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NL Journal of Medical and Pharmaceutical Sciences

Volume 1 Issue 3 December 2025 Research Article

Efficacy of Subarachnoid Anesthesia with Hyperbaric Bupivacaine and Morphine in Cesarean Section

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Received Date: July 07- 2025 **Publication Date:** November 10- 2025

Abstract

Introduction: Spinal anesthesia with hyperbaric bupivacaine is the preferred technique for cesarean sections due to its efficacy and maternal-fetal safety. The addition of low-dose morphine prolongs postoperative analgesia, improving pain control without increasing adverse effects.

Objective: Evaluate the efficacy of anesthesia with 0.5% hyperbaric bupivacaine and intrathecal morphine in patients undergoing cesarean delivery.

Methods: A quasi-experimental study with two groups was conducted at the National Hospital Guido Valadares, in Dili, Timor-Leste, from January to June 2024. The study included 63 patients who underwent cesarean section with spinal anesthesia as the technique of choice.

Results: No statistically significant differences were observed between groups in terms of vital signs variation ($p > 0.05$). The study group showed significantly lower scores on the visual analog scale in the postoperative period ($p = 0.00$). The most common complication in the study group was pruritus (20.6%).

Conclusions: The combination of morphine and hyperbaric bupivacaine in spinal anesthesia provides more effective postoperative analgesia compared to the use of bupivacaine alone.

Keywords: Subarachnoid Anesthesia; Local Anesthetic; Bupivacaine; Morphine; Cesarean Section; Analgesia.

Introduction

Anesthesia in cesarean sections plays an essential role in relieving pain and improving maternal-neonatal care. The choice of anesthetic technique depends on factors such as the urgency of the procedure, the preoperative state and the patient's preferences. In this context, the anesthesiologist plays a key role in ensuring safe and effective management of these obstetric procedures [1]. Subarachnoid regional anaesthesia is currently the most widely used technique, as it is considered the safest option. The development of neuraxial techniques, together with the combination of local anesthetics, opioids and adjuvants, has demonstrated benefits both intraoperatively and in the control of postoperative pain [2,3,4].

Administration of the local anesthetic into the subarachnoid space results in rapid and complete blockage of sensory, motor, and sympathetic functions. Its advantages include the immediate initiation of analgesia and the low fetal transfer of the drug, given the low dose used [5,6].

The dose of the local anesthetic is decisive for the extent and duration of the blockage, and must be adjusted to the physiological changes of pregnancy. Pregnant women require lower doses than non-pregnant women, an effect that can be enhanced with adjuvants [7,8].

Bupivacaine, especially in its hyperbaric form, is widely used for its efficacy and safety profile. However, its adverse effects, such as hemodynamic instability, increase with high doses [9]. Therefore, the combination with adjuvants is advantageous, as it improves blockage and reduces unwanted effects [10].

Morphine was the first opioid approved by the Food and Drug Administration (FDA) for administration on the neuraxis and, at low doses, has been shown to be effective and safe for post-cesarean pain control. Its analgesic action, although slow onset, can extend up to 24 hours, being useful in the immediate postoperative period [11]. The objective of this study is to evaluate the results of subarachnoid anesthesia with 0.5% hyperbaric bupivacaine and intrathecal morphine in patients undergoing cesarean section at the Guido Valadares National Hospital, to contribute to the strengthening of the available evidence and the optimization of obstetric anesthetic protocols.

Methods

A quasi-experimental two-arm study was conducted at the Guido Valadares National Hospital in Dili, Timor Leste, from January to June 2024.

The universe consisted of 63 patients who underwent cesarean section in the surgical block of the aforementioned institution, where the anesthetic method of choice was subarachnoid anesthesia. Intentional probabilistic sampling was applied by investigator criteria, in which all patients met the inclusion criteria.

Patients over 17 years of age, without associated diseases or mild systemic disease, and who agreed to participate in the research by signing an informed consent form, were included in the study. Exclusion criteria were established for patients with a history of allergy to the drugs used and absolute contraindications to the use of subarachnoid anesthesia.

To carry out the quasi-experiment, the population was divided into two treatment groups. Group I (control group), in which the conventional anesthetic method was applied with hyperbaric bupivacaine (0.5%), 10 mg subarachnoid, and Group II (study group), in which hyperbaric bupivacaine (0.5%), 7.5 mg plus morphine 80 mcg subarachnoid was used. The distribution of patients into groups was simple random.

The data were obtained from the clinical records of the patients included in the anesthesia sheet, as well as from the interview with them, they were collected through a form prepared from the theoretical information reviewed and containing the variables of interest for the research such as: age group, gestation time at the end of pregnancy, vital parameters such as heart rate, mean arterial pressure and peripheral oxygen saturation measured at the beginning of the surgical intervention and at the end of it, intensity of postoperative pain according to the visual analogue scale (VAS) which was applied in two stages (T1 and T2): second and eighth hour of the immediate postoperative period and postoperative complications, Mild pain was considered 1-3 points, moderate 4-6 points, and severe 7-10 points [12].

The information was processed and analyzed in a database created for this purpose in the IBM SPSS version 27.0 statistical package for Windows, descriptive statistics were used to summarize the variables and for the preparation of frequency distribution tables, the mean ($\bar{x}$) and standard deviation (SD) for age and gestation time were also used.

The Kolmogorov Smirnov test was applied to rule out aberrant values in the sample. Variables with Gaussian distribution were subjected to the parametric Student's T test for independent samples, and those with a distribution deferential to normal were subjected to the U Man Whitney test, which measures differences in distributions for independent samples with ordinal or quantitative variables, bilateral asymptotic significance values were established (si $p \leq 0.05$). All statistical processing had a reliability of 95%.

Approval was requested from the Health Research Committee of the Guido Valadares National Hospital. All information was used for scientific purposes only, and the ethical principles dictated in the Declaration of Helsinki were taken into account [13].

Results

When analyzing the distribution of patients according to age group and gestation time at the time of delivery, it was observed that the average age was 33.16 ± 5.10 years. Similarly, the average gestation time was 38.8 ± 0.7 weeks. When analyzing both variables with the test statistic, it was observed that there were no statistically significant differences between the two groups (Table 1).

Table 1: Results of subarachnoid anesthesia with hyperbaric bupivacaine and morphine in cesarean section. Distribution of patients in terms of age group and gestation time at the end of pregnancy.

Variables	Group I (control)	Group II (study)	P
Age	33.4 ± 5.18	32.8 ± 5.10	0.7
Gestation Time	38.7 ± 0.7	38.9 ± 0.7	0.06

Source: Clinical Records

a- data expressed as $\bar{x}$ and

In the analysis of the vital signs compared in the two evaluation moments, it was observed using the non-parametric statistical test Mann Whitney's U that there were no statistically significant differences between heart rate, mean arterial pressure, and pulsatile oxygen saturation measured in the second moment ($p > 0.05$). However, it was observed that the heart rate at the first moment showed a probability associated with the test statistic of less than 0.05, which allows us to propose with 95% reliability that the heart rate varies in relation to the anesthetic treatment (Table 2).

Table 2: Distribution of patients according to group and vital parameters evaluated at the two moments of the transoperative period.

Vital Parameters	Time	Group I (Control) Mean ± SD	Group II (Study) Mean ± SD	P-value
Heart Rate (bpm)	T1	101.0 ± 11.2	93.9 ± 9.4	0.02
	T2	83.6 ± 6.5	82.8 ± 7.2	0.50
Mean Arterial Pressure (mmHg)	T1	85.6 ± 5.7	83.5 ± 6.4	0.30
	T2	75.5 ± 6.3	76.7 ± 3.7	0.10
SpO_2 (%)	T1	97.8 ± 3.7	98.7 ± 0.6	0.10
	T2	98.6 ± 0.6	98.8 ± 0.3	0.60

Source: Clinical Records

Regarding the distribution of patients according to group and pain intensity using VAS evaluated in the postoperative period, it was found that no patient in the study group reported pain at first, while 68.8% of the control group reported mild pain. The second evaluation time showed that 53.3% of the patients in the control group had moderate pain, while mild pain was less representative. At no time of evaluation was severe pain found in both treatment groups. The statistical test showed a probability associated with the test statistic of less than 0.05, which allows us to state with 95% reliability that the intensity of postoperative pain varies in relation to the anesthetic treatment used (Table 3).

Table 3: Distribution of patients according to postoperative pain intensity and treatment group.

Postoperative pain		T1		T2		P-value
		No.	%	No.	%	
Group I (control)	No pain	10	31.3	2	6.3	0.000
	Light	22	68.8	12	37.5	
	Moderate	-	-	18	53.3	
	Severe	-	-	-	-	
Group II (study)	No pain	31	100	24	77.4	0.000
	Light	-	-	5	16.1	
	Moderate	-	-	2	6.5	
	Severe	-	-	-	-	
Total		63	100	63	100	

Source: Clinical Records

In 42.9% of the patients, no postoperative complications were recorded, the most frequent being pruritus in the study group (20.6%), nausea (20.6%) and vomiting were less representative (15.9%). No respiratory depression was found in both treatment groups (Table 4).

Table 4: Distribution of patients according to postoperative complications and treatment group.

Complications	Group I (Control)		Group II (Study)		Total	
	No.	%	No.	%	No.	%
No complications	19	59.4	8	25.8	27	42.9
Itching	-	-	13	41.9	13	20.6
Nausea	7	21.9	6	19.4	13	20.6
Vomiting	6	18.8	4	12.9	10	15.9
Respiratory depression	-	-	-	-	-	-

Source: Clinical Records

Discussion

Studies on postoperative analgesia in cesarean section report average ages similar to those of this research [3,14]. However, pregnancy at an early age represents a global problem, especially in sectors of low socioeconomic status, influenced by the lack of sex education and lack of knowledge about contraception [15]. The ideal age for pregnancy is between 20 and 35 years, the interval in which most of the patients in the study were found. In this range, physiological conditions are more favorable, with a lower incidence of chronic diseases and obstetric complications, unlike adolescents and women over 40 years of age [16].

The values obtained at the first moment of heart rate measurement, it could be seen that the study group presented less variation in this vital parameter, remaining close to the normal range. Similar data are collected in the research by Alvarez [17], who evaluated the efficacy of 0.5% hyperbaric bupivacaine using several doses, although his study included 150 patients undergoing cesarean delivery, determined that the increase in heart rate was more frequent with doses of 10 mg and 12 mg (11.4%; 12.5%), the same author points out that it is a consequence of the initial vasodilation caused by neuraxial anesthesia.

Similarly, Alegre [3] conducted a prospective, randomized, double-blind clinical trial with 99 patients randomly distributed into three groups, where he used a fixed dose of 9 mg of hyperbaric bupivacaine. During the evaluation of vital parameters, it was observed that the group that received anesthetic treatment with intrathecal morphine was the one that most frequently registered hypotension and the need for vasopressor agents different results are reported in the present study, where the mean arterial pressure remained in the normal range.

It should be noted that, although there were no statistical differences in mean arterial pressure in our research, it was observed that the study group presented fewer variations in it, hence the benefit of the low dose of subarachnoid local anesthetic [17].

Postoperative pain after cesarean section represents a determining factor in the clinical evolution of the maternal-neonatal binomial, interfering with functional recovery, early ambulation, breastfeeding and affective bonding, which positions it as one of the obstetric procedures with the highest intensity of pain and the lowest clinical tolerance in the postoperative period [18].

During the evaluation of postoperative pain, it was shown that the application of anesthetic treatment with hyperbaric bupivacaine (0.5%)7.5 mg plus morphine 80 mcg resulted in a reduction in its intensity. Similar results were found by Garces et al., [11] regarding the intensity of acute pain during the first 24 hours of the postoperative period, where none of the patients reported intense or severe pain; only two patients presented pain greater than or equal to four on the visual analog scale. Another study conducted by Martínez et al., [18] in which the efficacy and safety of spinal administration of fentanyl 25 mcg and morphine 50 mcg was compared to epidural administration of ropivacaine 1.2% for pain control in patients undergoing cesarean section, a lower postoperative pain score was found in the group that received opioids intrathecally which evidenced an analgesic superiority of this technique.

One of the limitations of this study was that, despite having administered low-dose intrathecal morphine, the assessment of pain intensity was restricted only to the first eight hours postoperatively, which prevented a comprehensive assessment of the duration of the analgesic effect up to 24 hours after surgery. However, recent reviews indicate that, although there is no optimal dose of morphine as an adjuvant to intrathecal anesthesia, between 50 and 150 mcg improves patient quality and satisfaction, in addition to presenting acceptable side effect profiles [19,20].

In relation to the above, a study where the effectiveness of postoperative analgesia with bupivacaine plus intrathecal morphine in prostate surgery was evaluated. It was determined that the presence of pruritus was the most frequent complication in the group that received intrathecal morphine with an incidence of 53.3%, nausea and vomiting occurred in both groups without significant differences. in addition, no case of respiratory depression was recorded [22] likewise, Garces et al., [11] in their research identified that the presence of pruritus and nausea were the predominant adverse reactions with 48.33% and 28.33% respectively, without finding respiratory depression in the sample studied, results that contrast with the present research. However, Hattera et al., [23] in a randomized controlled trial found no statistically significant differences in analgesic quality and the presence of side effects when comparing the use of 50 mcg of intrathecal morphine versus a 100 mcg dose.

The authors of the present research consider that the use of 0.5% hyperbaric bupivacaine (7.5 mg) associated with intrathecal morphine (80 mcg) as an adjuvant was more effective than hyperbaric bupivacaine (10 mg) as the only anesthetic agent, in terms of the improvement of early post-cesarean analgesia and the absence of serious adverse effects, which supports its use as a safe and effective anesthetic method in this surgical procedure.

Conclusion

The combination of hyperbaric bupivacaine and intrathecal morphine provided more effective post-caesarean analgesia during the first few hours, compared to the use of bupivacaine alone, without compromising cardiovascular stability or increasing the incidence of serious adverse effects.

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Citation: Yuliel Varona Rodriguez., et al. "Efficacy of Subarachnoid Anesthesia with Hyperbaric Bupivacaine and Morphine in Cesarean Section". NL Journal of Medical and Pharmaceutical Sciences 1.3 (2025): 21-26.