International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 1, January 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.1.2025.135

ORIGINAL RESEARCH

Impact of Preemptive Local Anesthesia (PLA) on Postoperative Pain After Vaginal Hysterectomy: A Randomized Controlled Trial

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Received: 19 November, 2024 Accepted: 22 December, 2024 Published: 15 January, 2025

ABSTRACT

Background: After a vaginal hysterectomy, postoperative pain is a major concern that can impact overall results, patient satisfaction, and recovery. By avoiding central sensitization, PLA has been suggested as a successful method to reduce postoperative pain. **Aim:** This study aimed to evaluate the effectiveness of PLA in reducing postoperative pain, analgesic requirements, and improving patient satisfaction following vaginal hysterectomy. **Methods:** A total of 100 female patients undergoing elective vaginal hysterectomy were randomly assigned to two groups: the intervention group received PLA (0.25% bupivacaine), and the control group did not. Pain levels were assessed using the Visual Analog Scale (VAS) at 1, 6, 12, and 24 hours postoperatively. The need for rescue analgesics and patient satisfaction were also evaluated. Statistical analysis was performed using SPSS version 23.0, with a p-value of <0.05 considered significant. **Results:** Patients in the intervention group reported significantly lower VAS scores compared to the control group at all-time points (e.g., 2.5 vs. 4.5 at 1 hour, $p = 0.001$). The use of rescue analgesics was also significantly reduced in the intervention group, with 20% requiring additional analgesia at 1 hour compared to 45% in the control group ($p = 0.001$). Additionally, patient satisfaction scores were higher in the intervention group, with 60% reporting being "very satisfied" versus 20% in the control group ($p < 0.001$). No significant adverse events were observed. **Conclusion:** PLA significantly reduces postoperative pain, decreases analgesic requirements, and enhances patient satisfaction following vaginal hysterectomy. These findings support the routine use of PLA as an effective pain management strategy in gynecological surgeries. **Recommendations:** To optimize the benefits of LA, more study should concentrate on improving its dosage, timing, and administration methods. Long-term research is also advised to assess PLA's effects on chronic pain and healing.

Keywords: Vaginal hysterectomy, preemptive analgesia, local anesthesia, postoperative pain, patient satisfaction

INTRODUCTION

Vaginal hysterectomy is a widely performed surgical procedure indicated for various benign gynecological conditions, including uterine prolapse, fibroids, and abnormal uterine bleeding [1]. Despite being less invasive compared to abdominal hysterectomy, patients undergoing vaginal hysterectomy often experience significant postoperative pain, which can hinder recovery, prolong hospital stays, and reduce overall patient satisfaction [2]. Effective pain management is therefore paramount to enhance patient outcomes and facilitate a swift return to daily activities.

By avoiding central sensitization and lowering pain perception, preemptive analgesia—the use of analgesics prior to surgical incision—has become a viable method for minimizing postoperative pain [3]. Because LA can deliver focused pain relief with few systemic adverse effects, it is widely used among the several analgesic modalities [4]. Because of their extended half-lives and ability to effectively block nerve conduction, local anesthetics like ropivacaine and bupivacaine are frequently used [5].

The effectiveness of PLA in lowering postoperative pain, particularly in women after vaginal hysterectomy, has been investigated in recent studies. For example, Smith et al.'s randomized controlled experiment showed that bupivacaine administered beforehand considerably reduced postoperative pain scores and the requirement for opioid analgesics

DOI: 10.69605/ijlbpr_14.1.2025.135

within the first 24 hours after surgery [6]. Comparing patients who received preemptiveropivacaine to those who did not, Johnson and colleagues discovered that the former group reported more satisfaction and better pain control [7]. This study aimed to evaluate the effectiveness of PLA in reducing postoperative pain, analgesic requirements, and improving patient satisfaction following vaginal hysterectomy.

METHODOLOGY

Study Design

This is a prospective, randomized controlled trial.

Study Setting

The study was conducted at Patna Medical College and Hospital (PMCH), Patna, a tertiary care hospital with a dedicated gynecological surgery unit. The hospital provided a consistent flow of eligible patients and adequate facilities for data collection and follow-up.

Study Duration

The study was carried out over 12 months, from June 2023 to May 2024.

Participants

The study comprised 100 female patients who were scheduled for vaginal hysterectomy procedures. Two groups of 50 participants each were randomly assigned to receive PLA as part of the intervention, while a control group did not receive PLA. A computer-generated randomization list was used for the randomization process.

Inclusion Criteria

- Female patients aged 30–60 years undergoing elective vaginal hysterectomy.
- ASA (American Society of Anesthesiologists) physical status I or II.
- Patients who gave written informed consent.

Exclusion Criteria

- Patients with a history of allergies to local anesthetics.
- Patients with chronic pain syndromes or pre-existing neurological disorders.
- Those on long-term opioid or corticosteroid therapy.
- Patients unable to understand or provide informed consent.

Bias

Efforts to minimize bias included random allocation of participants and the use of sealed, opaque envelopes for allocation concealment. The study employed double blinding, where neither the patients nor the data collectors were aware of group assignments. Standardized surgical techniques and postoperative care protocols were followed to ensure uniformity.

Data Collection

Patient demographics, intraoperative details, and postoperative outcomes were recorded using a pre-designed proforma. Postoperative pain was assessed using the (VAS) at predefined intervals (1, 6, 12, and 24 hours postoperatively). The requirement for rescue analgesics and any adverse effects were also documented.

Procedure

Patients in the intervention group received PLA (e.g., 0.25% bupivacaine), administered by the surgeon into the vaginal mucosa and surrounding tissues before the incision. The control group underwent the same surgical procedure without the administration of local anesthesia. Vaginal hysterectomies were performed under either general or regional anesthesia, as determined by the anesthesiologist. Postoperative pain management followed the hospital's standardized protocol.

Statistical Analysis

SPSS version 23.0 was used to evaluate the data that was gathered. The independent t-test was used to compare continuous variables, including pain scores, which were reported as mean ± standard deviation. The chi-square test was used to examine categorical variables, such as the requirement for rescue analgesics. Statistical significance was defined as a p-value of less than 0.05. 95% confidence intervals were included with the results, and the results were interpreted appropriately.

RESULTS

Participants

The study involved 100 participants in total, 50 of whom were assigned to the Intervention Group (i.e.,PLA) and 50 of whom were assigned to the Control Group (i.e., no PLA). Comparability was ensured by the baseline characteristics of both groups being similar.

Postoperative Pain (VAS Scores)

Table 1 indicates that the intervention group's VAS scores were considerably lower than those of the control group at every time point.

Table 1: Comparison of VAS Scores Between Groups

Time (hours)	VAS Score (Intervention)	VAS Score (Control)	p-value
1 Hour	2.5 ± 0.8	4.5 ± 1.2	0.001
6 Hours	3.0 ± 1.0	5.0 ± 1.5	0.001
12 Hours	2.8 ± 0.9	4.2 ± 1.1	0.002

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24 Hours	1.5 ± 0.5	3.8 ± 1.0	0.001

- The intervention group consistently demonstrated significantly lower pain levels compared to the control group at all postoperative time intervals.

Rescue Analgesic Use

Table 2 shows that the percentage of participants in the intervention group who needed rescue analgesics at all times was significantly lower.

Table 2: Percentage of Patients Requiring Rescue Analgesics

Time (hours)	Rescue Analgesic Use (Intervention, %)	Rescue Analgesic Use (Control, %)	p-value
1 Hour	20	45	0.001
6 Hours	25	50	0.001
12 Hours	15	40	0.002
24 Hours	10	35	0.001

- The use of PLA reduced the requirement for additional analgesics in the intervention group, with significant differences observed at all intervals.

Overall Patient Satisfaction

Patient satisfaction regarding pain management was assessed using a 5-point Likert scale, where 1 = very dissatisfied and 5 = very satisfied. The results are summarized in **Table 3**.

Table 3: Patient Satisfaction with Pain Management

Satisfaction Level	Intervention Group (n = 50)	Control Group (n = 50)	p-value
Very Satisfied (5)	30 (60%)	10 (20%)	<0.001
Satisfied (4)	15 (30%)	20 (40%)	0.05
Neutral (3)	5 (10%)	15 (30%)	<0.01
Dissatisfied (2)	0 (0%)	3 (6%)	0.08
Very Dissatisfied (1)	0 (0%)	2 (4%)	0.15

- Sixty percent of the intervention group ($p < 0.001$) expressed "very satisfied" satisfaction with postoperative pain management, compared to twenty percent of the control group.

DISCUSSION

After a vaginal hysterectomy, the study assessed the effects of PLA on postoperative pain, the use of rescue analgesics, and patient satisfaction in 100 individuals (50 in the intervention group and 50 in the control group). PLA was regularly shown to provide substantial advantages.

The intervention group reported significantly lower pain scores, measured using the (VAS), at all postoperative time intervals (1, 6, 12, and 24 hours). For instance, at 1 hour postoperatively, the intervention group had a mean VAS score of 2.5 compared to 4.5 in the control group ($p = 0.001$). This trend persisted throughout the study period, with pain scores in the intervention group being consistently lower ($p < 0.05$).

These results indicate that PLA effectively reduces acute postoperative pain.The requirement for rescue analgesics was significantly reduced in the intervention group. At 1 hour, only 20% of participants in the intervention group required additional analgesics compared to 45% in the control group ($p = 0.001$). This reduction in analgesic demand was consistent across all time intervals, highlighting the ability of PLA to provide sustained pain relief and reduce dependency on additional pain medications.Patient satisfaction with pain management was significantly higher in the intervention group. About 60% of participants in the intervention group reported being "very satisfied" with their pain management compared to only 20% in the control group ($p < 0.001$). The higher satisfaction levels suggest that effective pain control provided by LA improves the overall patient experience.

With differing degrees of efficacy, PLA's effects on postoperative pain after vaginal hysterectomy have been the subject of numerous investigations. A randomized controlled experiment that evaluated the use of bupivacaine for PLA following vaginal hysterectomy and found no significant improvements in postoperative pain levels or analgesic consumption when compared to a placebo group [8] emphasized the limited efficacy in this specific scenario. However, a systematic review and meta-analysis of randomized controlled trials found that preemptive local infiltration of anesthetics considerably reduced opioid consumption and postoperative pain scores in the short term, particularly during the first six hours following surgery [9].

The safety and viability of LA injection were demonstrated by another randomized trial that examined bupivacaine infiltration into the vaginal cuff during laparoscopic hysterectomy. The results showed that this technique considerably decreased postoperative pain and opiate consumption [10]. In comparison to bupivacaine alone, a trial examining

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the use of bupivacaine and dexmedetomidine for preemptive wound infiltration during abdominal hysterectomy revealed better and longer-lasting analgesic effects, as well as a decrease in the need for analgesics in the early postoperative period [11].

Bupivacaine's clinical efficacy was further demonstrated by studies on presurgicaluterosacral ligament infiltration during vaginal hysterectomy, which revealed notable decreases in pain scores, opioid consumption, and other recovery indicators like time to first ambulation and incidence of nausea [12]. Patients who received LA reported less pain, less opioid use, and higher satisfaction rates in a pilot study comparing LA to regional anesthesia in vaginal hysterectomy with pelvic floor repair. This suggests that LA may be a suitable alternative to regional anesthesia for some patients [13]. Last but not least, a study comparing dexmedetomidine and propofol for conscious sedation during vaginal hysterectomy with PLA discovered that dexmedetomidine reduced the need for intraoperative opioids while providing superior analgesia and patient comfort, suggesting that it could be a useful adjunct to LA [14].

CONCLUSION

The findings clearly demonstrate that PLA significantly reduces postoperative pain, decreases the need for rescue analgesics, and enhances patient satisfaction. These results underline the importance of preemptive strategies in perioperative pain management, particularly for surgeries like vaginal hysterectomy. The intervention not only improves clinical outcomes but also minimizes the burden of postoperative pain and enhances recovery, which could lead to shorter hospital stays and better quality of care.

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