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# Comparison of haemodynamic changes and level of block during Spinal anaesthesia-Lithotomy v/s Supine position using Ropivacaine and Bupivacaine

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***Abstract***
***Background and Aims:*** *Spinal anaesthesia is associated with various haemodynamic changes due to sympathetic blockade. Various surgical positions also affects haemodynamics, lithotomy position increases the systolic arterial pressure from the sub extremities with the effect of auto transfusion. Study was designed to compare haemodynamic changes in supine and lithotomy position during spinal anaesthesia, also to compare pharmacological effect and side effect of ropivacaine and bupivacaine in subarachnoid block as secondary outcome variables*
***Material & Methods:*** *Prospective randomized study includes a total of 120 ASA I-II patients who underwent elective haemorrhoidectomy, fissurectomy, TURP and hernia repair. Patients randomly assigned in four groups- Group B (Supine),Group B (Lithotomy), Group R (Supine), and Group R (Lithotomy) based on patients position and type of hyperbaric drug (ropivacaine or bupivacaine) used. Intraoperatively haemodynamic parameters, level of sensory block, onset of motor block, and adverse effects were recorded.*
***Results and conclusion:*** *This study demonstrated that lithotomy position provides more haemodynamic stability as compared to supine position, also concluded that hyperbaric ropivacaine provide less extensive sensory block, which regressed more rapidly & provide more haemodynamic stability as compared to bupivacaine.*
***Keywords****: Supine, lithotomy, bupivacaine, ropivacaine, dextrose, autotransfusion.*

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## I. Introduction

Spinal anaesthesia is most popular and safe technique for providing anaesthesia for infraumbilical surgeries, it is associated with various hemodynamic changes; most common complication encountered with spinal anaesthesia is hypotension[1]. The main mechanism is, the sympathetic blockade causing arterial and venous dilatation[2]. Arterial dilatation results in decreases in total peripheral resistance and SAP of up to 30 %.[3]However, venous dilatation can cause severe hypotension as a result of a decrease in venous return and cardiac output. Restoring venous filling pressure by fluid administration or head down tilt is considered one of the most important modality for treating it. Some positions of surgery are also associated with haemodynamic changes. Lithotomy position meaningfully increases the systolic arterial pressure from the sub extremities with the effect of autotransfusion.[4]As a volume of approximately 500–1000 mL blood passes from the lower extremity to the central circulation as an effect of autotransfusion.[4]Secondly the tissue concentration of local anesthetic in spinal anesthesia is controlled by the tissue blood flow in addition to the CSF. Racemic bupivacaine, a long-acting local anesthetic agent is being used widely for regional anaesthesia but concerns have been raised over its potential cardiac and central nervous system toxicity. Ropivacaine, pure L-isomer of bupivacaine with less lipophilicity and quite similar physicochemical properties, with less potential for cardiotoxicity and CNS toxicity, is a safer alternative to bupivacaine.

Hence we designed a study to compare haemodynamic changes and level of block in supine and lithotomy position using intrathecal ropivacaine and bupivacaine as primary outcome variables, we also compared pharmacological effect and side effect of ropivacaine and bupivacaine in subarachnoid block as secondary outcome variables.

## II. Material & Methods

This prospective, randomized, double blind study was conducted in a tertiary care centre after approval from Hospital Ethical Committee. One hundred & twenty patients of 30 -75 yrs age, belonging to American Society of Anaesthesiologist (ASA) physical status I or II, weighing between 50 -80 kg and scheduled for TURP and hernia surgeries under spinal anaesthesia were included in the study. Patients with contraindication to spinal anaesthesia, major neurological, cardiac diseases and coagulopathies were excluded from the study.

A detailed pre-anaesthetic check-up, general physical examination and necessary investigations were done one day prior to surgery. The procedure was explained to the patient, and written informed consent was taken. Randomization was done using chit in box method. Patients were divided into 4 groups comprising of 30 patients in each group.

**Group B (Supine)**: received 0.5% bupivacaine heavy 3ml+1ml distilled water intrathecally.
**Group B (Lithotomy):** received 0.5% bupivacaine heavy 3ml+1ml distilled water intrathecally.
**Group R (Supine)**: received 0.75% ropivacaine 3ml +1ml 25% dextrose intrathecally.
**Group R (Lithotomy):** received 0.75% ropivacaine 3ml +1 ml 25% dextrose intrathecally.

After confirming fasting status, patients were taken into operation theatre and intravenous access was secured. All patients were premedicated with 0.03 mg/kg IV midazolam 30 min before the anesthesia. Standard monitoring of non invasive blood pressure (NIBP), continuous electrocardiogram (ECG) and pulse oximetry (SpO2) was established. Baseline vitals were noted, preloading was done with ringer's lactate solution at a dose of 15 ml/kg. Spinal anesthesia was performed at L3-L4 or L4-L5 interspace in sitting position. Once clear free flow of CSF is obtained, the study drug solution of 4ml was injected through the using a 25 G Whitacre spinal needle. Patients immediately placed in supine position in Group B(S) and Group R(S), and placed in lithotomy position 5 minutes after injection of local anaesthetic in Group B (L) and Group R (L). For blinding, drug solution was prepared by one anaesthetist and spinal anaesthesia was performed by another one. All the observations were done by anaesthetist who was not involved in drug preparation and administration.

Intraoperatively level of sensory block, onset of motor block, haemodynamic parameters and adverse effects were recorded.

The level of sensory block was assessed by pin prick method using 22-gauge hypodermic needle bilaterally at the mid-clavicular line, every 2 minute for the first 15 minutes and then at 30, 45, and 60 minutes after injection and, thereafter, at 30 minutes interval until the patient complained of pain. Motor block was assessed using Bromage scale, (0-no motor block; 1-inability to raise extended leg, able to move knees and feet; 2-inability to raise extended leg and move knee; able to move feet; 3-complete motor block of limb). If hypotension occurred (hypotension defined as SBP <20% of the baseline value) was treated with injection ephedrine 6mg bolus. A decrease in HR below 60 beats/min treated with injection atropine 0.6mg.

**Statistical analysis** was done using SPSS version XVII. All the concerned data was calculated as mean, S.D., SED, SEM, and confidence interval for descriptive statistics and student's paired t-test & one way analysis of variance (ANOVA) were used for comparison.

## III. Results

All the groups were comparable with respect to age, weight, height and ASA status [Table 1]. The characteristics of sensory and motor blocks are shown in (Table 2). Onset of sensory block was significantly faster in group B(S) 2.68 ±0.67 min and B(L) 2.93 ±0.25min as compared to 5.70 ±1.08min in group R(S) and 5.63 ±1.15 min in group R(L) (P<0.0001). Height of maximum block achieved was till 7.33±1.21 dermatome in both group B(S) and B(L),while in group R(S) 9.40±1.19 and in group R(L) 9.46±1.04, significantly higher dermatomal block was seen in bupivacaine group(*P*<0.0001).No difference was observed in supine and lithotomy position. Time for two segment regression was faster in group R(S) and R (L) 96.33±16.86 min and 100.50±18.95 min respectively, as compared to147.16±17.65 min and 142.50±17.05min in group B(S) and B (L) respectively. This difference was highly significant statistically (*P*<0.0001)

Quality of motor block was comparable among all four groups. (P=0.935)

## IV. Table & Figures

**Table 1: Demographic variables**

| Parameters | Group B(S) (n=30) | Group B(L) (n=30) | Group R(S) (n=30) | Group R(L) (n=30) | *P* value |
|---|---|---|---|---|---|
| Age(yrs) | 62.36±8.600 | 67.96±8.33 | 62.2±9.02 | 65.46 ±10.95 | 0.556 |
| Height(feet) | 5.61±0.20 | 5.61±0.20 | 5.61±0.19 | 5.62±0.18 | 0.988 |
| Weight(kg) | 64.40±7.72 | 62.53±6.96 | 64.40±6.31 | 62.53±5.63 | 0.509 |
| ASA (I/II) | 27/3 | 25/5 | 26/4 | 27/3 | 0.845 |

Values presented as mean±SD, Group B(S)-Bupivacaine(Supine); B(L)- Bupivacaine(Lithotomy);R(S)-Ropivacaine(Supine);R(L)-Ropivacaine(Lithotomy);ASA-American Society of Anesthesiologists; SD-Standard deviation; *P<0.05* is taken as statistically significant.

**Table 2:** Characteristics of sensory and motor blockade

| Parameters | Group B(S) | Group B(L) | Group R(S) | Group R(L) | *P* |
|---|---|---|---|---|---|
| Height of block achieved (T4-T10) | 7.33±1.21 | 7.33±1.21 | 9.40±1.19 | 9.46±1.04 | <0.0001 |
| [#]Onset of sensory block (min) | 2.68 ±0.67 | 2.93 ±0.25 | 5.70 ±1.08 | 5.63 ±1.15 | <0.0001 |
| [Ω] Quality of motor block (Bromage scale) | 2.93±0.25 | 2.68 ±0.67 | 2.90 ±0.30 | 2.90 ±0.30 | 0.935 |
| [$]Time for 2 segment regression (min) | 147.16±17.65 | 142.50±17.05 | 96.33±16.86 | 100.50±18.95 | <0.0001 |

[#]Statistical significance between Gp B(S) & Gp B(L) (*P>0.05*)*;Gp B(S) & Gp R(S) (*P*< 0.001)**; Gp B(S) & Gp R(L) (*P* <0.001)**; Gp B(L) & Gp R(S) (*P* <0.001)**; Gp B(L) & Gp R(L) (*P*< 0.001)**; Gp R(S) & Gp R(L) (*P*> 0.05)*, [$]Statistical significance between Gp B(S) & Gp B(L) (*P>0.05*)*;Gp B(S) & Gp R(S) (*P*< 0.001)**; Gp B(S) & Gp R(L) (*P* <0.001)**; Gp B(L) & Gp R(S) (*P* <0.001)**; Gp B(L) & Gp R(L) (*P*< 0.001)**; Gp R(S) & Gp R(L) (*P*> 0.05)*, foot notes:Gp-group,**P>0.05* (Non-Significant); ***P<0.05* (Significant); ****P<0.0001* (Highly Significant); [Ω]Bromage grade IV

**Figure 1:** Comparison of Mean blood pressure in B (Supine) v/s B (Lithotomy) position

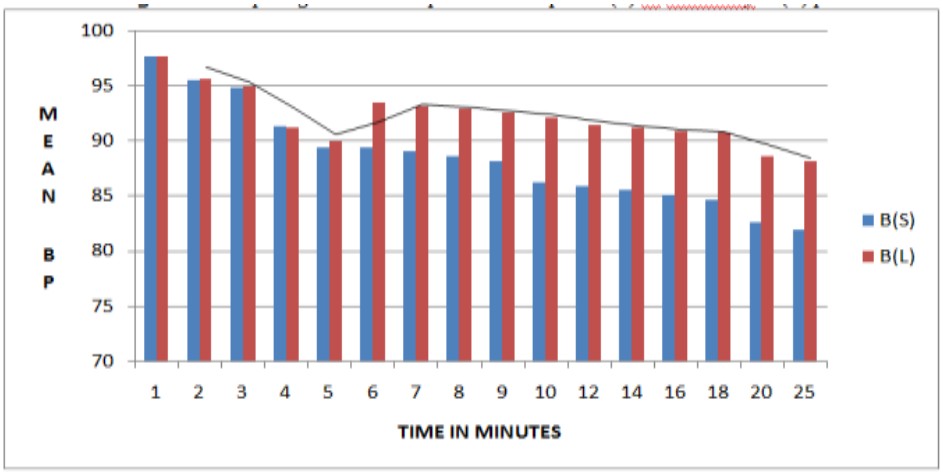



**Figure 2:** Comparison of Mean blood pressure in R(Supine) v/s R (Lithotomy) position

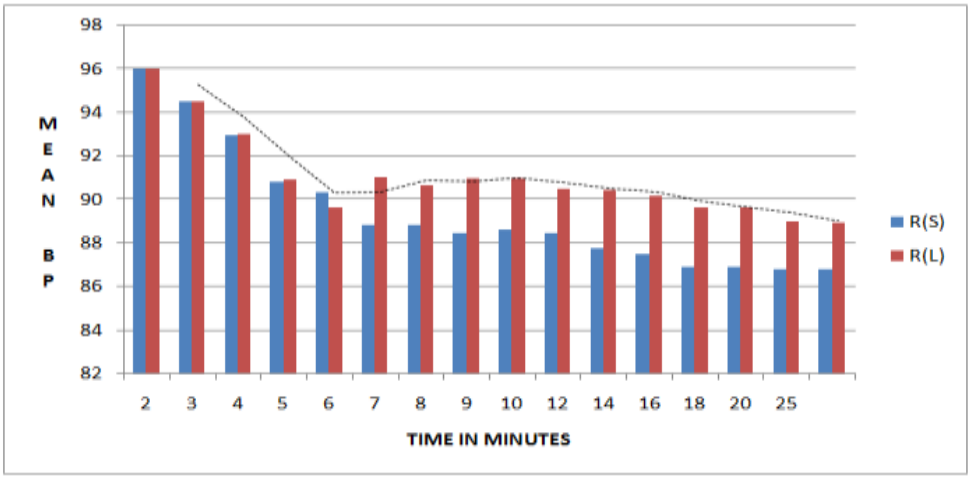
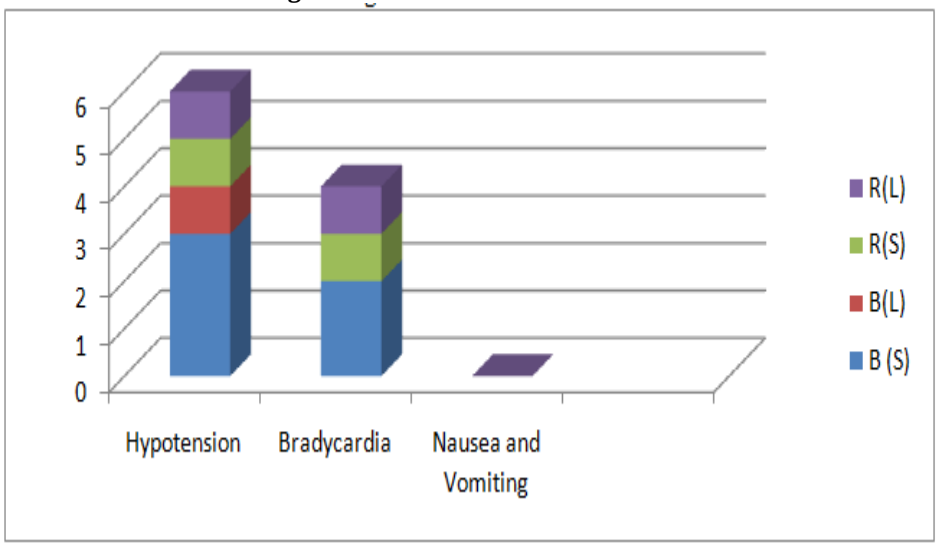


**Figure 3:** Incidence of adverse effects




## IV. Discussion

In this study, we observed that the haemodynamic changes in lithotomy position are comparatively lesser than in supine position after spinal anesthesia. Lithotomy position after spinal anaesthesia attenuates the decrease in arterial blood pressure, similar findings were observed by Miyabe and colleagues[4] they showed that SBP increased meaningfully in patients in the lithotomy position compared to the supine position. Better haemodynamic stability in lithotomy position can be attributed to the autotransfusion ,by the return of the pooled venous blood from the lower extremities (500-1000 mL) to the heart (autotransfusion effect). [5]Preoperative mean blood pressure of patients in both the groups were comparable, When patient placed in supine position as in B(S) group , *mean blood pressure* fall 101 mm hg to 82mm hg causing a decrease by 19% of MBP from preoperative values. While in lithotomy position as in B (L) group, the *mean blood pressure* fall 101mm hg to 88mm hg causing 13% decrease in of MBP from the preoperative values. Our results are in concordance with Gaffney et al [6, 7] and Moriyama [8] et al. Mirt Kamenik et al [9] demonstrated that a decrease in CO after spinal anesthesia is prevented by placing the patient in the Trendelenburg position, or infusion of either lactated Ringer's solution or 6% hydroxyethyl starch solution.

We also observed that there is no change in level of block in supine and lithotomy position. Theoretically placing the patient in the lithotomy position immediately after the injection of a hyperbaric solution might be expected to limit cephalad spread by abolishing the lumbosacral curve, the 'slope' down which the local anaesthetic moves under the influence of gravity. However, this has not been shown to have an effect on spread, perhaps because even the most extreme positioning does not abolish the curve altogether. We also found that onset of sensory blockade is faster with hyperbaric bupivacaine in comparison to hyperbaric ropivacaine, while the maximum height achieved of sensory block was higher in hyperbaric ropivacaine group. Positioning didn't affect the height of sensory block as it was comparable in both supine and lithotomy position.

Miyabe et al also observed that lithotomy position does not affect the cephalad spread of analgesia.[12] Yoshiki Masuda [13] and Eileen Levin[14] studied about the effect of the lithotomy position on spinal anesthesia with tetracaine. They had found no significant differences between the groups in the cephalad spread of analgesia.

Time to two segment regression is lesser in hyperbaric ropivacaine group as compared to hyperbaric bupivacaine. This study has shown that a glucose-containing solution of ropivacaine, hyperbaric relative to cerebrospinal fluid, can produce predictable and reliable spinal anaesthesia for a wide range of surgical procedure, similar observations were made in previous studies.[15, 16]

J. B. Whiteside studied that hyperbaric ropivacaine provides reliable spinal anaesthesia of shorter duration and with less hypotension than bupivacaine. McDonald and colleagues compared hyperbaric preparations of ropivacaine and bupivacaine in equal doses and observed that both produced sensory blocks of similar onset and extent, but there was less motor block, which regressed faster, with ropivacaine.[18]

## V. **Conclusion**

This study concluded that hyperbaric ropivacaine provide less extensive sensory block, which regressed more rapidly & provide more haemodynamic stability as compared to bupivacaine. Although the onset of sensory block is slow as compared to bupivacaine but the quality of motor block similar with both the drugs. Hyperbaric ropivacaine can be preferred in surgical procedures of shorter duration requiring lower level of block & hemodynamic stability.

Lithotomy position provides more haemodynamic stability as compared to supine position. It should be preferred when surgery is possible in lithotomy position & where haemodynamic stability is required.

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