

# Single Space Technique for Combined Spinal Epidural Anaesthesia (CSEA) by Needle Through Needle (CSEA NEEDLE) for Various Abdominal & Lower Limb Orthopaedic Surgeries

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## ABSTRACT

**Introduction:** The advantages of CSEA are a combination of the rapid response of spinal & epidural anaesthesia by single space. Study aimed to access sensorimotor blockage characteristics, hemodynamic stability of patients.

**Material and methods:** In present Randomised observation study, 100 elective patients of various abdominal & lower limb surgeries were enrolled & divided in 3 sub groups according to highest sensory level of anaesthesia required for surgery.

Group A: At T<sub>8</sub> level (10 ml 0.25% Bupivacvaine)

Group-B: Between T<sub>4</sub> - T<sub>8</sub> level. (12 ml 0.25% Bupivacvaine)

Group-C: At T<sub>4</sub> level. (15 ml 0.25% Bupivacvaine)

Perioperative haemodynamic monitoring was done and depicted in tabular form. Peroperative complications, adverse effects were noted and treated accordingly. For post-operative analgesia Inj. Tramadol (100 mg) in 10 ml NS was injected through epidural catheter. Epidural space was located by loss of resistance method by CSEA needle.(Needle through needle). Spinal Bupivacaine heavy (0.5%) 3.5 ml (17.5 mg) was given by CSEA needle, spinal needle withdrawn, Then Epidural catheter was introduced about 3-4 cm in Epidural space. Sensory block was assessed by using pinprick method and motor block by using Bromage scale.

## Result:

**Conclusion:** So it is concluded that combined spinal epidural block given by SST is advantageous in prolonged urosurgical, gynaecological, vascular and other various lower limb surgeries.

**Keywords:** Combined Spinal Epidural Anaesthesia (CSEA), Single Space Technique (SST)

## INTRODUCTION

Regional anaesthesia is being practiced for patients undergoing surgery on lower half of the body since a long time. It has many advantages over general anaesthesia.<sup>1</sup>

Regional anaesthesia not only avoids problems related to general anaesthesia but also decreases blood loss, reduces chances of deep vein thrombosis, provides post-operative analgesia and can be useful in patients with respiratory and metabolic diseases.

The combined spinal epidural technique (CSEA) involves subarachnoid blockade and epidural catheter placement<sup>2</sup> during the same procedure.

Brownridge<sup>3</sup> used CSEA in 200 patients.

1982, M.B. Coates<sup>4</sup> have access single space method for CSEA. Ideally it combines the best features of subarachnoid blockade like rapid onset as well as profound blockade and

of epidural blockade like titratable levels and ability to prolong blockage as required.<sup>5,6,7</sup>

The combined spinal epidural technique also avoids their respective disadvantages, like single shot nature of spinal blockade, inability to extend the blockage, slower onset of action and missed segments, incomplete motor block, poor sacral spread of epidural blockade. Hence, combination of these two methods would be an attractive choice.<sup>7</sup>

The CSEA is a recent innovation in regional anaesthesia by which main advantages of spinal and epidural are combined and retained at the same time their drawbacks are minimized.<sup>7</sup>

The combined spinal epidural block offers high speed of onset, efficacy and minimal toxicity of a spinal block, combined with the potential of improving an inadequate block or prolonging the duration of anaesthesia with epidural supplements and extending the analgesia into the postoperative period.<sup>8,9</sup>

These advantages make combined spinal epidural blocks increasingly popular in various major abdominal surgeries. Epidural anaesthesia has been suggested to provide better results for high risk surgical patients.

The present prospective study was designed to evaluate the combined spinal epidural technique by Single space technique (SST) in patients undergoing various abdominal surgeries of long duration.

## MATERIAL AND METHODS

The present study of CSEA was done in VS General hospital & SVP hospital NHLM Medical college Ahmedabad from Feb 2018 to February 2020, to provide rapid response and good muscle relaxation and to avoid supplementation with general anaesthesia for prolonged surgery and also to provide post operative analgesia with lower incidence of perioperative complications.

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### Inclusion criteria

The study of combined spinal epidural anaesthesia using single space technique for various elective abdominal surgeries was carried out in either sex and age group ranging from 15 - 65 years belonging to ASA physical status I and II.

### Exclusion criteria

Patients having CNS disease, coagulation disorders, skin infection over back, history of backache, headache or any neurological deficit, history of spine surgery or any abnormality of vertebral column were excluded from the study.

Before planned surgery preoperative anaesthetic assessment was conducted including general and systemic examination in detail.

The procedure was explained and detail informed consent was taken. VAS was explained to each patient in detail.

### Investigation

CBC, BT, CT, Renal function tests (RFT), Blood urea, S.Creatinine, Liver function tests, Random blood sugar, ECG, x-ray Chest

### Premedication

Inj. Ondansatron (4 mg) i. & Inj. Glycopyrrolate (0.2 mg) i.v.

### Procedure

In the operation theatre, after applying all the required monitors, intravenous line was secured with no. 18G intracath and patient was preloaded by Inj. Ringer lactate 10 - 15 ml / kg of body weight.<sup>3,6</sup> Ryle's tube was inserted in patients undergoing gastro intestinal surgeries. All the patients were catheterised preoperatively for monitoring urine output intraoperatively as well as post operatively and i.v. fluids supplemented accordingly.

### Single Space Technique for combined spinal epidural anaesthesia

Under strict aseptic precaution patient in left lateral position, a wheel was raised with local anaesthetic Inj. Lignocaine Hydrochloride (1%) 2 ml in midline between two spines of L1-L2 intervertebral space. Epidural puncture was performed with Tuohy needle no 18G and epidural space was located with help of loss of resistance technique.<sup>2</sup>

After locating epidural space, spinal needle was introduced through Epidural needle (needle through needle) of B. Brown company through CSEA needle & after free clear flow of CSF inj Bupivacaine 3.5 ml given with full aseptic & antiseptic technique .

Then after withdrawal of spinal needle, epidural catheter no. 20G was inserted and placed 3-4 cm properly to block desired segments Testdose with Inj. Lignocaine Hydrochloride with adrenaline (1%) 3 ml injected through catheter to rule out accidental intrathecal or intravenous placement of catheter and also checked patency of catheter.

Immediately after completion of the procedure patients were returned to supine position and following observations were recorded.

The onset of Sensory block was assessed by using pinprick test. Highest level of sensory block and time to reach highest

level were recorded.

Motor blockage was assessed by using Bromage scale and its onset time is recorded. This is defined as the time to reach grade of 3 in Bromage scale.

### Bromage Scale

Grade	Criteria
0	Full flexion of knees and feet.
1	Just able to flex the knees, full flexion of feet.
2	Unable to flex the knees, some flexion of feet.
3	Unable to move legs or feet.

Proper tilt to the operation table was given to achieve desired level of analgesia and after establishment of adequate level of analgesia, surgery was started and time of beginning of surgery was noted, i.v. fluids were continued intraoperatively at the rate of 10 ml / kg / hour.

Intraoperatively pulse, BP (by non invasive blood pressure), SPO<sub>2</sub> and respiratory rate were monitored for every 5 mins for first 30 mins and thereafter every 30 min till the end of surgery. Oxygen was given by ventimask during surgery (4 - 6 lit/min.)

Time to 2 segment regression was noted.

Bradycardia was defined as pulse rate < 60 / min and was treated with Inj. Atropine sulfate 0.6 mg i.v.

Hypotension was fall in SBP more than 30% of baseline value and was treated with i.v. fluids and Inj. Mephentermine sulfate 6 mg if required.

Any other Complications like nausea, vomiting were noted by 4 point scale.as (1) means no, (2) mild, (3) moderate, and (4) for severe nausea vomiting, treated as 1 & 2 by head low position, ventimask oxygen (3) & (4) by inj.ondansatron 4 mg.IV given.

Intraoperatively after 120 to 150 minutes when patient had 2 segment regression, then Inj. Bupivacaine (0.25%) was given through epidural catheter in adequate volume (10-15) ml according to level required.

Time to first Epidural top up dose was noted. Onset and duration of the epidural top up dose was noted. These can be repeated intraoperatively if required.

Total no.of Epidural doses and time were noted. Epidural catheter secured properly and patients were observed in post operative ward. Rest, foot end elevation and hydration were advised; tight abdominal binders were advised .

When patients were started feeling pain Inj. Tramadol 50 mg diluted in 10 ml of Normal saline was given through epidural catheter. Inj. Ondansatron 4 mg i.v. stat was given before Inj. Tramadol. After giving Inj. Tramadol pulse, BP, SPO<sub>2</sub> and respiratory rate were monitored .

All the patients were kept in post operative ward under observation with continuous ECG monitoring, SPO<sub>2</sub>, pulse, BP and respiratory rate. Patients were observed carefully for any complications.

Postoperative Epidural Analgesia in form of Epidural Tramadol 50 mg when VAS was more then 4. Total number of Analgesic requests noted in 24 hours.

Epidural catheter removed after 24 hours, removed carefully and benzoin seal applied.Removed intact Epidural tip

shown to patient & relatives & notification of it was done for medicolegal purpose.

The patients were also asked to report complications like headache, backache, dysaesthesia in buttocks, thigh and lower limb upto 1 wk.

### STATISTICAL ANALYSIS

Data was collected in MS Excel spreadsheet and analysed by SPSS software 16 (IBM, Armonk, NY, USA)

Numerical values were analysed by ANOVA (Analysis of Variance).

Categorical variables were analysed by Chi Square test.

P>0.05 is nonsignificant.

P<0.05 is Significant

P<0.001 is Highly significant.

### RESULTS

100 patients of either sex undergoing various abdominal & lower limb surgeries, ASA physical status I / II were selected for combined spinal and epidural anaesthesia technique (table-1).

Highest sensory level achieved was T4 (36% of patients), T4 level required in vascular surgeries and some gastrointestinal surgeries, while for gynaecological surgeries T8 sensory level for anaesthesia was sufficient and for urosurgical and

some general abdominal surgery T6 (B/W T4-T8) sensory level is required (table 2a,2b).

The table-4 shows that there is no significant difference in haemodynamic parameters during intraoperative period & Oxygen saturation and respiratory rate were unaffected in all the 3 groups. (p>0.05)

Incidence of hypotension (4%) and incidence of bradycardia (8%) occurred in group- C patients where T4 sensory level required for anaesthesia.

Postoperative vital parameters were watched & all patients were stable. Table 5 and 6 shows intra operative and post complications respectively.

### DISCUSSION

Combined spinal epidural anaesthesia is an attractive technique for various abdominal (urosurgical, gynaecological and vascular) & lower limb surgeries.

Spinal anaesthesia provides an early onset of action and good muscle relaxation. Epidural anaesthesia provides supplementation for prolongation of anaesthesia and also provides post-operative pain relief.<sup>8,10,12</sup>

In the present study, 100 cases of ASA status I or II for various abdominal & lower limb surgeries of long duration were studied.

In the present study, the patients were divided in 3 groups

Parameters (Mean+/-SD)	Group A (n=32)	Group B (n=32)	Group C (n=36)
Age (yrs)	58.7+/-12.5	56.2+/-13.7	57.8+/-12.2
Sex (Male/Female)	18/14	16/16	18/18
Height (cm)	155.5+/-2.5	154.7+/-2.7	154.0+/-3.3
Weight (kg)	62.8+/-3.4	61.4+/-3.3	62.3+/-2.8
ASA Grade (1/2)	22/10	24/8	28/8
Duration of surgery (min)	240+/-20	234+/-17	245+/-10

**Table-1:** Demographic parameters:

Group	Type of Surgery	No. of patient
I	Urological abdominal surgery	8(8%)
II	Gynaecological surgery	28(28%)
III	Vascular surgery	16(16%)
IV	Lower Limb orthopaedic surgeries	48(48%)
	Total	100(100%)

**Table-2a:** Distribution of patients according to surgery

Group	Highest sensory level of anaesthesia	No. of patient
A	At T8 level	32 (32%)
B	B/W T4-T8 level	32(32%)
C	At T4 level	36(36%)
	Total	100(100%)

**Table-2b:** Distribution according to sensory level

Group	Dose (in ml.)	Duration (in min.)
A	5	25.0 ± 7.0710
B	5	25.0 ± 7.0710
C	7	32.0 ± 4.8795

**Table-3:** Characteristics of second epidural top up dose (Mean ± SD) (Inj. Bupivacaine 0.25%)

Duration (min)	Group-A (n=32)				Group-B (n=32)				Group-C (n=36)			
	HR (Beats /min.)	BP mmHg	SPO2 (%)	RR per min	HR (Beats/ min.)	BP mmHg	SPO2 (%)	RR per min	HR (Beats/ min.)	BP mmHg	SPO2 (%)	RR per min.
Pre-op. After block	80.88	133.11 / 73.22	99.22	14	77.0	132.5 / 80.5	99.0	15.5	79.58	122.83 / 78.5	98.66	16.66
5	78.88	118.88 / 73.33	99	12.44	72.5	125.0 / 72.5	99.0	13.5	74.83	120.83 / 73.0	98.75	13.0
10	80.66	116.11 / 72.44	99	13.11	69.0	119.0 / 70.0	99.0	12.5	71.0	117.33 / 70.85	98.75	12.66
15	78.80	111.77 / 70.44	99	12.40	68.5	108.5 / 65.5	98.75	12.0	68.0	114.5 / 66.16	98.83	12.16
20	79.33	113.77 / 71.77	98.88	12.88	71.0	102.5 / 68.0	99.0	12.5	64.0	96.50 / 64.5	98.0	12.10
25	78.44	106.88 / 67.33	98.66	12.66	70.5	100.67 / 67.50	98.5	12.5	66.16	105.0 / 65.5	98.66	12.66
30	74.22	116.44 / 71.70	99	12.66	73.20	113.5 / 72.5	99.0	13.0	71.16	110.50 / 67.5	98.91	12.00
60	72.77	116.86 / 75.33	98.88	13.11	74.5	115.0 / 72.0	99.0	12.0	76.17	109.67 / 73.66	99.00	12.66
90	82.0	122.22 / 71.11	99	12.44	79.0	117.0 / 74.5	99.0	13.5	79.0	114.97 / 68.33	99.00	12.51
120	84.88	132.66 / 82.0	99	12.88	85.0	128.0 / 72.5	99.0	12.5	81.58	124.25 / 70.5	99.0	13.16
150	88.44	136.86 / 81.33	98.77	13.55	89.5	134.0 / 80.5	99.0	13.5	83.83	128.33 / 81.15	99.0	12.66
180	90.0	135.0 / 83.0	99	12.0	90.66	125.33 / 72.0	99.0	12.66	74.27	118.36 / 66.66	98.75	12.16
210	89.0	131.0 / 78.0	99	13.0	84.66	124.0 / 73.33	99.0	12.66	72.17	124.72 / 71.45	98.0	12.66
240	85.0	128.0 / 80.0	99	13.0	84.0	120.0 / 65.33	99.0	12.66	73.63	123.45 / 75.36	99.0	12.90
270	87.0	131.0 / 85.0	99	13.0	86.33	126.33 / 76.66	99.0	12.0	85.27	120.54 / 74.37	99.0	13.09

Table-4: Intraoperative haemodynamic monitoring (mean)

Complications	Group - A	%	Group - B	%	Group - C	%
Hypotension	0	-	0	-	4	4%
Bradycardia	0	-	0	-	8	8%
Vomiting Nausea	0	-	4	4%	4	4%
Difficulty of catheter Insertion	-	-	4	4%	8	8%
Catheter knot	-	-	-	-	-	-
Accidental vessel puncture	-	-	-	-	-	-

Table-5: Intraoperative complications (Total 100 cases)

Complications	Group - A	%	Group - B	%	Group - C	%
Hypotension	0	-	0	-	0	-
Bradycardia	0	-	0	-	0	-
Vomiting	0	-	4	4%	2	4%
Respiratory depression	0	-	0	-	0	-
Backache	4	4%	4	4%	2	4%
PDPH	0	-	4	4%	0	-
Pruritus	0	-	0	-	0	-
Allergic reaction	0	-	0	-	0	-
TNS	0	-	0	-	0	-

Table-6: Post operative complications (n=100)

(A, B and C) according to the highest sensory level of anaesthesia required.

Group-A: at T<sub>8</sub> level.

Group-B: Between T<sub>4</sub> - T<sub>8</sub> level

Group-C: at T<sub>4</sub> level.

#### Selection of patients

In the present study of 100 cases, 56 patients (56%) were of ASA grade I and 44 patients (44%) were of ASA grade-II.

In 2007, Dipasri Bhattacharya, Tewari I, Chaudhari<sup>10</sup> had

selected sixty patients aged 65 - 80 years, ASA - III for sequential CSEA and found similar findings.

#### Technique

In the present study of 100 cases single space technique was used for CSEA by needle through needle method.

In 1982, M.B. Coates<sup>4</sup> used SST for CSEA and observed that there is less discomfort and less trauma to the patients. One potential disadvantage of single space method is that the epidural catheter can migrate to subarachnoid space through

the puncture produced by the spinal needle.

In 1992, Lifschitz et al<sup>11</sup> described DST for CSEA. They had given spinal anaesthesia in L<sub>3</sub> - L<sub>4</sub> space and epidural catheter was placed in L<sub>1</sub> - L<sub>2</sub> space.

Mumtaz Etal<sup>12</sup> & peach Etal<sup>13</sup> used single space technique (SST) for CSEA

Nandini Dave<sup>14</sup> had used this technique for major gynecology surgeries

### Onset of sensory and motor block

In the present study, after giving spinal anaesthesia, onset of sensory block was in  $5.4 \pm 1.15$  mins, onset of motor block was in  $9.52 \pm 1.08$ mins and time from injection to highest sensory level was in  $10.72 \pm 1.65$  mins.

In 1992, R. Lifschitz and R. Jedeiki<sup>11</sup> used CSEA in various urosurgical and abdominal surgeries by giving Inj. Bupivacaine (0.5%) heavy 3.5 ml. They found that onset of sensory block was in  $5.0 \pm 1.03$ mins. and onset of motor block was in  $10.14 \pm 1.12$  mins.

operations on legs, groin and other general abdominal surgeries by using Inj. Bupivacaine heavy (0.5%) 3 - 4 ml and found that median block height achieved was T<sub>6</sub> (Range between T<sub>4</sub> - T<sub>8</sub>).

### Epidural top up dose

In the present study, Inj. Bupivacaine (0.25%) was used for epidural top up dose.

In group-A, the duration of 1st epidural top up dose (10 ml) was  $37.22 \pm 4.40$ mins. The duration of 2nd epidural top up dose (5ml) was  $25.0 \pm 7.07$  mins.

In group-B, the duration of 1st epidural top up dose (12 ml) was  $55.0 \pm 4.08$  mins. The duration of second epidural top up dose (5ml) was  $25.0 \pm 7.07$ mins.

In group-C, the duration of 1st epidural top up dose (15 ml) was  $67.5 \pm 16.58$  mins. The duration of 2nd epidural top up dose (7 ml) was  $32.0 \pm 4.87$ mins.

In the present study, the highest sensory level of anaesthesia was at T4 level. This was achieved by using 15 ml of Inj. Bupivacaine (0.25%) through epidural catheter. The duration was  $67.5 \pm 16.5$ mins.

In 2002, Radhika Dhanpal<sup>15</sup>, John Chrayath and Coworkers; had used Inj. Bupivacaine (0.5%) 10 ml for epidural top up dose and concluded that deposition of a local anaesthetic into the epidural space increases the level of spread of a subarachnoid block and also provided excellent analgesia and muscle relaxation in all patients.

In 1994, K. Sharma<sup>16</sup> and his coworkers had used 10 - 15 ml of Inj. Bupivacaine (0.25%) for epidural top up dose and found excellent analgesia in all patients.

### Perioperative haemodynamic monitoring

In the present study of 100cases, incidence of hypotension was 4% (4 patient of group - C). This was corrected immediately by giving i.v. fluids and Inj. Mephentermine 6 mg i.v.

This hypotension may be due to more volume of the drug (15 ml) given to block upper segments.

In 1986, Rawal N<sup>17</sup> observed Hypotension in 13% of cases following subarachnoid block.

In 1987, B. Dennison<sup>6</sup> had observed similar incidence of hypotension (10 -15%) but said that the incidence could be less than 5% by preloading with Inj. Ringer Lactate solution. Peach etal<sup>13</sup> had observed similar incidence of bradycardia and nausea (between 5 - 10%) after spinal anaesthesia for various abdominal surgeries, corrected by Inj. Atropine sulfate 0.6 mg.

In 1994, K. Sharma P. Chhari, S. Gupta<sup>16</sup> reported low incidence of hypotension (4 - 7%) which responded to Inj. Ringer lactate infusion alone or Inj. Mephentermin.

In present study, incidences of Bradycardia was noted in 8patients of group - C (8%) where T<sub>4</sub> sensory level was achieved. They were treated by Inj. Atropine sulfate (0.6 mg) i.v. Incidence of nausea was 8%. This was in tuboplasty patients during tubal manipulation and was treated by Inj. Ondansatron (4 mg) i.v.

### Postoperative complications

In the present study, only one patient (4%) had post dural puncture headache and was treated by head down position, rest and i.v. fluids. Brownridge<sup>3</sup> in 1981 who studied 200 cases of CSEA for LSCS noted no cases of post dural puncture headache. This was because of use of small gauge spinal needle (26G).

The cause of low incidence of post dural puncture headache could be the meticulous puncture of the dura with a fine needle inserted with the bevel parallel to the longitudinal fibers of the dura in single attempt to elicit free flow of CSF. Also the local anaesthetic (Inj. Bupivacaine 0.25%) used in CSEA for epidural top up dose might exert a protective effect against further loss of CSF. (Bromage P.R. 1978).

In the present study 12 patients complained of mild BACKACHE (12% incidence). They were treated by rest and conventional analgesia., 8 patients (8%) complained of vomiting and were treated by Inj. Ondansatron 4 mg i.v.

In 2004, Hughes et al<sup>18</sup> after CSEA observed mild to severe backache in 15% of the patients. They were treated by analgesics.

In 2002, Marcel Veranteren et al<sup>22</sup> after giving CSEA in major abdominal surgeries found that 10-15% of patients had complaints of vomiting post-operatively. They were treated by i.v. fluids and conventional antiemetics.

Premila Naik<sup>20</sup> & Rathi<sup>21</sup> have used epidural & No patients developed hypotension, pruritus, respiratory depression or allergic reactions, TNS.

### Post-operative analgesia

Inj. Tramadol (50 mg) was given through epidural catheter for post operative analgesia and patients were monitored for 24 hours in post operative ward. None of them had hypotension, hypoxia or respiratory difficulties in post-operative ward. Premia naik<sup>25</sup> & Rathi<sup>30</sup> have used epidural tramadol for Postoperative analgesia

Lifschitz<sup>12</sup> and coworkers (1982), administered 3 mg of morphine approx. 15 min before the end of surgery and no respiratory depression or difficulty was noted.

OP Sanjay<sup>22</sup> VR Kadam and Coworkers (2003), used Inj. Bupivacaine (0.25%) with fentanyl 10 µg/ml for post

operative pain relief after thoracotomy. They concluded that in the early post operative period the use of 0.25% Bupivacaine with fentanyl improves epidural analgesia in patients undergoing lung resection.

Rawal et al<sup>23</sup> (1986) used 4 mg of morphine to provide post operative analgesia in LSCS patients without any untoward effects.

## CONCLUSION

The combined spinal epidural block given by single space technique (SST) is useful for prolonged urosurgical, gynaecological, vascular and other various general abdominal surgeries.

This technique provides rapid onset of action, reliable surgical anaesthesia, excellent muscle relaxation. The epidural catheter enable to extend the block for surgery with local anaesthetic drug and achieve excellent analgesia and muscle relaxation and reducing the likelihood of toxicity and stable haemodynamic.

It also provides excellent post operative pain relief well accepted by the patients. Incidence of post dural puncture headache is virtually absent.

In a Nutshell combined spinal epidural anaesthesia by single Space Technique is a safer, effective technique that provides rapid onset, adequate muscle relaxation, excellent analgesia, stable haemodynamics and extension of analgesia and anaesthesia as per need of surgery and as well as post-operative analgesia.

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