THE EFFECTIVENESS OF GREATER AURICULAR NERVE (GAN) BLOCK USING ISOBARIC ROPIVACAINE AS AN ANALGESIC ADJUVANT AS COMPARED TO INTRAVENOUS OPIOID AS ANALGESIA FOR MIDDLE EAR SURGERY

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ABSTRAK

Penelitian ini bertujuan untuk menilai efektivitas Blok Saraf Aurikular Besar menggunakan ropivakain isobarik terhadap jumlah penggunaan opioid selama dan setelah operasi, penilaian hemodinamik, intensitas nyeri, dan penilaian respons mual dan muntah post-operatif. Jenis penelitian ini adalah eksperimental murni (eksperimental sejati). Desain penelitian yang digunakan adalah uji acak terkontrol buta tunggal (RCT). Jumlah subjek dalam penelitian ini adalah 48 pasien berusia di atas 18 tahun hingga 65 tahun yang menjalani operasi telinga bagian tengah-bagian dalam di Rumah Sakit Prof IGNG Ngoerah, Denpasar. Analisis data dilakukan menggunakan SPSS versi 26 untuk uji t-tidak tergantung. Hasil penelitian menunjukkan bahwa fentanyl P1 adalah 77,08 ± 32,90 mg dan P0 adalah 97,92 ± 37,53 mg, p = 0,003. Kebutuhan morfin ditemukan dalam 3 jam, P1 adalah 0,58 ± 0,77 mg dan P0 ditemukan menjadi 1,04 ± 0,69 mg, p < 0,001. Kebutuhan morfin 6 P1 adalah 0,79 ± 0,72 mg dan P0 ditemukan menjadi 2,63 ± 1,27 mg, p < 0,001. Kebutuhan morfin selama 24 jam P1 adalah 1,50 ± 1,14 mg dan P0 ditemukan menjadi 3,92 ± 1,66 mg, p < 0,001. Intensitas nyeri ditemukan lebih rendah pada 3, 6, 12, 18, dan 24 jam pada P1 (p <0,05). Perbaikan hemodinamik > 20% pada P0 ditemukan pada 15, 30, 60, dan 120 menit, sedangkan kelompok P1 ditemukan stabil (p <0,001). Skor mual dan muntah selama 24 jam P1 adalah 1,92 ± 1,01 dan P0 adalah 2,75 ± 1,03, p = 0,007.

Kata kunci **:** blok saraf aurikular besar, intensitas nyeri, ropivakain isobarik, stabilitas hemodinamik, telinga bagian tengah-dalam

ABSTRACT

This study aims to assess the effectiveness of Greater Auricular Nerve Block using isobaric ropivacaine on the amount of opioid use during and after surgery, hemodynamic assessment, pain intensity, and assessment of the post-operative nausea and vomiting response. This type of research is pure experimental (true experimental). The research design used was a single-blind randomized controlled trial (RCT). The number of subjects in this study were 48 patients aged over 18 years to 65 years who underwent middle-inner ear surgery at Prof IGNG Ngoerah Hospital, Denpasar. Data analysis was carried out using SPSS version 26 for the independent t-test. The results of the study showed that fentanyl P1 was 77.08 ± 32.90 mg and P0 was 97.92 ± 37.53 mg, p = 0.003. The need for morphine was found within 3 hours, P1 was 0.58 ± 0.77 mg and P0 was found to be 1.04 ± 0.69 mg, p < 0.001. The need for morphine 6 P1 was 0.79 ± 0.72 mg and P0 was found to be 2.63 ± 1.27 mg, p < 0.001. The 24-hour morphine requirement P1 was 1.50 ± 1.14 mg and P0 was found to be 3.92 ± 1.66 mg, p < 0.001. Pain intensity was found to be lower at 3, 6, 12, 18, and 24 hours on P1 (p < 0.05). Hemodynamic improvements of > 20% at P0 were found at 15, 30, 60, and 120 minutes, while the P1 group was found to be stable (p < 0.001). The nausea and vomiting score for 24 hours P1 was 1.92 ± 1.01 and P0 was 2.75 ± 1.03, p = 0.007.

Keywords ***:*** *greater auricular nerve block, pain intensity, isobaric ropivacaine, inner-middle ear, hemodynamic stability*

INTRODUCTION

Patients undergoing middle ear surgery at Prof I.G.N.G Ngoerah Teaching Hospital were administered general anesthesia, and the combination of general anesthesia with Greater Auricular Nerve (GAN) Block using isobaric ropivacaine has not been previously studied in assessing hemodynamic stability, nociceptive response, and intra- and post-operative opioid requirements. Intravenous opioid analgesics were administered to patients undergoing middle ear surgery, which poses an increased risk of postoperative nausea and vomiting (PONV). The use of general anesthesia combined with Greater Auricular Nerve Block using isobaric ropivacaine during surgery may benefit patients by maintaining hemodynamic stability and reducing opioid use, thus decreasing the risk of nausea and vomiting.

Microsurgery of the middle ear is also the most popular procedure in otology. The most common ear disorders requiring surgery are caused by Chronic Suppurative Otitis Media (CSOM), with an incidence rate of 65-330 million cases of otorrhea, where 60% of them suffer from conductive hearing loss causing discomfort to patients. General anesthesia is performed with the principle of patient comfort due to manipulation of position during surgery and requires positional stability due to microsurgery. Many studies have been conducted to help reduce the need for intravenous opioids, which can increase the risk of PONV, including peripheral nerve blocks. Peripheral nerve blocks studied include GAN block and Superficial Cervical Plexus (SCP) block (Ellison et al., 2020; Liu et al., 2020; Ökmen & Metin Ökmen, 2018; Ritchie et al., 2016). Pain management also plays a crucial role in postoperative mobility, but managing pain using opioid analgesics can be challenging due to opioid-related side effects such as nausea and vomiting.

The Greater Auricular Nerve (GAN) is a major sensory branch of the cervical plexus. Its innervation includes the inferior part of the ear, the skin above the mastoid process, the parotid gland, and the mandibular angle. GAN is more sensitive to local anesthetic block because it is located superficially, passing through the sternocleidomastoid muscle. Although this technique can be performed with anatomical landmark guidance, the use of ultrasound (USG) for needle guidance can enhance the success of the block. GAN block can be used for various emergency treatments, emergency departments, and surgical procedures to improve patient comfort, reduce pain, and decrease the need for intravenous (IV) anesthesia. Despite its usefulness and relatively straightforward blockade, literature describing the use of this technique is limited (Ellison et al., 2020; Liu et al., 2020; Ökmen & Metin Ökmen, 2018; Ritchie et al., 2016).

Selective GAN block produces fewer complications and side effects, including vessel puncture and blockade of the phrenic plexus, brachial plexus, and deep cervical plexus. The GAN method has the advantage of being highly selective for the large auricular nerve below with USG guidance. The helix, antitragus, lobule, and mandibular angle are consistently blocked by GAN, supporting the effectiveness of this low-volume regional anesthesia technique. Ultrasound-guided large auricular nerve blockade can be recommended as the only regional anesthesia technique in the sensory areas of the helix, antitragus, lobule, and mandibular angle and as part of a high-security analgesia concept compared to landmark methods. The advantage of USG guidance in the GAN method is to provide direct imaging and precise blockade of small and large peripheral auricular nerves with 100% accuracy (Thallaj et al., 2010).

The effectiveness of using GAN in parotidectomy cases was found in 67 patients undergoing the procedure, where there were no disturbances in quality of life, the blocked nerves could fully recover, and it could reduce postoperative pain intensity better than without GAN, with VAS of 1.9 ± 1.5 within 24 hours compared to without GAN with 3.1 ± 1.9 (Yan et al., 2021) (Yan et al., 2021). The risks of GAN procedure include local infection at the injection site and hematoma (Thallaj et al., 2010).

This study aims to assess the effectiveness of Greater Auricular Nerve Block using isobaric ropivacaine on the amount of opioid use during and after surgery, hemodynamic assessment, pain intensity, and assessment of postoperative nausea and vomiting response. If it is proven that Greater Auricular Nerve Block with isobaric ropivacaine can reduce the postoperative opioid requirement and maintain hemodynamic stability, it can provide valuable input for consideration regarding its use in relation to the clinical benefits of patients undergoing middle ear surgery at Prof. Dr. I.G.N.G Ngoerah Teaching Hospital.

METHOD

This study is a pure experimental research type. The research design used is a single-blind randomized controlled trial (RCT). The study begins with eligible samples being allocated at random into two groups: Group P0 (General anesthesia using intravenous opioids) and Group P1 (General anesthesia combined with Greater Auricular Nerve Block using isobaric ropivacaine). After the intervention guided by ultrasound during middle ear surgery, measurements were taken for hemodynamic stability during the operation, postoperative pain intensity, total opioid requirement during and 24 hours after the operation, as well as the side effects of nausea and vomiting.

This research was conducted in the Operating Room of the Central Surgical Installation (CSI) and the Amerta Wing of Prof. Dr. IGNG Ngoerah Teaching Hospital in Denpasar, starting from December 2023 until the required sample size was reached. The target population for this study includes all patients aged 18 to 65 years who are scheduled to undergo middle ear surgery. The research sample was drawn from the accessible population using consecutive sampling technique, where subjects meeting the research criteria were selected according to their arrival sequence until the required sample size was met. The inclusion criteria were as follows: patients aged 18 to 65 years undergoing middle ear surgery at Prof. IGNG Ngoerah Teaching Hospital in Denpasar with ASA physical status I-II. Exclusion criteria included drug allergies, cardiovascular disorders including blood pressure disturbances (hypertension and hypotension), history of opioid abuse, history of chronic analgesic medication use for more than 3 months, recent use of blood thinners within the last 7 days, and patient unwillingness to participate in the study. Dropout criteria comprised complications during the procedure such as severe bleeding, cardiac arrhythmias, and shock, allergic reactions to ropivacaine and opioids, and postoperative ventilator use. The sample size was estimated using the formula for multiple hypothesis sample size calculation with numerical outcomes. The formula utilized a hypothesis test for 2 populations (two-sided test) with the difference between 2 means. Based on previous research by (Ökmen & Metin Ökmen, 2018) the estimated sample size for each group was 22, considering a significance level (α) of 5% and a power ($1-\beta$) of 95%. Due to potential dropouts, an additional 10% was added to each group, resulting in a total required sample size of 48.

The sampling method employed was consecutive sampling, where all accessible populations meeting the inclusion criteria and not meeting the exclusion criteria or dropout criteria were selected in the order of their arrival, forming the eligible sample. For sample allocation, randomization was performed using a permuted block randomization technique. The samples in this study were divided into two groups: Group P0 (general anesthesia using intravenous opioid analgesics) and Group P1 (general anesthesia with Greater Auricular Nerve Block using isobaric ropivacaine).

The data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 23 for Windows. Data analysis was performed in three stages descriptive analysis aimed to describe the characteristics of subjects and research variables based on treatment groups. For numeric data, mean and standard deviation (SD) were presented if the

data distribution was normal; otherwise, median and interquartile range (IQR) were presented. Categorical data were presented as relative frequencies. The results of descriptive analysis were presented in cross-tabulation tables to assess the comparability of subjects between groups. The normality test was conducted for numeric data using the Shapiro-Wilk normality test since the sample size was less than 50. Data were considered normally distributed if $p > 0.05$ in the normality test. The homogeneity test was used to examine whether the data were homogenous or not (test of the equality of variances) using the F test (Levene's Test for Equality of Variance). Data were considered homogenous if $p > 0.05$ in the Levene's Test. The difference in total opioid consumption and pain scale between treatment groups was assessed using an independent t-test if the data distribution was normal. If one or both data sets were not normally distributed, the non-parametric Mann-Whitney test was used. Comparison of proportions for categorical data was conducted using 2x2 cross-tabulation analysis, and the statistical test used was the Chi-Square test. The comparisons were displayed in Relative Ratios (RR).

RESULTS

Characteristics of the Study Data

The total number of subjects in the study amounted to 48 respondents, divided into 2 groups, with each group consisting of 24 respondents, and no dropouts were found until the end of the study. The characteristics of the research data are presented in Table 1.

The mean age between the two groups did not differ significantly, with a p-value of 0.212. Group P1 had a mean age of 58.00±8.68 years, while Group P0 had a mean age of 60.58±4.96 years. The majority of subjects were males in both groups, with no significant difference found between them, with a p-value of 0.755. In Group P0, there were 16 (66.7%) male subjects and 8 (33.3%) female subjects, while in Group P1, there were 17 (70.8%) male subjects and 7 (29.2%) female subjects. Height was obtained with a mean between the two groups not significantly different, with a p-value of 0.379. Group P0 had a mean height of 1.61±0.44 m, and Group P1 had a mean height of 1.60±0.59 m. Weight was obtained with a mean between the two groups not significantly different, with a p-value of 0.967. Group P0 had a mean weight of 63.46±7.59 kg, and Group P1 had a mean weight of 63.54±6.39 kg. Body mass index (BMI) was obtained with a mean between the two groups not significantly different, with a p-value of 0.603. Group P0 had a mean BMI of 24.46±3.37 kg/m2, and Group P1 had a mean BMI of 24.98±3.49 kg/m2.

Table 1. Characteristics of Research Data

Variable	**Group**		**p-value**
	P1 (Blok GAN) (n=24)	P0 (Kontrol) (n=24)	
Age (years) (18-65) Mean ± SD	58,00±8,68	60,58±4,96	0,212a
Gender			
Male	16 (66,7%)	17 (70,8%)	0,755b
emale	8 (33,3%)	7 (29,2%)	
Height (m) mean±SD	1,61±0,44	1,60±0,59	0,379a
Weight (kg) mean±SD	63,46±7,59	63,54±6,39	0,967a
BMI kg/m2 mean±SD	24,46±3,37	24,98±3,49	0,603a
ASA			
ASA II	17 (70,8%)	16 (66,7%)	0,755b
ASA I	7 (29,2%)	8 (33,3%)	
Baseline Systolic (mmHg) mean±SD	115,92±9,19	113,92±5,25	0,360 a
Baseline Diastolic (mmHg) mean±SD	70,04±6,96	72,67±6,45	0,183 a
Baseline MAP (mmHg) mean±SD	85,21±5,28	85,96±4,40	0,596a

Baseline Heart Rate (bpm) mean±SD	71,67±7,34	73,21±7,96	0,489a
Duration of surgery (minutes)	87,08±24,04	92,50±23,45	0,434a

The highest obtained ASA value is ASA II compared to ASA I, with the result that both groups are not significantly different, with p=0.755. Group P0 obtained ASA II in 17 subjects (70.8%) and ASA I in 7 subjects (29.2%), while Group P1 obtained ASA II in 16 subjects (66.7%) and ASA I in 8 subjects (33.3%).

The baseline MAP results showed no significant difference between the two groups, with a p-value of 0.596. Group P0 had a mean ± SD of 85.21±5.28 mmHg, while Group P1 had a mean ± SD of 85.96±4.40 mmHg. Similarly, the baseline heart rate results indicated no significant difference between the two groups, with a p-value of 0.489. Group P0 had a mean ± SD of 71.67±7.34 bpm, whereas Group P1 had a mean ± SD of 73.21±7.96 bpm. The duration of the operation was also found to have no significant difference between the two groups, with a p-value of 0.197. Group P1 had a mean ± SD of 87.08±24.04 minutes, while Group P0 had a mean ± SD of 92.50±23.45 minutes. The normality of the data was confirmed using the Shapiro-Wilk test, and the homogeneity was assessed using Levene's test, as detailed in the appendix. The results indicated that the data were normally distributed and homogeneous.

Total Intravenous Opioid Use During and After Inner Ear Surgery

The total requirement for fentanyl during surgery and morphine 24 hours post-surgery is presented in Table 2., showing that the use of Greater Auricular Nerve Block technique using isobaric ropivacaine as an analgesic adjuvant can reduce opioid use during and after middle-inner ear surgery compared to the control. The results in Table 2. demonstrate a significant difference in fentanyl administration, with a p-value of 0.003. The mean for Group P1 was 77.08±32.90 mcg, whereas Group P0 had a mean of 97.92±37.53 mcg. There was a significant difference in morphine requirement at 3 hours, with a p-value of less than 0.001. The mean for Group P1 was 0.58±0.77 mg, whereas Group P0 had a mean of 1.04±0.69 mg. Similarly, there was a significant difference in morphine use at 6 and 24 hours post-surgery, with p-values of less than 0.001. For 6 hours, Group P1 had a mean of 0.79±0.72 mg, while Group P0 had a mean of 2.63±1.27 mg. At 24 hours, Group P1 had a mean of 1.50±1.14 mg, and Group P0 had a mean of 3.92±1.66 mg.

Table 2. Test of Difference in Opioid Administration

Variable	Group (Mean ± SD)	p-value
P1 (GAN Block)		
Fentanyl (mcg)	77.08 ± 32.90	0.003*
Morphin (mg)		
- 3 hours	0.58 ± 0.77	0.036*
- 6 hours	0.79 ± 0.72	<0.001*
- 24 hours	1.50 ± 1.14	<0.001*
P0 (Control)		
Fentanyl (mcg)	97.92 ± 37.53	
Morphin (mg)		
- 3 hours	1.04 ± 0.69	
- 6 hours	2.63 ± 1.27	
- 24 hours	3.92 ± 1.66	

Test of Pain Intensity Difference

The results for pain intensity are presented in Table 5.3 and Figure 5.1, indicating that the pain intensity was lower at 3, 6, 12, 18, and 24 hours post-operation when using the Greater Auricular Nerve Block technique with ropivacaine as an adjuvant analgesic compared to intravenous opioid usage ($p<0.05$).

Table 3. Comparison of Opioid Administration

Variable	Variable Group (mean±SD)		p-Value p[a]
	P1 (Blok GAN) (n=24)	P0 (Kontrol) (n=24)	
Fentanyl Administration (mcg)	77,08±32,90	97,92±37,53	0,003*
Morphine Administration (mg)			
Morphine at 3 hours	0,58±0,77	1,04±0,69	0,036*
Morphine at 6 hours	0,79±0,72	2,63±1,27	<0,001*
Morphine at 24 hours	1,50±1,14	3,92±1,66	<0,001*

Difference Test of Pain Intensity

The results of the pain intensity are presented in Table 5.3 and Figure 5.1, indicating that the pain intensity was lower at 3, 6, 12, 18, and 24 hours when using the Greater Auricular Nerve Block technique with ropivacaine isobaric, compared to intravenous opioid use ($p<0.05$).

Table 4. Difference Test of Pain Intensity

Pain Intensity (in hours)	Variable Group (mean±SD)		p-Value p[a]
	P1 (Blok GAN) (n=24)	P0 (Control) (n=24)	
3	0	4,08±1,21	<0,001*
6	0,81±0,71	3,54±1,38	<0,001*
12	0,75±1,11	2,63±1,17	<0,001*
18	0,75±0,73	2,25±0,53	<0,001*
24	0,58±0,42	2,04±0,85	<0,001*

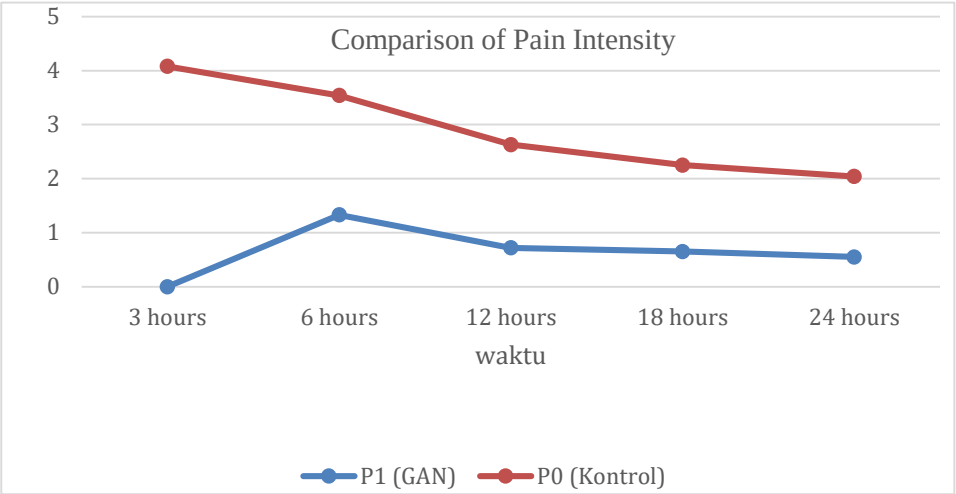

Figure 1. Results of Pain Intensity Differences

Comparison of Hemodynamic Parameters

In this study, a comparison was made between systolic, diastolic, mean arterial pressure (MAP), and heart rate (HR) hemodynamics as presented in Tables 5.4-5.7 and depicted in Figures 2-5.

Table 5. Comparison of Systolic Blood Pressure

Systolic (in minutes)	Group (mean±SD) mmHg		p-Value p[a]
	P1 (Blok GAN) (n=24)	P0 (Control) (n=24)	
Baseline	115,92±9,19	113,92±5,25	<0,001*
15	121,00±9,33	139,67±9,55	<0,001*
30	119,29±9,84	137,73±9,99	<0,001*

60	119,17±8,13	137,29±9,99	<0,001*
120	117,25±8,06	135,29±9,99	<0,001*
240	115,17±7,95	131,67±9,04	<0,001*
480	119,42±8,62	128,92±5,25	0.053
720	116,67±8,22	118,33±5,29	0,508
1440	115,67±8,22	115,88±4,86	0,687

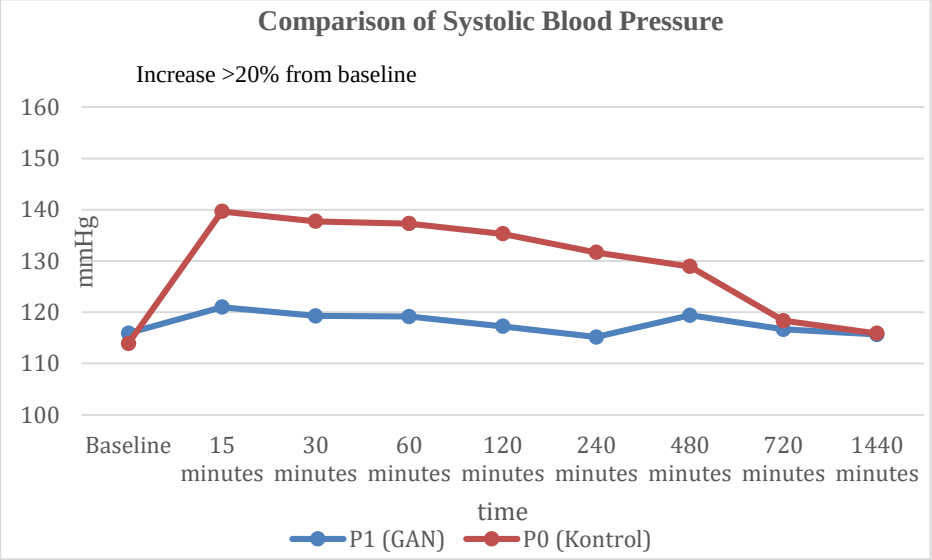

Figure 2. Systolic Blood Pressure Changes

Significant differences were observed in systolic blood pressure at minutes 15, 30, 60, 120, and 240 post-operation (P<0.05) when using Greater Auricular Nerve Block with ropivacaine isobaric compared to intravenous opioids during middle ear surgery. At minutes 480, 720, and 1440, no significant differences were noted between the two groups, indicating stability in systolic blood pressure. The P0 group showed an increase of more than 20% from baseline at initial to 120 minutes. Significant differences in diastolic blood pressure were observed at minutes 15, 30, 60, 120, and 240 post-operation (P<0.05). At minutes 480, 720, and 1440, no significant differences were noted between the two groups, indicating stability in diastolic blood pressure. The P0 group showed an increase of more than 20% from baseline at initial to 120 minutes.

Table 6. Comparison of Diastolic Blood Pressure

Diastolic (in minutes)	**Group (mean±SD) mmHg**		**p-Value p[a]**
	P1 (Blok GAN) (n=24)	P0 (Control) (n=24)	
Baseline	70,04±6,96	72,67±6,45	<0,001*
15	78,38±8,79	89,75±5,04	<0,001*
30	77,79±6,81	89,00±5,23	<0,001*
60	76,08±7,38	88,38±5,02	<0,001*
120	74,58±7,25	87,63±5,28	<0,001*
240	73,25±7,65	80,79±4,30	<0,001*
480	71,63±7,30	74,42±5,95	0,153
720	69,88±7,75	72,67±5,50	0,158
1440	70,08±7,75	72,63±5,64	0,168

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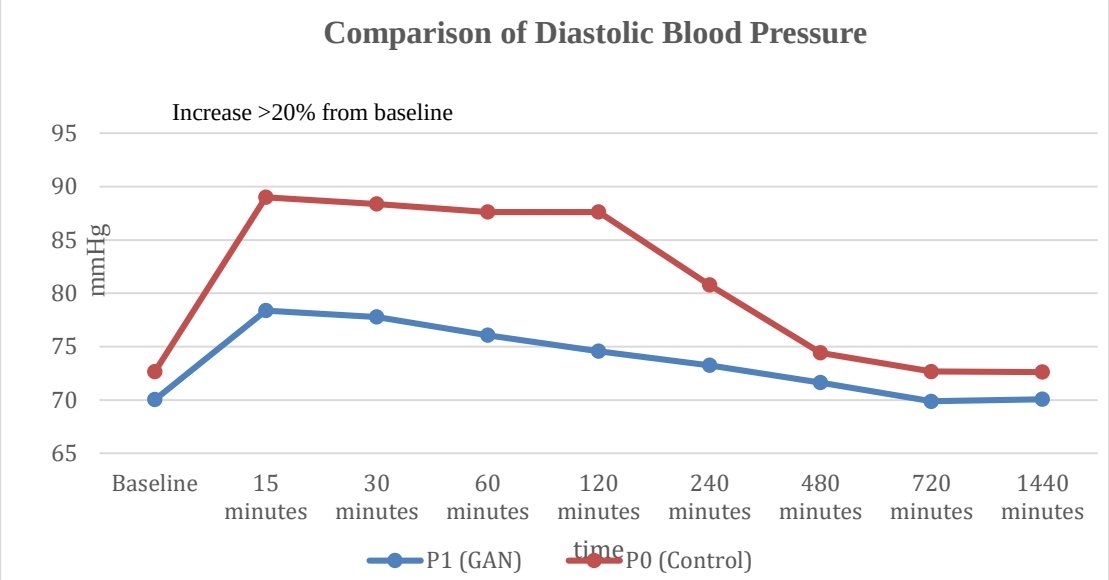

Figure 3. Diastolic Blood Pressure Changes

Mean arterial pressure (MAP) exhibited significant differences at minutes 15, 30, 60, 120, and 240 post-operation (P<0.05). At minutes 480, 720, and 1440, no significant differences were observed, indicating stability in MAP. The P0 group showed an increase of more than 20% from baseline at initial to 120 minutes.

Table 7. Comparison of Mean Arterial Pressure (MAP)

MAP (in minutes)	Group (mean±SD) mmHg		p-Value p[a]
	P1 (Blok GAN) (n=24)	P0 (Control) (n=24)	
Baseline	85,21±5,21	85,96±4,40	<0,001*
15	92,58±5,86	106,42±4,59	<0,001*
30	91,67±5,14	105,21±5,04	<0,001*
60	90,38±5,41	104,63±4,97	<0,001*
120	88,88±5,09	103,50±5,14	<0,001*
240	87,17±5,18	97,75±3,89	<0,001*
480	87,42±5,19	89,29±3,72	0,157
720	85,46±5,53	86,79±3,48	0,323
1440	85,47±5,49	85,04±3,78	0,225

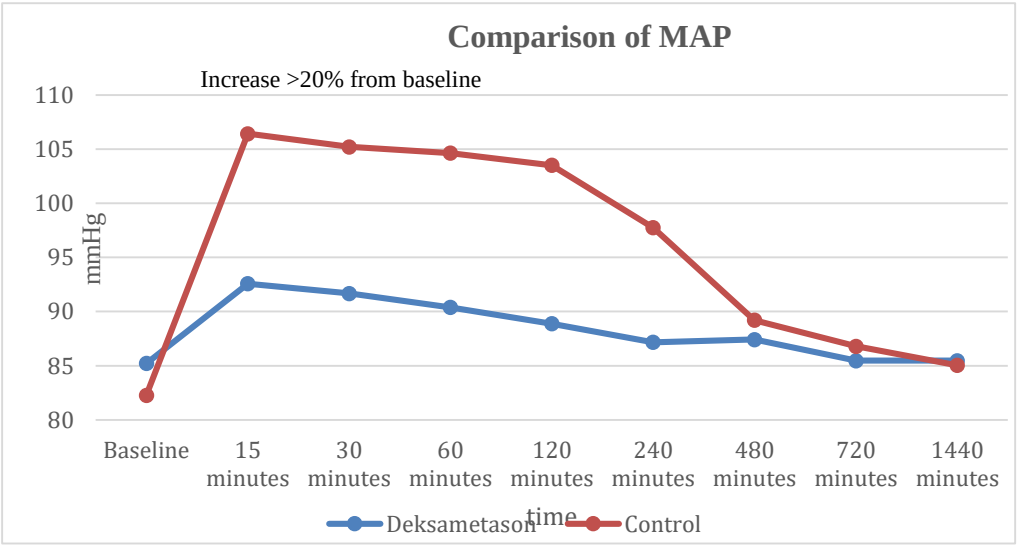

Figure 3. Mean Arterial Pressure Changes

Test of Differences in Incidence of Nausea and Vomiting

The comparison of nausea and vomiting incidence is presented in Table 5.8, indicating that in group P1, the nausea-vomiting score over 24 hours was 1.92±1.01, whereas in group P0, it was 2.75±1.03. This suggests that the risk of experiencing nausea and vomiting is significantly lower in group P1, with a statistical significance of p=0.007.

Table 8. Comparison of Nausea and Vomiting Incidence

Nausea-Vomiting	Group (mean±SD) mmHg		p-Value p[a]
	P1 (Blok GAN) (n=24)	P0 (Kontrol) (n=24)	
Nausea-vomiting score	1,92±1,01	2,75±1,03	0,007*

DISCUSSION

The results of this study indicate that there were no differences in the characteristics of data between the GAN block group and the control group. This suggests that age, gender, BMI, ASA score, baseline hemodynamic parameters, and duration of surgery did not confound the results of the study, thereby affecting changes in opioid use during and after surgery, postoperative pain intensity, intraoperative hemodynamic stability, and the risk of nausea and vomiting. GAN procedures in the study were also found to have no side effects. Reports of side effects typically include pain at the block site, hematoma, and local infection (Ritchie et al., 2016; Yang et al., 2015).

In this study, the average age of patients undergoing middle and inner ear surgery in the GAN block group was 58 years, while the control group had an average age of 60 years. This is consistent with data from the WHO in 2020, which reported an average age of 60 years (Nieman & Oh, 2020). In the United States, most middle and inner ear surgeries occur around the age of 70 (Sadikovna, 2022). The majority of middle and inner ear surgeries in Asia are performed on individuals aged 55-65 years (Wu et al., 2020). A report from Sardjoto General Hospital in Yogyakarta in 2020 found that 42 patients undergoing inner and outer ear surgery were over 41 years old (Kementerian Kesehatan, 2020). In a study by (Yang et al., 2015), the mean age of 25 subjects undergoing GAN procedures was 62.5 years.

The majority of middle and inner ear surgeries are performed on males, consistent with WHO data indicating that 60% of such surgeries are performed on males (Nieman & Oh, 2020). Similarly, a study by (Yang et al., 2013) found that out of 25 subjects undergoing GAN procedures, 16 were males. The study results show that the use of the Greater Auricular Nerve Block technique using isobaric ropivacaine can reduce the use of intravenous opioid drugs during and after inner ear surgery. This finding is consistent with a case report by (Ritchie et al., 2016), which stated that GAN block can serve as the sole anesthesia for procedures that minimize or eliminate intravenous sedatives and opioids. The GAN block technique provides sensory nerve block to the outer ear segments, including the helical tail, antitragus, and lobule of the ear, with varied supply to the helical spinal cord, tragus, and concha involving the blockade of the entire superficial cervical plexus at the border of the sternocleidomastoid muscle using a large amount of local anesthesia compared to selective procedures. Acquisition of the GAN with ultrasound imaging on the anterior surface of the sternocleidomastoid muscle is relatively easy and produces excellent imaging. Thallaj and colleagues noted a 100% success rate in identifying the GAN using ultrasound imaging, with a block success rate approaching 100% when needle insertion tests were performed and compared with the contralateral ear (Thallaj et al., 2010).

The use of the Greater Auricular Nerve Block technique using isobaric ropivacaine can reduce postoperative inner ear pain intensity compared to intravenous opioid use. This may be due to the GAN block technique communicating with several cranial nerves by sending nerve

fiber impulses to the transversal, supraclavicular, major auricular nerves toward the parenchyma of the parotid and connecting with the facial nerve (FN), the auricular branch of the vagus nerve, and the posterior auricular nerve, and communicating between sensory nerves and motor nerves in the craniofacial area. The superficial branch of the GAN communicates with the auricular temporal nerve, while the deep branch of the GAN communicates with the posterior auricular nerve FN, simultaneously. Communication between the superficial branch and the temporal auricular branch is sensory nerve communication, while communication between the deep GAN branch and the posterior auricular nerve is communication between sensory nerve branches and motor nerves (Yang et al., 2015)). (Yang et al., 2013) stated that sensory nerves may be involved in coordinating proprioceptive information from muscles via motor nerves that communicate with them (Yang et al., 2015).

The use of the Greater Auricular Nerve Block technique using isobaric ropivacaine can maintain hemodynamic stability during surgery compared to intravenous opioids in inner ear surgery. The study results indicate that the GAN technique has strong potential in stabilizing hemodynamics. In a case report of an 80-year-old patient undergoing resection of lesions in the right posterior auricle and left infra-orbital region with a history of hypertension, mitral valve disease, and congestive heart failure, it was found that during the GAN block procedure, the patient's hemodynamics remained stable from the procedure to the postoperative period. The extensive major auricular nerve block ranges from 1.4-2.0 mm with a median size of 1.7 mm in anatomical studies with direct analgesic effects on peripheral nerves assisted by ultrasound equipment so that the major auricular nerves in the cervical plexus can be blocked directly, reducing the amount of general anesthesia required and thus having an effect on maintaining hemodynamic stability (Ritchie et al., 2016).

The use of the Greater Auricular Nerve Block technique using isobaric ropivacaine can reduce postoperative nausea and vomiting compared to intravenous opioids in inner ear surgery. This is because the reduced amount of opioids used leads to a decrease in the side effects of nausea and vomiting. The GAN block technique works on the entire superficial cervical plexus at the border of the sternocleidomastoid muscle without central muscarinic cholinergic side effects, thus reducing the side effects of nausea and vomiting (Yan et al., 2021).

This study has limitations such as being a single-center study, so the results may not be generalizable to other locations. Researchers also limited subjects to those with ASA scores of 1-2, and an age limit of up to 65 years, so it is hoped that further research can evaluate a larger number of subjects and include older age groups.

CONCLUSION

The use of Greater Auricular Nerve Block technique with isobaric ropivacaine offers several significant benefits during inner ear surgery procedures. Firstly, this technique can reduce the need for intravenous opioid drugs during and after the surgery, thus decreasing the risk of opioid-related side effects. Secondly, this approach has been shown to significantly decrease post-operative pain intensity compared to intravenous opioid use, providing additional comfort for patients in the postoperative period. Thirdly, the blockage of the great auricular nerve can also maintain hemodynamic stability during surgery, potentially reducing the risk of complications during the procedure. Lastly, implementing the Greater Auricular Nerve Block technique can reduce the incidence of postoperative nausea and vomiting, providing additional benefits for patients in their recovery after inner ear surgery. Therefore, the use of this technique offers a comprehensive and effective approach to pain management and postoperative care.

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