up, with Group C maintaining the lowest pain levels (0.5 ± 0.3) compared to Group B (0.9 ± 0.4) and Group A (1.3 ± 0.5) ($p = 0.05$). These results confirm that multimodal analgesia provides superior pain control compared to NSAIDs alone or NSAIDs with acetaminophen.These findings are consistent with previous studies. A study by Kehlet and Dahl (2003) emphasized that multimodal analgesia, by targeting different mechanisms of the pain pathway, results in better pain control than single-modality treatments. Their review demonstrated that combining NSAIDs with regional anesthesia techniques significantly reduced postoperative pain scores in various surgical procedures.[6] Similarly, McDonnell et al. (2007) found that multimodal analgesia resulted in significantly lower VAS scores compared to opioid monotherapy in patients undergoing abdominal surgery, further supporting our findings.[7] The study demonstrated a significant reduction in opioid consumption among patients in the multimodal analgesia group. At 6 hours postoperatively, Group C had a mean opioid consumption of 5.0 ± 1.5 mg, compared to 10.2 ± 2.1 mg in Group A and 8.1 ± 1.8 mg in Group B ($p < 0.001$). This reduction persisted at all subsequent time points, indicating that multimodal analgesia effectively minimizes the need for opioids.This finding aligns with a study by Buvanendran et al. (2010), which found that patients receiving a multimodal analgesic regimen, including NSAIDs and regional anesthesia, required significantly less opioid medication postoperatively compared to those receiving opioids alone.[8] Their study reported a 40% reduction in opioid consumption, which is similar to the opioid-sparing effect observed in our study. Another study by Joshi et al. (2008) demonstrated that multimodal analgesia reduced opioid use by 30-50%, leading to improved postoperative recovery.[9]Higher patient satisfaction scores were observed in the multimodal analgesia group (Group C) across all time points. At 24 hours postoperatively, Group C reported a mean satisfaction score of 8.0 ± 1.0, while Group A reported 6.0 ± 1.2, and Group B reported 6.8 ± 1.1 ($p = 0.001$). This suggests that effective pain management through multimodal strategies enhances overall patient satisfaction.A study by White and Kehlet (2010) supports this observation, noting that patients receiving multimodal analgesia reported higher satisfaction levels due to better pain control and fewer side effects.[10] Their study found that patients who experienced lower pain levels had significantly higher satisfaction scores ($p < 0.01$). Similarly, Beaussier et al. (2009) reported that patients receiving a multimodal analgesic regimen had 20% higher satisfaction rates compared to those receiving opioid monotherapy.[11]The incidence of adverse effects such as nausea, vomiting, sedation, and dizziness was comparable across all groups, with no statistically significant differences ($p > 0.05$ for all adverse effects). However, Group C exhibited a trend toward fewer opioid-related side effects, likely due to the reduced opioid consumption facilitated by the multimodal approach.This is in line with findings from a study by Wu et al. (2005), which reported that multimodal analgesia regimens were associated with a lower incidence of opioid-related adverse effects, attributing this benefit to the opioid-sparing effect of combining multiple analgesic modalities.[12] Another study by Macintyre et al. (2010) found that patients receiving multimodal analgesia had a 25% lower

incidence of nausea and vomiting compared to those receiving opioids alone. These findings further support the use of multimodal analgesia to reduce opioid-related complications.[13]

CONCLUSION

This study demonstrates that multimodal analgesia is significantly more effective than NSAIDs alone or NSAIDs with acetaminophen in postoperative pain management following hernia repair surgery. Patients in the multimodal group experienced lower pain scores at all time points ($p < 0.05$), reduced opioid consumption ($p < 0.005$), and higher satisfaction levels ($p < 0.01$) compared to the other groups. Additionally, multimodal analgesia did not increase the incidence of adverse effects and showed a trend toward fewer opioid-related complications. These findings support the routine implementation of multimodal analgesia in hernia repair surgery to improve patient outcomes, enhance recovery, and minimize opioid reliance.

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