Original Article

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Compare the Efficacy of Classical Subarachnoid Block Using and Unilateral Spinal Anaesthesia

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Abstract

Aim : To compare the efficacy of classical subarachnoid block using 0.5% bupivacaine (3.5 ml) and unilateral spinal anaesthesia using 0.5% bupivacaine (2ml) in patients undergoing unilateral lower limb surgeries. *Materials and Methods:* The present prospective study was done for a period of 2 years. 60 cases undergoing unilateral lower limb surgeries were chosen. They were divided into two group 30 patients of control group received 3.5 of 0.5% bupivacaine and turned to supine position immediately. 30 patients of Study group- received 2ml of 0.5% bupivacaine and kept in lateral decubitus position for 15 minutes and then turned supine. Pre operatively, heart rate, Systolic and diastolic blood pressure were checked and were recorded. Intra-operatively hemodynamic parameters, onset and duration of sensory and motor blockade were recorded every 1 minute until 10 minutes thereafter every five minutes for 30 minutes and thereafter every 15 minutes until 60. *Results:* The demographic data reveals that both the groups are comparable in age, sex and height ratios. The baseline SBP, DBP, HR were recorded every 1 minute until 10 minutes every 5 minutes until 30 minutes and thereafter every 15 minutes until 60 minutes. Heart rate variation was statistically significant at 7 minutes, 8 minutes, 9 and 10 minutes, with more fall in heart rate in control group than in study group. The SBP was 129.7 +/- 6.48 at the time of giving spinal anaesthesia showed a gradual fall until 20 minutes and gradually increased to baseline at 60 minutes. P-values are statistically significant at 5 minutes 6 minutes 7 minutes 8 minutes 9 minutes 10 minutes 15 minutes 20 minutes with more fall in blood pressure in control group compared to study group. The fall in diastolic blood pressure observed in control group is statistically significant at 6,7,8,10,15,20,25,30,45,60 minutes. Analysis of motor blockade in the 2 group shows that unilateral spinal block induced lesser degree of motor blockade to the classical subarachnoid block group. This difference was found to be statistically significant. There was no statistically difference in the level of sensory blockade between the groups. There was no statistically difference in the onset time and duration of sensory blockade between the groups. There was statistical difference in duration of motor blockade with longer blockade in both groups. *Conclusion:* Unilateral low does subarachnoid block offers better hemodynamic stability in the intra-operative period.

Keywords: Unilateral Spinal Anaesthesia; Bupivacaine; Hemodynamic Stability.

Introduction

The patient is the centre of medical universe around which all our work revolve and towards which all our efforts end. Pain is one of the most dreaded effects of disease and all medical persons should take its relief as one of their main duties. Anesthesiologists have an important role to play in the fascinating field of pain management. They should develop the art of relieving pain. If pain is agony relieving pain is ecstasy. "for all the happiness mankind can gain is not in pleasure, but in rest from pain," In spite of marvelous advances in medical since, many patients are concerned about having operative procedures because of their fear of ensuing postoperative pain. Unrelieved postoperative pain results in patient's discomfort,

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long hospital stay, poor patient outcome and greater use of health care resources.

Spinal anesthesia is frequently used in sub umbilical surgeries like lower abdominal surgeries, gynecological and urological procedures and lower extremity orthopedic procedures. However it has its own complications like hypotension bradycardia urinary retention post–dural puncture headache (PDPH) transient or permanent neurological symptoms. The cardiovascular changes are related to cephalic distance to which the local anesthetic spreads in the subarachnoid space and thus to the extent of preganglonic sympathetic denervation some of these complications, if not all, can be minimized by asymmetrically distributing anaesthesia to the operating side especially in unilateral lower limb surgery. This technique also has advantage of fast blockade recovery and increased patient's satisfaction. Unilateral anesthesia can be achieved by using hyperbaric local anesthetic solution keeping the operating limb in the dependent position [1].

Lower limb surgeries require low sensory block level for which low doses of local are anesthetics are sufficient which gives advantage of higher cardiovascular stability less chance of prolonged motor block and similar home discharge compared with bilateral spinal anaesthesia with only a slight delay in preparation time. Anaesthetic injection in the lateral position, low anesthetic doses, direction of pencil point or cutting needles and slow injection rate have been suggested to induce unilateral spinal anaesthesia. Unilateral spinal anaesthesia has nat been practiced in many hospitals although one-limb surgeries are frequently conducted. The safety improves if the block can be localized to the area of surgery. Spinal anesthesia is economical efficient and affordable total analgesia in lower limbs surgeries.

A special technique of spinal anesthesia named hemispinal was described for one limb surgeries, which was named as spinal hemi analgesia. This is also known as unilateral spinal anaesthesia. The distance between the left and right spinal root is only 10-15 mm in the lumbar or lower thoracic level. Such a small distance should reasonably prevent from producing strictly unilateral block of the spinal nerve root. However, various clinical reports suggested that using small doses of either hypo or hyperbaric anesthetic solution injected at low speed through direction needles in patients lying in the lateral decubitus position for 10-15 minutes results in preferential distribution of spinal anaesthesia towards the operated side, providing intense surgical block on that side, when small doses of bupivacaine is used. Even though the term unilateral spinal anaesthesia has been in vogue for a long time, most of the research on this are recent. Even though performing spinal anaesthesia is technically easier, the complications which are usually like hypotension and bradycardia can be detrimental to the high risk group of patients [2].

Unilateral spinal anaesthesia is frequently used in lower limb surgeries, several advantages are claimed for this anaesthetic technique, including fewer hemodynamic complications selective block on the operating side, avoidance of unnecessary paralysis on the non-operating side, better mobilization during the recovery period, lower incidence of postoperative urine retention, as well as good patient satisfaction. Recently the need for cardio stable anaesthetic techniques has increased because of the increase in debilitating diseases, with other organ systems also involved and thus safety increases in lower limb surgeries. Thus review of the clinical study on this topic trying to outline the feasibility and potential clinical benefits of unilateral spinal anaesthesia.

Materials and Methods

The present prospective study was undertaken in the department of Anesthesia from October, 2013 to June, 2015. Cases were chosen at random 60 cases in patients undergoing unilateral lower limb surgeries. The study was approved by the institution's research and ethics committee. The total number of patients were 60. They were divided into two groups 30 patients of control group, received 3.5 of 0.5% bupivacaine and turned to supine position immediately. 30 patients of Study group- received 2ml of 0.5% bupivacaine and kept in lateral decubitus position for 15 minutes and then turned supine.

Inclusion Criteria

Patients between 18-60 yrs of age, ASA physical status 1and 2, Unilateral lower limb surgeries.

Exclusion Criteria

Age of > 60yrs, ASA grade 3 and 4 patients, post spinal surgeries, spinal deformity, history of allergy to study drugs, pregnancy, coagulopathy or thrombocytopenia, neurological disorder, local site infection and patients who are not co-operative to positioning for subarachnoid block.

Randomization- the patients were allocation into two groups by simple randomization using sealed envelope method. A thorough pre-anaesthetic evaluation was performed by taking detailed history and clinical examination. All the patient's height, weight, basal heart rate, respiratory rate and blood pressure was measured. Detailed physical examination of CVS, CNS, RS, and spine. Routine blood investigations like-complete blood count, blood sugar urea and serum creatinine, electrolytes, HIV and HBsAg were performed. ECG was routinely taken for all patients.

The procedure was explained and informed consent was obtained. When the patients reached the operating room monitors were attached which included electro cardiogram, noninvasive blood pressure and pulse oximetry. A wide bore cannula was inserted and the patient was pre loaded with 20 ml/kg of crystalloid solution. All base line vitals were recorded.

The procedure was done by the investigator on all patients to maintain uniformity of technique. For study group using 25 gauge quincke's spinal needle with the patients in lateral position (the side to be operated on the dependent side) the drug was given after assuring free flow of clear CSF over 15 seconds. Patients were kept in the lateral position for 15 minutes after which the patients was positioned for surgery. Surgery was allowed to proceed. For control group 3.5ml of hyperbaric 0.5% bupivacaine was given in the lateral position and immediately turned supine.

Assessment of the patients and recording of data, pre operative heart rate, systolic and diastolic blood pressure were checked and were recorded, intraoperatively, they were recorded every 1 minute until 10 minutes thereafter every five minutes for 30 minutes and thereafter every 15 minutes until 60 minutes, in the recovery room, after every 30 minutes till the oral analgesic was given. Bradycardia was defined as heart rate less than 60/minute and if the heart rate dropped below this 0.6 mg of atropine was given intravenously.

Hypotension was defined as drop in systolic blood pressure less than or equal to 30% which was treated with rapid infusion of crystalloid and / or 6mg of ephedrine was given intravenously, and repeated if necessary. Side effects such as nausea vomiting and pruritus were recorded in the intra-operative period. Sensory blockage was assessed in the dependent as well as non-dependent limbs, sensation was assessed using pin prick by a blinded observer. This was recorded every 5 minutes after positioning the patients for 60 minutes. The sensory levels were checked in the post operative period in the recovery room.

Motor blockade was assessed using modified BROMAGE score

Grade 0: no motor block

Grade 1: inability to raise extended leg; able to move knees and feet

Grade 2: inability to raise extended leg and move knee; able to move feet

Grade 3: complete motor blockade of the limb

Both the dependent as well as nondependent limbs were assessed for the motor blockade at 15, 30 and 60 minutes after positioning the patient

Duration of motor blockade and duration of analgesia were also noted. All recoded data entered using Microsoft excel and analyzed for determining statistical significant comparison of the means between the groups was done by two sample t-test assuming equal variances and chi square test. A p-value <0.05 is considered significant with an alpha error of 0.05% and power of study 80%

Results

There were 60 patients in this study. Each group consisted of 30 patients.

Control group – received 3.5ml of 0.5% bupivacaine and turned to supine position immediately. Study group- received 2ml of 0.5% bupivacaine and kept in lateral decubitus position for 15 minutes and then turned supine.

The mean age in control group is 44.70+/- 13.16 the mean age in study group is 47.80+/-12.39. There is no statistical significance between the groups with respect to age, so the two groups are comparable with respect to age. Male: female ratio: 1:1.4 ; in control group and 1.3:1 in study group. The demographic data reveals that both the groups are comparable in age, sex and height ratios.

There is no statistically significant diffierence between the groups with regard to demographic data Haemodynamics- P=0.0335 (statistically significant). Bradycardia- heart rate < 60 beats/ min. Heart rate comparison revealed that the occurrence of bradycardia requiring treatment was more in control group (33%) versus the study group 1 (13.2%).

Hypotension, significant drop of blood pressure more than 30%, revealed that the occurrence of hypotension requiring treatment was more in control

group (33.3%) verses the study group (13.3%). This difference was found to be statistically significant.

The baseline SBP, DBP, HR were recorded every 1 minute until 10 minutes every 5 minutes until 30 minutes and thereafter every 15 minutes until 60 minutes.

Table 1: Distribution of patients according to age between the two group

Age intervals in yrs	Control group	Study group
17-26	4	3
27-36	5	4
37-46	6	5
47-56	5	7
57-66	10	11
Mean ±SD	44.7±13.16	47.8±12.39
Sex		
Female	14	13
Male	16	17
Height in cms		
152-155	3	3
156-160	5	6
161-165	11	10
166-170	7	7
171-1754	4	4
Mean ± SD	163.4±5.84	163±5.88

Table 2: Comparison of percentage of bradycardia and hypotension between two groups

Variable	Control group	Study group
Bradycardia	10	4
Percentage	33.3	13 .2
Hypotension with treatment	12	4
Percentage	40%	13%

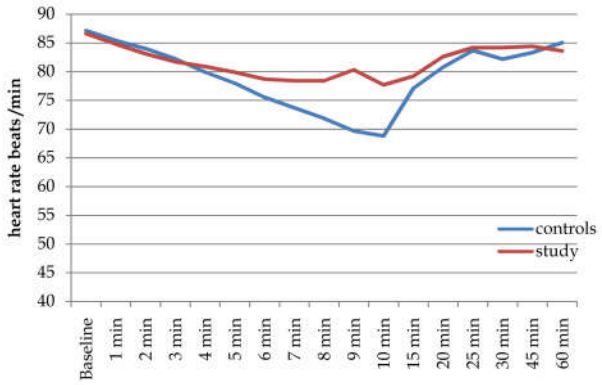

Fig. 1: Variation of heart rate in groups

Heart rate variation was statistically significant at 7 minutes, 8 minutes, 9 and 10 minutes, with more fall in heart in control group than in study group. The heart rate variation was more in control group when compared to study group.

The SBP was 129.7 +/- 6.48 at the time of giving spinal anaesthesia showed a gradual fall until 20 minutes and gradually increased to baseline at 60 minutes. P- values were calculated using two sample t-test p values are statistically significant at 5 minutes 6minutes 7 minutes 8 minutes 9 minutes 10 minutes 15 minutes 20 minutes With more fall in blood pressure in control group compared to study group

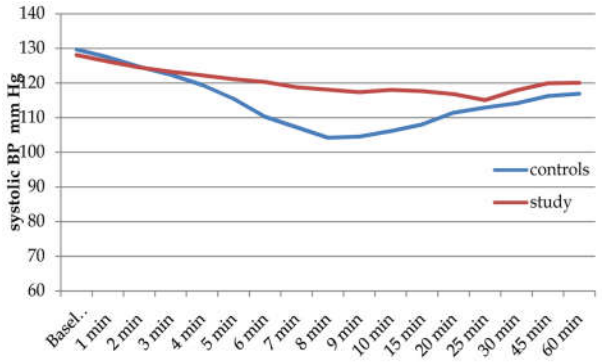

Fig. 2: Variation of systolic blood pressure in groups

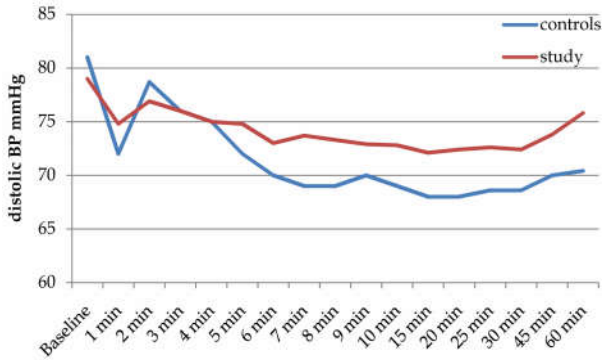

Fig. 3: Variations in diastolic pressure between two group

The fall in diastolic blood pressure observed in control group is statistically significant at 6,7,8,10, 15,20,25,30,45, and 60 minutes.

Analysis of motor blockade in the study group shows that unilateral spinal block induced lesser degree of motor blockade to the classical subarachniin block group. This difference was found to be statistically significant.

The level of block in control group extended between T6 to T11. In the study group, the block extended between T9-T12. There was no statistically difference in the level of sensory blockade between the groups.

Table 3: Comparison of motor blockade in both groups

Motor blockade	Bromage scale	Dependent limb 0	1	2	3	Non Dependent limb 0	1	2	3
At 15	Control group	0	0	3	27	0	0	3	27
minutes	Study group	4	0	11	15	12	4	6	8
At 30	Control group	0	0	3	27	0	0	3	27
minutes	Study group	4	0	11	15	9	5	5	11
At 60	Control group	0	0	0	30	0	0	0	30
minutes	Study group	0	0	8	22	9	4	6	11

Table 4: Comparison of onset and duration of sensory and motor blockade

Parameter	Control group (Mean ±SD)	Study group (Mean ± SD)	p-value
Onset of sensory blockade	105.433 ± 20.94	108.7 ±23.36	0.5
Onset of motor blockade	201.7± 46.57	198.33± 41.01	0.761
Duration of motor blockade	176. 33±31.4	154.63±36.5	0.019
Duration of analgesia	128.5 ±21.89	125.166±6.94	0.51

Discussion

This prospective randomized study was done in 60 patients of ASA 1 and 2. The practicality of producing a unilateral spinal block and ability to reduce haemodynamic instability was studied. The ability of a low dose bupivacaine subarachnoid block in maintaining a unilateral spinal block and its ability to decrease haemodynamic alteration was also studied [3].

Anaesthesologists often act on procedures involving just one lower limb. Unilateral spinal anaesthesia may show advantages for these procedures as compared to conventional technique, with lower incidence of hypotension, fast recovery and increased patient's satisfaction. Anaesthetic injection in the lateral position, low anesthetic dose , direction of pencil point or cutting needles and slow injection rates have been suggested to induce unilateral spinal anesthesia. For this purpose, hyperbaric, isobaric and hypobaric bupivacaine solutions have been used to induce unilateral spinal anesthesia.

In this study 0.5% hyperbaric bupivacaine was used as unilateral block can be produced reliably using hyperbaric solutions. With isobaric or hypobaric solutions the incidence of bilateral block has been shown to be higher. Limiting the spread of the spinal block offers many clinical advantages. First and foremost the haemodynamic impact of spinal anaesthesia is greatly reduced, as the increased venous capacity in affected side is compensated by a reflex vasoconstriction in the non blocked areas. Moreover, it has been demonstrated by clinical trials comparing unilateral spinal anesthesia with conventional bilateral spinal block that cardiac index values are much more stable during the former than during the latter, with a smaller reduction in arterial blood pressure and heart rate, with a much lower incidence of clinically relevant hypotension (5% vs 20%). These characteristics justify the unilateral spinal anaesthesia in elderly patients with poor cardiovascular status. The other advantageous features include increased patient autonomy after surgery due to lack of motor block in the non operated leg. This aids in nursing management, maintains spontaneous urination, provides early ambulation after surgery as well as improved patient well being by avoiding the unpleasant experience of sudden, though reversible paraplegia. Spread of anaesthetic solution depends upon amount of drug, type of drug,

volume of solution, rate of injection, patient position, direction of the bevel of the needle.

All the above factors were standardized in this study. The mean age in control group is 44.70±13.16. The mean age in study group is 47.80+/-12.39, the time to onset of analgesia and maximal motor blockade have been found to decrease with age. Recovery time from sensory block is prolonged in the older patients. The rate of two segment regression is not affected.

In this study no statistic difference was found in characteristics of sensory and motor blockade except for motor blockade which was longer in control group with significant p value of 0.01. The optimum time for maintaining the patient in lateral position and thereby producing a unilateral block is controversial. With high doses of hyperbaric bupivacaine (12.5mg and 15 mg), there is high incidence of bilateral block even when remains in lateral position for 30 minutes to one hour. Conversely with low doses of hyperbaric bupivacaine, motor block remains unilateral even when patient is made supine after 10 to 15 minutes in lateral position.

In this study we kept the patient in lateral position for 15 minutes following 7.5 mg of intrathecal hyperbaric bupivacaine. There was migration leading to bilateral block. Probably even lower doses as 3.5 mg of bupivacaine would limit the block to only one limb. In this study the onest time for loss of pin prick sensation at T10 in both the limbs was similar between 5 to 7 minutes. This was similar to the onset time of block with classical subarachnoid technique. Caseti A, Fanelli G et al [4] found onset times in dependent limb to be more rapid when compared to non-dependent limb. In this study we were not able to demonstrate any obvious difference in onset times.

Sensory blockade was assessed in the dependent as well as non-dependent limbs. Sensation was assessed using pin prick by a blinded observer. This was recorded every 5 minutes after positioning the patients, up to 60 minutes. The sensory levels were checked in the post operative period in the recovery room. In this study the sensory block had a wide variation in the upper level of block between the dependent and nondependent limb at 15 minutes. But with the passage of time this difference was narrowed or obliterated.

In control group the sensory block extended between T6-L1 with median being T8-T9. The study group the block extended between T9-T12 with the median of T10. This was not statically significant. Four out of 30 patients in the unilateral group (study group) had no sensory loss in the non dependent limbs.

A Casati, G. Fanelli et al [5] in their study demonstrated a difference in maximum sensory block achieved between the 2 limbs on the dependent limb the block extended between L1 to T2. With a mean of T10 and on the non dependent limb extended between T6 to L2 with a mean of T12. Battista Borghi et al [6] found that sensory block in dependent limb was T9 in unilateral block and T7 in bilateral block. In our study there was no statically significant difference in sensory block between the 2 limbs with average sensory blocks in both limbs being T9.

Analysis of motor block was done using modified bromage scale both in the dependent and nondependent limb exclusively comparisons were made at 15, 30, and 60 minutes interval, grade 2 and 3 of modified bromage scale were considered as significant motor blockade of limb. Based on these parameters the following observations were made.

Control group showed no statistical significant differences in motor blockade between the limb. Establishment and regression of motor blockade as recorded at 15 minutes and 60 minutes were matched between the two limbs. Study group showed a statistically significant difference in motor blockade between the two limbs at 15 minutes suggesting minimal motor blockade in non dependent limb. Significant motor blockade in dependent limb was 27/30 and in non dependent limb was 15/30. At 60 minutes significant, motor blockade in the dependent limb was 30/30 and in the nondependent limb was 22/30. This difference was statistically significant so as the limb lapsed the differential blockade obtained between the two limbs seem to reduce reflecting the slow spread of local anaesthetic solution to the non dependent limb assuming the change to supine position.

An analysis of motor blockade in the 2 group showed that unilateral block and low dose spinal block induced lesser degree of motor blockade when compared to the classical subarachnoid block group. This difference was found to be statistically significant In the study group the onset of motor blockade was faster and degree of motor blockade was more in the dependant limb when compared to the nondependent limb. This difference was also found to be statistically significant. Borghi et al [6] demonstrated a difference in motor block between the dependent and non dependent limbs. They recorded a bromage score of 0/1/2/23 of 0/2/3/45 in unilateral group in the dependent limb and bromage score of 0/1/2/3 of 0/3/11/36 in the classical subarachnoid block. In study group on the dependent limb bromage score was 4/0/11/15 and in the non dependent limb 11/5/5/9.

In this study, haemodynamic parameters as evidenced by systolic blood pressure diastolic and mean arterial blood pressure were comparable between study group and control group. Total sixteen patients have hypotension of more than 30% from base line value that required treatment. Control group had higher incidence of hypotension in twelve patients (40%) requiring treatment with vasopressors and fluids. The fall in blood pressure was statistically significant=0.0098.

The hemodynamic parameters recorded every 1 mints until 10 mints every 5 mints until 30 mints and thereafter every 15 mints until 60 mints. The SBP was 129.7+/-6.48 at the time of giving spinal anaesthesia showed a gradual fall until 20 minutes and gradually increased to baseline at 60 minutes. With more fall in blood pressure in control group compared to study group. Heart rate variation were statically significant at 7 minutes (p-value=0.02), 8 minutes (p-value=0.006), 9 minutes (p-value =0.0004) and 10 minutes (p-value=0.001). Two tailed p-value calculated using two sample t-test. The heart rate variation was more in control group when compared to study group. Bradycardia is heart rate <60 noted in 10 patients in control group compared to 4 patients in study group. This was statistically very significant with p=0.03.

Casati faneli et al [7] reported by a higher incidence of hypotension in classical group (22.4%) than unilateral group(5%) .The change in systolic blood was 28% in classical group and 12-18% in unilateral group. In this classical group showed a greater fall in blood pressure and heart rate than the unilateral group. Study group had lesser incidence of hemodynamic problems. These differences were also to be statistically significant. In a study from regional anaesthesia to assess unilateral anaesthesia and to verify the hypothesis about safety related superiority of this technique over bilateral anaesthesia in patients undergoing subarachnoid block with hyperbaric 0.5% bupivacaine the decrease in mean MAP at 5 and 6 min was 13.3 and 17.5 mmHg respectively. The comparative assessment of both technique of administration of 0.5% bupivacaine in the lateral decbitus position did not show difference between the fast and conventional injection : changes in MAP ranged from 1.8 to 4.2 mmHg.

Study concluded that unilateral spinal anesthesia was safer when low doses are used another study from Dobrydnjov et al [8] recommended that 5mg of hyperbaric 0.5% bupivacaine may be a good indication for outpatient procedures. A review of clinical articles suggests that attempting a unilateral spinal block results in a fourfold reduction in the incidence of clinically relevant hypotension with more stable cardiovascular parameters as compared to conventional bilateral spinal block.

Another prospective randomized parallel group study from Milan to evaluate cardiac performance during unilateral subarachnoid block and to compare it with that produced by standard bilateral spinal anaesthesia reported that use of 5 mg of 0.5% hperbaric buivacaine slowly injected through a directional needle provided a spinal block relatively restricted to the operative study with minimal effects on cardiovascular hemodynamics [9,10]. However in the present study with the small dose of drug block lasted for shorter duration and can be used in shorter duration surgeries which is a limitation.

Conclusion

From this study it can be concluded that in patients undergoing unilateral lower limb surgeries, Unilateral low does subarachnoid block offers better hemodynamic stability the intra-operative period. The onset quality and duration of block matches those produced by classical subarachnoid block subarachnoid in unilateral during the intra-operative period. It is possible to produce unilateral subarachnoid block by maintaining patients in lateral position for 15 min.

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