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ORIGINAL ARTICLE

EFFECT OF PROGRESSIVE MUSCLE AND AUTOGENIC RELAXATION ON POST-SPINAL PAIN AND ANXIETY: A THREE-GROUP RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Patients undergoing cesarean sections (CS) under spinal anesthesia often experience pain, anxiety, and peripheral vasoconstriction. This study, a randomized, blinded, controlled trial, compared progressive muscle relaxation (PMR) and autogenic training (AOT) with standard treatment to alleviate the aforementioned symptoms. Sixty-six female patients who underwent CS aged 20-35 were randomized into three groups: PMR (n=22), AOT (n=24), or standard (n=20). Pain and anxiety were evaluated using standardized instruments: Hamilton Rating Scale for Anxiety (HARS) and Numeric Rating Scale (NRS). Both groups indicated a statistically significant decrease in pain and anxiety as compared to the control group (p = 0.001). Both the PMR (Mean difference; pain, 2.54) and anxiety (17.37) improved significantly more than the AOT (pain, 1.23; anxiety, 11.68) group, while the control group minimally improved (pain, 0.32; anxiety, 2.27) over their pre-intervention scores. Statistical tests, Mann-Whitney U and Kruskal-Wallis, showed statistically significant differences between the three groups, p <0.034; p <0.001, 95% CI. Thus, the PMR is more effective than AOT or standard care. Therefore, PMR should be included in the postoperative care of nurse anesthetists in their pragmatic collaborative effort to support non-pharmacological symptom self-management in cesarean patients.

Keywords: *Anxiety; autogenic; caesarean section; pain; progressive muscle relaxation*

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BACKGROUND

A cesarean section (CS) is a surgical procedure that involves cutting through the abdominal and uterine walls to deliver a fetus. According to the WHO's Global Survey on Maternal and Perinatal Health, 46.1% of all births occur through a CS (Vogel et al., 2019). Moreover, approximately 94% of obstetric patients in the United States underwent a cesarean section in 2018 (Martin, Hamilton, Osterman, & Driscoll, 2019). According to data on 3,509 CS, the procedure is typically conducted if the patient exhibits the following conditions: pelvic fetal disproportion (21%), fetal distress (14%), placenta previa (11%), previous CS (11%), fetal anomalies (10%), pre-eclampsia (7%), and hypertension (7%) (Venancyana, Indrayani, & Lubis, 2022). The World Health Organization (2021) also reported that CS procedures increased sharply in China, from 3.4% in 1988 to 39.3% in 2010.

The prevalence of cesarean sections is rapidly increasing, with 137 countries showing rates of 10%-15% of births (Asamblea Mundial de la Salud, 2019; Tadevosyan et al., 2019). The need for cesarean sections may have increased from 6.7% in 1990 to 19.1% in 2014, due to the availability of antibiotics, blood transfusions, improved surgical techniques, and enhanced anesthesia techniques (Bizimana et al., 2016; Caughey et al., 2018; Magne, Puchi Silva, Carvajal, & Gotteland, 2017).

In Indonesia, the proportion of births delivered via cesarean section increased from 6.8% to 9.8%, primarily due to

medical indications and pregnancy-related complications (Zahroh et al., 2024). The highest CS rate is in Jakarta, the capital city of Indonesia (19.9%). Moreover, the 2017 Indonesian Demographic and Health Survey found that 17% of all births in medical facilities were cesarean sections (Riskesdas, 2018). This statistic proves that there is an increase in the number of CS deliveries with indications of KPD, with 13.6% caused by other factors, including fetal abnormality, PEB, and CS history (Kemenkes RI, 2018).

Spinal anesthesia is neuraxial anesthesia administered by placing local anesthesia in the intrathecal space (subarachnoid space) (Olawin & Das, 2021). Patients will typically experience excruciating pain in the first six hours following surgery because the anesthetic drugs' effects have worn off, and this change can cause anxiety. The average recovery time for postoperative patients is 72.45 minutes (Shewale, 2020).

It is critical to monitor the patient's postoperative pain and anxiety to observe the side effects of the anesthesia used in a cesarean section (Canobbio et al., 2017). Thus, during the postoperative period, the role of nurse anesthetists is indispensable for meeting the patients' needs and providing comfort by reducing pain and anxiety non-pharmacologically (Yaban, 2019).

Evidence-based practice further reveals that the perception and state of pain and anxiety are influenced by an individual's cultural background, beliefs, and values (Ramirez-Garcia et al., 2020). Therefore, non-pharmacological interventions, such as PMR and AOT, have been increasingly appreciated for their physiological effects, as they are culturally neutral. These techniques do not violate any religious or traditional principles. Thus, it is widely accepted by several different populations (Stanton & Meston, 2017). More importantly, it reflects a patient-centered approach that respects individual experiences and needs, making recovery an individual process over which patients can gain more control (Norelli, Long, & Krepps, 2021).

PMR can suppress sympathetic nerves, thereby reducing the sense of tension experienced by individuals, which in turn can decrease the quality of pain. Autogenic therapy can regulate the mechanism of action of the autonomic nervous system, serving as a balancing activity between the sympathetic and parasympathetic nervous systems (Stanton & Meston, 2017). However, there is still a lack of research on relaxation techniques for pain and anxiety management.

This study compares the effects of the gold standard of care, progressive muscle relaxation, and autogenic groups on lowering the pain and anxiety of patients undergoing spinal anesthesia following a cesarean section. We hypothesize that the progressive muscle relaxation technique, autogenic group, and gold standard of care will have a greater effect on reducing pain and anxiety than the gold standard of care (control) when applied to the same level of pain and anxiety.

METHOD

Study design

This study employed a single-blind, randomized, controlled trial approach. The researchers recorded all data related to spinal anesthesia with cesarean section surgery separately. Informed written consent was obtained two hours postoperatively from patients and their guardians, who were present as a witness. During the study, the researchers controlled the risk of clinical bias, and post-spinal anesthesia was monitored in the recovery room until the patient returned to the inpatient room. The events that met the criteria were then observed and analyzed, and the researchers also evaluated the patient's side effects in accordance with Good Clinical Practice (GCP) guidelines. The researchers continued to monitor the patient's condition until it was resolved. The CONSORT consolidated standardized trial reporting guidelines were adhered to in this study (Schulz, Altman, & Moher, 2023) (Figure 1).

Participants

This analysis utilized planned primary data from a double-blind, randomized clinical trial conducted at Ananda Hospital (Purwokerto, Indonesia), a 100-bed hospital specializing in maternal and childcare services. The trial involved 66 patients who were administered spinal anesthesia during their cesarean section surgery. The inclusion criteria for this study are as follows: patients aged 20-35 years old, with a physical status classified as ASA I-II risk score, undergoing elective surgery, and those scheduled for spinal anesthesia during their cesarean section surgery. Meanwhile, the exclusion criteria include patients with ASA risk scores greater than II and those with emergency conditions.

Along with these inclusion criteria, parity was collected in the baseline assessment. Although parity was not considered a potential factor for randomization, we note that primiparous and multiparous women may be differentially affected by preoperative anxiety, which will be detailed in the limitations section.

The spinal anesthesia patients with cesarean section surgery were randomized to one of two interventions: progressive muscle relaxation therapy and autogenic therapy. Due to differences in the timing and route of therapy administration for the three interventions, we used double-blind data.

Sample size

We calculated the sample size using an a priori power analysis with the G*Power software, version 3.1. We considered a medium effect size ($f = 0.4$), 80% power ($1 - \beta = 0.80$), and a significance level of 5% ($\alpha = 0.05$), which is appropriate for a three-group comparison. This analysis determined that the study would need to include at least 78 participants to detect significant differences. With an anticipated dropout rate of 20 percent, we increased the planned sample size to 94 participants before applying the inclusion and exclusion criteria (Figure 1).

Intervention

The first group received 15 minutes of progressive muscle relaxation therapy, which combines muscle stretching and suggestion, twice a day for 60 minutes. The second group received 15 minutes of autogenic relaxation therapy, a psychophysiological psychotherapy based on suggestion, twice a day for 60 minutes. Meanwhile, the third group received treatment with standard post-operative care, where the patients were monitored for vital signs, oxygen saturation levels, and pain throughout the study. This treatment was assisted with general nursing care to ensure patient comfort and safety. No relaxation or therapeutic treatments were applied to the third group. The observation was performed for 60 minutes in the recovery room post-spinal anesthesia. The post-operative patients' conditions under spinal anesthesia were unaffected by these non-invasive methods.

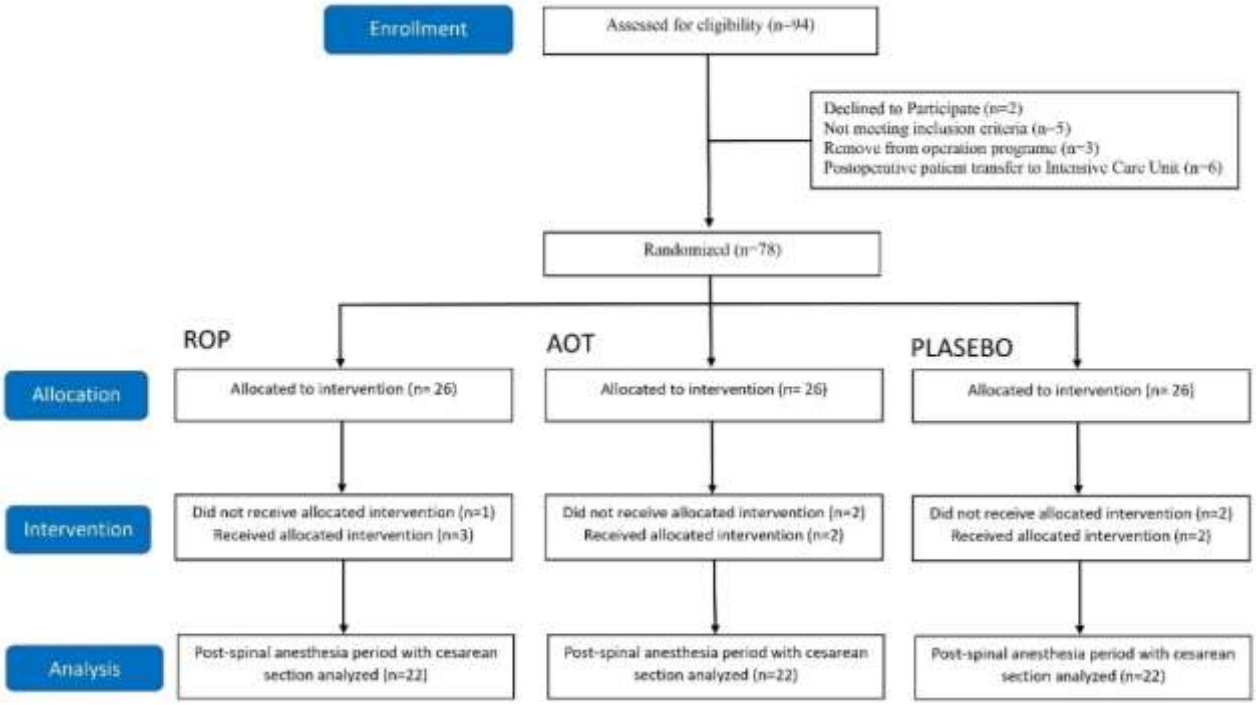

Figure 1. The consort diagram

Randomization

A simple randomization process was used to facilitate unbiased group allocation. Next, the researchers used computer-generated sequences from Random.org to randomly allocate participants into three groups in a 1:1:1 ratio for the Progressive Muscle Relaxation (PMR), Autogenic Training (AOT), or control group. Randomization produces several randomization orders, which a statistician, independent of the clinical application of this study, generated.

The randomization order avoided biased allocation at baseline. The randomization assignments were put in an opaque, sealed, and sequentially numbered envelope. Informed consent was obtained from participants who met the inclusion criteria. Then, they were allocated to a group based on the next envelope opened by an assistant who was blinded to the study aims. The blinded group allocation process did not include stratification or block randomization, and all random assignments were done without regard to the participant's demographic characteristics. This random allocation process was crucial to ensure that the study's randomized design was maintained, and it also minimized the potential for selection bias during the trial.

Data collection and outcome measurement

The researcher avoided inter-rater bias by appointing one member of the research team (named SMS) to observe, collect, and analyze the validity of all data. SMS is a registered nurse and trained clinical researcher who has previous experience in collecting observational data. No other enumerators contributed to this work to help maintain standardization in terms of both assessment and interpretation. Observers, in this case, do not take any action; they only observe the data collection process of each sample.

This study's main goal is to assess the patients' levels of pain and anxiety. The Hamilton Anxiety Rating Scale (HARS) was used to measure anxiety, and the Numeric Rating Scale (NRS) was used to measure pain levels. The assessment was done 120 minutes post-spinal anesthesia. A high score on the NRS and HARS indicates high pain intensity and anxiety. The NRS levels ranged from '1-3' mild pain; '4-6' moderate pain, '7-10' severe pain (Alghadir, Anwer, Iqbal, & Iqbal, 2018), while HARS levels were '1-14' no anxiety; '14-20' mild anxiety; '21-27' moderate anxiety; '28-41' severe anxiety; '42-56' severe anxiety (Ramdan, 2018).

Statistical analysis

The researchers used SPSS Statistics Version 26.0, released in 2018 by IBM Corporation, Armonk, NY, for all statistical analyses in this study (IBM, 2019). The distribution of demographic features in post-spinal anesthesia patients who underwent cesarean section surgery was analyzed by computing the mean, median, and standard deviation (SD) using a paired group difference test. Paired t-tests were employed if the data was parametric, and the Wilcoxon test was used otherwise.

Then, the unpaired t-test between the two groups used a two-sample/group t-test if the data were normally distributed. If the data were not normal and homogeneous, they were analyzed using the Mann-Whitney U test (Pallant, 2020). A multivariate analysis assessment was conducted using a prediction model to develop a model comprising several independent variables. A multivariate difference analysis was conducted among three groups using the Kruskal-Wallis test to examine the differences in improvement of NRS pain scale scores and HARS anxiety between the three groups.

Meanwhile, non-parametric analysis was used to compare the three groups, specifically the Kruskal-Wallis test for overall group differences, followed by Bonferroni post hoc comparisons to identify pairwise differences where applicable. Binomial data were displayed with standard deviation (SD), while nominal data were displayed in tables as number (n) and percentage (%). The significance of the analysis between groups was determined by $p<0.05$ (Hair JR, Black, Babin, & Anderson, 2010; Jöreskog, Olsson, & Y. Wallentin, 2016).

Ethical consideration

On April 1, 2022, the Harapan Bangsa University research ethics review board approved our study under the approval

number B.LPPM/838/03/2022.

RESULT

The data collection took place over two months (July-August 2022) at Ananda Hospital, which offers maternal and child health services in Purwokerto. The researchers recruited participants purposively using a consecutive sampling approach, as determined by eligibility and surgical time slots. The sampling strategy for recruiting participants was feasible within this time frame due to the high volume of cesarean section procedures performed at the hospital. Pain and anxiety scores were collected pre- and post-intervention using standardized instruments. Trained research staff performed all assessments, and they followed the protocol consistently for all participants.

Of the number of participants who underwent spinal anesthesia with cesarean-section surgery, two were excluded because they refused to participate (n = 2), five did not meet the inclusion criteria (n = 5), three were excluded from the cesarean-section surgery program (n = 3), and six were postoperative patients who transferred to Intensive Care Unit (n = 6). At the intervention stage, some participants were also excluded because their condition worsened n = 1 in the PMR group, n = 2 in the AOT group, and n = 2 in the control group. Moreover, some participants were excluded because they refused to continue the study n = 3 in the PMR group, n = 2 in the AOT group, and n = 2 in the control group. Thus, the final number of 66 participants were included in this study (Figure 1).

The normality tests indicated that most of the data were not normally distributed ($p < 0.05$), except the AOT group's post-test anxiety scores. Meanwhile, the homogeneity tests revealed statistically significant differences between groups for pre- and post-test anxiety scores ($p < 0.05$) and for pain in the control group ($p < 0.05$). Therefore, since these assumptions for conducting parametric tests were violated, we did not conduct any parametric tests.

The analysis showed that the participants' average age was 27.06 ± 5.09 years, their average education level was 3.04 ± 0.71, and their average body mass index was 30.69 ± 3.34. The average American Society of Anesthesiologists Physical Status score (ASA-PS) evaluation was 1.49 ± 0.50. Additionally, the participant's oxygen saturation (SpO2) averaged 1.14 ± 0.35, and their blood pressure averaged 1.54 ± 0.60. The demographic characteristics data for the three groups, as shown in Table 1, suggest no notable differences.

Furthermore, the data analysis revealed that the AOT group experienced a change in pain levels, with a mean value of 3.8% and a p-value of 0.001. This finding suggests that there is a noticeable difference after the participants were provided AOT relaxation therapy. Additionally, the PMR intervention group showed a significant difference in pain levels before and after treatment, with an average value of 3.09% and a p-value of 0.001. On the other hand, the control group showed no difference in pain levels between before and after, with an average of 4.77% (p = 0.106).

Moreover, there was a significant difference between the AOT intervention group's anxiety level before and after the intervention, with an average of 22.45% and p = 0.001. There was also a difference in the PMR group's anxiety, with an average value of 19.81% with p = 0.001. Conversely, with an average value of 36.95% and p = 0.170, there was no difference in the control group's anxiety levels (Table 2).

Table 1. Participants' characteristics (N = 66)

Characteristics	Treatment			*p*
	PMR (n = 22)	AOT (n = 22)	CONTROL (n = 22)	
Age (y)	26.63±4.78	27.45±5.56	27.12±4.93	0.867
Education	3.09±0.75	3.04±0.65	3.00±0.75	
Middle school	5 (22.7)	4 (18.2)	6 (27.3)	0.916
High school	10 (45.5)	13 (59.1)	10 (45.5)	
Colleges	7 (31.8)	5 (22.7)	6 (27.3)	
Body Mass Index (Kg/m^2)	30.45±3.46	31.09±3.03	30.54±3.54	
Normal 18 -25 (Kg/m2)	-	-	1 (4.5)	
Overweight 18,5-22 (Kg/m2)	8 (36.4)	6 (2.73)	3 (13.6)	0.794
Obesity >22 (Kg/m2)	14 (63.6)	16 (72.7)	18 (81.8)	
ASA-PS	1.54±0.50	1.45±0.50	1.50±0.51	
ASA I	10 (45.5)	12 (54.5)	11 (50)	0.834
ASA II	12 (54.5)	10 (45.5)	11 (50)	
Blood pressure	1.45±0.50	1.72±0.82	1.45±0.50	
Normal	12 (54.5)	11 (50)	12 (54.5)	
Pre-hypertension	10 (45.5)	6 (27.3)	10 (45.5)	0.264
Grade I hypertension	-	5 (22.7)	-	
Grade II hypertension	-	-	-	
SaO2 (%)	1.13±0.35	1.09±0.29	1.22±0.42	
95-100%	19 (86.4)	20 (90.9)	17 (77.3)	0.505
<95%	3 (13.6)	2 (9.1)	5 (22.7)	

** The values are shown as either the mean± the standard deviation or the number (percent). To assess group differences, the x-squared test was employed for categorical variables and the ANOVA for continuous variables.*

Table 2. Wilcoxon test results for pain and anxiety among cesarean section patients undergoing post-spinal anesthesia in the AOT, PMR, and control groups

Variable	Group	Post-pain	*p*	Post-anxiety	*p*
		Mean±SD		Mean±SD	
Post-Spinal Anesthesia Caesarean Section	Pre-AOT	5.04±0.84	0.000*	34.13±6.16	0.001*
	Post-AOT	3.81±1.09		22.45±3.44	
	Pre-ROP	5.63±1.00	0.000*	37.18±6.73	0.001*

Variable	Group	Post-pain	*p*	Post-anxiety	*p*
	Post-ROP	3.09±0.92		19.81±5.35	
	Pre-PMR	5.09±1.06	0.106*	39.22±5.98	0.017*
	Post-PMR	4.77±1.10		36.95±5.40	

**If the p-value is less than 0.05*, the paired test has an effect.*
**Values are shown as mean ± SD or as a number (percent). The Wilcoxon test was used for continuous variables to check for pairwise differences within groups.*

The results showed a difference in pain levels between the AOT intervention group and the control group, as evidenced by the post-test pain levels of the two groups, which revealed a mean difference of 10.14% with a p-value of 0.007. There is also a significant difference between the PMR intervention group and the control group, as evidenced by a mean difference of 16.28% between the two groups, with a p-value of 0.001. In contrast, the mean difference between the AOT intervention group (26.73%) and the PMR intervention group (18.27%) is 8.46% with a p-value of 0.023, indicating that the PMR intervention differs from the AOT intervention in terms of their effects on lowering the participant's pain level (Table 3).

There was also a difference between the AOT intervention group and the control group, as evidenced by the post-test anxiety levels of the two groups, which showed a mean difference of 21.86% with a p-value of 0.001. Moreover, a significant difference is observed between the PMR intervention group and the control group, as evidenced by a mean difference of 20.32% (p = 0.001). The PMR intervention also differs from the AOT intervention in terms of lowering anxiety, as evidenced by a mean difference of 8.18% and a p-value of 0.034 (Table 3).

Table 3. The Mann-Whitney U analyze the pain and anxiety levels of cesarean section patients who underwent post-spinal anesthesia in the control, PMR, and AOT groups

Variable	Group	Post-pain			Post-anxiety		
		Mean±SD	Df	*p*	Mean±SD	Df	*p*
Post spinal Caesarean section	Control	27.57±1.19	10.14	0.007	33.43±9.24	21.86	0.000
	AOT	17.43±1.19			11.57±9.24		
	Control	30.64±1.31	16.28	0.000	32.66±10.14	20.32	0.000
	ROP	14.36±1.31			12.34±10.14		
	AOT	26.73±1.06	8.46	0.023	26.59±4.35	8.18	0.034
	ROP	18.27±1.06			18.41±4.35		

**The paired test has an effect if the p-value is less than 0.05.*
**The Wilcoxon test was used for continuous variables to check for pairwise differences within groups. Values are shown as numbers (percent) or mean ± SD.*

Table 4. The results of the Kruskal-Wallis test of AOT, PMR, and control on reducing pain and anxiety in patients given post-spinal anesthesia for their cesarean section

Variable		n	Mean Rank	*df*	X^2	*p-value*
Post-pain spinal Anesthesia cesarean section	AOT	22	32.66	2	20.66	0.001
	ROP	22	21.14			
	Control	22	46.70			
Post-anxiety spinal Anesthesia cesarean section	AOT	22	28.95	2	43.46	0.001
	ROP	22	17.14			
	Control	22	54.41			

** If the p-value is less than 0.05.*, the multivariate test has an effect.*
**Values are shown as mean ± SD or as a number (percent). Kruskal-Wallis was used for continuous variables to test for pairwise differences within groups.*

The AOT group had the lowest score for decreasing the patient's pain post-spinal anesthesia, with an average of 21.14%. Conversely, the control group obtained highest score for decreasing the patient's pain post-spinal anesthesia, with an average of 46.70%. The x^2 result is 20.662 with an asymp.sig value of p = 0.027. Meanwhile, the ranking for the lowest anxiety reduction was the AOT group, with an average of 17.14%, and the highest was the control group, with an average of 54.41%.

The Kruskal Wallis test revealed that the AOT, PMR, and control interventions for reducing pain and anxiety in post-spinal anesthesia cesarean section patients have significant differences (Table 4). The results of the differences in pain reduction values for AOT compared to the control group have a significant value of p = 0.011, and the PMR intervention compared to the control group has a significant value of p = 0.001. Meanwhile, there was a difference in the pain reduction values between the AOT and PMR groups, with a significant value of p = 0.073. Thus, we confirm that there is a significant difference in the patient's level of pain reduction after being given spinal anesthesia for their cesarean sections in the PMR and AOT groups against the control group.

Next, the difference in anxiety reduction between the AOT intervention and the control group has a significant value of p = 0.001, and between the PMR intervention and the control group has a significant value of p = 0.001. Meanwhile, the AOT and PMR groups show no difference, with a significant p-value of 0.223. Thus, our study confirmed a significant difference in the reduction of pain and anxiety between the three groups, with a strong difference in effect in the PMR group (Table 5).

Table 5. Results of the Post Hoc Test post-test of AOT, PMR, and control interventions on reducing pain and anxiety in patients with post spinal anesthesia cesarean section

Variable	Test	Group	Grouping	Mean Df	Std. Error	Sig.
Post-pain	**Bonferroni**	AOT	ROP	0.7273	0.31544	0.073
			Control	-0.9545*	0.31544	0.011
		ROP	AOT	0-.7273	0.31544	0.073
			Control	-1.6818*	0.31544	0.000
		Control	AOT	0.9545*	0.31544	0.011
			ROP	1.6818*	0.31544	0.001
Post-anxiety	**Bonferroni**	AOT	ROP	2.6364	1.45330	0.223
			Control	-14.5000*	1.45330	0.001
		ROP	AOT	-2.6364	1.45330	0.223
			Control	-17.1364*	1.45330	0.001
		Control	AOT	14.5000*	1.45330	0.001
			ROP	17.1364*	1.45330	0.001

**Tests the null hypothesis that the error variance of the dependent variable is equal across groups.[a], homogeneity *If p =<0.05*. The values are presented as numbers (percent) or as mean ± SD. To test for pairwise differences in groups, the Post Hoc MANOVA was used for continuous variables.*

DISCUSSION

This study's results revealed that the reduction in pain and anxiety levels of the PMR group is much greater than that of the AOT and control groups. This finding may be attributed to the fact that progressive muscle relaxation stimulates endorphins, which function as a natural tranquilizer and reduce anxiety in the brain, blood vessels, muscles, and spinal cord (Toussaint et al., 2021). Endorphins work by activating opiate receptors found in the limbic system in the midbrain of the spinal cord. Opiate receptors and endogenous opiates then form an intrinsic pain suppression system. Opiate receptor binding can also reduce pain levels by preventing the release of neurotransmitters, thereby blocking pain signals from reaching the brain (Sharma et al., 2015).

This study's results align with Aziz Ismail and Elgzar (2018), who showed that PMR relaxation therapy decreased the pain and anxiety levels of post-spinal anesthesia patients who underwent cesarean sections. This study also proved PMR's significant effect on reducing pain and anxiety levels. Pain and anxiety often occur together in postoperative patients because they are worried about their condition. Pain and anxiety management techniques are categorized into two groups, including pharmacological and non-pharmacological techniques. However, non-pharmacological therapy is one of the primary choices to overcome the side effects of drug administration.

PMR therapy has been proven to control and reduce pain intensity by modulating the sympathetic nervous system reflex, affecting the frequency of peripheral nerves. PMR can also cause muscle fibers to contract tense muscles associated with a tense psyche and a relaxed physique, which will be accompanied by a decrease in mental and anxiety in post-spinal anesthesia patients undergoing cesarean sections (Toussaint et al., 2021). PMR reduces pain levels by decreasing the secretion of CRH (Corticotropin-releasing hormone) and ACTH (Adrenocorticotropic hormone) in the hypothalamus, resulting in lower adrenaline production (Herman et al., 2016).

Furthermore, (Özen & Koç, 2024; Rihi, Muniroh, & Susilawati, 2020) showed that adding progressive relaxation techniques to exercise therapy for patients' pain and anxiety post-section cesarean section has a significant effect compared to providing them exercise therapy alone due to its ability to provide relaxation. Isometric contractions activate the Golgi tendon organ to cause a relaxation response in the muscle (reverse innervation). This response also leads to decreased muscle tension and anxiety as it stabilizes hormones and neurotransmitters in the brain (Thiriet, 2018). Maximum relaxation can be achieved when the relaxation technique is applied for approximately nine seconds, a process attributed to the mechanism of reciprocal innervation. Furthermore, the relaxation response is enhanced by the release of endogenous opioid analgesics such as enkephalins, β-endorphins, and possibly dynorphins within the body following the application of progressive muscle relaxation techniques (Pilozzi, Carro, & Huang, 2020).

Progressive muscle relaxation (PMR) is a promising adjunctive therapy provided to patients who have undergone cesarean section surgery with spinal anesthesia to minimize their postoperative pain and anxiety (Topcu & Findik, 2012). PMR is a non-pharmacological and non-invasive method that can help patients overcome sadness and anxiety and improve their quality of life.

Nurse anesthetists can pay greater awareness and attention to non-pharmacological techniques such as AOT and PMR therapy to help lower the pain and anxiety felt by post-operative cesarean patients who were administered spinal anesthesia. Providing such interventions may reduce patient complaints of pain and anxiety levels, increasing patient satisfaction with health services despite the moderate pain and anxiety they may experience. Moreover, family support is essential for recovery after surgery. A recent meta-synthesis of the literature identified three family needs: timely information, involvement in care, and sufficient visiting time, key factors to promote recovery and family-centered care (Ismail, Lahati, & Morales, 2024).

Moreover, pain and anxiety are influenced by cultural and religious beliefs. In some cultures, pain may be viewed as a part of faith, which could lead to underreporting of symptoms. Some cultures may also accept pain or anxiety as part of the process of life; thus, seeking pain relief could be deemed inappropriate (El-Metwally et al., 2021). Cultural norms can also shape how and if it is acceptable to express anxiety, which may affect the success of the intervention directed at reducing anxiety (Gajtkó et al., 2020). Although we did not collect specific information on participants' cultural or religious backgrounds, these factors are essential for interpreting the patients' responses. Future work and research should include an assessment of cultural and religious beliefs to help develop pain and anxiety management strategies and pathways that are culturally and religiously appropriate.

The progressive muscle relaxation, autogenic, and control interventions in this study were administered to the patients only twice in the recovery room: once in the morning and once in the afternoon. However, several journals found it more effective to intervene three times over a twenty-four-hour period. This study also did not homogenize the administration of spinal anesthesia doses. Thus, some respondents were shivering and experienced hypotension while in the recovery room.

Additionally, this study lacks data regarding the participants' cultural and religious backgrounds, which may impact their perceptions and acceptance of the relaxation methods. Both relaxation techniques, PMR and AOT, are secular and non-invasive, designed to be acceptable to all patients. However, cultural and spiritual backgrounds can impact patient interpretation and engagement with the intervention. The lack of this contextual population information limits our ability to interpret the depth of the patient's responses to the therapies. Future studies should consider factors related to cultural and belief variables to enhance the study's applicability to wider populations and explore the overlap between cultural and spiritual beliefs and non-pharmacological management of pain and anxiety.

CONCLUSION AND RECOMMENDATION

This study demonstrated that Progressive Muscle Relaxation (PMR) significantly reduces the pain and anxiety levels of post-spinal anesthesia cesarean section patients compared to Autogenic Training (AOT) and conventional therapy. The activation of endorphins through PMR provides a natural tranquilizing effect, making it a valuable non-pharmacological intervention in postoperative care. However, PMR does not eliminate pain and anxiety, indicating the need for a combined approach with pharmacological methods. Future research should investigate the optimal frequency and duration of PMR interventions. Anesthesia nurses are also encouraged to adopt PMR techniques to enhance patient comfort and satisfaction. Further studies should also investigate the long-term effects of PMR and its integration with other relaxation techniques for comprehensive pain and anxiety management.

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