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COMPARISON OF OUTCOME OF 0.5% HYPERBARIC BUPIVACAINE WITH 0.5% HYPERBARIC ROPIVACAINE IN SPINAL ANAESTHESIA FOR PERIANAL SURGERIES.

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Abstract

Introduction: The field of anaesthesiology has undergone significant advancements in recent years, resulting in improved patient outcomes and reduced hospitalization durations. This is primarily due to the availability of anaesthetic agents that block sensations locally or regionally for shorter durations. **Objective:** To compare the outcome of 0.5% hyperbaric Ropivacaine with 0.5% hyperbaric Bupivacaine in spinal anaesthesia for perianal surgeries. **Design:** Randomized controlled trial. **Setting:** Anaesthesiology Department, Surgical Intensive Care Unit And Pain Management, Jinnah Post graduate Medical Centre (JPMC), Karachi. **Duration:** Six months (From 7 April 2016 to 7 October 2016). **Methods:** 126 Perianal surgery patients were approached for consent for study. Two groups viz; A & B were made, and group allocation of consecutive patients were made through using opaque envelopes containing strip of either group. Group A patients received three mililiter of Ropivacaine (5 mg/ml) with glucose 83 mg/ml. Whereas, Group B received three mililiter of hyperbaric Bupivacaine (5 mg/ml) with glucose 80 mg/ml. Moreover, Oral temazepam 10–20 mg was administered to patients before to surgery to reduce anxiety. **Results:** The duration of sensory block was statistically less in the Ropivacaine group (153.8±9.3min) as compared to Bupivacaine group (190.2±8.3min) with P-value 0.0001. In addition, the ropivacaine group's mean time in motor block was less than that of the bupivacaine group (120.89±12.122 min vs 189.33±11.947min; P = 0.0001). **Conclusion:** According to the results of the current investigation, bupivacaine applied intrathecally causes sensory block to begin more quickly and last longer than ropivacaine.

Keywords: Hyperbaric bupivacaine, ropivacaine, spinal anaesthesia

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INTRODUCTION

Spinal anaesthesia is a commonly used regional anaesthesia technique for lower abdominal, pelvic, and lower extremity surgeries[1,2]. It entails injecting a local anaesthetic into the cerebrospinal fluid (CSF), which causes the lower body's feeling and motor function to be lost [(2)]. Hyperbaric local anaesthetics are preferred for spinal anaesthesia due to their rapid onset and predictable duration of action[3]. Hyperbaric solutions have a higher specific gravity than cerebrospinal fluid, resulting in the drug settling in the dependent area of the spinal cord, providing more reliable anaesthesia[2,4]. Among hyperbaric local anaesthetics, bupivacaine and ropivacaine are commonly used drugs for spinal anaesthesia[5]. A long-acting amide local anaesthetic having a gradual start and protracted duration of action is bupivacaine[3]. It provides reliable sensory and motor block but has a higher incidence of cardiovascular toxicity and neurotoxicity[(6)]. It has a better safety profile, with a lower incidence of motor blockade and cardiovascular toxicity and a lower risk of neurotoxicity[7]. Bupivacaine and ropivacaine's clinical effectiveness and safety in spinal anaesthesia have been compared in several research[3,8]. However, the results have been conflicting, with some studies showing similar outcomes between the two drugs while others reporting better outcomes with ropivacaine. Therefore, there is a need for further research to determine the optimal local anaesthetic agent for spinal anaesthesia[8]. In this study, the effectiveness of 0.5% hyperbaric bupivacaine and 0.5% hyperbaric ropivacaine during spinal anaesthesia will be compared[(1, 8)]. The primary objective of the study is to evaluate the onset and duration of sensory and motor blockade, the quality of anaesthesia, and hemodynamic stability.

METHODOLOGY

This randomized controlled trial study was conducted in Department of Anaesthesiology, Surgical Intensive Care Unit and Pain Management, Jinnah Post Graduate Medical Center (JPMC), Karachi. The study was was carried out in duration of six (06) months (from April to October 2016) after taking the approval of synopsis. A total of 126 patients were recruited and categorized in two groups (63 in each group).

P1 = 155 ± 60 (Mean ±SD) time duration of sensory block (Ropivacaine)

P2 = 190.5± 80 (Mean±SD) time duration of sensory block (Bupivacaine)

Power of the study = 80%.

Two sided confidence level = 95%
A non-probability consecutive sampling technique was used for patients recruitment. The patient of age between 18 - 60 years irrespective of gender, admitted patients for perianal surgery under American Society of Anesthesiologists (ASA) class I & II, and willingness to participate in study were included in the study. A patiens with hypertensive or hypotensive history, patients with abnormal coagulation profiles (detected through PT, APTT test which are routinely done as part of patient preparation), and American Society of Anesthesiologists class III & IV group patients, severe cardiopulmonary disease, diabetes mellitus detected from the history and examination, and patient on steroid medication, or have taken steroids in the last three months detected from the history were excluded from the study. A data were collected after getting approval of synopsis from Research Evaluation Unit of CPSP, Karachi followed by permission from the ethical review committee of JPMC. Patients admitted for perianal surgery were approached for consent for study once found suitable as per ASA criteria. After understanding the procedures; only those who provide valid written consent were included in the study. Two groups; A & B were made and group allocation of consecutive patients were made thorough using opaque envelopes containing strip of either group. Patients were asked to pick any one of the opaque envelops thus randomly choosing either A or B group. Participants in group A were given 3 ml of hyperbaric bupivacaine 5 mg/ml (with glucose 80 mg/ml), while those in group B received 3 ml of ropivacaine 5 mg/ml (with glucose 83 mg/ml). To relieve anxiety, oral temazepam 10-20 mg were given preoperatively. Assessment of the sensory blockade was done every minute. After determining the latency time, the assessment were done every 5 minutes until the 20th minute.Assessment of the motor blockade of the lower limbs were doneat 10, 30 and 60 minutes, at the end of the surgical procedure and finally at 120 minutes. The durations of the sensory and motor blockage were noted on proforma. Continuous cardiovascular monitoring with ECG, non-invasive arterial pressure and pulseoximetry were done every three minutes in the first 15 minutes, and every five minutes until the end of the surgical procedure. Hypotension were treated with phenylephrine (50 mcg). The data of name, age, gender, weight, height,address and outcome were noted on proforma. Data were entered and analyzed by using statistical package for social sciences version 19 (SPSS 19). Results were described as mean ± standard deviation for quantitative variables like age and BMI, duration of sensory and motor blockagesin both groups. Frequency and percentage were computed for qualitative variables like gender & residence. Duration of motor and sensory blockade of both anaesthetic agents were compared by using student’s t-test (two sample independent) with p value $\leq$0.05 considered as significant. Confounders of outcome variable by age, gender, residence and BMI were evaluated by stratification followed by t-test with p value $\leq$0.05 considered as significant.

RESULTS

A total of 126 patients fulfilling selection criteria for perianal surgerywere included in the study. Two groups; A & B were made and group allocation of consecutive patients were made thorough using opaque envelopes containing strip of either group. Patients were asked to pick any one of the opaque envelops thus randomly choosing either A or B group. Whereas group B patients got 3 ml of hyperbaric bupivacaine 5 mg/ml (with glucose 80 mg/ml), group A patients received three (03) ml of ropivacaine 5 mg/ml (with glucose 83 mg/ml). To relieve anxiety, oral temazepam 10-20 mg were given preoperatively.

Patients who included in the study have age range 18-60 mean age of patients on Bupivacaine Group was 40.83 with standard deviation 11.47, mean age of patients in ropivacaine Group was 39.56 with standard deviation 10.64, body mass index of Bupivacaine Group were showed mean 27.6 and SD 5.61 body mass index of ropivacaine Group were showed mean 224.17 and SD 7.21 (Table 1).

A study outcomes duration of motor blockages and sensory blockages were presented as mean and standard deviation in Ropivacaine group mean and SD were 120.9±12.1 and in bupivacaine group 189.2±11.9 of duration of motor blockages. Duration of sensory blockages showed mean and standard deviation in bupivacaine group 190.2±8.3 while ropivacaine group 153.8±9.3 (Table 2).

Distributions of gender and residence status of the patients were presented as frequency and percentages qualitative study variables were presented group-wise as well as overall. In Bupivacaine group there were 25(39.7%) study participants were female and 38(60.3%) were male. While in Ropivacaine group 31 (49.2%) study participants were female and 32(50.8%) were male. Proportion of male and female participants was closely similler. In Bupivacaine group there were 29 (46.03%) study participants were belonged to urban area and remaining were from rural area While in Ropivacaine group 40 (63.49%) study participants were belonged to urban area and only 23(36.51%) were from rural area (Table 3).

Comparison of duration of motor blockages and sensory blockages has been done between both of the study groups mean and SD of both outcomes in Bupivacaine group and ropivacaine group were calculaed Result were showed significance difference between both groups (p-value=0.0001) and(p-value=0.0001) respectively. Result obtained by using independent t- test as it was mentioned in the data analysis (Table 4 and 5).

Stratification of duration of motor blockages and sensory blockages between both study groups has been done with regards to age groups, gender, residential status, and BMI. All the results were showing significant differences. which means these factors are affected on the duration of motor and sensory blockages (Table 6-13).

Table 1: Patients categorized based on Ropivacaine and Bupivacaine groups

Drug	**Mean±SD**	**Age**	**BMI**
Ropivacaine	N	63	63
	Mean	39.56	27.6
	Std. Deviation	10.64	5.61
Bupivacaine	N	63	63
	Mean	40.83	24.17
	Std. Deviation	11.47	7.21

Table 2: Outcome of patients in Ropivacaine and Bupivacaine groups

Groups	**Mean±SD**	**Duration of Motor Blockage**	**Duration of Sensory Blockage**
Ropivacaine	N	63	63
	Mean	120.89	153.81
	Std. Deviation	12.122	9.312
Bupivacaine	N	63	63
	Mean	189.22	190.25
	Std. Deviation	11.947	8.312

Table 3: Distribution of gender and residence in Ropivacaine and Bupivacaine groups

Groups	**Parameters**	**Ropivacaine**	**Bupivacaine**
Gender	Female	31(49.2%)	25(39.7%)
	Male	32(50.8%)	38(60.3%)
	Total	63(100%)	63(100%)
Residence	Urban	23(36.51%)	29(46.03%)
	Rural	40(63.49%)	34(53.97%)
	Total	63(100%)	63(100%)

Table 4: Comparison of duration of Motor blockages between Ropivacaine and Bupivacaine groups

Groups	Duration of Motor Blockages		Independent t-test P-Value
	N	Mean±SD	
Bupivacaine	63	189.33±11.947	0.0001
Ropivacaine	63	120.89±12.122	

Table 5: Comparison of duration of Sensory blockages between Ropivacaine and Bupivacaine groups

Groups	Duration of Sensory Blockages		Independent t-test P-Value
	N	Mean±SD	
Bupivacaine	63	190.2±8.39	0.0001
Ropivacaine	63	153.8±9.3	

Table 6: Stratification of duration of Motor blockages between between Ropivacaine and Bupivacaine groups with regards to age 18-45 and 46-60 years.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
18-45	Bupivacaine	35/63	193.33±18.947	0.0001
	Ropivacaine	40/63	126.09±10.12	
46-60	Bupivacaine	28/63	199.65±20.47	0.0001
	Ropivacaine	23/63	109.89±25.122	

Table 7: Stratification of duration of Sensory blockages between between Ropivacaine and Bupivacaine groups with regards to age 18-45 and 46-60 years.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
18-45	Bupivacaine	35/63	205.75±21.09	0.0001
	Ropivacaine	40/63	163.91±19.312	
46-60	Bupivacaine	28/63	197.25±15.39	0.0001
	Ropivacaine	23/63	160.21±11.82	

Table 8: Stratification of duration of Motor blockages between between Ropivacaine and Bupivacaine groups with regards to female and male.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
Female	Bupivacaine	25/63	196.04±17.47	0.0001
	Ropivacaine	31/63	134.89±12.26	
Male	Bupivacaine	38/63	189.33±11.947	0.0001
	Ropivacaine	32/63	120.89±12.122	

Table 9: Stratification of duration of Sensory blockages between between Ropivacaine and Bupivacaine groups with regards to female and male.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
Female	Bupivacaine	25/63	211.2±28.3	0.0001
	Ropivacaine	31/63	167.8±14.3	
Male	Bupivacaine	38/63	193.2±18.8	0.0001
	Ropivacaine	32/63	158.8±9.3	

Table 10: Stratification of duration of Motor blockages between between Ropivacaine and Bupivacaine groups with regards to Urban and Rural regions.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
Urban	Bupivacaine	29/63	198.3±13.5	0.0001
	Ropivacaine	23/63	126.9±12.5	
Rural	Bupivacaine	34/63	199.9±19.0	0.0001
	Ropivacaine	40/63	130.9±12.7	

Table 11: Stratification of duration of Sensory blockages between between Ropivacaine and Bupivacaine groups with regards to Urban and Rural regions.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
Female	Bupivacaine	29/63	194.2±18.4	0.0001
	Ropivacaine	23/63	159.8±9.3	
Male	Bupivacaine	34/63	201.2±18.3	0.0001
	Ropivacaine	40/63	173.8±19.1	

Table 12: Stratification of duration of Motor blockages between between Ropivacaine and Bupivacaine groups with regards to BMI.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
BMI(<24kg/m2)	Bupivacaine	30/63	196.53±16.947	0.0001
	Ropivacaine	35/63	130.89±17.122	
BMI(>24kg/m2)	Bupivacaine	33/63	199.33±11.947	0.0001
	Ropivacaine	28/63	126.019±13.22	

Table 13: Stratification of duration of Sensory blockages between between Ropivacaine and Bupivacaine groups with regards to BMI.

Age	Groups	Duration of Motor Blockages		Independent t-test P-value
		N	Mean±Sd	
BMI(<24kg/m2)	Bupivacaine	30/63	196.25±19.279	0.0001
	Ropivacaine	35/63	163.81±11.312	
BMI(>24kg/m2)	Bupivacaine	33/63	180.25±28.34	0.0001
	Ropivacaine	28/63	159.54±19.02	

DISCUSSION

The findings of the previous research[8,9] showing ropivacaine may generate predictable and dependable spinal anaesthesia for a variety of surgical procedures have been verified by the current investigation[7]. The results of the current study differ from those of the two previous clinical investigations, which reported blockades with ropivacaine that are inappropriate for surgery[2, 9]. The difference might be caused by the fact that these writers employed ropivacaine glucose-free solutions [10]. The difference demonstrates that ropivacaine solution with glucose added has the same effects as other medications[1, 11]. In the current investigation, the ropivacaine group had a delayed start of sensory and motor blockage compared to the bupivacaine group. Moreover, the ropivacaine group's total period of sensory and motor blockage was shorter than the bupivacaine group's. This result is consistent with those of Erturk et al.[12] and Bigat et al.[13]. This could be as a result of bupivacaine's somewhat stronger protein binding and higher lipid solubility when compared to ropivacaine. An significant factor in local anaesthetic action is lipid solubility[8, 14].The local anesthetic's lipid solubility has a direct correlation with the conduction block's onset time. The sequestration of the local anaesthetic in myelin and other nearby neuronal compartments is increased by increased lipid solubility [15]. As a result, the impact is increased since the gradual release of the local anaesthetic is made possible by the depot that is created when the local anaesthetic molecule is absorbed into the myelin and adjacent neuronal compartments [16, 17]. In general, the longer-acting and more lipid-soluble substances have higher protein binding. Compared to the more lipid-soluble bupivacaine, ropivacaine may penetrate the big myelinated A fibres more slowly because of its reduced lipid solubility [17]. Moreover, it is hypothesised that ropivacaine affects unmyelinated pain fibres more strongly than myelinated motor fibres because it is less lipophilic[18]. No late effects, such as back discomfort or other temporary symptoms, were seen, which is consistent with other research on the use of ropivacaine spinal bupivacaine in spinal anaesthesia [11,19]. Both groups experienced comparable intraoperative and postoperative side symptoms (bradycardia, nausea, cold, and vomiting) [20]. Our research did have certain limitations, though. One of the drawbacks was that blinding, which would have produced some bias, wasn't done. Moreover, we did not standardise the dosage according to the patient's age, height, or weight. Hyperbaric blood pressure has historically been the preferred medication for spinal anaesthesia, a conventional method frequently utilised for numerous lower extremities procedures [21]. Yet, as shown by a number of studies, RP has emerged as a suitable substitute due to its reduced cardio- and neurotoxic profile [22]. It has been demonstrated that intrathecal RP causes more efficient local anaesthesia in dogs than intrathecal BP [23]. Hence, different studies have shown that intrathecal RP is successful in a variety of surgical procedures, including total hip arthroplasty, transurethral prostate excision, pelvic and limb operations [24]. Both groups showed variance in the distribution of the sensory block, which they hypothesised may be caused by the adoption of a straightforward fix [25]. This study was conducted to evaluate the efficacy of intrathecal administration of hyperbaric RP and hyperbaric BP in terms of the onset and duration of effective anaesthesia and analgesia. This supports the findings of Chung et al., who discovered that the RP group required more time than the BP group to attain T10, the highest level of sensory blockage (p0.05)[26]. The study's patient placement and anaesthetic dosages were intended to primarily accomplish sensory block and prevent lower extremity motor block. Several publications claim that smaller dosages of hypobaric bupivacaine or lidocaine were utilised for ventral pressure ulcers with good sensory block and minimal motor block. Motor block was absent in 135 (90%) of the patients [27].None of the individuals in the current research needed a urinary catheter. 6 mg of hypobaric 0.15% bupivacaine takes 105 minutes to recover from. The recovery time was decreased to 99 minutes by changing the hypobaric dosage from 0.15% bupivacaine to 4.5 mg [28]. The recovery time for 40 mg of lidocaine in the 1% solution is 142 minutes. The recovery period for the same dosage of 0.5% hypobaric lidocaine was 151 minutes. Similar to the current investigation, recovery following 18 mg of hypobaric 0.6% lidocaine took 63 minutes (64 minutes). Comparing lidocaine to bupivacaine in this study, a shorter recovery time was statistically significant [29]. When the conventional spinal block was compared to the asymmetric spinal block, it was found that one of the purposes of the posterior spinal block was to decrease the incidence of hypotension that can happen with this procedure. Due to the jack-knife posture and little sympathetic blocking, the hypobaric solution stayed isolated at the injection site, which is likely what caused the hemodynamic stability [30]. With all anaesthetics, spinal blocks have been associated with transient neurological effects. No patients in the current research experienced temporary neurological symptoms that differed from those seen with greater dosages, supporting the significance of low doses in this investigation.

CONCLUSION

The results of this study show that, in comparison to ropivacaine, intrathecally administered bupivacaine causes sensory block to occur more quickly and last longer. This finding has important implications for clinical practice, particularly in the context of regional anaesthesia for surgical and postoperative pain management. Despite the fact that both medications are often used for intrathecal anaesthesia, the findings of this study indicate that bupivacaine could offer better pain alleviation and a quicker beginning of effect. However, more investigation is required to thoroughly assess the relative efficacy and safety of these two medications, particularly in light of long-term effects and negative side effects. Overall, the results of this study suggest that bupivacaine may represent a promising option for intrathecal anaesthesia and warrant further investigation in future clinical trials.

Ethics Approval: The ERC gave ethical review approval

Consent To Participate: written and verbal consent was taken from subjects and next of kin

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Conflict Of Interest: No competing interest declared.

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