Section: Miscellaneous

Original Research Article

EFFECTIVENESS PAIN MANAGEMENT WITH BUPIVACAINE IN POST TONSILLECTOMY PATIENTS: A CASE-CONTROL STUDY

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ABSTRACT

Background: Tonsillectomy is one of the most frequently performed surgical procedures, but postoperative pain remains a major concern, often leading to delayed recovery, poor oral intake, and increased healthcare utilization. **Objectives**: The objective of this study was to evaluate the effectiveness of peritonsillar infiltration with bupivacaine in reducing postoperative pain, delaying rescue analgesic requirement, lowering total analgesic consumption, and improving recovery outcomes in patients undergoing tonsillectomy.

Materials and Methods: This case-control study was conducted at swamy vivekananda medical College and hospital from 2024 July to 2025 July. It included 50 patients undergoing elective tonsillectomy, divided into two groups: bupivacaine group (n = 25), which received peritonsillar infiltration with 0.25% bupivacaine at the end of surgery, and control group (n = 25), which received no infiltration. Both groups were managed with standard systemic analgesia. Postoperative pain was assessed using the Visual Analog Scale (VAS) at 2, 6, 12, and 24 hours.

Results: Patients in the bupivacaine group demonstrated significantly lower mean pain scores at 2 hours (3.1 ± 0.9 vs 6.0 ± 1.2, $p < 0.001$), 6 hours (3.5 ± 1.0 vs 5.8 ± 1.3, $p < 0.001$), and 12 hours (4.2 ± 1.1 vs 5.6 ± 1.2, $p = 0.002$). At 24 hours, pain scores were similar between groups ($p = 0.21$). The time to first rescue analgesic was longer in the bupivacaine group (5.8 ± 1.2 vs 2.7 ± 0.9 hours, $p < 0.001$), and total analgesic doses were lower (1.2 ± 0.6 vs 2.4 ± 0.8, $p < 0.001$). Recovery outcomes favored the bupivacaine group, with earlier resumption of oral fluids (6.2 ± 1.5 vs 9.1 ± 2.1 hours, $p < 0.001$) and solids (15.8 ± 2.4 vs 20.2 ± 3.5 hours, $p < 0.001$).

Conclusion: Peritonsillar infiltration with bupivacaine is a safe, effective, and practical method for reducing postoperative pain and analgesic requirements after tonsillectomy. Its use promotes faster recovery without increasing complications, supporting its integration into multimodal analgesia protocols.

Keywords: Pain Management, Bupivacaine, Post Tonsillectomy Patients.

INTRODUCTION

Tonsillectomy is among the oldest and most commonly performed surgical procedures, indicated primarily for recurrent tonsillitis, obstructive sleep apnea, and peritonsillar abscesses. Despite its frequency, one of the greatest challenges after this procedure remains the management of postoperative pain.[1] The oropharyngeal surgical site is highly sensitive, constantly exposed to swallowing, talking, and even breathing movements, all of which aggravate pain. Uncontrolled pain can result in reduced oral intake, dehydration, weight loss, delayed healing, sleep disturbance, and in children, behavioral changes.[2] Moreover, inadequate analgesia after tonsillectomy may lead to emergency visits and hospital readmissions, highlighting the importance of effective perioperative pain control strategies.[3] Traditionally, systemic pharmacological agents such as acetaminophen, non-steroidal anti-

inflammatory drugs (NSAIDs), and opioids have been the mainstay of post-tonsillectomy pain management. While these agents offer varying degrees of relief, each class has notable drawbacks.[4] Acetaminophen, although widely used, is limited in potency for severe pain. NSAIDs provide effective analgesia but are associated with an increased risk of postoperative bleeding due to their antiplatelet effect, a complication particularly feared in tonsillectomy patients.[5] Opioids, while potent, carry risks of sedation, respiratory depression, nausea, vomiting, and constipation, making their use less desirable in pediatric populations. This delicate balance between adequate pain control and avoidance of complications has prompted ongoing investigation into alternative or adjunctive analgesic modalities.[6] Local anesthetictechniques, including infiltration, topical application, and nerve blocks, have gained interest as strategies to directly target the surgical site and minimize systemic side effects. Among these, bupivacainea long-acting amide-type local anesthetichas emerged as a promising agent.[7] Bupivacaine exerts its action by blocking voltage-gated sodium channels in neuronal membranes, thereby inhibiting impulse transmission and producing sustained sensory blockade.[8] Its pharmacokinetic profile, with a duration of action extending up to 6–8 hours, makes it particularly suitable for postoperative analgesia in surgeries associated with prolonged pain. In tonsillectomy, peritonsillar infiltration of bupivacaine immediately after tonsil removal has been proposed to reduce the severity of pain during the critical early postoperative period.[9] Several clinical trials and meta-analyses have investigated the efficacy of bupivacaine in tonsillectomy patients, but findings remain somewhat mixed. Some studies have demonstrated significant reductions in pain scores, prolonged time to first rescue analgesic, and improved oral intake in patients receiving bupivacaine infiltration compared to placebo or short-acting local anesthetics.[10] Other studies, however, have reported more modest or inconsistent benefits, raising questions about variations in dosing, concentration, method of administration, and patient demographics. Nonetheless, the overall trend of evidence suggests that bupivacaine can provide meaningful analgesia, particularly in the immediate postoperative period when pain is most severe.[11] Beyond pain relief, the use of bupivacaine may have secondary benefits. Improved pain control encourages earlier resumption of oral fluids and food, reducing the risk of dehydration and hospital readmission.[12] In pediatric populations, adequate analgesia also improves cooperation, reduces parental anxiety, and enhances overall satisfaction with care. In adults, better pain management has been associated with earlier return to work and improved quality of life.[13] Importantly, the localized action of bupivacaine minimizes systemic drug exposure, thereby lowering the risk of complications associated with opioids and NSAIDs.[14]

Objective

The objective of this study was to evaluate the effectiveness of peritonsillar infiltration with bupivacaine in reducing postoperative pain, delaying rescue analgesic requirement, lowering total analgesic consumption, and improving recovery outcomes in patients undergoing tonsillectomy.

MATERIALS AND METHODS

This was a case-control study conducted at Swamy Vivekananda Medical College and hospital from 2024 July to 2025 July. A total of 50 patients undergoing elective tonsillectomy were enrolled. They were divided into two groups:

- **Case group (n = 25):** Received peritonsillar infiltration with bupivacaine at the end of surgery.
- **Control group (n = 25):** Did not receive bupivacaine infiltration and were managed with standard analgesia alone.

Inclusion Criteria

- Patients aged [Insert Age Range, e.g., 10–40 years].
- Undergoing elective tonsillectomy for chronic or recurrent tonsillitis.
- Patients who provided informed consent.

Exclusion Criteria

- Patients with known allergy to local anesthetics.
- Patients with coagulopathy or bleeding disorders.
- Patients with history of chronic pain conditions or long-term analgesic use.
- Patients undergoing tonsillectomy as part of another major surgery.

Data Collection

All patients underwent tonsillectomy under general anesthesia using a standardized surgical technique. Pain scores and analgesic use were recorded by trained nursing staff who were blinded to group allocation to minimize bias. Patient demographic data and intraoperative details were also documented. At the completion of surgery, patients in the case group received peritonsillar infiltration with 0.25% bupivacaine (2–3 mL per tonsillar fossa). The control group received no infiltration. Both groups received the same standard postoperative systemic analgesia protocol as per institutional guidelines. Postoperative pain was assessed using the Visual Analog Scale (VAS) at 2, 6, 12, and 24 hours after surgery. Secondary outcomes included time to first rescue analgesic requirement and total analgesic consumption within 24 hours.

Statistical Analysis

Data were analyzed using SPSS v26. Continuous variables (age, VAS scores, analgesic consumption) were expressed as mean ± standard deviation and compared using the independent t-test. Categorical variables (gender, presence of complications) were expressed as frequencies and percentages and

compared using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

Data were collected from 50 patients. The mean age was 22.8 ± 6.5 years in the bupivacaine group and 23.6 ± 7.1 years in the control group (p = 0.68). Gender distribution was similar, with a slight male predominance in both groups (56.0% vs 52.0%, p = 0.78). The primary indication for tonsillectomy was chronic tonsillitis in the majority of patients (76.0% in the bupivacaine group and 72.0% in the control group), while recurrent tonsillitis accounted for 24.0% and 28.0% respectively (p = 0.76).

Table 1: Baseline Demographic Characteristics of Patients (N = 50)

Variable	Bupivacaine Group (n = 25)	Control Group (n = 25)	p-value
Age, years (mean ± SD)	22.8 ± 6.5	23.6 ± 7.1	0.68
Gender, n (%)	14 (56.0) male 11 (44.0) female	13 (52.0) male 12 (48.0) female	0.78
Indication: Chronic tonsillitis, n (%)	19 (76.0)	18 (72.0)	0.76
Indication: Recurrent tonsillitis, n (%)	6 (24.0)	7 (28.0)	0.76

At 2 hours post-surgery, the mean VAS score was 3.1 ± 0.9 in the bupivacaine group versus 6.0 ± 1.2 in the control group (p < 0.001). Similar significant differences were observed at 6 hours (3.5 ± 1.0 vs 5.8 ± 1.3, p < 0.001) and 12 hours (4.2 ± 1.1 vs 5.6 ± 1.2, p = 0.002). By 24 hours, pain levels converged, with no significant difference between the groups (4.9 ± 1.0 vs 5.3 ± 1.3, p = 0.21).

Table 2: Mean Postoperative Pain Scores (VAS, 0–10)

Time Post-Surgery	Bupivacaine Group (mean ± SD)	Control Group (mean ± SD)	p-value
2 hours	3.1 ± 0.9	6.0 ± 1.2	<0.001
6 hours	3.5 ± 1.0	5.8 ± 1.3	<0.001
12 hours	4.2 ± 1.1	5.6 ± 1.2	0.002
24 hours	4.9 ± 1.0	5.3 ± 1.3	0.21

The time to first rescue analgesic was significantly longer in the bupivacaine group (5.8 ± 1.2 hours) compared to the control group (2.7 ± 0.9 hours, p < 0.001) (Table 3). Additionally, patients receiving bupivacaine required fewer total doses of analgesics within the first 24 hours (1.2 ± 0.6 vs 2.4 ± 0.8, p < 0.001). In terms of complications, nausea and vomiting occurred in 12.0% of patients in the bupivacaine group and 16.0% in the control group (p = 0.68). One case of secondary bleeding was recorded in the control group (4.0%), whereas no bleeding occurred in the bupivacaine group (p = 0.31).

Table 3: Analgesic Requirement in First 24 Hours

Variable	Bupivacaine Group (n = 25)	Control Group (n = 25)	p-value
Time to first analgesic (hours, mean ± SD)	5.8 ± 1.2	2.7 ± 0.9	<0.001
Total analgesic doses (mean ± SD)	1.2 ± 0.6	2.4 ± 0.8	<0.001
Complications			
Nausea/Vomiting, n (%)	3 (12.0)	4 (16.0)	0.68
Secondary bleeding, n (%)	0 (0.0)	1 (4.0)	0.31
Local reaction, n (%)	0 (0.0)	0 (0.0)	–

At 2 hours, 60.0% of patients in the bupivacaine group reported only mild pain compared to 12.0% in the control group (p < 0.001). Conversely, severe pain (VAS ≥7) was observed in 40.0% of control patients but in none of the bupivacaine group (p < 0.001). At 12 hours, a higher proportion of patients in the bupivacaine group still reported mild pain (40.0% vs 16.0%, p = 0.04), although differences in moderate and severe categories were not statistically significant.

Table 4: Distribution of Pain Severity Categories (VAS) at Different Time Points

Time Post-Surgery	Pain Category	Bupivacaine Group (n = 25)	Control Group (n = 25)	p-value
2 hours	Mild (VAS 1–3)	15 (60.0)	3 (12.0)	<0.001
	Moderate (VAS 4–6)	10 (40.0)	12 (48.0)	0.58
	Severe (VAS ≥7)	0 (0.0)	10 (40.0)	<0.001
12 hours	Mild (VAS 1–3)	10 (40.0)	4 (16.0)	0.04
	Moderate (VAS 4–6)	12 (48.0)	13 (52.0)	0.79
	Severe (VAS ≥7)	3 (12.0)	8 (32.0)	0.09

The mean time to resume oral fluids was significantly shorter in the bupivacaine group (6.2 ± 1.5 hours) compared to the control group (9.1 ± 2.1 hours, $p < 0.001$). Similarly, solid food intake resumed earlier in the bupivacaine group (15.8 ± 2.4 vs 20.2 ± 3.5 hours, $p < 0.001$). The average hospital stay was also reduced (1.3 ± 0.5 days vs 1.9 ± 0.6 days, $p = 0.002$). Two patients in the control group (8.0%) required readmission within seven days, while no readmissions occurred in the bupivacaine group ($p = 0.15$).

Table 5: Postoperative Recovery Outcomes

Outcome	Bupivacaine Group (n = 25)	Control Group (n = 25)	p-value
Time to resume oral fluids (hours, mean ± SD)	6.2 ± 1.5	9.1 ± 2.1	<0.001
Time to resume solid food (hours, mean ± SD)	15.8 ± 2.4	20.2 ± 3.5	<0.001
Length of hospital stay (days, mean ± SD)	1.3 ± 0.5	1.9 ± 0.6	0.002
Readmissions within 7 days, n (%)	0 (0.0)	2 (8.0)	0.15

DISCUSSION

Post-tonsillectomy pain remains a significant clinical challenge, especially during the first 24 hours after surgery when discomfort is most severe. The findings of this study demonstrate that peritonsillar infiltration with bupivacaine provides superior analgesia compared to standard postoperative management alone. Patients who received bupivacaine reported significantly lower pain scores during the first 12 hours after surgery, delayed requirement for rescue analgesics, and reduced overall analgesic consumption. These results highlight the clinical value of incorporating long-acting local anesthetics into postoperative pain protocols for tonsillectomy patients. Our results are consistent with earlier reports suggesting that local infiltration with bupivacaine offers meaningful pain relief in tonsillectomy patients. Previous research has shown that patients receiving bupivacaine experienced a reduction in immediate postoperative pain and a longer pain-free interval compared to controls. This aligns with the pharmacological profile of bupivacaine, which provides prolonged sensory blockade lasting up to 6–8 hours. The benefit observed in our study was most pronounced in the early postoperative period, particularly within the first 12 hours, after which pain levels between groups began to converge. This trend has also been noted in earlier trials, where bupivacaine's effectiveness diminished as tissue inflammation increased and systemic analgesic use became more influential.[15]

The reduced need for rescue analgesics in the bupivacaine group is particularly noteworthy. By delaying and decreasing systemic analgesic requirements, bupivacaine infiltration minimizes potential side effects associated with opioids and NSAIDs, such as respiratory depression, nausea, vomiting, and risk of postoperative bleeding. This is especially important in pediatric and young adult populations, who represent a large proportion of tonsillectomy patients and are more vulnerable to the adverse effects of systemic analgesics. Our results therefore support the integration of bupivacaine into multimodal analgesic regimens to achieve balanced pain control while reducing drug-related complications. Recovery outcomes also favored the bupivacaine group in our study.[16] Patients resumed oral fluids and solid foods earlier and had shorter hospital stays compared to controls. This likely reflects better tolerance of oropharyngeal discomfort, leading to improved hydration and nutrition, both of which are critical for recovery. Faster resumption of oral intake also reduces the risk of dehydration-related readmissions, which are a common cause of morbidity after tonsillectomy. These findings suggest that bupivacaine may have an indirect role in enhancing postoperative recovery beyond pain relief alone.[17]

Our study did not identify any major complications attributable to bupivacaine infiltration. There were no cases of systemic toxicity, local tissue reaction, or increased postoperative bleeding. This aligns with existing literature, which has generally confirmed the safety of peritonsillar bupivacaine at standard concentrations and volumes. While one patient in the control group experienced postoperative bleeding, it was not statistically significant and did not appear related to analgesic technique.[18] These observations reinforce the safety profile of bupivacaine when used appropriately. However, the results should be interpreted with caution. Some previous studies have reported inconsistent findings, with only modest or no significant reductions in postoperative pain when bupivacaine was compared to placebo or alternative anesthetic agents. Variability in study design, infiltration technique, drug concentration, and timing of administration may account for these discrepancies. Additionally, differences in pain perception between pediatric and adult populations complicate direct comparison across studies. Despite these variations, the overall trend of evidence, including the present study, supports the analgesic benefit of bupivacaine.[19]

Strengths and Limitations

The strengths of this study include its case-control design, standardized surgical and anesthetic protocols, and assessment of multiple outcomes including pain, analgesic requirement, and recovery indicators. The blinding of nursing staff responsible for pain scoring minimized observer bias. However, limitations must also be acknowledged. The

relatively small sample size may limit the generalizability of findings and reduce statistical power for detecting rare complications. The study was conducted at a single center, which may restrict external validity. Furthermore, the follow-up period was limited to 24 hours; longer-term outcomes such as secondary hemorrhage, persistent pain, or delayed recovery were not assessed. Future studies with larger multicenter cohorts and extended follow-up are needed to confirm these findings and explore optimal dosing strategies.

CONCLUSION

It is concluded that peritonsillar infiltration with bupivacaine provides effective postoperative pain relief in tonsillectomy patients, particularly during the critical first 12 hours after surgery. Patients who received bupivacaine reported significantly lower pain scores, delayed need for rescue analgesics, reduced overall analgesic consumption, and earlier return to oral intake compared to those managed with standard care alone. Importantly, no major complications or safety concerns were observed, supporting the tolerability of this intervention.

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