



## ORIGINAL ARTICLE

# To Compare the Effect of Flexion and Extension on Unilaterality of Spinal Anaesthesia in Lateral Decubitus Position Using Low Dose Hyperbaric Bupivacaine

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## Abstract

**Background and aims:** Unilateral spinal anaesthesia is a safe and easy technique for lower limb surgeries. Therefore, this study was carried out to analyse the effect of flexion and extension on unilaterality of spinal anaesthesia in lateral decubitus position. **Material and methods:** The study was conducted on seventy patients posted for elective unilateral lower limb surgeries. They were randomly allocated into two groups, patients in group F maintained spinal flexion in lateral decubitus position for 15 minutes, whereas those in group E extended their hips and knee immediately after spinal anaesthesia with 8mg of 0.5% hyperbaric bupivacaine. Patients remained in lateral decubitus position for 15 minutes and then turned supine. **Results:** Strict unilateral sensory block at 15 minutes was present in 32 patients in group F and 7 patients in group E (P-value<0.05). At 15 minutes, strict unilateral motor block was present in 23 patients in group F and in only 10 patients in group E (P-value<0.05). The mean time taken to reach Bromage 4 in dependent limb was 15.29 min in group F and it was 15.14 min in group E, which is comparable (P-value>0.05). **Conclusion:** Maintaining flexion of spinal column for 15 min increases the probability of unilateral spinal block in comparison to extension of spine in lateral decubitus position.

## Keywords

Cauda Equine, Lateral Decubitus Position, Unilateral Spinal Anaesthesia

## Introduction

Spinal anaesthesia involves the injection of small amount of local anaesthetic into the subarachnoid space to produce a reversible loss of sensation, autonomic and motor function. The injection of local anaesthetic in the subarachnoid space can result in hemodynamic perturbations and respiratory changes.<sup>[1-3]</sup> Many of these complications can be dealt with by selectively distributing anaesthesia to the operating side as in unilateral limb surgeries<sup>[4,5]</sup> Unilateral spinal blockade in lateral position has been found to be more selective to the dependent

side using hyperbaric local anaesthetic when patient is maintained in lateral flexed position rather than lateral position with lower limbs extended after performing unilateral spinal blockade. In comparison to conventional technique it requires a bit longer preparation time, but provides less hemodynamic side effects with higher cardiovascular stability, increased autonomy after surgery and better patient acceptance.<sup>[6]</sup> Takiguchi *et al* have shown that cauda equina sinks to the dependent side due to gravity, in cerebrospinal fluid, during lateral decubitus

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position with both the lower limbs extended. It has been observed that in flexed lateral position, the tightened cauda equina moves to the non dependent side and remains in the central part of the intrathecal sac.<sup>17)</sup>

Hence, we took on the task to study the effect of spinal flexion and extension in lateral decubitus position on the unilaterality of spinal anaesthesia using hyperbaric Bupivacaine.

### Material and Methods

After obtaining approval from Hospital Ethics Committee (IEC/GMC/2021/403, dated 25/01/2021), this study was conducted on 70 patients, ASA grade 1 and 2 patients, aged 20-50 years, of either sex, scheduled for elective unilateral lower limb surgeries below knee, lasting not more than 2 hrs. A written informed consent was obtained from these patients. Exclusion criteria for spinal anaesthesia included, patients with height less than 150 cm and more than 170 cm, patients with absolute contraindications, patients with known history of hypersensitivity or allergy to study drug, patients with BMI more than 30kg/m<sup>2</sup>.

Patients were randomly allocated into two groups: Group F: patients who maintained flexion for 15 min before changing to supine after spinal anaesthesia. Group E: patients who maintained extension for 15 min before changing to supine after spinal anaesthesia.

In the operation theatre, routine ASA monitoring was started. The patient was placed in lateral decubitus position, with operating side dependent on operating table, with hip and knee joints flexed. The intervertebral space of L3-L4 was identified and spinal anaesthesia was performed with 27-gauge Quincke needle with midline approach and bevel facing downwards. Intrathecal placement of the needle was confirmed with free flow of CSF and 1.6ml (8mg) of 0.5% hyperbaric Bupivacaine was injected over 80 seconds. At the end of 15 min, patients in both the groups were turned to supine position. An anaesthesiologist blinded to patient groups recorded the spread of sensory and motor blockade.

Sensory level was assessed using pinprick bilaterally, at every 1 min for 5 min followed by every 5 min after administration of the drug. Motor blockade was assessed bilaterally using modified Bromage scale. 0= no paralysis, 1= inability to raise extended leg, 2= inability to flex knee, 3= inability to do dorsiflexion of foot but can wiggle toes, 4= inability to move at all.

After turning the patient supine sensory and motor

blockade was evaluated every 5 min till 15 minutes. Patient was handed over to the surgeon thereafter. Hemodynamic variables such as blood pressure and heart rate were monitored before spinal anaesthesia, just after spinal anaesthesia, and every 5 min interval till the end of surgery. After the patients were turned into supine position, spread of sensory and motor block was recorded. A strict unilateral sensory block was defined as analgesia of only the dependent side, whereas then on dependent side maintained complete somatic sensibility to superficial pain to pinprick. A strict unilateral motor block was defined as a motor block of grade 4 on dependent side in the absence of motor block on nondependent side. Time of onset of sensory block was defined as the time from completion of administration of the drug till patient had loss of sensation to pinprick at L1 dermatome. The duration of sensory block was defined from the completion of administration of drug till the patient regained sensation at S2 dermatome.

A heart rate of less than 60 beats per minute was regarded as bradycardia and was treated by using IV atropine in dose of 0.02-0.025 mg/kg. A mean blood pressure less than 20% of baseline or systolic blood pressure less than 90 mm of Hg was considered as hypotension and was treated by IV mephentermine 6mg.

### Statistical analysis

At end of surgery all data were compiled and were transferred to the Microsoft excel and then it was analysed statistically using SPSS (22 version) software by using appropriate tests. A sample size of 58 patients was calculated by assuming mean difference of 20 and standard deviation of 35 and 23 taking Type 1 error (alpha)=0.05 and Type 2 error(beta)=0.2 (power of test). This was similar to a previous study<sup>2</sup>. By using open EPI software for the better validation of results we considered 70 patients which were divided into two groups, with 35 patients in each group.

### Results

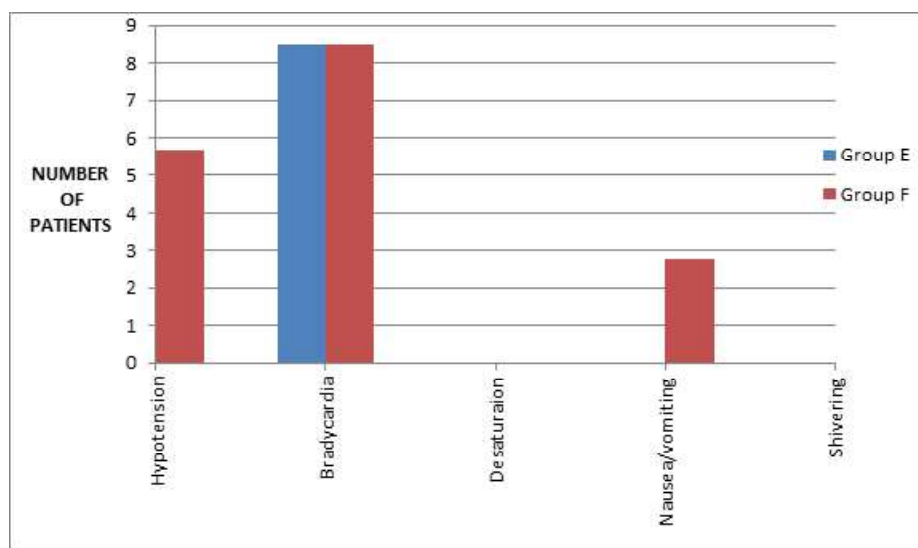
No significant difference in demographic characteristics were seen between groups E and F (Table 1). Characteristics of spinal block are shown in Table 2. Although the sensory and motor characteristics of block were strictly unilateral at 15 minutes, this difference ceased to be significant at 1 hour where unilateral characteristics of block were lost.

Both the groups remained statistically comparable at all the times as regards to the heart rate and mean arterial

**Table 1. Demographic data of the patients in both the groups**

Parameters	Flexion	Extension
Age in years	36.11 ± 5.83	35.17 ± 7.24*
Sex – Male	20(57.1%)	18(51.4%)*
Female	15(42.8%)	17(48.5%)*
Weight in KGs	65.51±5.46	67.94±6.35*
Height in cms	159.40±4.46	160.06±4.76*

\*P-value>0.05



**Fig 1 . Complications in both the groups**

pressure. Three patients (8.5%) in Group E and two patients (5.7%) in Group F developed hypotension. Three patients (8.5%) in Group E and three patients (8.5%) in Group F developed bradycardia. None of the patients in Group E developed nausea and vomiting and only one patient (2.8%) in Group F developed nausea and vomiting. (Fig 1)

**Discussion**

When unilateral spinal anaesthesia is indicated, the main objectives are to provide analgesia and motor block on only one side, improving patient satisfaction and decreasing the hemodynamic changes associated with subarachnoid blockade. However, this necessitates maintaining the patient in a lateral decubitus position for 10-15 minutes, resulting in the prolongation of preoperative time. However, the benefits of stable hemodynamic status will definitely outweigh this delay, and in clinical practice, it would seem realistic to consider 15 minutes as the upper limit during which the patient can be left in a lateral decubitus position after injection. [2,8] Various factors influence the selectivity of the local

anaesthetic (LA) agent to dependent segments of the spinal cord which include using hyperbaric local anaesthetics, slow injection of the drug, maintaining lateral decubitus position for a sufficient period of time for the LA to get fixed to the spinal nerves, using smaller volume of drug, and using pencil-point needles. [9] In our study, strict unilateral sensory and motor block were statistically significant at 15 min as flexion of spine resulted in strict unilateral sensory and motor block but at 1 hr both the groups were comparable. Our results were similar to Kulkarni et al. who proved that flexed position increased the number of patients having selectivity for both sensory and motor blockade to dependent position during the first 15 min. This selectivity persisted even at 60min although the percentage of patients had reduced. [2] We are unable to pinpoint a specific reason for this difference in the results in the 2 studies; perhaps the potency of local anesthetic used in administration of spinal block varied in the 2 studies.

Takiguchi *et al.* used MRI to prove with straightening of vertebral column in the lateral position, the cauda equina

**Table 2. Characteristics of spinal anaesthesia**

Parameter	Flexion	Extension	P value
<b>Strict unilateral sensory block</b>			
At 15 min	32	7	<b>0.001</b>
At 60 min	20	13	0.150
<b>Strict unilateral motor block</b>			
At 15 min	23	10	<b>0.002</b>
At 60 min	10	5	<b>0.24</b>
<b>Onset of sensory block in minutes</b>	5.57±1.86	15.14±3.92	<b>0.00</b>
Dependent limb	0	0	
Non-dependent limb			0.526
<b>Onset of motor block in minutes</b>			
Dependent limb	15.29±1.17	15.14±0.84	
Non-dependent limb	0	0	
<b>Time taken to achieve peak sensory level (min)</b>			
Dependent limb	16.14±2.13	25.86±3.92	<b>0.00</b>
Non-dependent limb	11.14±2.13	41.43±3.92	<b>0.00</b>
<b>Duration of sensory block (min)</b>			
Dependent limb	156.57±6.39	157.14±6.67	0.716
Non-dependent limb	23.14±4.71	46.86±7.58	0.00
<b>Duration of motor block (min)</b>			
Dependent limb	176.29±4.90	172.57±8.52	<b>0.03</b>
<b>Peak sensory level</b>			<b>NOT APPLICABLE</b>
Dependent limb	<b>T10</b>	<b>T12</b>	
Non-dependent limb	<b>S1</b>	<b>L5</b>	

sinks by gravity and moves to the dependent side. With flexion of vertebral column in lateral position, the tightened cauda equine moves to the nondependent side and rests in the central part of the intrathecal sac. This increases the possibility of dense unilateral block <sup>[10]</sup>. Kim et al studied influence of spinal flexion in the lateral decubitus position on the unilaterality of spinal anaesthesia using hyperbaric bupivacaine (8mg) administered at L3-L4 interspace through a 25-gauge Quincke needle, patients maintained lateral position for 15 minutes with and without spinal flexion and then gently returned to supine position. They concluded that maintaining flexion of the spinal column during lateral decubitus positioning altered the initial onset of sensory block with respect to laterality. <sup>[11]</sup> In our study the onset of sensory block in dependent limb was earlier for group F as compared to group E. Onset of motor block was comparable in both the groups in dependent limb as motor blockade was assessed at 15 min and patients in both the groups already attained Bromage 4 motor block in 15 min. None of the patients attained Bromage 4 block in non-dependent limb in any

of the two groups. The peak sensory level was achieved earlier in Group F in both dependent and non-dependent limbs.

Meyer J, *et al* studied unilateral spinal anaesthesia with hyperbaric Bupivacaine 0.5% injected via 29 gauge Quincke needle and concluded that bilateral sympathetic blockade was prevented in more than 69% of the patients<sup>[12]</sup>. Valanne JV *et al* compared hyperbaric Bupivacaine 4mg versus 6mg for outpatient knee arthroscopy and concluded that 4 mg low flow (2 min) technique with hyperbaric Bupivacaine towards the dependent side-oriented injection and maintenance of lateral position for 10 min produced selective spinal anaesthesia with rapid recession of motor block and early discharge home. <sup>[13]</sup>

Imbelloni LE *et al* used low dose that is 5mg of 0.5% hyperbaric Bupivacaine that provided predominantly unilateral block after 20 minutes of lateral decubitus position. Major unilateral spinal anaesthesia advantages were hemodynamic stability, patient satisfaction and faster anaesthetic recovery. <sup>[14]</sup> Selda Sen *et al.* studied



hypotension induced by lateral decubitus or supine spinal anaesthesia in elderly with low ejection fraction undergoing hip surgery and found that elderly patients with low ejection fraction were more likely to be predisposed to higher sensorial block level and hypotension was more common during spinal anaesthesia with supine position compared to lateral decubitus position<sup>115</sup>. Singh TK *et al.* concluded that 7.5 mg of hyperbaric Bupivacaine alone or with fentanyl or clonidine produced predominantly unilateral spinal anaesthesia in more than 70% patients in the entire group with stable cardiovascular parameters.<sup>116</sup> Tekye SMM *et al* and Alipour M *et al* compared the effects and complications of unilateral spinal anaesthesia versus standard spinal anaesthesia in lower limb orthopaedic surgery and concluded that if unilateral spinal anaesthesia was performed using a low dose, low volume and low flow injection technique, it provides adequate sensory motor block and helps to achieve stable hemodynamic parameters during orthopaedic surgery on a lower limb. Patients were more satisfied with this technique as opposed to the conventional approach.<sup>117</sup> Gadkari CP *et al* studied unilateral spinal anaesthesia for inguinal hernia surgery in 60 patients undergoing elective hernioplasty. Patients received injection bupivacaine 0.5% 12.5mg and injection clonidine 15µg in subarachnoid block. Unilateral spinal anaesthesia achieved stable hemodynamic, adequate duration of block for surgery and rapid recovery.<sup>118</sup>

### Conclusion

Administration of low dose of hyperbaric Bupivacaine 0.5% and maintaining the flexion of spine results in early onset of block, early achievement of peak sensory level and prolongs the duration of block in dependent limb. Thus, strict unilaterality and dense block is seen in dependent limb with flexion of spine which is advantageous as it overcomes the hemodynamic perturbations associated with bilateral block. It also facilitates early ambulation and shortens the hospital stay.

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### Conflicts of Interest

There are no conflicts of interest.

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