EFFECTIVENESS OF SUPRAZYGOMATIC MAXILLARY BLOCK SUPPLEMENTATION IN GENERAL ANESTHESIA FOR MIDFACIAL SURGERY

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ABSTRAK

Operasi midfasial sering menimbulkan nyeri hebat yang dapat mempengaruhi durasi perawatan pascaoperasi. Opioid tetap menjadi standar utama dalam mengelola nyeri akut pascaoperasi, namun penggunaannya terkait dengan efek samping seperti mual, muntah, sedasi, dan risiko komplikasi pernapasan. Oleh karena itu, blok saraf regional seperti Suprazygomatic Maxillary Block (SMB) menawarkan alternatif untuk mengurangi dosis opioid dan efek sampingnya, mendukung konsep Enhanced Recovery After Surgery (ERAS). Penelitian ini merupakan uji coba terkontrol secara acak, single-blind, dan dilakukan di satu lokasi dengan 40 sampel yang dibagi menjadi dua kelompok: Kelompok P1 (anestesi umum dengan SMB menggunakan 5 ml ropivakain 0,375%) dan Kelompok P2 (anestesi umum tanpa SMB). Parameter yang dianalisis meliputi kebutuhan fentanyl intraoperatif, waktu pemberian analgesik penyelamat pertama, total kebutuhan opioid dalam 24 jam, kejadian mual dan muntah, serta kualitas pemulihan pascaoperasi (QoR-40), menggunakan SPSS versi 26. Hasil penelitian menunjukkan bahwa kebutuhan fentanyl intraoperatif lebih rendah pada Kelompok P1 (2,10 mcg/kgBB vs. 2,61 mcg/kgBB, p<0,001). Waktu pemberian analgesik penyelamat pertama lebih lama pada Kelompok P1 (13 jam vs. 2 jam, p=0,004), dan total kebutuhan opioid dalam 24 jam lebih rendah (0 mcg vs. 180 mcg, p<0,001). Kelompok P2 memiliki risiko mual dan muntah yang lebih tinggi (RR 2,54, p=0,004) dan skor QoR-40 pascaoperasi yang lebih rendah (198 vs. 162, p<0,001). Kesimpulannya, suplementasi SMB secara efektif mengurangi kebutuhan opioid intra dan pascaoperasi, menunda waktu pemberian analgesik penyelamat pertama, serta menurunkan risiko mual dan muntah pascaoperasi.

Kata kunci : anestesi umum, kualitas pemulihan, Maxillary Block, operasi midfasial, opioid

ABSTRACT

Midfacial surgery often causes severe pain that can affect the duration of postoperative care. Opioids remain the gold standard for managing acute postoperative pain, but their use is associated with side effects such as nausea, vomiting, sedation, and the risk of respiratory complications. This study is a single-site, single-blind, randomized controlled trial involving 40 samples divided into two groups: Group P1 (general anesthesia with SMB using 5 ml of 0.375% ropivacaine) and Group P2 (general anesthesia without SMB). The analyzed parameters included intraoperative fentanyl requirements, time to first rescue analgesic administration, total opioid requirements within 24 hours, incidence of nausea and vomiting, and postoperative quality of recovery (QoR-40), using SPSS version 26. The results showed that intraoperative fentanyl requirements were lower in Group P1 (2.10 mcg/kgBW vs. 2.61 mcg/kgBW, p<0.001). The time to first rescue analgesic was longer in Group P1 (13 hours vs. 2 hours, p=0.004), and the total opioid requirement within 24 hours was lower (0 mcg vs. 180 mcg, p<0.001). Group P2 had a higher risk of nausea and vomiting (RR 2.54, p=0.004) and a lower postoperative QoR-40 score (198 vs. 162, p<0.001). In conclusion, SMB supplementation effectively reduces intraoperative and postoperative opioid requirements, delays the need for the first rescue analgesic, and decreases the risk of postoperative nausea and vomiting.

Keywords *: general anesthesia, opioids, midfacial surgery, Maxillary Block, quality of recovery*

INTRODUCTION

Surgery in the midfacial area is a procedure that requires special attention to airway patency and postoperative pain management. Significant postoperative pain can affect patient recovery time and increase the risk of postoperative complications (Kenth & Walker, 2024). Therefore, general anesthesia with effective analgesics is necessary during and after surgery to reduce pain and improve patient comfort. However, the use of opioids as the primary analgesic in midfacial surgery remains a concern due to its considerable side effects, including the risk of upper airway obstruction, respiratory complications, as well as other adverse effects such as postoperative nausea and vomiting (PONV), sedation, itching, urinary retention, constipation, and the risk of tolerance due to long-term use (Wu et al., 2024).

Opioids are the gold standard for managing acute postoperative pain, but their use can increase the risk of complications that prolong hospital stays (Rahman et al., 2023). As an alternative, regional anesthesia techniques such as the Suprazygomatic Maxillary Block (SMB) have been developed to reduce opioid requirements and associated side effects (Alvarez et al., 2021). This nerve block works by inhibiting pain impulses from the maxillary nerve, which is responsible for pain during midfacial surgical procedures. Previous studies have shown that SMB can reduce intraoperative opioid requirements and prolong the time to first rescue analgesic administration after surgery (Nores et al., 2020).

A study by (Le et al., 2023) reported that patients receiving SMB as part of multimodal pain management experienced a 40% reduction in opioid requirements compared to those who received only general anesthesia. Additionally, another study by (Lin et al., 2024) found that SMB not only reduced opioid consumption but also decreased the incidence of PONV and improved patient recovery quality based on the Quality of Recovery-40 (QoR-40) score. A recent study by (Wardani et al., 2024) conducted in Indonesia also supported these findings, demonstrating that patients who received SMB had lower pain levels and shorter recovery durations compared to those who received only general anesthesia without regional nerve blocks.

Besides its effectiveness in reducing opioid requirements, SMB also has a high safety profile with minimal risk of complications. This technique is relatively easy to perform and can be integrated into the Enhanced Recovery After Surgery (ERAS) protocol for midfacial surgeries (Anderson Jara Ferreira et al., 2024). Therefore, this study aims to evaluate the effectiveness of SMB in reducing intraoperative and postoperative opioid consumption, delaying the need for the first rescue analgesic, and decreasing the incidence of side effects such as PONV, thereby improving the overall quality of patient recovery following midfacial surgery.

METHOD

This study is a true experimental research utilizing a single-blind randomized controlled trial design. The subjects were divided into two groups: the experimental group, which received the Suprazygomatic Maxillary Block (SMB), and the control group, which received standard anesthesia without an adjuvant nerve block. Randomization was performed to assign subjects to either the experimental or control group, and blinding was applied to both the subjects and the researcher. The study evaluated total intraoperative fentanyl consumption, the duration of the analgesic effect, total opioid requirements within the first 24 hours postoperatively, and recovery quality using the QoR-40 score. The research was conducted in the operating room of the Central Surgical Installation at a teaching hospital from April to October 2024.

The inclusion criteria consisted of adult patients aged 18–65 years undergoing mastectomy surgery with an ASA physical status classification of I–III. The exclusion criteria included a

history of drug allergies, infections at the intended nerve block site, severe cardiovascular disorders, a body mass index (BMI) of ≥30 kg/m², chronic analgesic use, ongoing anticoagulant therapy that had not been discontinued according to guidelines, coagulopathy, refusal by the patient or their guardian to sign the informed consent form, and patients with impaired consciousness. Subjects were classified as dropouts if they experienced complications such as allergic reactions, severe bleeding, or death, or if they required ventilatory support postoperatively.

The Suprazygomatic Maxillary Block (SMB) procedure begins after the patient has undergone general anesthesia and endotracheal intubation. The block site is identified above the zygomatic bone to ensure accurate needle placement. A high-frequency linear array ultrasound transducer (7–12 MHz) is prepared and positioned longitudinally along the side of the face, just below the zygomatic bone, with a 45° tilt in both the frontal and horizontal planes. The pterygopalatine fossa is then identified as the target area, bordered anteriorly by the maxilla and posteriorly by the greater wing of the sphenoid bone. A 50 mm sono-visible needle is inserted using an out-of-plane technique, perpendicular to the skin. The needle is advanced to a depth of approximately 20 mm until it reaches the greater wing of the sphenoid bone. It is then slightly retracted and redirected toward the nasolabial fold at an angle of 20° forward and 10° downward.

Once the needle is correctly positioned, local anesthetic is administered using 0.375% ropivacaine at a dose of 0.1 ml/kg, with a maximum volume of 5 ml, ensuring negative aspiration before injection. After the anesthetic is delivered, the needle is withdrawn and repositioned to its neutral state. Postoperatively, patients receive analgesia through patient-controlled analgesia (PCA) morphine on demand, with a bolus dose of 20 mcg per squeeze, a maximum dose of 100 mcg every four hours, and a lockout interval of six minutes. Additionally, oral ibuprofen 400 mg is administered every eight hours, while paracetamol 500 mg is given every six hours to enhance pain management. Following surgery, patients are transferred to the ward, where the Acute Pain Service (APS) team closely monitors their pain management. The first use of the PCA button and the total opioid consumption within the first 24 hours are recorded through the PCA machine. Any complications or side effects during surgery and postoperatively, such as hypotension, arrhythmia, bradycardia, nausea, vomiting, intravascular injection, lower extremity muscle weakness, and systemic toxicity of local anesthesia, are documented in the evaluation records for further analysis.

The statistical analysis in this study is conducted to describe the characteristics of the subjects and research variables based on the treatment group. Descriptive analysis is used to present numerical data, where normally distributed variables are expressed as mean and standard deviation (SD), while non-normally distributed variables are reported using the median and interquartile range (IQR). To determine the distribution pattern, a normality test is performed using the Shapiro-Wilk test at a significance level of 0.05. Variables such as age (years), body mass index (BMI) (kg/m²), pain scale distribution, total intravenous opioid use, time interval to the first postoperative PCA use, and postoperative recovery quality are assessed. Data is considered normally distributed if $p > 0.05$. A homogeneity test is conducted to evaluate variance equality between groups using Levene's test, where variance is deemed homogeneous if $p > 0.05$ and non-homogeneous if $p \leq 0.05$.

To compare total intraoperative and postoperative intravenous opioid consumption, analgesic duration, and postoperative recovery quality measured through the QoR-40 score, an independent t-test is applied when the data follows a normal distribution. If the data distribution is non-normal, the Mann-Whitney test is used instead. For qualitative data representation, variables such as ASA physical status and complications, including nausea and vomiting, are analyzed using percentages and figures presented through a 2x2 cross-tabulation analysis. The Chi-Square test is applied to examine statistical significance. Conclusions are drawn based on

a 95% confidence interval (CI) and a significance level of $\alpha < 0.05$. All statistical analyses are performed using SPSS statistical software.

RESULTS

The sample's characteristics can be seen in Table 1. All the subjects between the case and the control group were comparable.

Table 1 Subject Characteristics

Patient Characteristics	Group		p-value
	Case (n=20)	Control(n=20)	
Age (year)	34 (23)	33,5 (33)	0,989[a]
Gender			
Male	15 (75%)	10 (50%)	0,102[b]
Female	5 (25%)	10 (50%)	
IMT (kg/m2)	24,08±4,11	24,09±3,31	0,97[c]
ASA Physical Status			0,183[b]
I, n (%)	4 (20%)	9 (45%)	
II, n (%)	11 (55%)	6 (30%)	
III, n (%)	5 (25%)	5 (25%)	
Surgery duration (minute)	106,00±21,55	106,00±25,63	1,000[c]
Apfel Score			
1	5 (25%)	10 (50%)	0,102[b]
2	15 (75%)	10 (50%)	

[a]Uji *Mann-Whitney*; [b]Uji Chi-Square, [c]Independent sample t-test, significant if $p < 0.05$

Comparison Of Total Intraoperative Fentanyl Consumption In Both Groups

The results of the analysis of intraoperative fentanyl requirements using the Mann-Whitney test are presented in Table 2, showing that the SMB group with general anesthesia had a median intraoperative fentanyl requirement of 2.10 mcg/kg body weight with an IQR of 0, which was lower than the single anesthesia group with a median of 2.61 mcg/kg body weight and an IQR of 0. This difference was statistically significant with $p<0.001$.

Tabel 2. Differences in Fentanyl Use Intraoperatively Between Group A and Group B

Groups	Group A (general anesthesia+ SMB)	Group B (general anesthesia)	p-value
Total fentanyl intraoperatively (mcg/kgBW) (Median ± IQR)	2,10 (0)	2,61 (0)	<0,001*

* Mann-Whitney Test.

Comparison Of Analgesic Duration Until First Rescue Analgeticin Both Groups

The analysis of Analgesic duration until first rescue analgeticin both groups using Mann-Whitney are presented in table 3.

Tabel 3. Analgesic Duration Until First Rescue Analgetic Between Group A and Group B

Groups	Group A (general anesthesia+ SMB)	Group B (general anesthesia)	p-value
Analgesic duration until first rescue analgetic (Hour)	13 (0)	2 (1)	0,004*

* Mann-Whitney Test.

The SMB group with general anesthesia had a median time to first rescue analgesic administration of 13 hours with an IQR of 0, which was longer than the single anesthesia group

with a median of 2 hours and an IQR of 1. This difference was statistically significant with p=0.004.

Analysis of Total 24-Hour Opioid Requirement for Suprazygomatic Maxillary Block Supplemented with General Anesthesia Compared to General Anesthesia Alone in Midfacial Surgery

The analysis of the total 24-hour opioid (fentanyl) requirement using the Mann-Whitney test is presented in table 4.

Tabel 4. Total Opioid Consumption 24 Hours Postoperative Between Group A and Group B

Groups	Group A (general anesthesia+ SMB)	Group B (general anesthesia)	p-value
Total opioid consumption 24 hours postoperative (mcg)	0 (0)	180 (35)	<0,001*

* Mann-Whitney Test.

The SMB group with general anesthesia had a median total 24-hour opioid (fentanyl) requirement of 0 mcg with an IQR of 0, which was lower than the single anesthesia group with a median of 180 mcg and an IQR of 35. This difference was statistically significant with p<0.001.

Analysis of Opioid Side Effects for Suprazygomatic Maxillary Block Supplemented with General Anesthesia Compared to General Anesthesia Alone in Midfacial Surgery

The risk of opioid side effects, analyzed using the bivariate Chi-Square test, is presented in Table 5. The results showed that nausea and vomiting were most frequent in the general anesthesia group, affecting 7 subjects (35%), while no cases of nausea and vomiting were found in the SMB-supplemented general anesthesia group. The relative risk was 2.54 times higher in the single general anesthesia group, with a 95% CI (1.66-3.87), which was statistically significant with p=0.004.

Tabel 5. Comparison Of Side Effects Between Group A and Group B

Groups	Group A (SMB)	Group B	RR	CI95%	p-value
Nausea Vomiting					
Yes	7 (35%)	0 (0%)	2,54	1,66-3,87	0,004*
No	13 (65%)	20 (100%)			
Bradycardia					
Yes	-	-			
No	20 (100%)	20 (100%)			
Hypotension					
Yes	-	-			
No	20 (100%)	20 (100%)			

* Chi-Square Test.

Analysis of Postoperative Recovery Quality (QoR-40) for Suprazygomatic Maxillary Block Supplemented with General Anesthesia Compared to General Anesthesia Alone in Midfacial Surgery

The analysis of differences in postoperative recovery quality (QoR-40), using the Mann-Whitney test, is presented in Table 6. The results showed that the overall total QoR quality in the SMB group with general anesthesia had a median of 198 and an IQR of 14, which was

higher than the single anesthesia group with a median of 162 and an IQR of 12. This difference was statistically significant with p<0.001.

Tabel 6. Comparison Of Side Effects Between Group A and Group B

Groups	Group A (SMB)	Group B	RR
Comfort	60 (8)	48 (3)	<0,001*
Feeling	45 (2)	32 (3)	<0,001*
Physical Independence	25 (2)	20 (2)	<0,001*
Patient's support	35 (1)	35 (1)	0,467
Pain	35 (2)	26,5 (4)	<0,001*
Total recovery quality	198 (14)	162 (12)	<0,001*

* *Mann Whitney test* p<0,05

The individual scores for comfort, emotions, independence, and pain quality were also found to be statistically significantly higher in the SMB group with general anesthesia compared to the single anesthesia group, with p<0.001. Meanwhile, the family support score showed no significant difference, with a p-value of 0.467.

DISCUSSION

This study shows that patients receiving SMB supplementation with general anesthesia had lower intraoperative fentanyl requirements, with a median of 2.1 mcg/kg body weight compared to 2.61 mcg/kg in the general anesthesia-only group, a difference that is statistically significant (p<0.001). This finding supports evidence that regional anesthesia techniques like SMB can reduce the need for additional analgesics like fentanyl during surgery, which is crucial for minimizing opioid side effects. This is further demonstrated by reduced opioid-related side effects, including PONV (postoperative nausea and vomiting), making this difference not only statistically but also clinically significant. This study aligns with other research indicating that regional nerve blocks, such as SMB, help reduce intraoperative opioid needs. Research by Wang and Dillon demonstrated that regional blocks in the facial area effectively reduce analgesic needs by inhibiting pain transmission more effectively in the surgical area (Smith et al., 2021). Additionally, a study by Echaniz et al. supports this finding, emphasizing that nerve blocks in facial surgery not only reduce opioid requirements but also improve patient comfort during recovery (Miriam De Nadal & Hernández-Alfaro, 2024).

The Suprazygomatic Maxillary Block (SMB) reduces the need for fentanyl during surgery by blocking pain signal transmission through specific nerves associated with the surgical area. SMB targets the maxillary nerve (V2), a branch of the trigeminal nerve that innervates the midface. By blocking this nerve, SMB directly prevents pain transmission from the surgical area to the central nervous system, meaning the brain doesn't receive strong pain stimuli. Consequently, the body requires fewer systemic analgesics, such as fentanyl, to control pain (Cao et al., 2021; Miriam De Nadal & Hernández-Alfaro, 2024). Additionally, by blocking pain transmission, SMB minimizes stress responses typically triggered by intraoperative pain, such as increased heart rate and blood pressure. SMB also helps stabilize patient hemodynamics during surgery due to lower pain stimulation, allowing for a reduced opioid dose compared to general anesthesia alone without nerve block. Thus, SMB is very beneficial for reducing intraoperative opioid use, preventing excessive opioid side effects, and improving patient comfort during and after surgery (Norozy et al., 2020). The study found that the group receiving SMB supplementation with general anesthesia had a delayed time to first rescue analgesic administration, with a median of 13 hours, statistically significant (p=0.004) compared to the single general anesthesia group with a median of 2 hours. This shows SMB's effectiveness in extending the duration of analgesia.

A previous study by Abu Elyazed & Mostafa using 0.5% bupivacaine reported an analgesia duration of 8 hours. The longer analgesia duration in this study may be due to the different local anesthetic used. Ropivacaine theoretically has anti-inflammatory effects by reducing IL-6 and TNFα levels and also has vasoconstrictive effects, which can extend the analgesic duration (Echaniz et al., 2019; Meechan, 2002). The SMB block functions by blocking pain signal transmission from the maxillary nerve (V2), which reduces or eliminates pain perception in the midface area. This blocking effect not only reduces the need for analgesics during surgery but also extends the pain-free postoperative period, as evidenced by delayed rescue analgesic requirements. Longer-lasting analgesia with SMB provides additional comfort for patients, reducing the need for postoperative opioids and helping to minimize side effects associated with excessive use of systemic analgesics. This is especially beneficial in midfacial surgery, which can cause significant postoperative pain, particularly when general anesthesia alone is insufficient for continuous pain control. This study supports the use of regional nerve blocks like SMB in midfacial surgery to enhance postoperative pain management.

These results are consistent with studies by Elyazed and Mostafa, Chiono et al., Echaniz et al. , Nores et al., and Smith et al., which report that regional blocks in the face, including SMB, effectively extend pain-free duration and reduce postoperative analgesic use (Abu Elyazed & Mostafa, 2018; Alfaro-de La Torre et al., 2019; Nores et al., 2020; Smith et al., 2021). The total 24-hour opioid (fentanyl) requirement in the SMB supplementation group with general anesthesia was lower, with a median of 0 mcg, compared to 180 mcg in the single general anesthesia group, a statistically significant difference ($p<0.001$). The median was used in statistical calculations due to non-normally distributed data, while the mean total 24-hour opioid requirement in the SMB supplementation group with general anesthesia was 3 mcg, compared to 192 mcg in the single general anesthesia group. This demonstrates SMB's effectiveness in reducing postoperative opioid consumption, which is crucial, as opioids are often associated with various side effects, including nausea, vomiting, respiratory depression, and risk of dependency.

Single general anesthesia produced a higher risk of nausea and vomiting, with a Risk Ratio (RR) of 2.54 (95% CI 1.66-3.87; $p=0.004$) compared to the group receiving SMB supplementation. Interestingly, in the SMB group, no subjects experienced postoperative nausea and vomiting, showing a significant difference in these side effects. This suggests that SMB has a protective effect against postoperative nausea and vomiting (PONV). SMB can reduce intraoperative and postoperative opioid needs, a major factor in PONV. With lower opioid use, the risk of complications like nausea and vomiting is significantly reduced. In contrast, in the single general anesthesia group, higher opioid use likely contributed to the higher incidence of PONV.

These findings support existing evidence that regional blocks like SMB can minimize opioid use and therefore reduce the incidence of PONV, a common side effect of general anesthesia and opioid use. Implementing SMB as part of anesthesia management in midfacial surgery not only provides better pain control but also enhances patient comfort by reducing side effects associated with general anesthesia (Tsur et al., 2023; Wang & Dillon, 2021). Study results show that the overall quality of recovery (QoR) for the SMB supplementation group with general anesthesia was higher, with a median of 198 compared to 162 in the single general anesthesia group, a statistically significant difference ($p<0.001$). This indicates that using SMB not only improves pain control but also overall patient recovery quality. The aspects of comfort, emotions, independence, and pain control each showed significant differences with $p<0.001$, meaning patients in the SMB group felt more comfortable, more independent, and experienced less pain after surgery compared to those who received only general anesthesia. Interestingly, there was no significant difference in family support between the two groups, with a p-value

of 0.467. This suggests that family support, while important in patient recovery, is not influenced by the type of anesthesia used. Thus, the superior effects of SMB in enhancing clinically measurable recovery aspects confirm that SMB supplementation offers clear additional benefits over single general anesthesia in postoperative recovery, particularly in terms of patient comfort, pain, and independence. Overall, these results emphasize the importance of regional blocks like SMB in improving patient recovery outcomes after surgery while reducing risks associated with pain and opioid use, enabling decreased anti-nausea medication use, and shortening recovery times.

CONCLUSION

This study demonstrates that Suprazygomatic Maxillary Block (SMB) supplementation in general anesthesia significantly reduces intraoperative fentanyl requirements, with a median of 2.1 mcg/kg compared to 2.61 mcg/kg in the general anesthesia-only group ($p<0.001$). SMB is effective in minimizing opioid use, reducing side effects such as postoperative nausea and vomiting (PONV), and enhancing patient comfort. SMB works by blocking pain transmission through the maxillary nerve (V2), which not only decreases the need for analgesics during surgery but also extends the postoperative pain-free period. The SMB group had a significantly longer median time to first rescue analgesic administration (13 hours) compared to the general anesthesia-only group (2 hours) ($p=0.004$), highlighting its effectiveness in prolonging analgesia. The use of ropivacaine, which has anti-inflammatory and vasoconstrictive effects, contributed to the longer analgesic duration.

Additionally, the 24-hour postoperative opioid requirement was significantly lower in the SMB group, with a median of 0 mcg compared to 180 mcg in the general anesthesia-only group ($p<0.001$). The risk of PONV was also lower in the SMB group, with a risk ratio (RR) of 2.54 (95% CI 1.66-3.87; $p=0.004$), indicating a protective effect of SMB against opioid-related side effects. In terms of recovery quality, the SMB group had a significantly higher Quality of Recovery (QoR) score, with a median of 198 compared to 162 in the general anesthesia-only group ($p<0.001$). Patients in the SMB group experienced less pain, greater comfort, and improved independence after surgery, although there was no significant difference in family support ($p=0.467$). Overall, this study confirms that SMB is an effective regional anesthesia technique for reducing intraoperative and postoperative opioid requirements, minimizing side effects, and improving patient recovery outcomes following midfacial surgery.

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