Original Research Article

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Comparison between Combined Sciatic-Fascia Iliaca Compartment Block and Unilateral Spinal Anesthesia for Unilateral Lower Limb Surgery: A Retrospective Study

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Abstract

Introduction: We aimed this study to evaluate the efficacy, quality and safety of combined sciatic and Fascia Iliaca Compartment Block with Unilateral Spinal Anaesthesia for selected lower limb surgeries. *Materials & Methods:* Data collected retrospectively from prescheduled 60 patients of ASA grade I & II, were equally distributed in two groups - Spinal group and the Block group. The time taken for the application of the block, number of attempts, qualilty of anaesthesia, hemodynamic parameters, duration of block & post op first analgesic need were compared. *Results:* The patients of Block group had a greater hemodynamic stability, longer duration of sensory & motor blockade with a longer time for the need of rescue analgesic although the block application time was shorter in spinal group and quality of blockade was significantly better requiring no additional sedation or analgesia intraoperatively. Complication rates were comparable in both groups though tourniquet pain was common in block group & hypotension in spinal group. Bilateral blockade was seen only in spinal group. *Conclusion:* Combined sciatic-fascia iliaca compartment block is a suitable alternative to spinal anaesthesia when hemodynamic stability and analgesia is considered, especially in high risk patients.

Keywords: Unilateral Spinal; Combined Sciatic and Fascia Iliaca Compartment Block; Lower Limb Surgeries.

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Introduction

Outpatient procedures and discharge poses a significant challenge for the anaesthesiologist to provide patients with suitable modes of anaesthesia helping early post op recovery, good analgesia with fewer complications [1]. For unilateral lower limb surgeries, unilateral spinal anesthesia is generally most commonly practiced and well established procedure for its completeness of blockade. The sciatic nerve alongwith Fascia Iliaca Cmpartment Block (FICB) can provide almost complete anaesthesia for unilateral lower limb, though the success rate of blockade is lower even in experienced hand [2, 3]. The study was thus aimed at comparing the quality, efficacy, success rate and feasibility of combined sciatic block and FICB with that of unilateral spinal blockade for unilateral anesthesia of lower limb in below knee and some selected above knee surgeries.

Aims & Objectives

This study was conducted aiming to compare

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1. Post-blockade hemodynamic parameters during unilateral spinal anaesthesia and combined sciaticofemoral block.
2. Onset and duration of blockade.
3. Duration of analgesia and need for first analgesic.
4. Success rate of both blocks.

Methods

After acquiring approval of Institutional Ethical Committee, this study was conducted at ESIPGIMSR Andheri (E). The size of the study population was estimated to detect the mean time to perform the blockades by, at least, one minute less by using unilateral spinal anesthesia instead of combined sciatic- fascia iliaca block based on a common standard deviation of no more than 1.2 minutes, with a power of 90%, and significance level of $\alpha = 0.05$, resulting in 26 patients in each group. Data collected from prescheduled 60 patients of ASA grade I & II, equally distributed retrospectively and randomly (by coin method) in two groups - Spinal group and the Block group. Patient with age ranging from 30 to 70 yrs, body weight 50 to 80 kg, height 150-180 cm of both genders scheduled for below knee surgeries or selective above knee surgeries (e.g. split skin grafting) were included in the study. Patients with cardiovascular or respiratory disorders, neuropsychiatric derangement, coagulopathy, surgeries around hip joint and patients with history of local anaesthetic sensitivity were excluded.

Standard monitoring according to the American Society of Anaesthesiologiy guidelines were applied for each patient, venous cannulation done with 20 gauze intravenous catheter, patients were transfused with intravenous fluids as per requirement throughout the surgery.

In the Spinal group, with the patient in left or right lateral decubitus, subarachnoid puncture was performed in the L_3-L_4 intervertebral space with a 25G Quincke's needle. After free flow of cerebrospinal fluid (CSF), the bevel of the needle was directed towards the dependent side and 7.5-10 mg (1.5-2 mL) of hyperbaric 0.5% was injected over 30 second. The number of attempts to access the subarachnoid space was evaluated. Patients were maintained in this position for 10 minutes and then positioned according to the need of the surgery.

In the block group, first sciatic block was performed via modified Winnie's approach [4]. PSIS, Greater Trochanter and sacral hiatus was identified. Greater Trochanter was joined with PSIS and sacral hiatus through a line respectively. The intersection point of the line joining GT and sacral hiatus with that of the perpendicular drawn from the midpoint of the line joining GT and PSIS was marked as entry point. A 10 cm insulated short beveled PNS needle (B. Braun) was introduced at this point keeping it perpendicular to the skin in all direction and local anaesthetic agent was injected after attaining end motor response at a current of 0.5 mA. Inversion and plantar flexion was considered as end motor response.

Then, in supine position, a point at the junction of lateral third and medial two third of the line joining the ASIS and Pubic Tubercle was taken as the entry point and with same PNS needle, two pops were elicited after entering skin above inguinal ligament. Patellar twitch was elicited before injecting the local anaesthetic agents at a current of 0.5 mA. This point anatomically correspond to suprainguinal approach for FICB.

Inj Lignocaine at a dose of 5 mg/kg and Inj Bupivacaine at 2 mg/kg were taken and the total volume was diluted upto 50 ml. 20 ml of this solution was injected for sciatic block and rest for the FICB.

The time to perform the block was evaluated in both groups. The technical implementation time (T1) was defined as the time needed for application of block after antiseptic skin preparation. The surgery delivery time (T2) was defined as the time needed for starting the surgery after injection of the local anaesthetic agent was done.

Comparison of the sensory and motor blockades in the limb to be operated was done with that of the contralateral limb. The sensory blockade was evaluated by the loss of cold and pinprick sensations bilaterally, in the spinal group, and on the dermatomal distributions of the femoral, lateral femoral cutaneous, obturator, common peroneal, and tibial nerves, in the block group. The motor blockade was evaluated by the modified Bromage scale (0 = absence of blockade; 1 = thigh blocked; 2 = hip and knee blocked; 3 = hip, knee, and ankle blocked). Maximum duration of motor and sensory blockade was noted.

Vital parameters (Heart rate, Systolic Blood Pressure, Diastolic Blood Pressure, SpO_2) were noted at regular intervals. Hypotension (a reduction in SBP > 25% when compared to the baseline) was treated with titrated boluses of mephenteramine and crystalloid, while bradycardia (HR < 45 bpm) was treated with atropine (0.01 mg/kg IV).

When the patients felt pain (visual analog scale (0-10 cm) score >3) in any step of the operation, they were first sedated with titrated doses of midazolam and if required, with 1µg/kg fentanyl. Quality of anesthesia was labelled as excellent when no additional drugs was administered, good when Benzodiazepine was used, adequate when opioid was used, and inadequate when general anesthesia was needed.

Intraoperative complications such as hypotension, bradycardia, tourniquet pain etc and post op complications such as residual neurological deficit, hypoesthesia, paraesthesia, PDPH was noted. Post operatively, parenteral analgesia with NSAIDS, Paracetamol and Tramadol (SOS) was administered. Time taken for first analgesic need was also noted.

Data were entered in Microsoft Excel and analysed using Stata Version 13.1. We calculated the means and standard deviations for the linear variables (such as age, technical implementation time, surgery delivery time, total time, mean duration of sensory and motor block, pulse rate, Systolic and diastolic Blood Pressure) and proportions for the categorical variables (such as sex, ASA Status, number of block attempts, grades of motor block, complications, quality of block). The means between two groups were compared using the unpaired t-test. The proportions were compared using the chi square test or the Fisher's exact test (for low expected cell counts). A p value of less than 0.05 was considered to be statistically significant.

Results

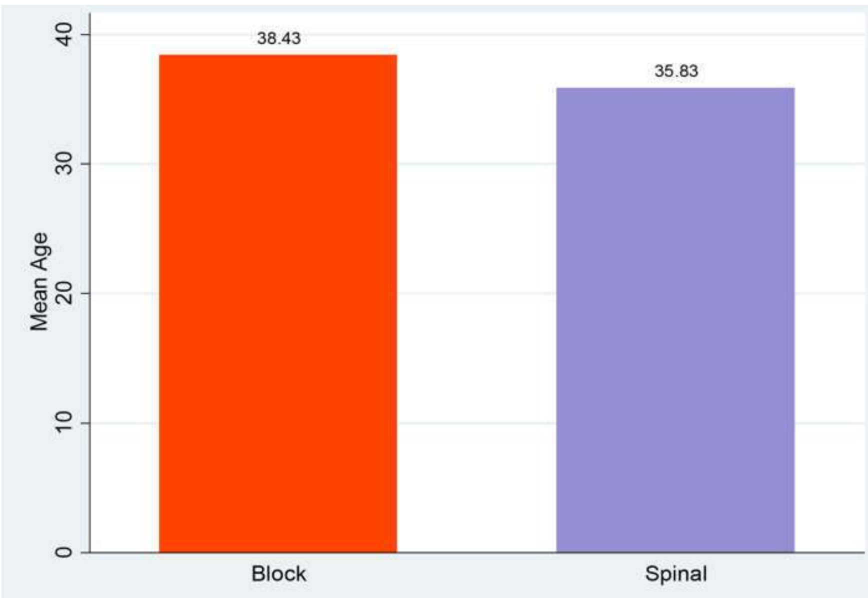
The demographic profiles (age, sex, ASA status) were comparable in both the groups (Table 1, Graph 1, 2 & 3).

In the Block group, the end motor response could be obtained in the first attempt in 24 patients (80%), in the second attempt in 5 patients (16.67%) and in the third attempt in 1 patient (3.33%). In the spinal group, access to the subarachnoid space could be achieved in the first attempt in 22 patients (73.33%), in the second attempt in 6 patients (20%) and in 2 patients (6.67%) in three attempts (Table 2). This was statistically not significant as the p value was 0.81.

In the block group, sciatic block required multiple attempts in 2 cases and in the other 4 cases, the FICB warranted multiple attempts. Most number of attempts were required to achieve quadriceps twitch during the FICB.

The technical implementation time needed in the block group was 11.90± 2.33 mins, and 5.93±1.13 mins in the Spinal group (Table 3, Graph 4). The surgery delivery time (Table 4, Graph 4) was also higher in the Block group (17.56±2.07 mins) than the spinal group (11.07±0.56 mins)

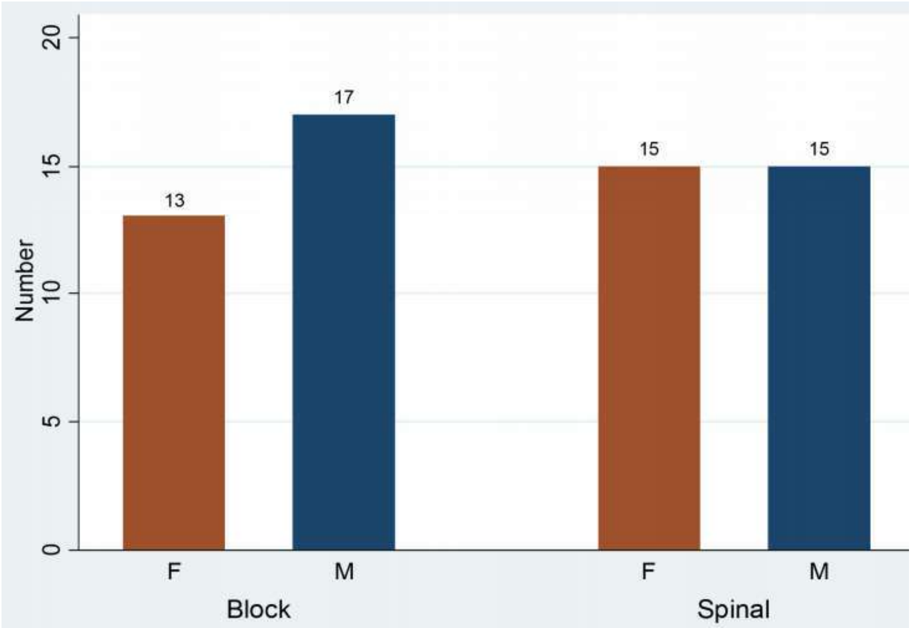
Total time measured (Table 5, Graph 4) in the block group was higher (29.46±3.0 min) than that of the spinal group (15.0±1.53 min). This was statistically significant as the p value was <0.0001.



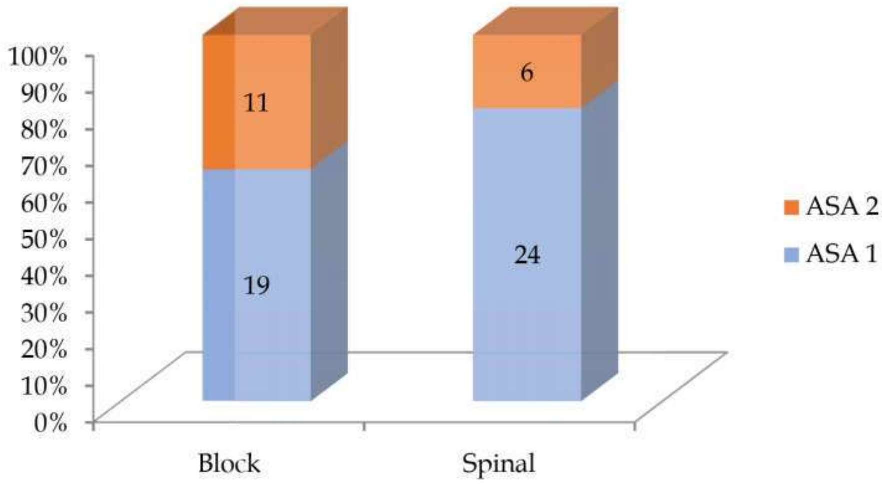
Graph 1: Distribution of study groups as per age

Table 1: Comparison of Demographic variables in the study groups

Variables	Block group	Spinal group	P value
Age	38.43 (12.02)	35.83 (10.85)	0.38
Sex (M/F)	17/13	15/15	0.61
ASA Status (I/II)	19/11	24/6	0.15



Graph 2: Distribution of Study groups according to number of males and females



Graph 3: ASA status in the study groups

Table 2: Comparison of Number of attempts in the study groups

Group	No of attempts 1	2	3	Total
Block	24	5	1	30
%	80.00	16.67	3.33	100
Spinal	22	6	2	30
%	73.33	20.00	6.67	100
Total	46	11	3	60
%	76.67	18.33	5	100

Table 3: Comparison of the technical implementation time in the study groups

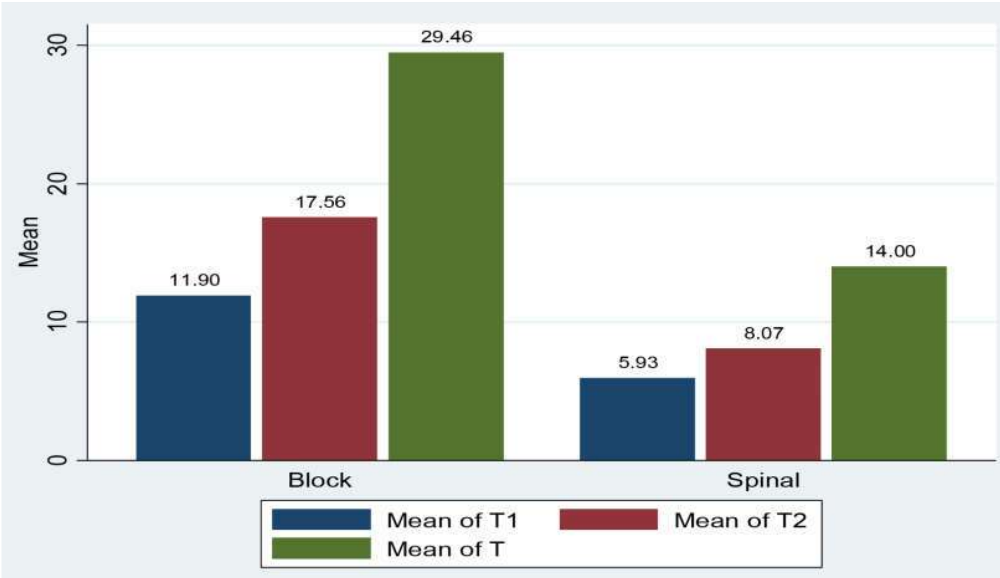
Group	Observed	Mean	Std. Dev.	[95% Conf.	Interval]	P value
Block	30	11.90	2.33	11.03	12.76	<0.0001
Spinal	30	5.93	1.13	5.51	6.35	

Table 4: Comparison of the surgery delivery time in the study groups

Group	Observed	Mean	Std. Dev.	[95% Conf.	Interval]	P value
Block	30	17.56	2.07	16.79	18.34	<0.0001
Spinal	30	11.07	0.56	7.86	8.28	

Table 5: Comparison of the total time needed in the study groups

Group	Observed	Mean	Std. Dev.	[95% Conf.	Interval]	P value
Block	30	29.46	3.00	28.34	30.58	<0.0001
Spinal	30	14.00	1.53	13.43	14.57	



Graph 4: Comparison of the time needed for blockade
(Where T1= technical implementation time, T2= Surgery delivery time, T= Total time)

In the block group, 22 (73.33%) patients had a Grade 3, 5 (16.67%) had grade 2 and 3 (10%) patients had Grade 1 motor block as per Bromage Scale. In the Spinal group, 28 (93.33%) patients had Grade 3 motor block and none had grade 1 block (Table 6). This was not statistically significant (p value is 0.09>0.05).

Among the 30 cases, sciatic block was successful in 28 (93.33%) cases and FICB was sucessful in 26 (86.67%) cases.

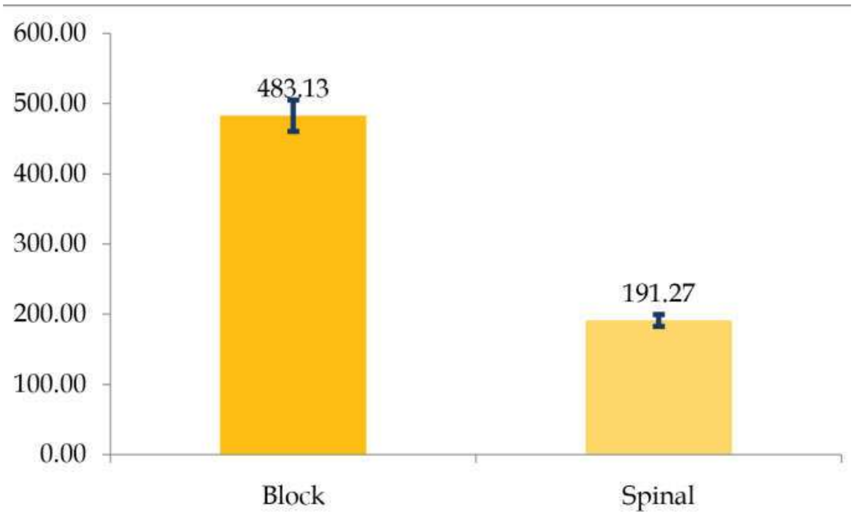
The mean duration of sensory block in Block group was significantly higher (483.13±60.11 min) as compared to the Spinal group (191.27±22.45 min). The mean duration of the motor block was also significantly higher in the Block group (p value was <0.0001 in both cases). In the Spinal group, 6 patients had a bilateral block whereas there was no such event in the Block group (Table 7, 8 & Graph 5, 6).

In the block group, 19 out of 30 cases required use of tourniquet which was comparable to the spinal group (20 of 30 cases) as the p value was >0.05.

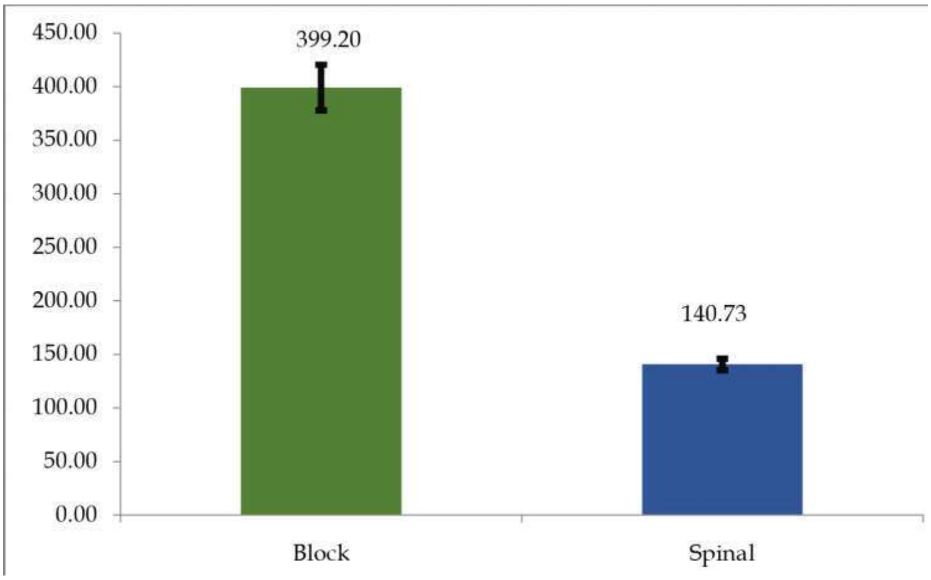
The fall in mean pulse rate in the spinal group was significant immediately post induction to the 20 mins post induction as in all instances the P value were<0.05. The mean pulse rate in the block group had a relatively stable course (Table 9, Graph 7). The same was applicable for Systolic Blood pressure. The SBP decreased significantly and

Table 6: Comparison of the Grades of Motor Block in the study groups

Group	Grade of Motor Block 1	2	3	Total
Block	3	5	22	30
%	10.00	16.67	73.33	100
Spinal	0	2	28	30
%	0.00	6.67	93.33	100
Total	3	7	50	60
	5.00	11.67	83.33	100



Graph 5: Comparison of mean duration of sensory block in the study groups



Graph 6: Comparison of mean duration of Motor block in the study groups

Table 7: Comparison of the mean duration of Sensory Block in the study groups

Group	Observed	Mean	Std. Dev.	[95% Conf. Interval]	
Block	30	483.13	60.11	460.69	505.58
Spinal	30	191.27	22.45	182.88	199.65

Table 8: Comparison of the mean duration of Motor Block in the study groups

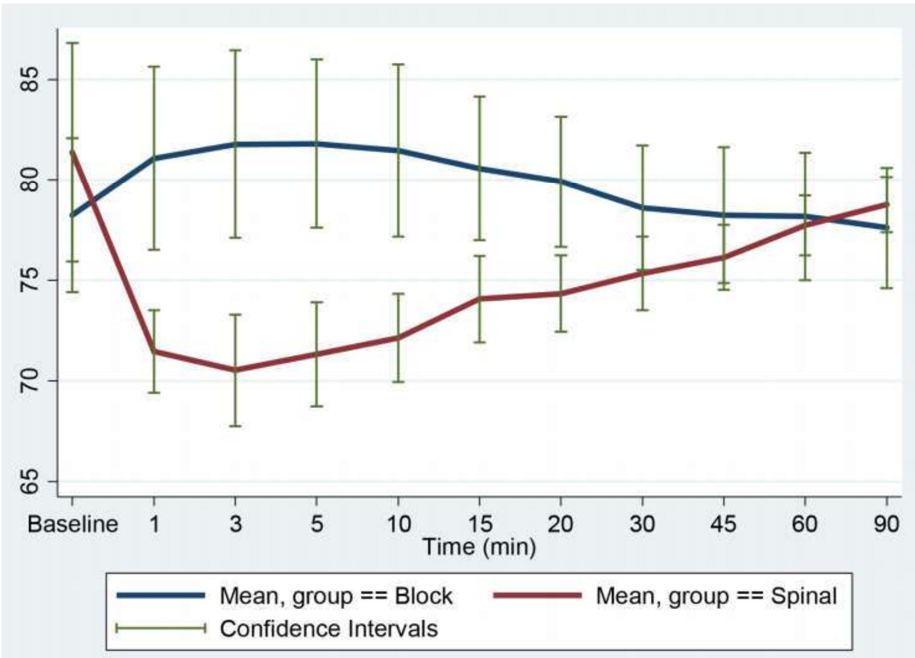
Group	Observed	Mean	Std. Dev.	[95% Conf. Interval]	
Block	30	399.20	57.29	377.81	420.59
Spinal	30	140.73	14.53	135.31	146.16

Table 9: Comparison of the Mean Pulse rate in the study groups

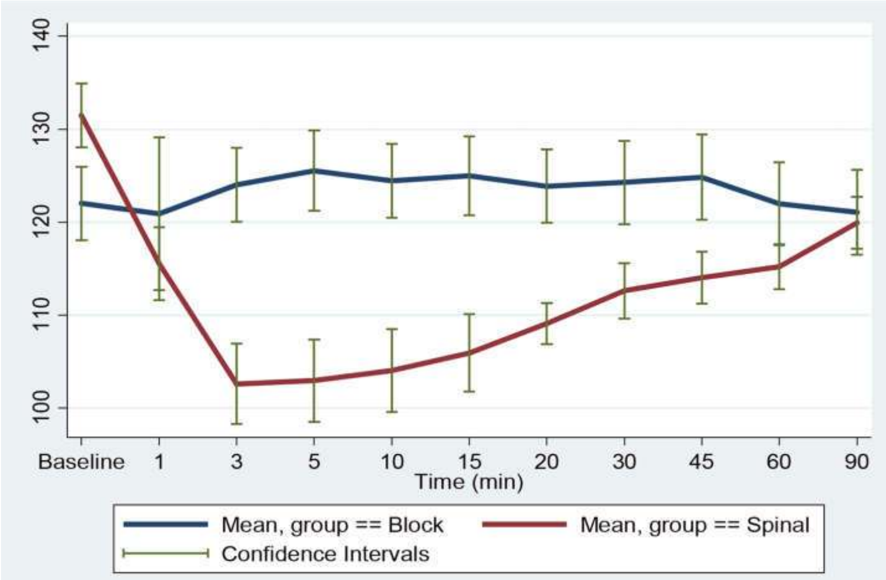
Pulse rate	Block Group		Spinal Group		p value
	Mean	Std. Dev.	Mean	Std. Dev.	
Baseline	78.23	10.28	81.37	14.59	0.3403
1 min	81.07	12.22	71.47	5.48	0.0002
3 min	81.77	12.53	70.53	7.41	0.0001
5 min	81.80	11.27	71.33	6.92	0.0001
10 min	81.47	11.52	72.13	5.87	0.0002
15 min	80.57	9.61	74.07	5.74	0.0024
20 min	79.90	8.67	74.33	5.10	0.0036
30 min	78.60	8.31	75.33	4.91	0.0688
45 min	78.23	9.07	76.13	4.35	0.2574
60 min	78.17	8.51	77.73	3.98	0.8014
90 min	77.60	8.00	78.77	3.67	0.4707

Table 10: Comparison of the Mean Systolic Blood Pressure in the study groups

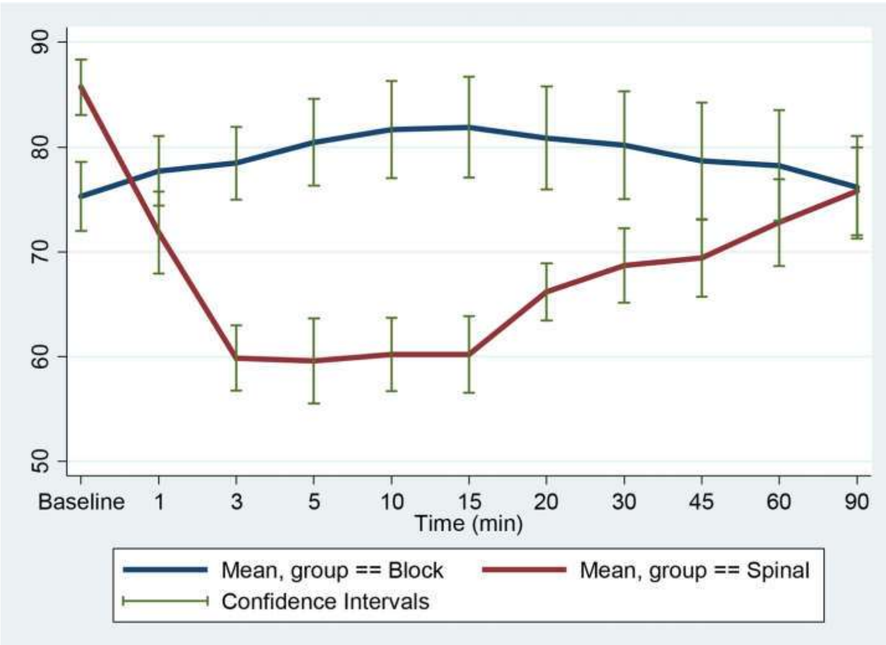
Systolic Blood Pressure	Block Group		Spinal Group		p value
	Mean	Std. Dev.	Mean	Std. Dev.	
Baseline	122.00	10.55	131.47	9.23	0.0005
1 min	120.90	21.98	115.53	10.50	0.2325
3 min	124.03	10.68	102.60	11.62	<0.0001
5 min	125.53	11.58	102.93	11.91	<0.0001
10 min	124.47	10.66	104.03	11.99	<0.0001
15 min	124.97	11.36	105.93	11.11	<0.0001
20 min	123.87	10.62	109.07	5.89	<0.0001
30 min	124.27	12.03	112.60	8.05	<0.0001
45 min	124.83	12.31	114.00	7.50	0.0001
60 min	121.97	11.99	115.20	6.47	0.0086
90 min	121.07	12.27	119.93	7.51	0.6677



Graph 7: Comparison of the trend of pulse rate in the study groups



Graph 8: Comparison of the trend of Systolic Blood Pressure in the study groups



Graph 9: Comparison of the trend of Diastolic Blood Pressure in the study groups

Table 11: Comparison of the Mean Diastolic Blood Pressure in the study groups

Diastolic Blood Pressure	Block Group		Spinal Group		p value
	Mean	Std. Dev.	Mean	Std. Dev.	
Baseline	75.30	8.85	85.73	7.10	<0.0001
1 min	77.73	8.91	71.83	10.49	0.0223
3 min	78.47	9.37	59.87	8.33	<0.0001
5 min	80.47	11.07	59.60	10.94	<0.0001
10 min	81.67	12.44	60.20	9.40	<0.0001
15 min	81.90	12.91	60.20	9.82	<0.0001
20 min	80.87	13.20	66.20	7.30	<0.0001
30 min	80.17	13.81	68.70	9.57	0.0004
45 min	78.70	14.93	69.40	9.84	0.0061
60 min	78.23	14.15	72.80	11.11	0.1035
90 min	76.17	13.15	75.80	11.26	0.9080

remained lower in the spinal group during 3min post induction to 60 min post induction in comparison to the block group (Table 10, Graph 8). The diastolic BP had a similar course as of Systolic Blood Pressure (Table 11, Graph 9).

The overall complication rates were comparable in the study groups (p value 0.75>0.05). There were 7 cases (23.33%) out of 30 cases in the block group who experienced tourniquet pain. 6 patients (20%) had significant hypotension in the spinal group (Table 12, 13). There were 2 cases with urinary retention in the late post operative period in the spinal group and none in the block group. No events of any paresthesia or persistent sensory motor deficit in any of the patients of either group noted. There were no events of local anaesthesia systemic toxicity in the Block group. No patient in the spinal group complained of post dural puncture headache (Table 14).

When the quality of blockade was compared, the unilateral spinal provided excellent blockade in 100% cases, whereas in the block group, 5 patients

Table 12: Comparison of the overall complications in the study groups

Group	Complication		Total
	None	Any	
Block	23	7	30
%	76.67	23.33	100
Spinal	24	6	30
%	80.00	20.00	100
Total	47	13	60
%	78.33	21.67	100

Table 13: Comparison of the complications encountered in the study groups

Group	Complication			Total
	None	Hypotension	Tourniquet pain	
Block	23	0	7	30
%	76.67	0.00	23.33	100
Spinal	24	6	0	30
%	80.00	20.00	0.00	100
Total	47	6	7	60
%	78.33	10.00	11.67	100

Table 14: Comparison of the late post op complications in the study groups

Group	Late post op complications		Total
	None	Urinary	
Block	30	0	30
%	100.00	0.00	100
Spinal	28	2	30
%	93.33	6.66	100
Total	58	2	60
%	96.67	1.67	100

Table 15: Comparison of quality of blockade in the study groups

Group	Quality of block			Total
	Adequate	Good	Excellent	
Block	2	5	23	30
%	6.67	16.67	76.67	100
Spinal	0	0	30	30
%	0.00	0.00	100.00	100
Total	2	5	53	60
%	3.33	8.33	88.33	100

(16.67%) had a good block (required midazolam) and 2 patients (6.67%) had adequate blockade (required fentanyl). This was statistically significant (p value 0.01<0.05). No patient in the block group required general anaesthesia (Table 15).

Discussion

Neuraxial anaesthesia in the form of spinal anaesthesia is one of the commonest procedures practiced for lower limb surgeries. The main objective of providing unilateral spinal anaesthesia is unilateral motor block, lesser incidence of hypotension and greater patient satisfaction due to movement of the contralateral limb. Peripheral nerve block is an excellent alternative for rendering the entire lower limb anaesthetized. The objective of our study was to compare the feasibility, success rate of combined sciatic and FICB block with that of the unilateral spinal anaesthesia. The study was also meant to show the comparison between hemodynamic variables, time of onset and duration of sensorimotor block and complication of the procedures.

Clearly, the demographic profile did not pose any bias in our study as they were comparable in both the groups. The time required for performing the sciatic and FICB block was significantly higher (29.46±3.00 min) as compared to the Spinal group (14.0±1.53 min) even after attempting to cut short the technical implementation time in the block group by painting the two puncture sites in the same setting and draping both of them using a single sterile plastic drape maintaining strict asepsis. The duration was more due to blocking of two nerves by precise elicitation of end motor response and the change of position while performing two separate blocks. This increased mean duration was in accordance with the studies conducted by Sari et al. [5]. The time of onset of sensory motor blockade was 17.56±2.07 mins in the block group which was higher than the studies conducted by Palkhiwala et al (14.41±3.11 min), Sari et al. [5] (12.9±2.53 min) and less than that of A. Singh et al. [6] (21.3±9.94 min). This was probably due to use of different drug mixture, addition of adjuvants (Adrenaline) in their studies and patients' individual variation.

Like any other regional anaesthesia technique, knowledge of the anatomy is fundamental for the sciatic block and FICB. The number of attempts to find the desired responses was not significantly different between the study groups as careful landmark identification and markings were done in the study. Identifying the quadriceps contraction during FICB warranted more attempts as the approach was suprainguinal and the needle was needed to direct little medially unlike the standard femoral block technique. No cases showed true 3-in-1 block as the obturator nerve was spared in all cases. The sciatic block was successful in 93.33% cases and the FICB was successful in 86.67% cases. A. Singh et al. [6] also reported the high reliability and relatively low failure rate (4%) in their study. Raj kumar et al. [7] also reported 99.44% success rate in their study. Our study results are comparable with both of them. 12 to 20 mg of bupivacaine in spinal anesthesia show higher block level even with the patient remaining in the sitting position for one hour [8], while small doses (5-8 mg) with the patient made to remain in the lateral position for 10 to 15 minutes [9], resulted in restricted blockade. In this study, maintaining the patient in lateral decubitus for 10 minutes, selective unilateral blockade was observed in 80% of the patients. As expected, combined sciatic block & FICB resulted in selective unilateral blockade.

Only 2 patients in the Spinal group had a motor block of grade 2 (as per Bromage Scale) while there were a higher number of inadequate block in the block group. This was somewhat similar to the study by Imbeloni et al. [10] (30 in spinal and 19 in block group had Bromage 3).

When the quality of blockade was compared, the unilateral spinal provided excellent blockade in 100% cases which was statistically significant (p value 0.01<0.05) in comparison to the block group. In a study by Montes et al. [11], adequate anesthesia could not be provided by femoral sciatic block in one of 25 patients. In another study by Fanelli et al. [12], this rate has been reported as 4%. Anesthesia can be insufficient in FICB due to the low distribution of local anesthetic agent to the obturator and lateral femoral cutaneous nerves and due to this reason in this study, tourniquet inflation caused sufficient pain and discomfort in patients requiring additional sedative and analgesic drugs. This was comparable to the study done by Sari et al. [5].

The total duration of sensory blockade (483.13± 60.11 min) and motor blockade (399.20±57.29 min) was significantly higher in the block group than that of the Spinal Group (191.27±22.45 & 140.73±14.53 min respectively). That suggests, the VAS score was better for a longer duration in the block group and thus the first analgesic need was significantly delayed. This was similar to the studies by Casati et al. [13], Sari et al. [5]. Since the side effects and complications related with the anesthesia method affect the hospitalization duration of patients, the important factors affecting the hospital stay related to this study are duration of complete return of motor and bladder functions. Same side extremity motor block duration is the main limiting factor affecting the hospitalization duration in the present study, as the total duration of the motor blockage was statistically significant ($p<0.001$) and the discharge was delayed in block group as many patients were uncomfortable while carrying weight of the entire body on a single limb even with support.

The hemodynamic parameters like pulse rate, systolic blood pressure and diastolic blood pressure were significantly lower in the spinal group post induction than that of the block group and again become comparable after 45-60 mins post blockade which can be explained by the greater sympathetic blockade experienced in the spinal group than that of the block group, although it was clinically insignificant as the patients were of ASA grade I & II. Fanelli et al. [14] found that a decrease in MAP and cardiac index occurs in the spinal group, while no hemodynamic changes occurred in the block group. This was also similar to Sari et al. [5].

The complications associated with this block are local anesthetic toxicity, neuraxial block due to proximal spread, neurological complications like needle trauma, intraneuronal injection and neuronal ischemia. In our study, none of the patients had any significant complications. Hypotension occurred in the spinal group, more in the cases where there was bilateral blockade. Tourniquet pain was seen in the block group intraoperatively when the block was inadequate. Only two patients had post operative urinary retention in the spinal group. Our study results are comparable with that of the study by Zaric et al. [15]. Fowler et al. [16] reported that Peripheral Nerve Block may provide effective unilateral analgesia with lower incidence of opioid related and autonomic side effects and fewer serious neurological complication compared to epidural analgesia.

Conclusion

The sparing of obturator nerve and otherwise inadequate block causing tourniquet pain, longer hospital stay due to prolonged motor blockade in outpatient procedures might be a limitation of the combined sciatic block and FICB. But this block still remains a suitable alternative to unilateral spinal anaesthesia for its better hemodynamic profile and longer duration of analgesia with comparable complication rate rendering it an attractive choice in high risk cases, particularly in patents with cardiovascular comorobidities, where the adverse consequences of even slightest attenuation of hemodynamic parameters are not well tolerated.

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