

ORIGINAL RESEARCH

Unilateral spinal anesthesia for varicose vein surgery: Comparison of levobupivacaine with fentanyl and clonidine

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ABSTRACT

Background: Unilateral block shows advantages of spinal block without the typical adverse effects seen with bilateral block. In this study, we compared unilateral spinal anaesthesia using isobaric levobupivacaine admixed with fentanyl or clonidine in patients undergoing varicose vein surgery in terms of onset, duration of motor and sensory block, hemodynamic parameters, requirement of first analgesic rescue therapy and side effects. **Material and method:** 90 patients of ASA I/II scheduled for varicose vein surgery allocated into three groups (n=30). All three groups received 5mg isobaric levobupivacaine + normal saline(0.5ml) group A, 5mg isobaric levobupivacaine+25 µg fentanyl(0.5ml),group B, 5mg isobaric levobupivacaine+ 25 µg clonidine (0.5ml),group C making volume of 1.5 ml in each respectively for unilateral spinal anaesthesia. **Results:** All groups were comparable with respect to age, height, weight and ASA. Sensory block onset time was faster in group B(3.20±1.00 min) as compared to group A and C while onset of motor block was earlier in group C(10±0 min). Duration of sensory and motor block and requirement of rescue analgesia was prolonged in group C(5.15±0.60) as compared to group A and B. All hemodynamic parameters were stable with no intra and postoperative complications. **Conclusion:** Major advantages of unilateral spinal anaesthesia are its hemodynamic stability, increased patient autonomy, early discharge and no complications as seen with conventional bilateral spinal block so this might be a better alternative for outpatient procedures.

Keywords: unilateral block, levobupivacaine, varicose vein surgery

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INTRODUCTION

Spinal anaesthesia in humans was first performed by August Bier in 1898 using local anaesthetic cocaine. Spinal anaesthesia using bupivacaine was done by Fimber in 1966. Spinal anaesthesia using levobupivacaine was introduced in 1980s.^[1] Unilateral anaesthesia is a specific regional anaesthesiology technique. It was first described by Tanasichuk et al. in 1961 as spinal hemianalgesia in patients who were to undergo extremity surgery.^[2]

Spinal anaesthesia is a frequently applied technique with its ease of performance and high success rate for lower limb surgeries. It is widely used for providing a fast and effective sensory and motor blockade. This blockade reduces the stress response to surgical trauma, decreases morbidity and mortality in comparison with general anaesthesia. However side effects such as hypotension, bradycardia, nausea,

vomiting, post puncture headache and urine retention are observed. Hypotension is the most frequent side effect of conventional bilateral spinal anaesthesia, occurring in more than 30% of the patients.^[3]

The unilateral block affects the sensory, motor and sympathetic functions on one side of the body without the typical adverse effects seen with a bilateral block. The advantages of unilateral spinal anaesthesia include much lower incidence of clinically relevant hypotension, lower incidence of urine retention, better patient satisfaction, better mobility during recovery time and block restriction on operative side.^[3]

Various adjuncts used along with local anaesthetics for spinal anaesthesia are- opioids, clonidine, dexmedetomidine, magnesium sulphate. Intrathecal alpha 2 agonists prolong the duration of local anaesthetics and reduce the required dose. Various local anaesthetics used for spinal anaesthesia are-

bupivacaine, lidocaine, chlorprocaine, mepivacaine, levobupivacaine and ropivacaine.^{[4],[5]}

Spinal levobupivacaine, is an S (-)-enantiomer of bupivacaine. It along with racemic bupivacaine or other local anaesthetics, either isobaric or hyperbaric, has been used for obstetrics, orthopaedics, herniorrhaphy, and transurethral surgeries^[6,7,8,9]. Only one study compared the isobaric to the hyperbaric form of the same agent.^[10] However we have no conclusive data yet, whether one form is superior to the other. Therefore the sensory and motor block characteristics, quality of anaesthesia and hemodynamic in patients who require a higher level of spinal block for lower abdominal surgeries with either hyperbaric or isobaric levobupivacaine are of particular interest.

The main advantage of levobupivacaine is that it is less cardiotoxic than bupivacaine.^[11] Clonidine, either intrathecal or orally, can prolong spinal anaesthesia and is free of the opioid -related side-effects. Clonidine hydrochloride, an imidazoline derivative, is a centrally acting α_2 adrenergic agonist and was introduced as an antihypertensive agent for more than two decades ago.^[11] We have chosen this study because previously no such study using isobaric levobupivacaine has been conducted for unilateral block. This study aimed to compare unilateral spinal anaesthesia with isobaric levobupivacaine admixed with fentanyl or clonidine in patients undergoing varicose vein surgery, to compare among the groups time of onset, duration of motor and sensory block in both dependent and non-dependent extremity, hemodynamic parameters, requirement of first analgesic rescue therapy and side effects.

MATERIALS AND METHODS

This prospective, comparative randomized study was carried out in Department of Anaesthesiology in collaboration with department of General surgery, King George's Medical University, Lucknow after getting approval of ethical clearance from institutional ethical committee over a period of August 2018 to July 2019. Written and informed consent was taken from all study participants.

90 patients of age 20-65 years, ASA grade 1 and 2, BMI 25-40 were included for elective varicose vein surgery. Patients with any contraindication to regional anaesthesia or to any drug used in the study, body mass index >40, peripheral neuropathy and patients having multiple comorbidities were excluded.

Patients were divided into 3 groups by computer generated random table

Group A: received 5mg isobaric levobupivacaine (1ml) + normal saline(0.5ml)

Group B: received 5mg isobaric levobupivacaine (1ml) + 25 μ g fentanyl (0.5ml)

Group C: received 5mg isobaric levobupivacaine (1ml) + 25 μ g clonidine (0.5ml)

After shifting patient to operation theatre, standard monitoring like electrocardiogram, heart rate, pulse oximetry and noninvasive arterial blood pressure were applied and baseline parameter like blood pressure (systolic, diastolic and mean arterial pressure), heart rate and oxygen saturation were recorded. After taking intravenous line, patients were preloaded with 10ml/kg of ringer lactate solution 15 minutes prior to block. With all aseptic precautions, a midline spinal puncture was performed at L3/L4 interspace with a Quincke 25-G spinal needle in the sitting position and patient was maintained in lateral position to operative site for 20 minutes.

Motor blockade was assessed by using Modified Bromage Scale. [0 = no motor block (free movements of legs and feet), 1 = inability to raise extended leg; just able to flex knees with free movement of feet, 2 = inability to raise extended leg or flex knees but able to move feet, 3 = complete motor block of limb i.e. unable to move legs or feet.]

The sensory block was assessed by pinprick test using a short bevelled sterile 26G hypodermic needle. The time to achieve anaesthesia up to T12 level was recorded.

The time of onset and duration of sensory and motor block was recorded. We monitored heart rate, non-invasive blood pressure and SPO2 in the three groups. The time of rescue analgesic therapy was noted. Hypotension has been defined as systolic blood pressure of <90 mm of Hg or >20% decrease from baseline value. Tachycardia has been defined as heart rate >100/min and bradycardia as heart rate <50/min, or >25% decrease in baseline values. Any side effects including hypotension, bradycardia, nausea and vomiting, sedation, and shivering were recorded.

The statistical analysis was done by using SPSS (Statistical Package for Social Sciences) Version 21.0 statistical Analysis Software. The results were analyzed using descriptive statistics and making comparisons among various groups. Discrete (categorical) data were summarized as in proportions and percentages (%) and quantitative data were summarized as mean \pm SD.

RESULTS

Total 90 cases were included in the study and divided into three groups (Group A,B,C with 30 subjects in each group). The groups were comparable for age, height, weight and in term of ASA grading.

The baseline pulse rate was comparable in all the groups. There was no difference in pulse rate among groups A and B. There was fall in pulse rate in group C after 30 min. However this was not clinically and statistically significant as fall in pulse rate was within physiological range. None of the patients had bradycardia (pulse rate <50bpm). {FIGURE 1}

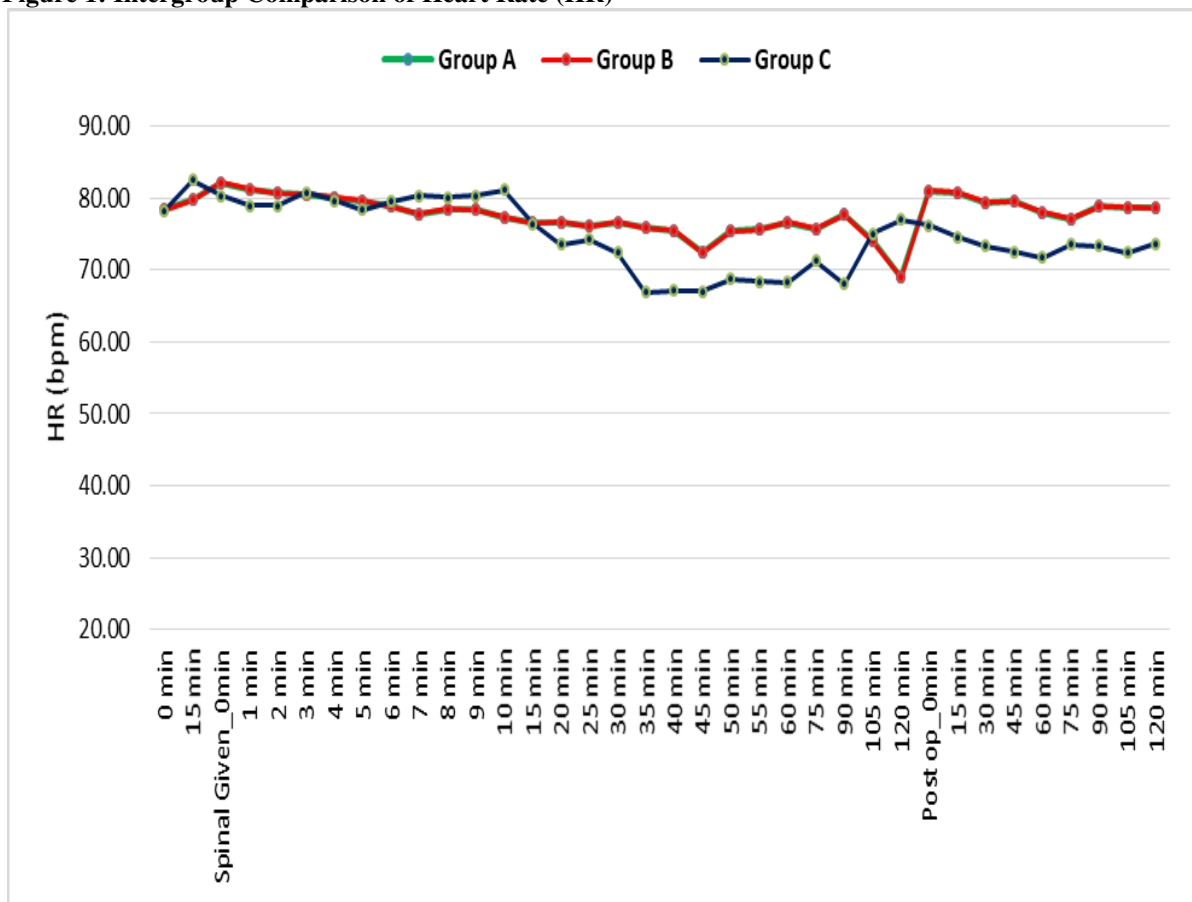
Table –1: Modified Bromage Scale

- 0= no motor block (free movements of legs and feet)
- 1= inability to raise extended leg; just able to flex knees with free movement of feet
- 2= inability to raise extended leg or flex knees but able to move feet
- 3= complete motor block of limb i.e. unable to move legs or feet

Table –2: Baseline Characteristics of Cases

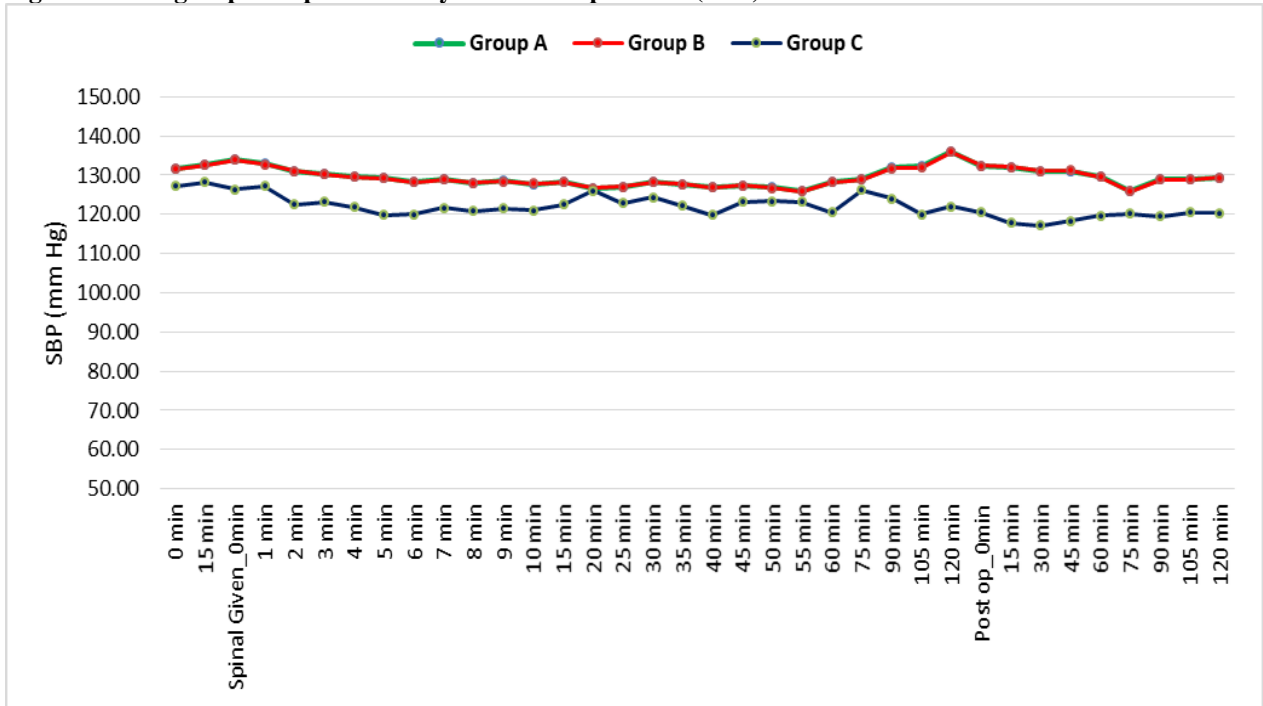
Group	Group A		Group B		Group C		F-value	p-value
	Mean	SD	Mean	SD	Mean	SD		
Age	43.21	8.58	43.45	8.85	41.70	4.29	0.47	0.625
Height	155.53	3.30	155.40	3.18	156.11	3.79	2.71	0.072
Weight	62.93	4.24	62.73	4.14	63.07	4.03	0.05	0.952
ASA Grade	No.	%	No.	%	No.	%		
I	5	16.7%	6	20.0%	9	70.0%	0.823	0.442
II	25	83.3%	24	80.0%	21	30.0%		

Figure 1: Intergroup Comparison of Heart Rate (HR)



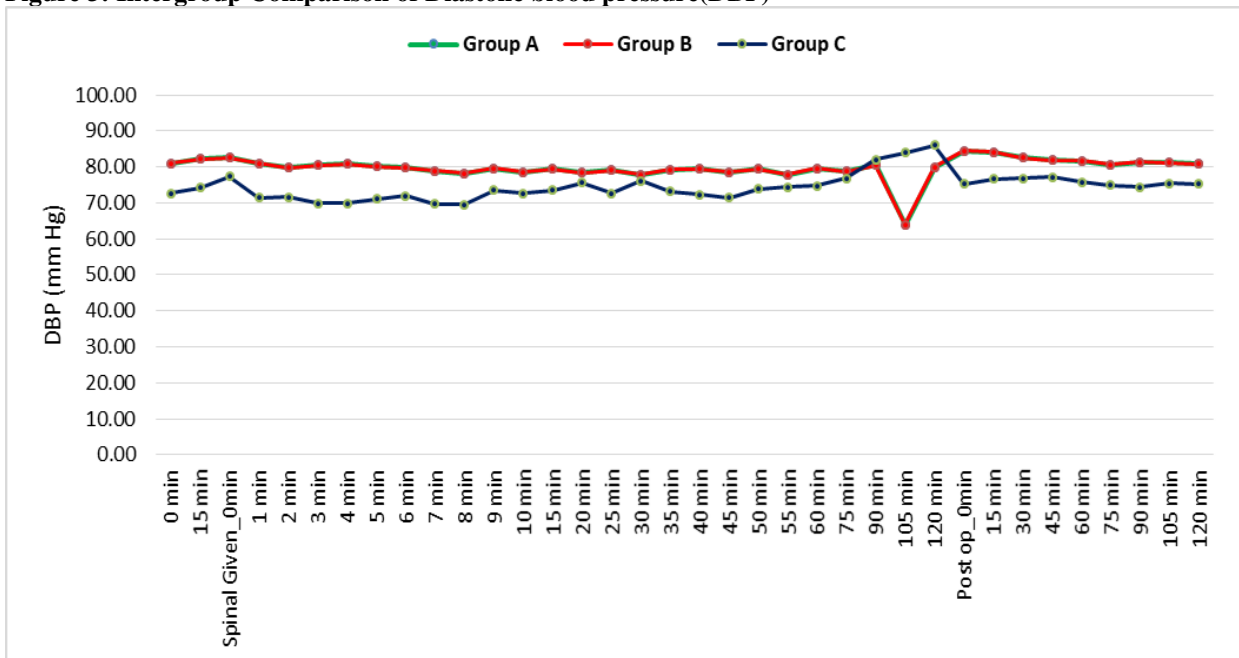
The baseline systolic blood pressure was comparable in three groups. No significant difference was observed in SBP, DBP, MAP, SPO2 at any time between three groups from spinal given to 120 min post spinal ($p > 0.05$). {FIGURE 2}

Figure 2: Intergroup Comparison of Systolic blood pressure (SBP)



On comparing the Bromage, it was found that Bromage was zero upto 10 min in group A, B and 8 min in group C in dependent leg that was not significant. But the mean Bromage of group C was more than the groups A & B. The time of onset of motor block in dependent leg was earlier in group C and the difference was statistically significant ($p < 0.05$). The duration of motor block in dependent leg was prolonged in group C. {FIGURE 3}

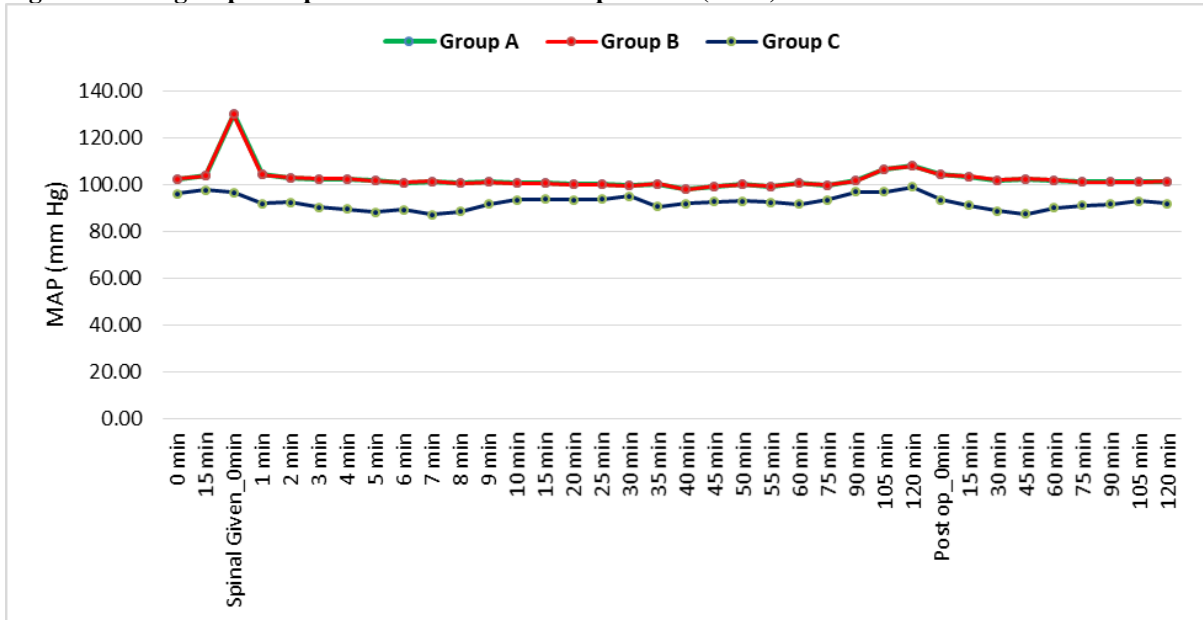
Figure 3: Intergroup Comparison of Diastolic blood pressure (DBP)



In non-dependent leg Bromage was zero upto 20 min post spinal. The time of onset of motor block in non-dependent leg was at 20 min in all the three groups which was statistically not significant ($p > 0.05$). The minimum sensory onset time was detected for group B while maximum for group A. Highly significant difference is found among the groups ($p < 0.001$). {FIGURE 3}

The sensory maximum level reach time in dependant leg was detected lowest for group C while highest for group A. Highly significant difference is found among the groups ($p < 0.001$). The end of sensory effect time was detected lowest for group A while highest for group C. Highly significant difference is found among the groups ($p < 0.001$). {FIGURE 4}

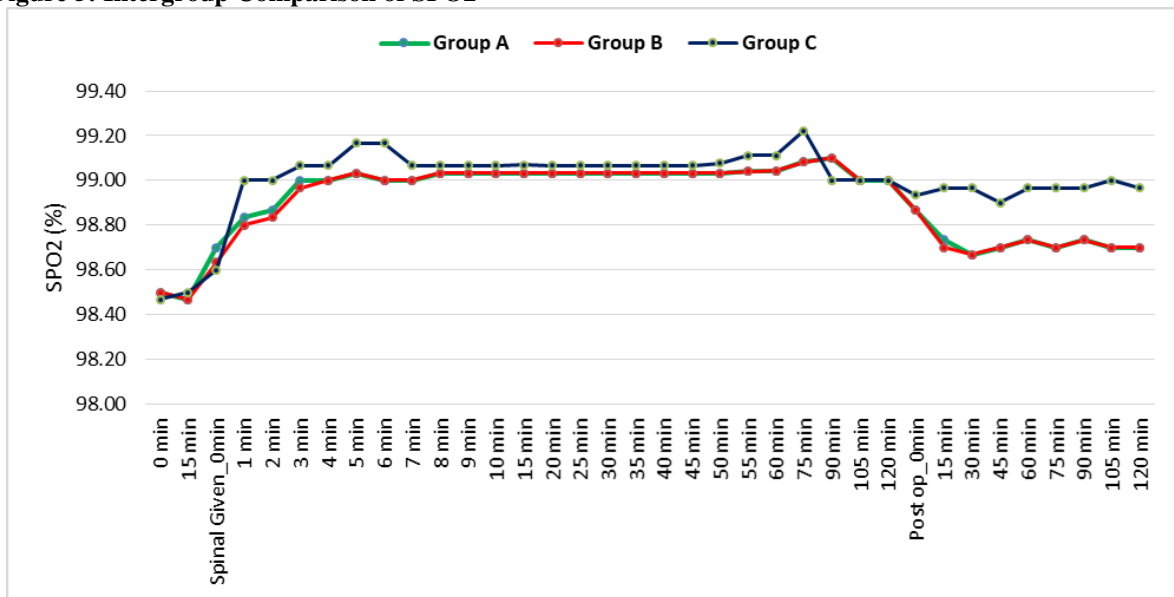
Figure 4: Intergroup Comparison of Mean Arterial pressure (MAP)



The minimum sensory onset time in non-dependent leg was detected for group C while maximum for group A. The sensory onset time was comparable in all three groups ($p=0.533$). The sensory maximum level reach time in non-dependent leg was detected lowest for group C while highest for group B. The sensory maximum level reach time was found to be statistically significant among all the groups ($p=0.006$). The end of sensory

effect time in non-dependent leg was detected lowest for group A while highest for group C. For end of sensory effect time highly significant difference was found among all three groups ($p<0.001$). On comparing the requirement of analgesic therapies among the groups, the significant difference was found among the three groups with maximum time duration for group C and minimum for group A ($p<0.001$).{FIGURE 5}

Figure 5: Intergroup Comparison of SPO2



In our study low dose of isobaric levobupivacaine (5 mg) induced total unilateral block in 23 (76.67%) of patients in group A, 20 (66.67%) of patients in group B and 18(60.0%) of patients in group C at 20 minutes{FIGURE 6 }, but this figure evolved to just

13 (43.33%) of patients in group A, 11(36.67%) of patients in group B , and 10 (33.33%) of patients in group C at 50 minutes, showing that isobaric levobupivacaine moves in the CSF in this time-frame. No intra and postoperative complications were found.

Figure 6: Intergroup Comparison of Bromage in both dependent and non- dependent leg.

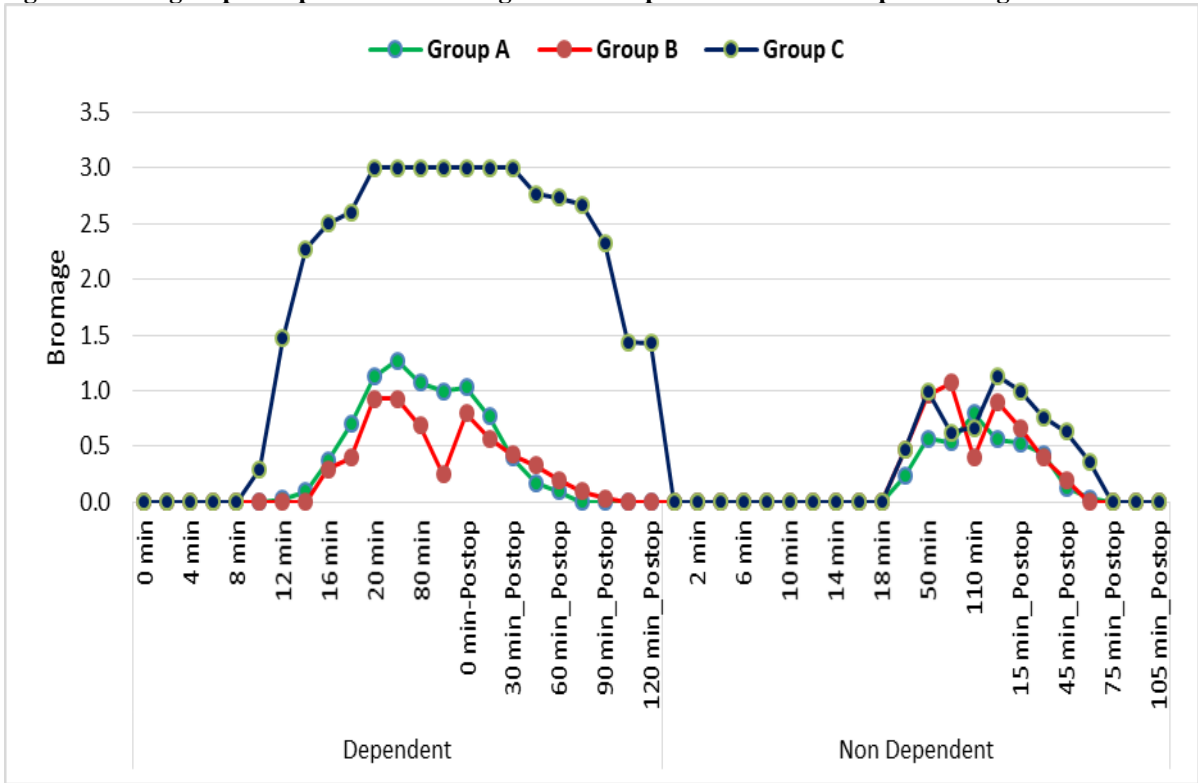


Figure 7: Intergroup Comparison of sensory parameters in dependent leg

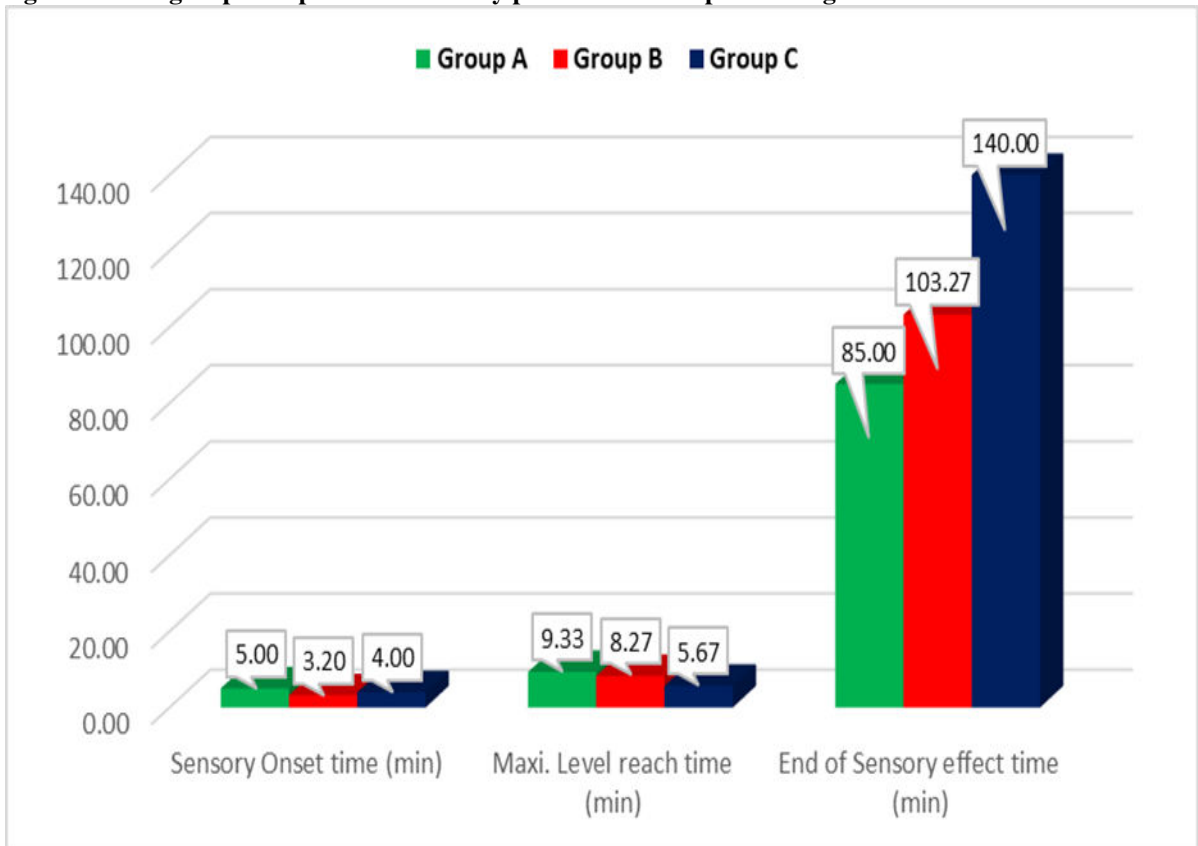


Figure 8: Intergroup Comparison of sensory parameters in non-dependent leg

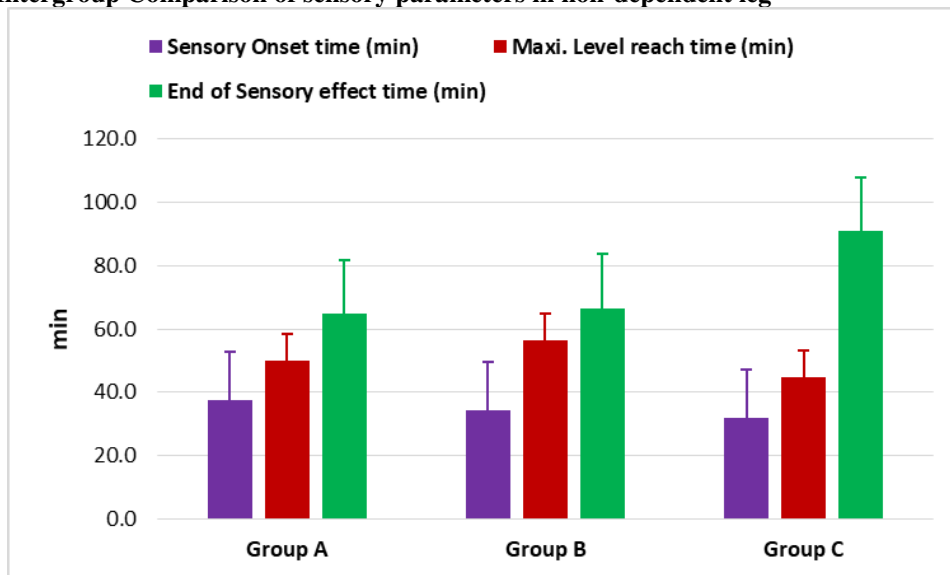


Figure 9: Intergroup Comparison of Requirement of Analgesic

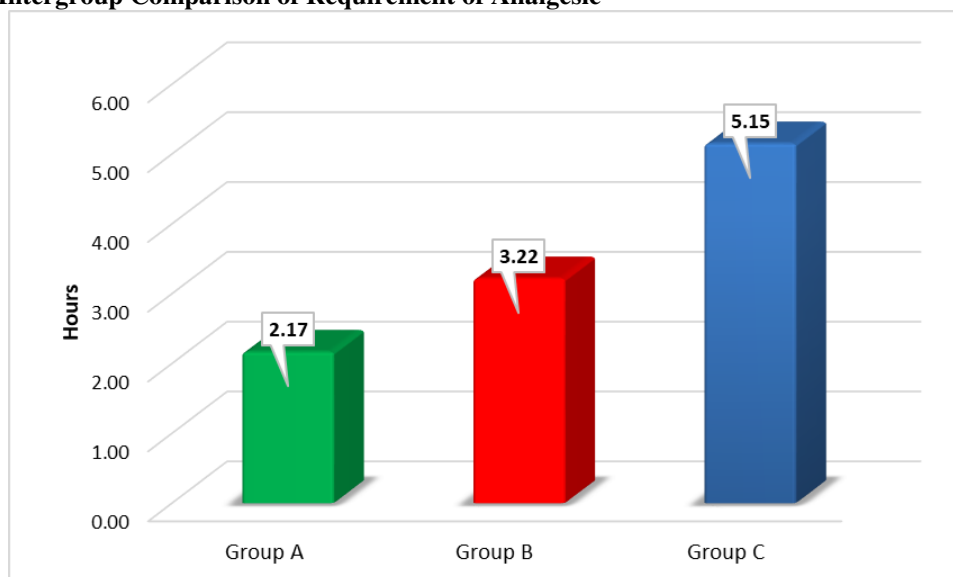


Figure 10: Block in dependent and nondependent leg at 20 min

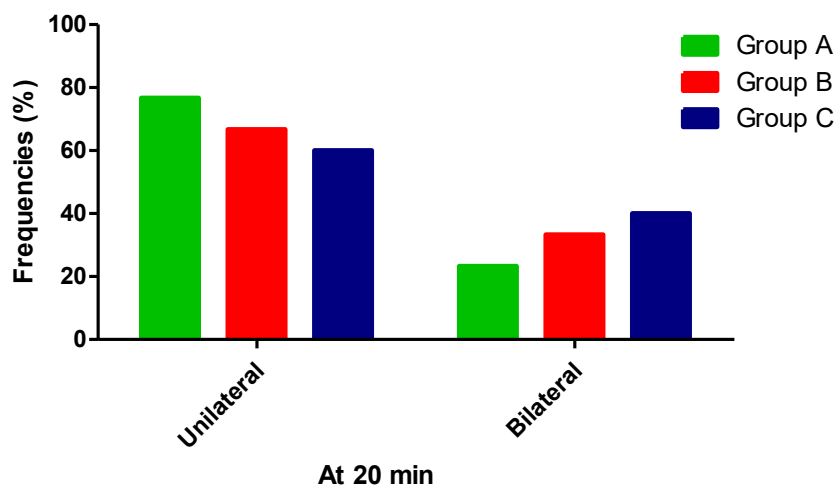
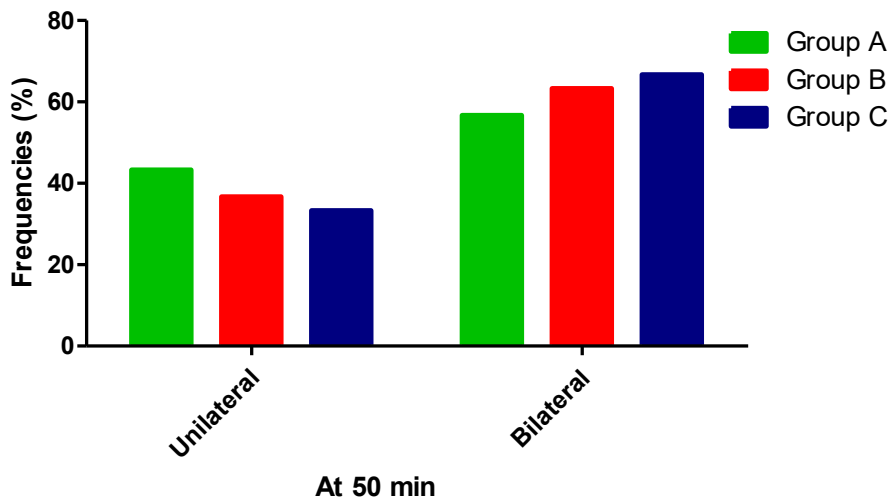


Figure 11: Block in dependent and nondependent leg at 50 min



DISCUSSION

Spinal anaesthesia has been considered a standard technique for surgical repair of varicose veins. However it carries a risk of hemodynamic disturbances as a consequence of sympathetic blockade. The most common side-effects of sympathetic denervation are hypotension and bradycardia itself due to both arterial and venous dilation. Arterial vasodilation is not maximal after spinal blockade as vascular smooth muscles continue to possess some autonomic tone after sympathetic denervation. Therefore, a mild decrease in total peripheral vascular resistance and mean arterial pressure can be observed if cardiac output is not decreased.

Anaesthesiologists are often faced with unilateral surgical procedures on one lower limb, especially during outpatient and orthopaedic procedures. In such situations, unilateral spinal anaesthesia is advantageous over conventional spinal anaesthesia. These advantages include decreased hypotension, faster anaesthetic recovery and increased patient satisfaction. These advantages were also seen in the other studies.^{[16],[18],[19]}

Unilateral spinal anaesthesia has been increasingly used in recent years for inducing unilateral short lasting motor block, allowing patients comfort and lesser hemodynamic changes.^[7,18,22,23] So we chose comparative study of isobaric levobupivacaine with different adjuvants in spinal anaesthesia for unilateral effect of block in terms of onset of sensory and motor block, hemodynamic changes and postoperative complications. The groups were comparable in terms of age, weight, height and ASA grading.

In our study we used small dose of isobaric levobupivacaine 5mg (1ml) for unilateral spinal anaesthesia. This corresponds to study of **Nesek et al^[19]** and **Imbelloni et al^[17]**. Isobaric levobupivacaine was chosen in present study because studies done by **Nesek et al^[19]**, **Gogus et al^[20]**, **Boyaci et al^[28]** found that levobupivacaine provide stable hemodynamic

profile, effective sensorial blockade with less motor blockade, less side effects, so that it could be used at low doses as a good alternative to bupivacaine.

Unilateral spinal anaesthesia may be induced with hypobaric, isobaric, or hyperbaric solutions and the incidence of unilateral spinal anaesthesia varies according to the study. With isobaric solutions the incidence is 37% as studied by **Kuusniemi et al^[12]**.

In our study low dose of isobaric levobupivacaine induced total unilateral block in 23 (76.67%) of patients in group A, 20 (66.67%) of patients in group B and 18(60.0%) of patients in group C at 20 minutes, but this figure evolved to just 13 (43.33%) of patients in group A, 11(36.67%) of patients in group B, and 10 (33.33%) of patients in group C at 50 minutes. It shows that isobaric levobupivacaine moves in the CSF in this time-frame. This is consistent with study conducted by **Imbelloni et al.^[17]**

In our study, the mean time for onset of sensory block was significantly lower in group B as compared to group C and group A that are statistically significant. This showed similar result in terms of onset of sensory block to the previous studies of **Gogus et al^[20]**, **Attri et al^[24]**, and **Khadse et al^[27]**.

As well as time to reach maximum sensory level was faster in group C as compared to group B and group A. This feature corresponds to study conducted by **Mahendru et al^[21]**.

Isobaric 0.5% levobupivacaine is a long-lasting local anaesthetic, which is usually overdosed during short lower limb procedures. The dose of 5 mg of isobaric 0.5% levobupivacaine has allowed a faster recovery time in both dependent leg and non-dependent leg in group A as compared to group B and group C. This is consistent with studies conducted by **Kuusniemi et al^[13]**, and **Beato et al^[15]**.

Similarly mean time for onset of motor block in dependent leg was earlier in group C while duration of motor block was prolonged in group C which corresponds to study conducted by **Soren et al^[25]**.

In our study in group A at 20 minutes, motor block of grade 2 in the dependent leg was noted in 13 patients, and grade 1 blocks occurred in 4 patients. At 50 minutes in group A, three additional patients exhibited motor block. In group A Grade 1 motor block of the non-dependent leg occurred in 7 patients at 20 minutes. At 50 minutes, motor block was noted in 17 patients, of grade 1. In group B in dependent leg at 20 minutes, 18 patients had motor block, grade 1 block occurred in 10 patients and of grade 2 in 8 patients. In non-dependent leg, at 20 minutes motor block was noted in 10 patients of which grade 1 was found in 6 patients, and grade 2 in 4 patients. At 50 minutes motor block was noted in 19 patients, of which 9 had grade 1 block and 10 had grade 2. In group C all patients had motor block in dependent leg of which 8 patients had grade 2, rest patients had grade 3. In group C in non-dependent leg at 20 minutes 12 patients had motor block, of grade 1 was found in 10 patients and of grade 2 in 2 patients. At 50 minutes 20 patients had motor block, of which grade 2 was found in 11 patients and grade 1 in 9 patients. Motor block in the dependent leg was higher as compared to the non-dependent leg in all evaluations. This corresponds to study conducted by **Imbelloniet al**^[17].

In our study, we noticed stable hemodynamic in terms of systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and oxygen saturation among all the three groups without any incidence of hypotension, bradycardia and respiratory depression. This might be due to drug isobaric levobupivacaine used in the study which is a cardiostable drug used for unilateral block effect. This is consistent with the study conducted by **Imbelloniet al**^[17].

Duration of analgesia in group C was maximum and minimum in group A while in group B it was found to be intermediate between C and A. The difference among three groups were statistically significant. This is comparable with the study conducted by **Attri et al**^[24], **Bajwa et al**^[26], **Bogra et al**^[29].

In terms of complications in our study, none of the patients in study group developed bradycardia (PR < 50/min), hypotension (fall in BP > 25% of baseline), desaturation, nausea, vomiting, shivering or respiratory depression (RR < 8/min). This feature shows that unilateral block restricts the sympathetic block to one side thus avoiding side-effects. **Chohan et al**^[30], **Nesek et al**^[19] also observed the same.

Major advantages of unilateral spinal anaesthesia with 5 mg isobaric bupivacaine are its cardiocirculatory stability and fast regression, and it might be a new alternative for outpatient procedures. It can also be concluded from our study that Isobaric levobupivacaine moves in the CSF after 20 minutes resulting in reducing the number of unilateral block in all groups.

CONCLUSION

The results of our study demonstrate that both drugs fentanyl 25µg and clonidine 25 µg when used as

adjuvants to levobupivacaine 5mg are effective in unilateral spinal anaesthesia for lower limb surgeries with good haemodynamic stability and post-operative analgesia. However clonidine group have prolonged effect (sensory block) and can be used in surgeries with longer duration.

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