Comparison of sequential combined spinal epidural anaesthesia and spinal anaesthesia in lower limb surgery: A prospective randomised double blind study

Shah Akif Mutahar[1], Santpur Madhavi[2,*], Santpur Unmesh[3], Kanchan Swati[4], Agarwal Somika[5]

[1]Senior Resident, [2]Associate Professor, [3]Professor, [4,5]Post Graduate Student, [1,2,4,5]Dept. of Anaesthesia, [3]Dept. of Obstetrics and Gynaecology, [1]Government Medical College, Srinagar, [2-5]Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Punjab, India

***Corresponding Author: Santpur Madhavi**
Email: madhavisantpur90@gmail.com

Received: 19th September, 2018 **Accepted:** 16th November, 2018

Abstract

Introduction: Spinal anaesthesia is a popular anaesthesia technique for lower limb surgeries. The haemodynamic changes that occur, may be sudden and deleterious, particularly in geriatric patients. Moreover the duration of spinal anaesthesia is limited. Thus, a safer approach of sequential combined spinal epidural (SCSE) anaesthesia is emerging currently. The technique combines benefits of both.
Aim: To evaluate the changes in hemodynamic parameters while using SCSE block and spinal anaesthesia for lower limb surgeries.
Study Design: A prospective, randomised, double blind study.
Materials and Methods: Sixty ASA grade I and II physical status, who underwent lower limb procedures were included in the study. They were divided equally into Group I (spinal) and Group II (SCSE). The haemodynamic parameters in the two groups was observed.
Results: From 2 minutes to 20 minutes, there was statistically significant rise in pulse rate in group I, associated with decrease in blood pressure in group I (p value<0.05). After 60 min both the groups were comparable.
Conclusion: Sequential combined spinal epiduralblock maintains hemodynamic stability with minimal complications as compared to spinal anaesthesia.
Key messages: Sequential spinal epidural anaesthesia maintains cardiovascular stability.

Keywords: Sequential spinal epidural, Spinal, Haemodynamics, Side effects.

Introduction

Majority of orthopaedic patients belong to geriatric age group who may have associated medical ailments. Regional anaesthesia can be considered safe and beneficial here, because of its distinct advantages. The limitations of spinal include hypotension, postdural puncture headache and a limited duration of anaesthesia.[1,2] Epidural anaesthesia provides flexibility of block, prolonged postoperative analgesia using epidural catheter[3] without producing much hemodynamic derangements.

Combined spinal epidural technique was described for the first time by "Soresi."[4]

Combined spinal epidural anaesthesia is like "to paint the fence" from both sides.[5] The block in SCSE results from a relatively small amount of the spinal local anaesthetic followed by the epidural drug.[6]

In SCSE, low dose of spinal intended to be inadequate for surgery is used in an attempt to reduce hypotension and the block is then deliberately extended cephalad with epidural drug. This technique is becoming very popular in elderly high risk patients and in patients with compromised cardiopulmonary reserve.[7,8]

Epidural volume extension (EVE) has been shown to increase the upward spread of the block due to "volume effect"[9]and this may be achieved by injection of saline or local anaesthetic agent in the epidural space.

The present study aims to compare the hemodynamic changes between sequential combined spinal epidural technique and spinal anaesthesia for lower limb surgeries.

Aim

1. To compare changes in vital parameters using SCSE and subarachnoid block for lower limb surgeries as a primary outcome measure.
2. To observe side effects and complications as a secondary outcome measure.

Objectives

1. To measure the systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR) and oxygen saturation (SpO_2).
2. To record postoperative complications with either technique.

Materials and Methods

After seeking permission from Ethical Committee of the Institution, the study was carried out in 60 patients from June 2014 to June 2016 in the department of Anaesthesia. The patients were randomly assigned to two groups of 30 each as defined below, by a computer generated number. An anaesthetist who was not involved in the study made the observations. ASA Grade I and II patients, aged between 18-60 years of either gender, posted for lower limb surgery with expected duration of surgery up to 2 hrs were included in the study.

Group I: Patients received spinal anaesthesia at L3-4 intervertebral space with 15mg (3ml) of 0.5% hyperbaric bupivacaine.

Group II: Patients received SCSE anaesthesia with 7.5 mg of 0.5% hyperbaric bupivacaine in the subarachnoid space and 6 cc of 0.5% bupivacaine through epidural catheter.

Pre-operative Evaluation

Thorough pre-anaesthetic check up was done a day before surgery. Routine blood and radiological investigations were done in all patients. A written, well informed consent was taken from all patients for both, to be included in the study and to undergo anaesthesia. Tablet ranitidine 150 mg and tablet alprazolam 0.25mg was given to all patients night before surgery and repeated on the day of surgery.

Anaesthesia Technique

After taking the patient in operation theatre, multipara monitor was attached and preoperative pulse rate (PR), blood pressure (BP) and oxygen saturation (SpO2) were noted. Anaesthesia workstation and all the necessary drugs and equipment were kept ready. An intravenous (IV) access was taken using 18 G cannula. IV ringer lactate infusion (10ml/kg body weight) was given to preload the patient 20 minutes before surgery. Patients were randomly allocated to one of the groups as per computer generated number.

Group I: Sub arachnoid block was given under all aseptic measures at L3-4 intervertebral space. After confirmation of free flow of cerebro-spinal fluid (CSF), 3ml of 0.5% hyperbaric bupivacaine was given.

Group II: Taking all aseptic measures SCSE anaesthesia was given in sitting position at L3-4 intervertebral space. Patients received 1.5ml of 0.5% hyperbaric bupivacaine through spinal route and 6 ml of 0.5% bupivacaine through epidural catheter immediately after giving supine position.

Intraoperative Monitoring

The vital parameters, height of sensory blockade, side effects if any and complications were observed. HR, SBP, DBP, mean BP and SpO2 was observed and recorded.

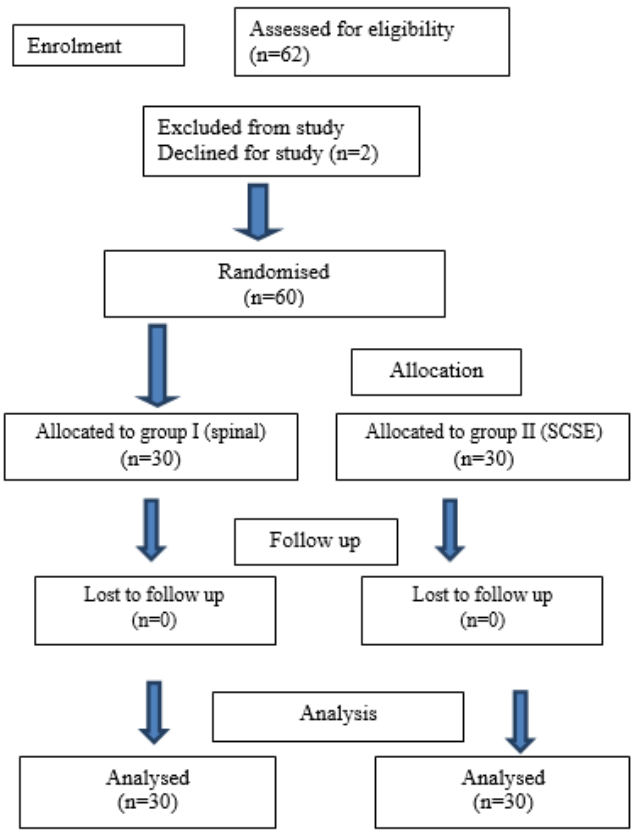
Intraoperative complications

Fall in HR, fall in BP, nausea/vomiting, depression of the respiratory system, high spinal block, chest pain, sedation and mouth dryness were observed and treated.

Statistical Analysis

The presentation of the data was done in numbers and percentages. Quantitative data was formulated as mean and SD. Chi square test and Data was analysed by SPSS (statistical package for social science) version 20. Qualitative T test was applied to the data and the p-value < 0.05 was considered as statistically significant among the two groups.

Consort Diagram:



Observations and Results

Table 1: Shows the distribution of cases according to maximum sensory level achieved.

Maximum Sensory Level achieved	Group I		Group-II		Total	p-value
T_6	16	53.3%	6	20%	22	0.007
T_8	8	26.7%	9	30%	17	0.774
T_{10}	6	20%	15	50.0%	21	0.015
Total	30	100.0%	30	100.0%	60	

As shown in table 1,in group I, the number of patients who achieved T_6 were 53.3% and in group II it was 20%, ($p<0.05$) was statistically significant. In group I the number of patients which achieved T_8 were 26.7% and in group II it was 30%, ($p>0.05$). In group I the number of patients with T_{10} were 20% and 50% in group II. ($p<0.05$).

Table 2: Shows distribution of cases as per pulse rate changes

Pulse rate	Group I		Group II		t	p-value
	Mean	± SD	Mean	± SD		
Pulse_0 min	82.50	5.70	82.03	4.25	0.359	0.721
Pulse_2min	84.10	5.74	80.40	4.01	2.894	0.005
Pulse_4min	85.77	6.12	81.17	3.74	3.511	0.001
Pulse_6min	85.97	5.84	82.33	3.75	2.867	0.006
Pulse_8 min	87.60	5.83	84.10	2.84	2.953	0.005
Pulse_10 min	87.70	7.34	83.33	2.70	3.061	0.003
Pulse_15 min	86.77	7.71	83.00	2.75	2.520	0.015
Pulse_20 min	86.23	6.71	83.67	2.02	2.005	0.050
Pulse_25 min	85.97	9.13	84.83	2.38	0.658	0.513
Pulse_30 min	83.80	5.67	85.23	3.04	-1.220	0.227
Pulse_45 min	85.90	6.62	85.20	3.02	0.527	0.601
Pulse_60 min	85.13	6.21	84.77	2.67	0.297	0.768
Pulse_75 min	86.17	9.22	85.23	1.59	0.546	0.587
Pulse_90 min	87.23	7.25	85.40	2.19	1.325	0.190
Pulse_105 min	87.17	7.65	84.90	2.62	1.536	0.130
Pulse_120 min	87.67	6.70	85.13	2.11	1.975	0.053

As depicted in table 2, the baseline mean pulse in group I was 82.50±5.70 beats / min (bpm) and in group II was 82.03±4.25 bpm.($p>0.05$) During intraoperative period in group I it was from 83.80±5.67 to 87.70±7.3 (bpm) and in group II it was from 80.40±4.01 bpm to 85.40±2.19 bpm. From 2 minutes to 20 minutes, there was rise in pulse rate in group I. ($p<0.05$).

Table 3: The mean blood pressure (MBP) in group I and group II

MBP	Group I		Group II		t	p-value
	Mean	SD	Mean	SD		
MBP_0 min	92.50	4.99	95.10	5.52	-1.914	0.061
MBP_2 min	78.39	2.61	85.22	3.81	-8.097	0.000
MBP_4 min	77.70	2.31	85.59	3.37	-10.586	0.000
MBP_6 min	78.32	2.36	86.84	3.38	-11.337	0.000
MBP_8 min	78.51	2.10	88.16	3.47	-13.031	0.000
MBP_10 min	79.86	2.89	90.68	3.70	-12.637	0.000
MBP_15 min	80.97	2.43	91.98	3.86	-13.217	0.000
MBP_20 min	84.74	4.82	93.33	3.92	-7.569	0.000
MBP_25 min	88.29	5.44	94.32	4.75	-4.579	0.000
MBP_30 min	91.67	4.68	96.52	3.31	-4.640	0.000
MBP_45 min	94.17	4.60	98.41	3.42	-4.056	0.000
MBP_60 min	96.54	4.73	99.97	3.30	-3.247	0.002
MBP_75 min	98.12	3.89	98.64	3.33	-0.558	0.579
MBP_90 min	99.28	3.51	100.06	3.30	-0.884	0.380
MBP_105 min	99.42	3.75	100.69	2.31	-1.575	0.121
MBP_120min	99.69	4.51	100.74	2.47	-1.125	0.265

As shown in table 3, the baseline mean blood pressure was 92.50±4.99 mmHg in group I and 95.10±5.52 mmHg for group II. Intraoperatively it was between 77.70±2.31mmHg and 99.69±4.51mm Hg in group I and in group II it was 85.22±3.81mmHg and 100.74±2.47mmHg. From 2 min to 60 min there was decrease in MBP in group I in comparison to group II. ($p<0.05$) After 60 min both the groups were comparable.

Table 4: Postoperative complications

Complications	Group-I		Group-II		Total	p-value
Nausea	0	0.0%	0	0.0%	0	-
Vomiting	4	13.3%	1	3.3%	5	0.177
Bradycardia	2	6.7%	1	3.3%	3	0.554
Hypotension	1	3.3%	1	3.3%	2	1.000
Headache	1	3.3%	1	3.3%	2	1.000

As shown in table 4, in group I and II, none of the patients had nausea $p<0.05$. In group I, four patients had vomiting as against one patient in group II had vomiting $p>0.05$. The incidence of bradycardia and hypotension in either group was comparable. In group I and group II, one patient (3.3%) had headache $p>0.05$(not significant).

Discussion

The newly emerging concept of sequential combined spinal epidural technique is in vogue. In this technique, a low dose of local anaesthetic drug is injected in the intrathecal space in an attempt to reduce the chances of hypotension and at the same time achieve early onset of anaesthesia and then the block is deliberately extended cephalad with the epidural drug. This technique is becoming increasingly popular in modern obstetric practice because of various claimed benefits mainly stable haemodynamic status. The sequential CSEA is now being used in elderly high risk patients for orthopaedic surgery with encouraging results.[10] The SCSE technique combines the distinct benefits of both, the rapid, dense and reliable block of spinal with the flexibility of continuous epidural block to extend duration of analgesia.[6]

Both the groups were comparable with regard to age, sex and ASA grade as ($p>0.05$).

Table 5: Maximum dermatomal level achieved (Thoracic dermatome) in present study and other studies

Maximum level achieved	p-value
Our study	0.025
Battacharya et al[10] (2007)	<0.05
Okasha[50] (2014)	<0.02

The table 5, compares the p values of maximum level of sensory blockade achieved.

In our study, the number of patients who achieved T_6 and T_{10}level were statistically significant. ($p<0.05$) Patients who achieved T_8 were comparable in both groups. The study conducted by Bhattacharya et al[10] compared SCEA with spinal anaesthesia technique. In this study he observed, the highest level of sensory block was T_{10} in SCSE group and T_6 in spinal group with a range from $T_6 – S_5$ in SCEA group and from T_4 - S_5 in spinal group. This observation was in accordance with the present study.

The lower level could be beneficial in lower extremity surgeries so as to avoid haemodynamic instability resulting from sympathetic blockade, particularly in a compromised patient.

In the study, conducted by Okasha[11] the maximum height achieved in CSE with EVE was T_1 in 20% cases and below T_2 in 80% cases where as it was below T_2 in all patients of group with CSE without EVE (p value <0.02). This observation is not in accordance with our study. The mechanism attributed towards this could be due to the larger volume of saline injected in the epidural space which rapidly increases the epidural pressure and causing thecal compression to push the intrathecal drug in cephalad direction.

Haemodynamic Parameters

In the present study hypotension was considered as 25% fall in SBP from baseline level. Pulse rate less than 60 beats per minute was considered as bradycardia. The decrease in blood pressure was less in sequential spinal epidural in comparison with spinal block.

Pulse Rate

The baseline pulse rate in group I was 82.50±5.70 bpm and in group II was 82.03±4.25 bpm. During intraoperative period in group I, it ranged from 83.80±5.67 to 87.70±7.34 beats per minute (bpm) and in group II, it ranged from 80.40±4.01 bpm to 85.40±2.19 bpm.

Systolic Blood Pressure

From 2 min to 60 min there was significant difference in the fall of systolic blood pressure in group I in comparison to group II (p value<0.05). After 60 min both the groups were comparable. Thus haemodynamic stability in group II was better maintained.

The study conducted by Rajan S et al,[6] the incidence of hypotension in SCSE was 10%, where as in spinal it was 80%. Thus in SCSE hemodynamic parameters are maintained. The observation was in accordance with our study.

Diastolic Blood Pressure

On analysis of DBP, at 0 min both groups were comparable but from 2 min to 60 min there was decrease in DBP in group I in comparison to group II($p<0.05$). After 60 min both the groups become comparable Thus hemodynamic stability was better maintained in group II.

The study conducted by Vengamamba Tummala.[12] The incidence of hypotension was 2/30 in CSE and 20/30 in spinal, each group was 30 in number. The observation was in accordance with our study.

Mean Blood Pressure

We observed at 0 min, both groups were comparable. From 2 min to 60 min there was fall in mean blood pressure in group I in comparison to group II($p<0.05$).

In the study conducted by Bhattacharya et al.[10] The incidence of hypotension was three in SCSE and 24 in spinal, so in SCSE haemodynamic parameters were better maintained. The observation was in accordance with our study.

Postoperative Complications

In the present study, 13.3% patients had vomiting, 6.7% patients had bradycardia, 3.3% had hypotension and 3.3% had headache in group I and in group II 3.3% had vomiting, 3.3% had bradycardia, 3.3% had hypotension and headache.

Higher incidence of vomiting and bradycardia was seen in group I.

Gupta Priya et al[13] studied sequential combined spinal epidural versus epidural anaesthesia in orthopaedic and gynaecological surgery, a comparative evaluation showed less incidence of nausea and vomiting using sequential spinal epidural block.

In the study conducted by Bhattacharya et al.[10] the incidence of hypotension was three in SCSE and 24 in spinal, so in CSE hemodynamic parameters are maintained. The observation was in accordance with our study.

Conclusion

SCSE block provides modest level of blockade. The lower level of block may be beneficial in lower extremity surgeries so as to avoid haemodynamic instability resulting from sympathetic blockade, particularly in a compromised patient. The technique is associated with minimal complications. SCSE is thus a safe and effective technique. SCSE combines the rapidity, density, and reliability of the subarachnoid block with the flexibility of epidural block. SCSE appears to have a promising future in regional anaesthesia.

Conflict of Interest: None.

References

1. Felsby S, Juelsgaard P. Combined spinal epidural anaesthesia. *Anesth Analg* 1995;80:821-826.
2. Sharma K, Chari P, Gupta S. Combined spinal anaesthesia for lower limb orthopaedic procedures. *J Anaesth Clin Pharmacol* 1994;10:257-260.
3. Vercauteren M. Twenty years of clinical use of combined spinal epidural anaesthesia: The evolution equipment. Clinical dialogues on regional anaesthesia 2002;17:1-4.
4. Cook TM. Combined spinal-epidural techniques. *Anaesth* 2000;55:42-64.
5. Eldor J. Combined spinal epidural general anaesthesia. *Reg Anaesth* 1994;19:365-366.
6. Rajan S, Seetharaman M, Nair SG. Comparison of efficacy and safety of sequential combined spinal epidural anaesthesia versus spinal anaesthesia in high risk geriatric patients. *Amrita J Anaesth* 2014;1-44.
7. Fan S-Z,Susetio I, Wan Gyp, Low dose of intrathecal hyperbaric bupivacaine combined with epidural lidocaine for caesarean section – a balance block technique. *Anaesth Analg* 1994;78:474-477.
8. Hamdani GA, Chohan U, Zubair NA. Clinical usefulness of sequential combined spinal epidural anaesthesia in high risk geriatric patients for major orthopaedic surgery. *J Anesth Clin Pharmacol* 2002;18(2):163.
9. Blumgart CH, Ryall D, Dennison B, Thompson Hill LM. Mechanism of extension of spinal anaesthesia by extradural injection of local anaesthetic. *Br J Anaesth* 1992;69:457-460.
10. Bhattacharya D, Tewari I, Chowdhuri S. Comparative study of sequential combined spinal epidural anaesthesia versus spinal anaesthesia in high risk geriatric patients for major orthopaedic surgery. *Indian J Anaesth* 2007;51(1):32-36.
11. Okasha MM, Kamal S, Ramzy. An epidural volume extension with saline in combined spinal epidural anaesthesia for dynamic hip screw surgeries using low dose of intrathecal hyperbaric bupivacaine. Ain-Shams. *J Anaesthesiol* 2014;7:350-355.
12. Tummala V, Rao LN, Vallury MK, Sanapala A. A comparative study-efficacy and safety of combined spinal epidural anesthesia versus spinal anesthesia in high-risk geriatric patients for surgeries around the hip joint. *Anesth Essays Res* 2015;9(2):185-188. doi:10.4103/0259-1162.153764
13. Gupta P, Dua CK, Verma UC, Saxena KN, Chakraborty I. Sequential combined spinal epidural versus epidural anaesthesia in orthopaedic and gynaecological surgery. A comparative study. *Indian J Anaesth* 2002;46:453-456.

How to cite this article: Mutahar SA, Madhavi S, Unmesh S, Swati K, Somika A. Comparison of sequential combined spinal epidural anaesthesia and spinal anaesthesia in lower limb surgery: A prospective randomised double blind study. *Indian J Clin Anaesth* 2019;6(1):66-70.