RESEARCH

Efficacy of Ultrasound-Guided Bilateral Infraorbital Nerve Block Combined with General Anesthesia on Postoperative Pain and Quality of Recovery in Patients Undergoing Nasal Surgery: A Randomized Controlled Trial

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ABSTRACT

Background: Postoperative pain following nasal surgery is frequently moderate to severe, often necessitating high doses of opioids, which subsequently increase the risk of adverse clinical effects.

Objective: This study aimed to evaluate the clinical impact of integrating ultrasound-guided bilateral infraorbital nerve blocks with general anesthesia on the quality of analgesia and postoperative recovery in patients undergoing nasal procedures.

Methods: A single-blind randomized controlled trial was conducted involving 38 patients at Ngoerah Hospital between June and August 2025. Participants were randomly assigned to either Group P1 (general anesthesia with bilateral infraorbital block using 2 mL of 0.5% bupivacaine per side) or Group P2 (general anesthesia only). Measured outcomes included numerical rating scale (NRS) scores at 12 and 24 hours, time to first patient-controlled analgesia (PCA) demand, 24-hour total fentanyl consumption, and quality of recovery-15 (QoR-15) scores.

Results: Baseline characteristics were comparable between groups. Group P1 demonstrated significantly lower NRS scores at 12 hours and 24 hours ($p<0.001$) compared to Group P2. Furthermore, P1 required significantly less PCA intervention (31.6% vs 100%, $p<0.001$), exhibited a longer duration before the first analgesic demand ($p=0.008$), and consumed less total fentanyl over 24 hours ($p<0.001$). The QoR-15 scores were also significantly higher in Group P1 ($p<0.001$), indicating superior recovery quality.

Conclusion: Supplementing general anesthesia with bilateral infraorbital nerve blocks effectively mitigates postoperative pain, reduces opioid dependency, and enhances the overall quality of recovery after nasal surgery.

Keywords: analgesia; infraorbital nerve block; multimodal; nasal surgery; postoperative pain; QoR-15

INTRODUCTION

Nasal surgical procedures, including septoplasty, rhinoplasty, and functional endoscopic sinus surgery (FESS), are among the most frequently performed interventions in otorhinolaryngology.[1] These procedures serve critical roles in both functional airway restoration and reconstructive aesthetics.[1,2] Despite advancements in surgical techniques, postoperative pain remains a primary concern, typically characterized by moderate-to-severe intensity.[3,4] This physiological stress response is primarily triggered by extensive mucosal manipulation, periosteal trauma, nasal bone osteotomy, and the subsequent application of nasal packing, which induces pressure-related discomfort.[5,6] Clinical data suggests that inadequate pain control is prevalent, with nearly 50% of patients reporting significant distress during the acute postoperative phase.[3] At Ngoerah Hospital, the high volume of nasal surgeries—recorded at 172 cases in 2024—underscores the necessity for a standardized and effective analgesic protocol.

The management of post-nasal surgery pain has relied heavily on systemic opioid administration.[7] While opioids provide potent analgesia, their utilization is frequently complicated by a spectrum of adverse effects, such as postoperative nausea and vomiting (PONV), excessive sedation, and potential respiratory depression. These complications not only compromise patient comfort but also impede early mobilization, prolong hospital discharge, and increase overall healthcare costs. Consequently, contemporary clinical guidelines, including those from the American Society of Anesthesiologists (ASA), strongly advocate for the implementation of multimodal analgesia. This approach emphasizes the synergistic use of different analgesic classes and regional techniques to achieve superior pain control while achieving a significant opioid-sparing effect.[7,8]

Regional anesthesia, particularly peripheral nerve blocks, has emerged as a vital component of multimodal strategies.[7] The infraorbital nerve, a major sensory branch of the maxillary division of the trigeminal nerve (V2), provides essential innervation to the midface, including the lateral nasal walls, the dorsum, and the anterior nasal septum.[9,10] While alternative techniques such as the sphenopalatine ganglion block or maxillary nerve block are documented, they are often associated with higher technical complexity and a more invasive nature. In contrast, the infraorbital nerve block offers a targeted, highly effective, and safer profile for routine clinical use in nasal surgery.[2,11,12]

The evolution of ultrasound-guided (USG) techniques has revolutionized regional anesthesia by allowing real-time visualization of the nerve and surrounding vascular structures.[13,14] This precision ensures the accurate deposition of local anesthetics at the infraorbital foramen, thereby increasing the block's success rate and reducing the risk of accidental intravascular injection or nerve injury.[13,15] By integrating a ultrasound-guided guided bilateral infraorbital block with general anesthesia, clinicians can potentially provide prolonged preemptive analgesia, stabilize intraoperative hemodynamics, and significantly enhance the overall quality of recovery.[2,11]

Despite the growing global evidence supporting the efficacy of ultrasound-guided guided regional blocks, there is a notable scarcity of published research

evaluating the specific impact of bilateral infraorbital blocks in the Indonesian clinical setting, particularly concerning recovery quality scores (QoR-15).[16] This study, therefore, seeks to fill this gap by evaluating the effectiveness of combining a ultrasound-guided bilateral infraorbital nerve block with general anesthesia. The primary objectives are to analyze its impact on postoperative pain intensity, numerical rating scale (NRS), total 24-hour opioid consumption, and the comprehensive quality of recovery in patients undergoing nasal surgery at Ngoerah Hospital.[17–20]

METHOD

This study is a single-blind, randomized clinical trial aimed at assessing the efficacy of an ultrasound-guided bilateral infraorbital nerve block combined with general anesthesia for postoperative analgesia in nasal surgery. This research was conducted at the central surgical installation and the emergency operating room of Ngoerah Hospital. The study commenced after the researchers obtained ethical approval from the Research Ethics Committee of the Faculty of Medicine, Udayana University (No. 1504/UN14.2.2.VII.14/LT/2025).

Sample selection and data collection were carried out between June and August 2025 until the minimum sample size was met.

The subjects of this study were patients undergoing elective nasal surgery under general anesthesia. The participants represented a portion of the population that met the inclusion and exclusion criteria, specifically patients aged 18 to 65 years with an ASA physical status of I, II, or III. Research subjects were randomly divided into two groups: Group P1 received a bilateral infraorbital nerve block with 0.5% bupivacaine (2 mL per side) as an adjuvant to general anesthesia, and Group P2 received general anesthesia alone. A total of 38 subjects met the eligibility criteria, with no subjects lost to follow-up.

Standard monitoring and a standardized induction protocol using intravenous propofol (2 mg/kg), fentanyl (2 mcg/kg), and atracurium (0.5 mg/kg) were applied to all patients. In Group P1, the nerve block was performed after induction using a high-frequency linear array transducer (7–12 MHz) and a 25-gauge needle via an out-of-plane approach. The patients underwent surgery and were followed up for 24 hours after the operation. The patient's outcomes from medications were assessed by evaluating the NRS at 12 and 24 hours, time to first patient-controlled analgesia (PCA) fentanyl demand, total 24-hour fentanyl consumption, and the quality of recovery-15 (QoR-15) score. Randomization was conducted by the researcher using a computerized randomization method with www.randomizer.org.

RESULTS

This study successfully recruited a total of 38 participants, divided equally into two groups (n=19 per group). In this study, the basic characteristics reported include age, gender, body mass index (BMI), and ASA physical status to ensure baseline comparability. As noted in Table 1, the mean age in Group P1 (infraorbital block with general anesthesia) was 41.05 ± 12.86 years, while Group P2 (general anesthesia only) was 36.32 ± 13.96 years. The distribution of gender in Group P1 was 6 males (31.6%) and 13 females (68.4%), while Group P2 consisted of 11 males (57.9%) and 8 females (42.1%). Baseline

characteristics were statistically comparable between the two groups, with the exception of BMI, which was found to be slightly higher in the control group (22.49 ± 3.24 kg/m² vs 24.70 ± 2.11 kg/m²; p=0.018). (Table 1)

An analysis of the postoperative pain intensity difference between Group P1 and Group P2 was conducted. The difference analysis utilized the Mann-Whitney U test because the NRS data exhibited a non-normal distribution. At the 12-hour mark, Group P1 demonstrated a significantly lower median NRS score of 2 (2–3) compared to Group P2, which had a median score of 4 (3–5) ($p < 0.001$). This significant trend continued at the 24-hour mark, where Group P1 maintained a lower median NRS score of 1 (0–2) while Group P2 remained at 3 (2–3) ($p < 0.001$). These results indicate that the integration of a bilateral infraorbital nerve block effectively reduces pain severity following nasal surgery. (Table 2)

Furthermore, an analysis was performed regarding the opioid-sparing effect and the duration of analgesia. The difference analysis for the proportion of patients requiring PCA fentanyl was conducted using Fisher's exact test. Group P1 showed a significantly lower requirement for PCA rescue analgesia compared to Group P2 (31.6% vs 100%; $p < 0.001$). (Table 3)

For the patients who did require PCA, the time to first analgesic demand was analyzed using the Welch independent t-test, as the data met the assumption of normality but exhibited non-homogeneous variance. The analysis revealed a significantly longer duration in Group P1 compared to the control group (377.83 ± 120.50 minutes vs 175.84 ± 53.07 minutes; p = 0.008). (Table 4)

The total consumption of fentanyl over the 24-hour postoperative period was compared between the two groups. Statistical analysis using the Mann-Whitney U test indicated a substantial reduction in opioid requirements within the intervention group. Group P1 consumed significantly less total fentanyl, with a median of 145 mcg (IQR 100–150 mcg), compared to Group P2, which required a median of 220 mcg (IQR 195–265 mcg) ($p < 0.001$). The Hodges–Lehmann estimate revealed a median difference of -95 mcg (95% CI -120 to -70 mcg), further reinforcing the effectiveness of the infraorbital block in minimizing systemic opioid dependency. Notably, the calculated effect size of 0.82 indicates a large clinical effect of the nerve block on reducing postoperative opioid consumption. (Table 5)

Lastly, the quality of recovery was evaluated at 24 hours postoperatively using the QoR-15 questionnaire. A difference analysis using an independent T-test was conducted, as the QoR-15 data were normally distributed. The results showed that Group P1 achieved a significantly higher mean score (129.68 ± 5.36) compared to Group P2 (93.42 ± 3.29), with a p-value < 0.001. This higher score reflects superior patient-reported recovery outcomes across physical and emotional dimensions in the group receiving the bilateral infraorbital nerve block. (Table 6)

Tabel 1. Characteristics of the research sample

Characteristics	Intervention group		p-Value
	P1 (n=19)	P2 (n=19)	
Age (years)	41.05 ± 12.86	36.32 ± 13.96	0.284[1]
Gender (%)			
Male	6 (31.6)	11 (57.9)	0.103[2]
Female	13 (68.4)	8 (42.1)	
BMI (kg/m2)	22.49 ± 3.24	24.70 ± 2.11	0.018*[1]
Physical Status (%)			
ASA I	14 (73.7)	10 (52.6)	
ASA II	4 (21.1)	6 (31.6)	0.239[3]
ASA III	1 (5.2)	3 (15.8)	
Duration of Surgery (minutes)	118.05 ± 35.11	110.26 ± 27.19	0.449[1]
Duration of Anesthesia (minutes)	142 (122–197)	137 (124–147)	0.280[4]

[1]Independent t-test, [2]Chi-Square test, [3]Linear by Linear Association test, [4]Mann-Whitney U test,
Numerical variables are presented as mean ± SD for parametric data and median (Q1–Q3) for non-parametric data. Categorical variables are presented as n (%).
*p-value < 0.05 is considered statistically significant.

Table 2. Comparison of postoperative pain intensity (NRS) at 12 and 24 hours between groups

Variable	Intervention group		Δ Median P1–P2 (HL, 95% CI)	p-Value
	P1 n = 19 (IQR)	P2 n = 19 (IQR)		
NRS score at 12 hours	2 (2-3)	4 (3-5)	−2 (−3 to −2)	< 0.001[1]
NRS score at 24 hours	1 (0-2)	3 (2-3)	−2 (−2 to −1)	< 0.001[1]

[1]Mann–Whitney U test, p < 0.05 is considered statistically significant.
Data are presented as median (IQR). The Δ median P1–P2 is calculated using the Hodges–Lehmann estimate; negative values indicate that NRS scores in Group P1 are lower than in Group P2

Table 3. Time to first PCA demand (only for those who required it)

Variable	Intervention group		Mean difference (P1–P2), 95% CI	p-Value
	P1, n = 6 (Mean ± SD)	P2, n =19 (Mean ± SD)		
Time to first PCA demand (minutes)	377.83 ± 120.50	175.84 ± 53.07	201.99 (75.96–328.02)	0.008[1]

[1]Welch independent t-test; normality assumed (Shapiro–Wilk p > 0.05); non-homogeneous variance (Levene's test p < 0.001).
Note: n is calculated only for patients who required PCA demand.

Table 4. Comparison of postoperative PCA requirements between groups

Variable	Intervention group		p-Value
	P1	P2	
Patients requiring PCA			
Yes	6 (31.6%)	19 (100%)	<0.001[1]
No	13 (68.4%)	0 (0%)	

[1]Fisher's exact test,

Table 5. Comparison of total 24 hour postoperative opioid consumption between groups

Variable	Intervention group		p-Value	Δ median P1–P2 (mcg), HL (95% CI)	*Effect size* (r)
	P1 n = 19 (IQR)	P2 n = 19 (IQR)			
Total 24-hour fentanyl consumption (mcg)	145 (100-150)	220 (195-265)	< 0.001[1]	−95 (−120 to −70)	0.82

[1]*Mann Whitney U test*, p < 0.05 is considered statistically significant. Data are presented as median (IQR). The Δ median is calculated using the Hodges–Lehmann estimate; negative values indicate that fentanyl requirement in Group P1 is lower than in Group P2. Effect size r is calculated from $|Z|/\sqrt{N}$ ($r \approx 0.82$; large effect).

Table 6. Comparison of total QoR-15 scores at 24 hours postoperatively between the two research groups

Variable	Intervention group		Mean difference P1–P2 (poin, 95% CI)	p-Value	Effect size (Cohen's d)
	P1, n =19 (Mean ± SD)	P2, n =19 (Mean ± SD)			
Total QoR-15 score at 24 hours	129.68 ± 5.36	93.42 ± 3.29	36.26 (95% CI 33.32–39.21)	<0.001[1]	8.16

[1]*independent t-test*

Data are presented as mean ± standard deviation (SD). Data are presented as mean ± standard deviation (SD). Mean difference is calculated as P1–P2. Effect size is reported as Cohen's d = 8.16, indicating a very large effect.

DISCUSSION

The primary objective of this clinical investigation was to evaluate the efficacy of integrating ultrasound-guided bilateral infraorbital nerve blocks (IONB) with a general anesthesia regimen for managing postoperative pain and recovery quality in patients undergoing nasal surgery.[2,11] Surgical interventions on the nasal structures are frequently associated with significant postoperative distress, primarily triggered by mucosal trauma, nasal bone osteotomy, and the subsequent application of nasal packing.[3,5] Our findings offer strong support for the integration of this regional block within a multimodal pain management strategy, as it leads to superior postoperative analgesia and a more favorable recovery experience than general anesthesia.[7,11,18,20]

In the present study, baseline characteristics—including age, gender distribution, and ASA physical status—were statistically comparable between the two cohorts. Although a minor discrepancy in BMI was noted (p=0.018), both groups remained within a similar clinical range, ensuring that the variations in postoperative outcomes were a direct consequence of the nerve block intervention rather than inherent physiological differences between participants.[2,7,11]

A major highlight of this research is the dramatic attenuation of pain intensity in the IONB group. Patients in Group P1 demonstrated significantly lower NRS scores at both the 12-hour and 24-hour postoperative marks (p < 0.001).[17] This

finding aligns with previous studies, such as those by Kacar et al., which suggest that preemptive blockade of the terminal branches of the maxillary nerve effectively interrupts nociceptive signals before they can trigger central sensitization.[2,21] From a neuroanatomical perspective, the infraorbital nerve provides essential sensory feedback for the midface and anterior nasal structures.[9,10] By precisely depositing 0.5% bupivacaine at the infraorbital foramen under ultrasound guidance, we successfully mitigated the afferent pain pathways activated by surgical trauma.[13,15]

Furthermore, the data revealed a profound opioid-sparing effect. In the intervention group, the necessity for PCA fentanyl was limited to only 31.6% of subjects, whereas every patient in the control group required rescue opioids ($p < 0.001$).[7] Additionally, the latency to the first analgesic demand was significantly prolonged in Group P1 ($p=0.008$).[11] These results are consistent with the study of Kim et al., indicating that regional techniques stabilize the perioperative stress response and facilitate a smoother transition into the recovery phase. Reducing systemic opioid reliance is a critical clinical goal, as it diminishes the likelihood of adverse events such as respiratory depression, pruritus, and postoperative nausea, which often hinder early mobilization and patient comfort.[7,8,11]

This study also emphasized the enhancement of recovery quality, measured through the QoR-15 instrument.[16,18] The significantly higher scores observed in the IONB group ($p < 0.001$) indicate that the clinical benefits of this technique transcend simple pain relief. The QoR-15 scores reflect improvements in both emotional well-being and physical independence, suggesting that effective regional analgesia promotes a more holistic recovery experience. This supports the modern anesthetic paradigm that prioritizes patient-centered outcomes and the overall quality of the postoperative period.[18,19]

The application of ultrasound technology was fundamental to the success of this trial. Unlike traditional landmark-based palpation, which is subject to anatomical variability, real-time USG allows for exact needle placement and monitored local anesthetic spread, thereby minimizing the risk of vascular injury or nerve trauma. Infraorbital nerve block approach provides an optimal balance of technical feasibility and clinical effectiveness, making it a highly practical addition to routine multimodal pain management in nasal surgeries.[12,13,15]

CONCLUSION

The integration of ultrasound-guided bilateral infraorbital nerve blocks with general anesthesia demonstrates superior effectiveness compared to general anesthesia alone for patients undergoing nasal surgery. This combination significantly optimizes postoperative outcomes by providing lower pain intensity scores and extending the duration of analgesia. Furthermore, the application of this regional technique achieves a substantial opioid-sparing effect and enhances the overall quality of recovery, as evidenced by higher patient-reported recovery scores within the first 24 hours postoperatively.

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