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Original Research Article

Multimodal Analgesia Versus Opioid-Based Analgesia in Elective Gynecological Surgeries: A Comparative Study

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Abstract:

Background: Effective postoperative analgesia improves recovery and patient satisfaction after gynecological surgery. Opioids are effective but cause significant adverse effects. Multimodal analgesia combines drugs and techniques acting at different pain pathways to reduce opioid exposure.

Aim: To compare efficacy, opioid consumption, adverse effects, and patient satisfaction between multimodal and opioid-based analgesia in elective gynecological surgeries.

Methodology: A prospective randomized comparative study was conducted on 120 ASA I–II women undergoing elective gynecological procedures at Sheikh Bhikari Medical College and Hospital. Patients were allocated to multimodal (paracetamol, NSAID, TAP block, local infiltration) or opioid group (intravenous morphine). Pain scores (VAS), rescue analgesia, opioid consumption, adverse effects, and satisfaction were assessed over 24 hours.

Results: Multimodal analgesia showed significantly lower VAS scores at 1, 6, 12, and 24 hours ($p<0.001$). Mean opioid consumption was reduced (6.8±2.1 mg vs 14.2±2.8 mg), and time to rescue analgesia was prolonged (152±34 vs 68±18 min). Adverse effects were lower: nausea 10% vs 30%, vomiting 8.3% vs 25%, sedation 6.7% vs 23.3%, pruritus 5% vs 16.7%, respiratory depression 0% vs 6.7%. Patient satisfaction was significantly higher ($p<0.001$).

Conclusion: Multimodal analgesia provides superior pain control, fewer complications, reduced opioid requirement, and greater satisfaction compared with opioid-based analgesia.

Keywords: Multimodal analgesia, opioid analgesia, postoperative pain, gynecological surgery, VAS score, patient satisfaction.

Introduction

Perioperative care encompasses sufficient control of postoperative pain, which directly influences patient recovery, early mobilization process, and patient satisfaction with surgical treatment [1]. Trauma that occurs during surgery starts a series of inflammatory and neurophysiological events that stimulate nociceptors and amplify the transmission of pain. Unless postoperative pain is addressed properly, it does not only lead to a lot of discomfort, but also results in delayed ambulation, poor respiratory effort, and disruption of early oral intake. These effects have the long-term effects of increasing the length of stay and predisposing patients to atelectasis, deep vein thrombosis, and wound infection [2]. Moreover, chronic postoperative pain negatively influences psychological health and causes the reduction of patient satisfaction as the significant indicator of health care quality is now [3] .

The opioids have been regarded as the foundation of the postoperative analgesia process and have been regularly prescribed following surgical interventions due to their high analgesic activity [4]. The effect of opioids is mostly on central nervous systems μ-receptors leading to inhibition of nociceptive transmission and changes in pain perception. Although they are effective in the treatment of moderate to severe pain, their clinical applications have often been constrained by adverse effects that are well known. Some of the common complications of opioids used are nausea, vomiting, pruritus, sedation, respiratory depression, urinary retention, and postoperative ileus [5]. These negative outcomes do not only lead to patient discomfort but also slow down the process of mobilization and oral feeding, increasing the recovery and stay period of the patient. More importantly, the repetitive use of opioids

elevates the chances of tolerance and dependence, which is a concern with the long-term use of opioids and the possible abuse of these substances in the postoperative population.

Over the past few years, there has been a paradigm shift in the perception of the management of perioperative pain due to the increased awareness about opioid-related complications. There has been an increased use of strategies that seek to reduce the consumption of opioids and still ensure effective analgesia by clinicians. Multimodal analgesia is one of such strategies that was proposed to surmount the shortcomings of the single-agent opioid therapy [6]. Multimodal analgesia is the administration of several analgesic drugs and methods that work through various mechanisms and different locations of the pain pathway. This method can result in superior analgesic effects by acting on the peripheral nociceptors, spinal cord transmission, and central perception at the same time [7] compared to the application of a single drug.

Multimodal analgesia is usually a combination of non-opioid substances, including nonsteroidal anti-inflammatory agents (NSAIDs), acetaminophen, local anesthetics, and adjuvant agents in addition to regional anesthetics. All the components play a role in the control of pain by breaking nociceptive signaling at different levels. NSAIDs inhibit peripheral sensitization and inflammation, acetaminophen inhibits peripherally, and nerve conduction at the surgical site is blocked by local anesthetics. Collective action leads to better analgesia and enables a prominent decrease in opioid needs [8]. Reducing the use of opioids reduces the effects of opioids on patients, enhances early mobilization, and increases the rate of regaining normal physiological functions through multimodal analgesia.

Multimodal analgesia continues to be a crucial component in enhanced recovery protocols due to the ability of patients to breathe deeply, cough, and ambulate immediately after surgery due to effective pain relief without unreasonable sedation. The first ambulation enhances the circulation, decreases pulmonary complications, and the hospital stay is shortened. Moreover, there is reduced cost of healthcare because of lower complications and lower bed days that are required because of better recovery [9]. In this way, multimodal analgesia does not only enhance the clinical outcomes but also leads to cost-effective healthcare provision.

Gynecological operations such as hysterectomy and other such elective surgeries are usually associated with moderate to severe postoperative pains because of massive handling of tissues and manipulation of the visceral organs. Good analgesia in such patients is of great essence since poor management of pain in the patient population would interfere with early ambivalence and recovery. Surgically, opioid-based regimens had previously been popular in these surgeries, but the occurrence of postoperative nausea and vomiting in the female population is particularly high; thus, opioid minimization is particularly appealing. Thus, it is clinically relevant to consider alternative analgesic strategies yielding sufficient pain management and reduced side effects.

The analogy between multimodal analgesia and the traditional opioid-based analgesia is gaining more significance in the current anesthetic practice. Even though opioids are very effective, their analgesic efficacy and adverse effects should be well-balanced. The goal of multimodal analgesia is to achieve similar or better analgesia with a reduced opioid dose to achieve better patient comfort and speed up recovery. To measure its efficacy in elective gynecological surgeries in particular, to optimize the pain management procedures in postoperative, and to enhance the perioperative outcomes.

The present study aimed to compare multimodal analgesia regarding traditional analgesia which is based on the use of opioids in patients undergoing elective surgeries in the gynecological department. The main outcome indicator was the control of postoperative pain measured by the scores in Visual Analogue Scale (VAS). The total opioid consumption and adverse event occurrence were the secondary outcomes. As a hypothesis, multimodal analgesia would result in better pain management with less opioid consumption and lower side effects, which will lead to better postoperative outcomes and patient satisfaction.

Methodology

Study Design: This research was conducted as a prospective randomized comparative study aimed at evaluating the efficacy and safety of multimodal analgesia in comparison with opioid-based analgesia for postoperative pain relief in patients undergoing elective gynecological surgeries. The study will compare postoperative pain scores, rescue analgesic requirements, adverse effects, and patient satisfaction between the two analgesic techniques.

Study Area: The study was carried out in the Department of Anesthesiology, Sheikh Bhikari Medical College and Hospital, Hazaribagh, Jharkhand, India.

Study Duration: The study was conducted over a period of one year.

Sample Size: A total of 120 patients were included in the study. The enrolled participants were randomly allocated into two equal groups of 60 patients each using computer-generated random numbers and sealed opaque envelope technique to ensure proper randomization and allocation concealment.

Study Population: The study population will consist of female patients scheduled for elective

gynecological surgeries such as abdominal hysterectomy, vaginal hysterectomy, myomectomy, and ovarian cystectomy under spinal or general anesthesia at Sheikh Bhikari Medical College and Hospital.

Inclusion Criteria

Patients fulfilling all of the following criteria were included:

- Female patients aged 20 – 60 years
- ASA physical status I and II
- Scheduled for elective gynecological surgery (abdominal or vaginal hysterectomy, myomectomy, ovarian cystectomy etc.)
- Willing to participate and provide written informed consent

Exclusion Criteria

Patients were excluded if they had:

- ASA physical status III or above
- Chronic pain syndromes
- Long-term opioid use or opioid dependence
- Allergy to study drugs (paracetamol, NSAIDs, local anesthetics, opioids)
- Severe hepatic, renal, cardiac or neurological disease
- Coagulation disorders or infection at block site
- Psychiatric illness or inability to understand VAS score
- Pregnancy or emergency surgery

Data Collection: Preoperative evaluation will include recording demographic details such as age, weight, body mass index, ASA status, and type of surgery. Patients were educated preoperatively regarding the Visual Analogue Scale (VAS), a 10-cm scale where 0 indicates no pain and 10 indicates worst imaginable pain. Postoperative data will include VAS pain scores at 1, 6, 12, and 24 hours after surgery, time to first rescue analgesia, total rescue analgesic consumption, hemodynamic parameters, and adverse effects including nausea, vomiting, pruritus, sedation, and respiratory depression.

Study Procedure: All patients will undergo standard pre-anesthetic evaluation and fasting as per institutional protocol. After randomization, patients were allocated into two groups. Group M (multimodal analgesia group) will receive intravenous paracetamol, non-steroidal anti-inflammatory drug (diclofenac or equivalent), regional anesthesia in the form of transversus abdominis plane block using 0.25% bupivacaine, and local anesthetic infiltration at the surgical site. Group O (opioid-based group) will receive intravenous opioid analgesia such as morphine in appropriate weight-based dosage. Rescue analgesia was administered whenever VAS score is ≥4. Patients in the multimodal group will receive tramadol as rescue analgesia, whereas patients in the opioid group will receive additional opioid doses. All patients were monitored postoperatively for pain scores and complications.

Statistical Analysis: Data was entered into Microsoft Excel and analyzed using SPSS version 26.0 software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage. Independent t-test was used for comparison of continuous variables between groups, and Chi-square test was applied for categorical variables. Repeated measures ANOVA were used to analyze changes in pain scores over time. A p-value of less than 0.05 was considered statistically significant."

Result

Table 1 shows that both study groups were comparable in baseline characteristics. The mean age was similar between the opioid group (47.8 ± 6.4 years) and the multimodal group (48.2 ± 5.9 years) ($p = 0.72$), and BMI also did not differ significantly (25.9 ± 2.1 vs 26.4 ± 1.8 kg/m²; $p = 0.28$). The distribution of surgical procedures was comparable as well, with vaginal surgeries in 41.7% vs 38.3% and abdominal surgeries in 58.3% vs 61.7% of patients in the opioid and multimodal groups respectively ($p = 0.7$). Overall, there were no statistically significant differences, indicating both groups were demographically and clinically similar at baseline.

Table 1: Patient Demographics

Characteristics	Opioid Group (n = 60)	Multimodal Group (n = 60)	p-value
Mean age (years)	47.8 ± 6.4	48.2 ± 5.9	0.72
BMI (kg/m²)	25.9 ± 2.1	26.4 ± 1.8	0.28
Vaginal surgeries	25 (41.7%)	23 (38.3%)	0.7
Abdominal surgeries	35 (58.3%)	37 (61.7%)	0.7

Table 2 demonstrates postoperative pain intensity using VAS scores at different time intervals. The multimodal analgesia group consistently showed significantly lower pain scores compared to the opioid group at all time points: at 1 hour (4.2 ± 0.68 vs 6.6 ± 0.74), 6 hours (3.5 ± 0.73 vs 5.7 ± 0.82), 12 hours (3.2 ± 0.69 vs 5.1 ± 0.95), and 24 hours (2.8 ± 0.58 vs 4.5 ± 0.61), with all differences being highly significant ($p < 0.001$). This indicates superior and sustained analgesic efficacy with multimodal analgesia throughout the first postoperative day.

Table 2: Postoperative VAS Pain Scores			
Time Post-Surgery	**Opioid Group (Mean ± SD)**	**Multimodal Group (Mean ± SD)**	**p-value**
1 hour	6.6 ± 0.74	4.2 ± 0.68	<0.001
6 hours	5.7 ± 0.82	3.5 ± 0.73	<0.001
12 hours	5.1 ± 0.95	3.2 ± 0.69	<0.001
24 hours	4.5 ± 0.61	2.8 ± 0.58	<0.001

Table 3 shows total opioid consumption during the first 24 hours postoperatively. The multimodal analgesia group required significantly less opioid compared to the opioid group, with a mean morphine equivalent dose of 6.8 ± 2.1 mg versus 14.2 ± 2.8 mg ($p < 0.001$). Additionally, the time to first rescue analgesia was markedly longer in the multimodal group (152 ± 34 minutes) than in the opioid group (68 ± 18 minutes), indicating better and longer-lasting pain control with multimodal analgesia.

Table 3: Total Opioid Consumption (First 24 Hours)			
Parameter	**Opioid Group**	**Multimodal Group**	**p-value**
Mean morphine equivalent dose (mg)	14.2 ± 2.8	6.8 ± 2.1	<0.001
Time to first rescue analgesia (minutes)	68 ± 18	152 ± 34	<0.001

Table 4 presents postoperative adverse effects in the opioid and multimodal analgesia groups. The opioid group showed a significantly higher incidence of complications, including nausea (30% vs 10%, p=0.006), vomiting (25% vs 8.3%, p=0.01), sedation (23.3% vs 6.7%, p=0.01), pruritus (16.7% vs 5%, p=0.04), and respiratory depression (6.7% vs 0%, p=0.04). Overall, adverse effects were markedly lower in the multimodal group, indicating that multimodal analgesia was safer and better tolerated compared to opioid-based analgesia.

Table 4: Postoperative Adverse Effects			
Adverse Effect	**Opioid Group (n=60)**	**Multimodal Group (n=60)**	**p-value**
Nausea	18 (30%)	6 (10%)	0.006
Vomiting	15 (25%)	5 (8.3%)	0.01
Sedation	14 (23.3%)	4 (6.7%)	0.01
Pruritus	10 (16.7%)	3 (5%)	0.04
Respiratory depression	4 (6.7%)	0 (0%)	0.04

Table 5 shows patient satisfaction scores at 24 hours in the opioid and multimodal analgesia groups. In the opioid group, most patients reported moderate satisfaction (46.7%), followed by good (25%) and poor (20%), while only 8.3% experienced excellent satisfaction. In contrast, the multimodal group demonstrated significantly better satisfaction, with good (46.7%) and excellent (25%) responses being most common, and only 3.3% reporting poor satisfaction. The difference between the groups was statistically significant ($p < 0.001$), indicating that multimodal analgesia provided superior postoperative patient satisfaction compared to opioid analgesia alone.

Table 5: Patient Satisfaction Score (24 hours)			
Satisfaction Level	**Opioid Group**	**Multimodal Group**	**p-value**
Poor	12 (20%)	2 (3.3%)	<0.001
Moderate	28 (46.7%)	15 (25%)	
Good	15 (25%)	28 (46.7%)	
Excellent	5 (8.3%)	15 25%)	

Discussion

In gynecological surgeries, effective postoperative pain management is crucial since insufficient analgesia might provoke sympathetic response, delayed recovery, increased length of stay, and even shift to chronic pain syndromes (Ohnesorge et al., 2020) [10]. Opioids have been widely utilized traditionally as the cornerstone of postoperative analgesia; this is limited due to such adverse effects as nausea, vomiting, sedation, pruritus, ileus, and respiratory depression (Gibbison & Kinsella, 2009) [11]. It was thus decided to introduce the notion of multimodal analgesia that involves the integration of the various classes of analgesics that have different action points at the various nociceptive pathways to enhance analgesic efficacy without exposing the body to opioids (Helander et al., 2017) [12]. This principle is highly supported in our findings. In the current research, the results of the postoperative pain were compared using the visual analogue scale and the difference in the postoperative pain scores in

multimodal group showed significant reduction at all the time intervals. The intensity of pain in the opioid group was reduced to an intensive level at 1 hour and was 4.2 plus 0.68 in multimodal group, the absolute minimum difference was 2.4, which was maintained up to 24 hours (4.5 plus 0.61 vs 2.8 plus 0.58). Similarly, Seki et al. (2018) [13] reported a similar scale of early postoperative pain reduction with opioid-sparing anesthesia in laparoscopic gynecological surgery, which greatly lowered early postoperative pain and nausea. Even though their study was mostly concerned with postoperative nausea and vomiting, the analgesic effect that was seen is similar to the stable 2-point VAS that the cohort in our study saw".

Multimodal analgesia is physiologically supported as simultaneous inhibition of peripheral inflammation, spinal transmission, and central perception of pain reduces the dose of individual drugs needed (Zhu et al., 2022) [14]. Our opioid consumption results showed this pharmacologic synergy. The morphine equated 14.2 + 2.8mg taken by patients in the conventional opioid-based treatment per 24 hours was lower than the multimodal group (6.8 + 2.1mg) which was over 50 per cent lower number. The same opioid-sparing effects were reported by Ramaseshan et al. (2020) [15] who found that systematic multimodal approaches to surgery in the pelvic reconstructive surgery led to significant decreases in postoperative narcotic requirement and enhanced recovery outcomes. Similarly, Ackenbom et al. (2021) [16] found that opioid use was less in older women with an operation to repair pelvic organ prolapses when multimodal regimens were employed. Even though their absolute opioid needs varied due to the age of the patient and the complexity of their procedure, the relative decrease was similar to our results, which further validates the reproducibility of opioid-sparing advantages among gynecological operations. Moreover, our experiment showed time to first rescue analgesia prolongation (152 ± 34 vs 68 ± 18 minutes), which indicates persistent baseline analgesia. This fact supports the findings that there is better early postoperative comfort and a later rescue analgesic need when multimodal regimens are used (Willis-Gray et al., 2022) [17].

One of the most clinical effects of our study was the adverse effects. There was nausea in 30% of opioid-only patients and vomiting 25% versus 8.3, sedation 23.3% versus 6.7, pruritus 16.7% versus 5 and respiratory depression 6.7% versus none. These data are in line with the opioid-related complication profiles scheduled in the literature of gynecologic anesthesia (Gibbison & Kinsella, 2009) [11]. Seki et al. (2018) [13] also reported a substantial decrease in postoperative nausea and vomiting following opioid-sparing anesthesia, which proves that an opioid-sparing anesthesia reduces GIT adverse events directly by reducing opioid exposure. In another study by Togal et al. (2004) [18], the multimodal regimens that include intrathecal morphine are compared and fewer opioid related complications were found in multimodal regimens versus traditional approaches yet again supporting the notion that a reduced systemic opioid burden enhances safety. The fact that the respiratory depression was almost completely eliminated in our multimodal group is clinically significant since respiratory depression is the most dreaded complication of opioid analgesia.

Better analgesia and reduced side effects consisted in significantly enhanced patient satisfaction in our study. This is because only 3.3 percent of patients in multimodal group gave poor satisfaction versus 20 percent in opioid group and good or excellent satisfaction occurred in 71.7 percent or 33.3 percent respectively. Multimodal protocols have also been associated with improved patient satisfaction in gynecologic post-operative care paths, since better pain management leads to early discharge and decrease in hospital spending (Ackenbom et al., 2021) [19]. Ramaseshan et al. reported comparable associations between reduced opioid intake and better postoperative experience [15] reporting that the quality of recovery in patients treated with multimodal analgesia was higher. The expansion of satisfaction in our study probably indicates the positive transactional effect of developed analgesia (about 2-point VAS decreasing effect), the lessening of nausea/vomiting (20% absolute effect), and diminished sedation (which improve functional recovery).

In general, the current research supports the fact that increasing evidence indicates that multimodal analgesia is an effective method of managing postoperative pain better than opioid-based interventions when used in elective gynecological surgery. We have shown an improvement in pain scores, more than 50 percent decrease in opioid use, a postponed rescue analgesia, and significantly decreased adverse effects. These findings are in line with the already published clinical studies besides quantifying clinically significant gains within a similar patient group under surgery. The accumulating evidence points to the fact that multimodal analgesia supports quality improvement of immediate postoperative comfort, as well as recovery quality and safety, which might be why it should be used in elective gynecological surgery as the method of analgesia of choice.

Conclusion

The current comparative analysis shows that multimodal analgesia has better analgesic effects on postoperative pains than opioid-based analgesia during elective gynaecological surgeries. Multimodal therapy patients reported lower pain levels throughout all measured postoperative intervals and less opioid rescue analgesics, and the time to first analgesic request was higher, which implies longer analgesic

effects. Also, multimodal approach dramatically decreased the rate of such adverse events as nausea, vomiting, sedation, pruritus, and respiratory depression which are usually common among opioid users. Greater overall patient satisfaction was observed in the multimodal group because more comfort was achieved. Thus, multimodal analgesia seems a safer and more successful postoperative pain treatment plan compared to traditional opioid-based interventions in elective gynecological surgeries, which justifies its widespread clinical implementation in order to positively influence recovery and patient experience.

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