

A Comparative Study of Single Space Versus Double Space Technique in Combined Spinal Epidural Anaesthesia in Orthopaedic Lower Limb and Hip Surgeries

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ABSTRACT

Introduction: Regional anesthesia is safe and beneficial in lower limb and hip surgeries when compared to general anesthesia. Early ambulation, decreased incidence of venous thrombosis and less postoperative pulmonary complications are the major advantages of regional anesthesia. Combined spinal epidural is a step ahead in regional anesthesia which confers excellent postoperative analgesia along with intraoperative pain relief. Two types of CSE technique are there, single interspace technique and separate interspace technique. Very few studies were conducted to compare the advantages and disadvantages of one over the other. Objectives: The present study was undertaken to compare single space vs. double segment space technique for CSE block with regards to time needed for the procedural technique, onset of anesthesia, quality of surgical anaesthesia, haemodynamic alterations, intraoperative complications and postoperative sequelae.

Material and methods: 84 patients who belong to ASA I, II and III undergoing various lower limb and hip surgeries were randomly divided into 2 groups of 42 patients in each group, group A received CSE anaesthesia by double space technique (DST), group B received CSE anaesthesia by single space technique (SST). The parameters studied were; procedural time, onset of anaesthesia, quality of surgical anaesthesia, haemodynamic alterations, intraoperative and postoperative complications.

Results: The demographic profiles of the patients among the groups were comparable. The mean procedural time, onset of anaesthesia, quality of surgical anaesthesia did not differ between the groups, the number of patients who had a fall in pulse rate below 60/min and fall in systolic blood pressure more than 25% of baseline value was not significant. The incidence of back pain was higher in group A, however it is statistically insignificant. None of the patient in any group developed post dural puncture headache.

Conclusion: we concluded that both the techniques of combined spinal epidural (DST, SST) are almost same as regards to procedural time, onset of anaesthesia and quality of surgical anaesthesia. Both techniques are devoid of major intraoperative and postoperative complications.

Keywords: Anaesthesia, Combined Spinal Epidural, Orthopaedic Surgery, Double Space Technique, Single Space Technique.

hypertension, diabetes mellitus, coronary artery disease and chronic pulmonary diseases.

Regional anaesthesia in elderly patients has several advantages including early ambulation, decreased venous thrombosis and pulmonary embolism, decreased intraoperative bleeding, postop pulmonary complications and less postoperative morbidity and mortality

Spinal anaesthesia

The technique is simple, easier to perform, has a rapid onset of action. low doses of local anaesthetics are required¹ and low failure rates.

Disadvantages are: Intraoperative hypotension, limited duration of anaesthesia and post dural puncture headache.^{1,2}

Epidural anaesthesia

Advantages are:

- Flexibility of the block and can be extended in prolonged surgery.³
- Provide superior and prolonged postoperative analgesia using epidural catheter.³

Limitations:

- Technical difficulty
- Slow onset of action
- May not always include sensory anaesthesia
- Motor block may be insufficient
- Chance of local anaesthetic toxicity is more.³

To incorporate the advantages and overcome limitations of these two techniques, a combined spinal epidural (CSE) technique is used. Combined spinal epidural (CSE) technique involves intentional subarachnoid blockade and epidural catheter placement during the same procedure. A CSE technique will have a fast onset at low doses and will generate excellent quality of anesthesia which may be

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extended by the epidural component and offers possibilities for postoperative use.⁴

CSE technique is being used commonly in general surgery, orthopaedic and trauma surgery of lower limb, urological surgery, gynaecological surgery including cesarean section, management of labour pain and for postoperative analgesia. There are two different technique of combined spinal epidural anesthesia.

1. Needle through needle – single interspace technique
2. Double needle – separate interspace technique

Combined spinal epidural is a kind of balanced anesthesia which uses technique to accomplish the ideal kind of anesthesia for the patients .

Aims and objectives

To compare single space vs double space technique with regard to

- 1 Time needed for the procedural technique
- 2 Onset of anaesthesia.
- 3 Quality of surgical Anaesthesia.
- 4 Hemodynamic alterations.
- 5 Intraoperative complications.
- 6 Post operative sequelae.

MATERIAL AND METHODS

This quasi observational study was conducted in the department of anesthesiology and critical care at sri Mookambika institute of medical sciences, kulasekaram after the clearance of institutional ethical committee. 84 patients of either sex group ranging from 40 to 75 years, belonging to ASA 1 to 3, scheduled for elective lower limb and hip surgeries during the period of September 2019 to June 2021 were included in the study.

All the patients were examined a day prior to surgery. Detailed clinical history along with physical examination was done. Routine investigations were carried out in all the patients. The purpose and protocol of the study was explained to the patients, reassured and informed written consent was obtained. Patients were kept fasting for 6 hours prior to the scheduled time of surgery. They were premedicated with tab. alprazolam 0.25mg and tab. ranitidine 150mg night before and in the morning 2 hours before surgery. On the day of surgery, in the premedication room, all routine monitoring were established and baseline readings were recorded.

Patients were randomly allocated to one of the two groups using computer-generated sequence of random numbers as follows

Group A: double segment space technique

Group B: single space technique

Peripheral venous access was secured with 18 – gauge cannula and IV fluid Ringer Lactate 10ml/kg was started.

Procedures

In the operating room monitoring was continued, In group A, with all aseptic precautions epidural space was identified in L2 - L3 interspace using a 18 gauge Touhy needle after local infiltration with 2ml of 1% lignocaine, loss of resistance technique. After negative aspiration for blood and CSF,

epidural catheter was threaded in the touhy needle up to 5 to 7 cm, test dose of 3ml 2% lignocaine with 1: 200000 adrenaline – absence of tachycardia and motor blockade ruled out intravascular and subarachnoid placement of catheter.

In the L3-L4 interspace , sub arachnoid space was identified using a 27 gauge Quincke type spinal needle after infiltration of 2ml 1% lignocaine and 3 ml of 0.5% bupivacaine heavy was injected into the subarachnoid space after aspiration of clear CSF. Epidural catheter was fixed firmly at back of the patient and the patient was placed in supine position. All patients received first epidural topup 1hr after commencement of surgery.

In group B, epidural space was identified in L3-L4 interspace using 18 gauge Touhy needle after infiltration of 2ml 1% lignocaine, loss of resistance technique. 27 gauge pencil point spinal needle was inserted through the epidural needle into the subarachnoid space. 3 ml of 0.5% bupivacaine heavy was injected into the subarachnoid space after confirming free flow of CSF. Spinal needle was then removed and epidural catheter was threaded in through the epidural needle up to 5 to 7 cm in epidural space.

Monitoring

Continuous monitoring of the patients was facilitated with multi channel monitors. Baseline heart rate, blood pressure and spo2 was recorded before giving regional block. After the regional block, vitals were monitored every 3 minutes for initial 15 minutes and every 10 minutes thereafter till the completion of surgery. continuous ECG monitoring done, Oxygen 2lit/min was administered to all patients through nasal cannula.

Bradycardia, heart rate less than 60/minute was treated with injection glycopyrrolate 0.2mg intravenous. Hypotension defined as 25% decrease of systolic blood pressure from the baseline was treated with rapid infusion of intravenous fluids, incremental doses of ephedrine 5mg IV, glycopyrrolate when associated with bradycardia.

The following parameters were studied in the intraoperative period

- 1) Procedural time: from the skin infiltration to the fixation of epidural catheter
- 2) Onset of action: from the time of injection of local anaesthetic to the start of loss of sensation to pinprick at T7.
- 3) Quality of surgical anaesthesia: using a 4 grade scale.

This was graded as:

Excellent – no supplementary sedative or analgesia is required

Good – only sedative required

Fair – both sedative and analgesic required

Poor - general anaesthesia and tracheal intubation required.

- 4) Hemodynamic changes
- 5) Side effects - nausea, vomiting and shivering
- 6) Postoperative sequelae - backache and post dural puncture headache.

STATISTICAL ANALYSIS

The data collected was analyzed by descriptive and inferential statistical methods. Descriptive methods such as frequency, percentage, mean, standard deviation(SD) were calculated to summarize the data. Inferential methods chi-square test, fisher's exact test were used to find the significant difference between the two groups. Analysis was performed using the software SPSS 22.0. level of significance in our study was 0.05.

RESULTS

Demographic profile

The demographic profiles of the patients among the groups were comparable in terms of age, sex, ASA status, duration of surgery .

Procedural time

in group A procedural time ranged from 15.48 min to 16.65 min with a mean duration of 16.07 +- 1.87 min

In group B procedural time range from 14.77 min to 16.10 min with a mean duration of 15.4 -2.14 min. P=0.156 ,NS

Onset of anesthesia

In group A onset of anaesthesia ranged from 5.78 min to 6.22 min with mean value of 6.0 +- 0.698 min .

In group B onset of anaesthesia ranged from 5.60 to 6.02 min with mean value of 5.81 +- 0.671 min P=0.206,NS

Quality of surgical anesthesia

In both the groups, quality of surgical anesthesia were excellent in all the patients (n=84)

Pulse

In group A the pre-operative mean pulse rate was 78.79+-8.65bpm and during intraoperative period it ranged from 78.71 bpm +-10.24 to 82.95+-8.24bpm

In group B the pre-operative mean pulse rate was 80.60+-8.76 bpm and during intraoperative period it ranged from 79.26+-9.52bpm to 82.05+-9.67bpm

Systolic blood pressure

in group A the pre-operative mean SBP was 125.71+-10.55 mmHg and intraoperatively ranged from 119.52 +-8.84 mmHg to 121.05+-11.61 mmHg

In group B the preoperative mean SBP was 126.21+-11.85 mmHg and intraoperatively ranged from 119.52+-12.490 mmHg to 121.05+-10.87 mmHg

Intraoperative sequelae

bradycardia

In Group A 7% (n=3) patients had bradycardia while in group B 3% (n=1)had bradycardia. p=0.306 NS

Hypotension

In group A 10% (n=4) patients had hypotension while in group B 7% (n=3)had hypotension. p=0.693 NS

Postoperative complications

Backache

In group A 19%, 8 patients had backache while in group B 11.9%, 5 patients had backache at the puncture site in the

postoperative period p=0.365 NS

Post Dural Puncture Headache (PDPH)

Patients were followed for up to 72 hours postoperatively. None of the patients in our study complained of PDPH.

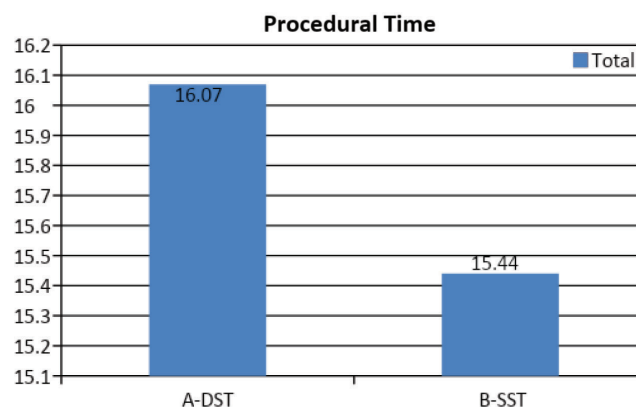


Figure-1:

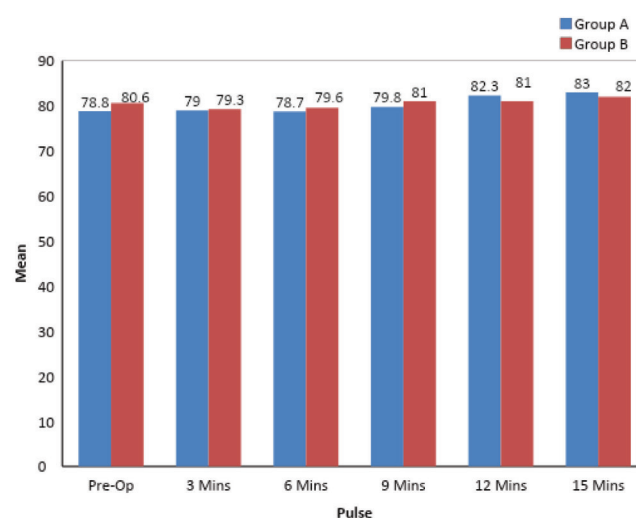


Figure-2:

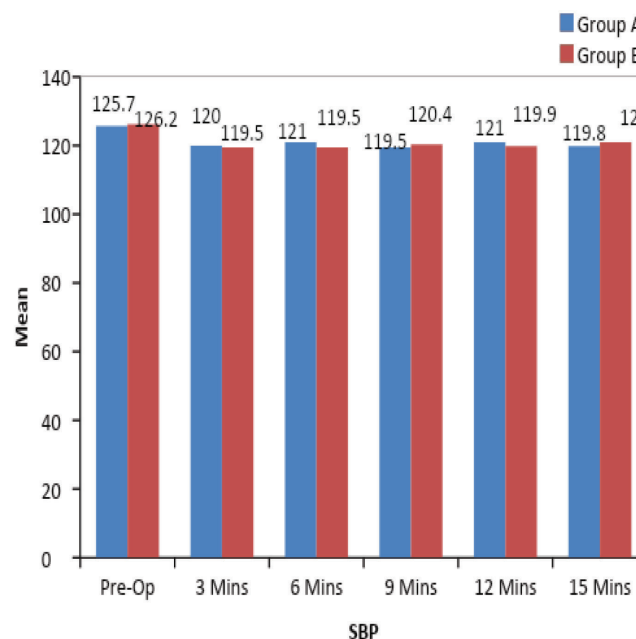


Figure-3:

Group	N	Mean	Std. Deviation	95% confidence interval for mean		t test p value	
				Lower bound	Upper bound		
A	42	6.00	.698	5.78	6.22	0.206	NS
B	42	5.81	.671	5.60	6.02		

Table-1: Onset of anaesthesia

Parameter		Group A		Group B		Total	
		Count	Column N%	Count	Column N%	Count	Column N%
Bradycardia	Present	3	7%	1	3%	4	5%
	Absent	39	93%	41	97%	80	95%
	Total	42	100%	42	100%	84	100%

Table-2:

Parameter		Group A		Group B		Total	
		Count	Column N%	Count	Column N%	Count	Column N%
Hypotension	Present	4	10%	3	7%	7	8%
	Absent	38	90%	39	93%	77	92%
	Total	42	100%	42	100%	84	100%

Table-3:

DISCUSSION

1) Procedural time

In this study time taken from skin infiltration to the fixation of epidural catheter was recorded as the procedural time which was as follows;

Group A-DST: The procedural time recorded was 16.07±1.87 min

Group B -SST: the procedural time recorded was 15.44±2.14 min

In our study we observed that the time taken for the procedure between the two group was not statistically significant. Reason for almost same duration for both the techniques may be due to the expertness in doing the spinal and epidural anaesthesia

Casati et al⁵ 1998, observed that time to readiness for surgery was 22.7 ±8.2 minutes in in SST and 29.8 ±8.3 minutes in DST. Backe SK et al⁶ 2004, observed time to perform the procedure was 12.9 min SST group and 15 min for DST. Kiyoyuki W, et al⁷ 2017 reported that DST takes 13 min to perform and SST 11 min

Our study is consistent with the above mentioned observations.

2) Onset of anaesthesia

In our study the mean onset of anaesthesia in group A was 6.0 ±0.698 min and for group B was 5.81±0.671min. The mean time taken between the two group was statistically insignificant.

The mean time of onset of anaesthesia in CSE observed by various authors ranged from 2 to 15 min. Backe SK⁶ et al 2004 noted that the time taken to achieve T5 block height was 15 minutes in DST and 12.5 minutes in SST group, which is similar to our study.

3) Quality of surgical anaesthesia

In the present study, quality of surgical anaesthesia was assessed by four grade scale. None of the patient was

converted to GA. Holmstorm et al⁸ 1993 and sharma et al² 1994 reported excellent quality of anaesthesia in all patients who received CSE either through SST or DST technique. Similarly None of the patient in our study had failure of spinal component either in SST and DST. We didn't observe any kind of technical problems or any serious complications from CSE techniques.

4) Haemodynamic changes

Hypotension was taken as 25% decrease in systolic blood pressure compared with baseline. Bradycardia was taken as pulse rate less than 60 beats/min.

A) Bradycardia

In group A 7%, 3 patients had bradycardia while in group B 3%, 1 had bradycardia

B) Hypotension

In group A 10%, 4 patients had hypotension, whereas in group B 7%, 3 had hypotension.

Low incidence of hypotension and bradycardia in CSE anaesthesia may be attributable to small diameter spinal needles that have a resistance. This may avoid injecting the local anaesthetic too fast into the subarachnoid space. Various authors have studied the hemodynamic changes in CSE. Bradycardia was nil in almost all cases and percentage of hypotension was also minimal, in their study sharma et al² 1994 it was 11% and in hamdani G.A et al⁹ 2002 it was 13%, which was similar to our study.

5) Postoperative complications

Backache

The incidence of backache in group A was 19% and 11.9% in group B. The reason for high incidence in group A is due to multiple needle punctures. incidence of backpain was statistically insignificant between 2 groups. Puolakka R et al¹⁰ 2001 reported that the incidence of back pain was similarly common (22.2%) in both the groups. Zoran S et al¹¹ 2013 reported that CSE was painful in 16% of DST

compared to 20% of SST. the present study is contrary to the observations of puolakka and zoran S.

Post dural puncture headache

In our study none of the patient from any group developed post dural puncture headache.

Thus our observation is consistent with the study of Rawal et al⁴ 1998, Brownridge et al¹² 1991, Fan et al¹³ 1994, Holmstorm et al⁸ 1993 and Gupta et al¹⁴ 2002 who have commented on the lack of PDPH following CSE anaesthesia.

CONCLUSION

From our study, we concluded that both the techniques of combined spinal epidural(DST,SST) are almost same as regards to procedural time, onset of anaesthesia and quality of surgical anaesthesia. Both techniques are devoid of major intraoperative and postoperative complications. Thus both the techniques can be safely used for orthopaedic lower limb and hip surgeries.

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