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Research Article

# Efficacy And Safety of Combined Spinal Epidural Anaesthesia Versus Spinal Anaesthesia in Lower Abdominal Surgeries

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## ABSTRACT

**Background:** Spinal and epidural anaesthesia are effective for various surgical procedures but have their own drawbacks. Spinal anaesthesia provides rapid onset but can cause significant hypotension and pain control issues. Epidural anaesthesia offers better pain management and extended postoperative relief but has a delayed onset and can lead to uneven anaesthesia distribution and toxicity risks. Combined spinal-epidural anaesthesia (CSEA) merges the benefits of both methods, providing rapid onset from the spinal component and extended analgesia from the epidural catheter.
**Methods**: A Hospital based comparative clinical study was conducted in the Department of Anaesthesiology and Critical Care, Diphu Medical College Diphu. After obtaining approval from the Institution Ethical Committee, 80 patients aged 20-50years of ASA grade I and II undergoing lower abdominal surgeries were randomly selected into two groups. Group A received Spinal Anaesthesia with 3ml Inj. Bupivacaine hyperbaric 0.5% and Group B received CSEA (Combined Spinal Epidural Anaesthesia) with an epidural catheter placement. 1.5ml (7.5mg) of Inj. Hyperbaric Bupivacaine (0.5%) delivered intrathecally, followed by incremental doses of Inj. Isobaric Bupivacaine 0.5% via epidural route to achieve T6 block.
**Results**: Both groups had similar sensory block onset. SA reached peak sensory block at T6 faster, while CSEA offered longer analgesia, suitable for longer surgeries or postoperative pain. Both provided high-quality surgical analgesia and comparable motor block. SA caused a more significant initial drop in blood pressure and a greater decrease in heart rate at 5 minutes, but both stabilized similarly. Adverse symptoms like nausea, vomiting, and backache were not significantly different between groups.
**Conclusion**: CSEA offers better haemodynamic stability, an extendable block, and more effective postoperative analgesia compared to SA but may provide less muscle relaxation. These factors are crucial for anaesthesiologists when selecting the appropriate anaesthesia technique based on surgery and patient needs

***Keywords****: spinal anaesthesia, combined spinal epidural anaesthesia, onset of sensory block, analgesia duration.*

## INTRODUCTION

Spinal and epidural anaesthesia are widely favoured methods for various surgical procedures worldwide due to their established effectiveness. However, each approach comes with its own set of benefits and pitfalls.

Spinal anaesthesia, while providing rapid onset of analgesia & anaesthesia, also results in substantial drop in blood pressure (hypotension), which can sometimes be challenging to manage. Epidural anaesthesia provides advantages such as better control over analgesia levels and the option to provide pain relief following surgery while having disadvantages like as a slower onset of action, the need for larger dosages of local anaesthetics, the possibility of uneven anaesthesia distribution (patchy anaesthesia) and risks of neurotoxicity and cardiac toxicity related to the medications used. The combined spinal epidural anaesthesia (CSEA) represents a valuable option in anaesthesia practice as it delivers the benefits of both epidural as well as spinal block whilst minimising their respective drawbacks. By providing rapid onset, extended analgesia and the ability to adjust blockade intensity, CSEA can improve patient comfort and safety throughout a variety of surgical procedures.

While international research has provided valuable insights into the comparative outcomes of spinal anaesthesia versus CSEA, there is a scarcity of Indian studies addressing this specific aspect of anaesthesia management.

With this background, the comparative clinical trial was conducted with the objectives of determine and compare the efficacy and safety of combined spinal epidural anaesthesia technique over spinal anaesthesia in patients undergoing lower abdominal procedures.

**MATERIALS AND METHODS**

This observational study was carried out in Diphu Medical College and Hospital, Diphu, for a period of 1 year (2023-24) after approval from the institutional ethics committee and written informed consent from the patients. All the patients aged 20-50 years of both genders undergoing elective lower abdominal surgeries, with either American Society of Anaesthesiologists (ASA) class I or II grading, with Body Mass Index BMI < 30 were taken and were randomly allocated into two equal groups each having forty patients. Group A received Spinal Anaesthesia [SA] while Group B patients received combined spinal and epidural anaesthesia [CSEA]. Patients with respiratory, cardiovascular, hepatic and renal disease, history of allergy to drugs used in study, local skin infections and Spine abnormalities, coagulopathies, contraindication to neuraxial anaesthesia, pregnant and lactating women were excluded from the study.

**SAMPLE SIZE CALCULATION:**

Considering onset of sensory block time [mins] to be "9.2$\pm$1.4 and 8.8$\pm$1.0" in patients receiving CSEA and SA respectively according to the study by V. Tummala et al, sample size for the present study was calculated and rounded of to be 40 in each group with 95% confidence and 90% power

Every patient received a tablet Alprazolam 0.25mg the night prior to surgery. Informed Consent, explaining the anaesthesia plan to the patient party, including the type of anaesthesia (either CSEA or SA) its implications and possible risks and benefits was obtained either from the patient or his/her guardian. Patients were connected to basic monitors, were preloaded with "10ml/kg of Ringer's lactate solution" before commencement of surgery, all patients were premedicated with "Inj. Midazolam 0.02-0.03 mg/kg" and "Inj. Ondensatron 8mg IV" and oxygen supplementation started @ 4L/minute via face mask.

**Group- A** patients received spinal anaesthesia with 25G Quincke's needle at "L3- L4 intervertebral space using a midline approach and a dose of 3ml (15mg) of Inj. Bupivacaine heavy 0.5%.

**Group-B** patients received Combined Spinal-Epidural Anaesthesia (CSEA). At the L2-L3 space 18-gauge Tuohy needle was advanced into the epidural space employing the loss of resistance technique to air. A sterile "20G epidural catheter" was then put through the epidural needle and 2-4 cm of the catheter advanced into the epidural space verified by negative aspiration of cerebrospinal fluid and blood. Spinal Anesthesia was given by 25-gauge Quincke needle at the L3-L4 intervertebral space by injecting "1.5 mL (7.5 mg) of 0.5% Inj. Hyperbaric bupivacaine. The drug was allowed to take effect. The level of the block was then extended to the desired T6 level by administering incremental doses of "0.5% isobaric bupivacaine through the epidural catheter (1.5 mL per unblocked thoracic segment and 2.0 mL per unblocked lumbar segment), as needed.

**OUTCOME MEASURES:**

Time of onset of sensory block was assessed by loss of pinprick sensation using safety pin protruding 2mm through a guard, time to onset of peak sensory block (T6 level): peak sensory block was defined as the interval between the onset of sensory block to lack of pain sensation at T6 level and was assessed by loss of pinprick sensation by use of safety pin protruding 2mm through a guard, degree of motor block was assessed by Modified Bromage Scale. Duration of Analgesia- was measured as the time interval between onset of sensory block to the time of first rescue analgesia (VAS > 4) in the post-operative period. The quality of analgesia was assessed and graded as per VAS SCORE.

All patients were observed for systolic blood pressure, pulse rate, diastolic blood pressure, respiratory rate as well as SpO2 at baseline, at 1 min after administration of drug, 5 min and at 15 min, 30mins, 90 mins and one post-operative reading taken. Incidences of other associated adverse effects such as vomiting, pruritus, nausea, headache, depression of respiratory system, seizures etc, if present, were also recorded.

**STATISTICAL METHODS FOR ANALYSIS:** The data collected was tabulated in Microsoft Excel Worksheet. Results on continuous measurements were presented as mean ± standard deviation and compared using Students t test. Discreet data had been expressed as number (%) and analysed using chi- square test. For non-parametric data Mann-Whitney U-test was used. For all analysis, the statistical significance was fixed at 5% level (p value < 0.05).

**RESULTS AND ANALYSIS**

There was no statistically significant difference between the age distribution (p value 0.4426), mean age (p value 0.236), height distribution (p value 0.463), BMI distribution ( p value 0.0773), gender distribution ( p value 0.654), ASA status ( p value 0.6547) and mean duration of surgery ( p value 0.749) between the two groups.

**TABLE- 1**

**COMPARISON OF ONSET OF SENSORY BLOCK BETWEEN TWO GROUPS**

| ONSET OF SENSORY BLOCK [mins] | GROUP A [SA] | GROUP B [CSEA] | *p value* |
|---|---|---|---|
| | *MEAN±SD* | *MEAN±SD* | |
| 1-2 | 1.71±0.27 | 1.83±0.17 | 0.1331 |
| >2-4 | 3.18±0.62 | 2.94±0.74 | 0.3132 |
| More than 4 | 4.83±0.58 | 4.88±0.74 | 0.9397 |
| TOTAL | 2.42±1.06 | 2.86+1.07 | 0.072 |

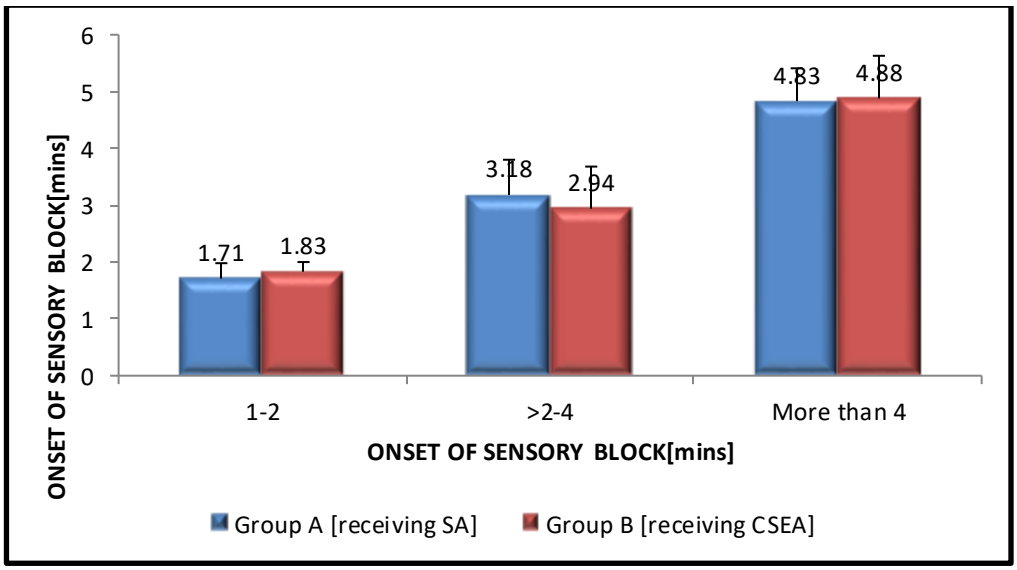


**Fig:1-Histogram showing comparison of onset of sensory block between two groups**

The total mean onset time is 2.42±1.06 minutes for Group A and 2.86±1.07 minutes for Group B (P value = 0.072), indicating no statistically significant difference in the onset of sensory block between the patients of two groups across all time ranges.

**TABLE-2**

**COMPARISON BETWEENTIME OF ONSET OF PEAK SENSORY BLOCK (T6 LEVEL)**

| **ONSET OF PEAK SENSORY BLOCK (T6 LEVEL in mins)** | **GROUP A(SA) Mean±SD** | **GROUP B(CSEA) Mean±SD** | ***p value*** |
|---|---|---|---|
| <4 | **3.35±0.95** | - | - |
| 4-8 | **4.94±1.15** | **6.98±0.72** | **<0.0001** |
| >8 | - | **9.62±0.95** | - |
| TOTAL | 4.43±0.94 | 8.37±1.58 | **<0.0001** |

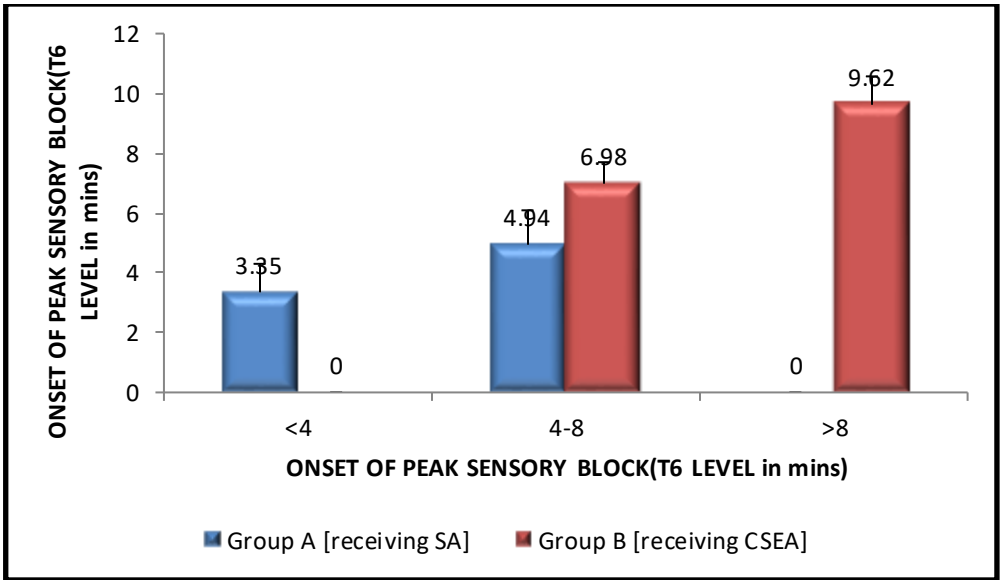


Fig: 2- Histogram showing peak onset of sensory block between two groups

The total mean onset time is 4.43±0.94 minutes for Group A and 8.37±1.58 minutes for Group B (P value < 0.0001), indicating a statistically significant difference, with Group A patients reaching peak sensory block (T6 level) faster than the patients of Group B.

**TABLE- 3**

**MODIFIED BROMAGE SCALE FOR DEGREE OF MOTOR BLOCK**

| MODIFIED BROMAGE SCALE | | GROUP-A [SA] | | GROUP-B [CSEA] | | *p value* |
|---|---|---|---|---|---|---|
| | | Freq | % | freq | % | |
| No Motor Block | 0 | 0 | 0.00 | 0 | 0.00 | 0.3055 |
| Inability to raise extended leg, able to move knee and feet | 1 | 0 | 0.00 | 0 | 0.00 | |
| Inability to raise extended leg and move knee, able to move feet | 2 | 1 | 2.50 | 3 | 7.50 | |
| Complete Motor Block | 3 | 39 | 97.50 | 37 | 92.50 | |
| TOTAL | | 40 | 100.00 | 40 | 100.00 | |

The P value of 0.3055 indicates no statistically significant difference in motor block levels between the patients of two groups.

**TABLE- 4**

**COMPARISON OF QUALITY OF ANALGESIA**

| PARAMETERS | Group A [*receiving SA]* | | Group B [*receiving CSEA]* | | *P value** |
|---|---|---|---|---|---|
| QUALITY OF SURGICAL ANALGESIA (ACCORDING TO VAS SCORE) | freq | % | freq | % | 0.4543 |
| 0 (NO PAIN) | 35 | 87.5 | 37 | 92.5 | |
| 1-3 (MILD PAIN) | 5 | 12.5 | 3 | 7.5 | |
| 4-6 (MODERATE PAIN) | 0 | 0 | 0 | 0 | |
| >7 (SEVERE PAIN) | 0 | 0 | 0 | 0 | |

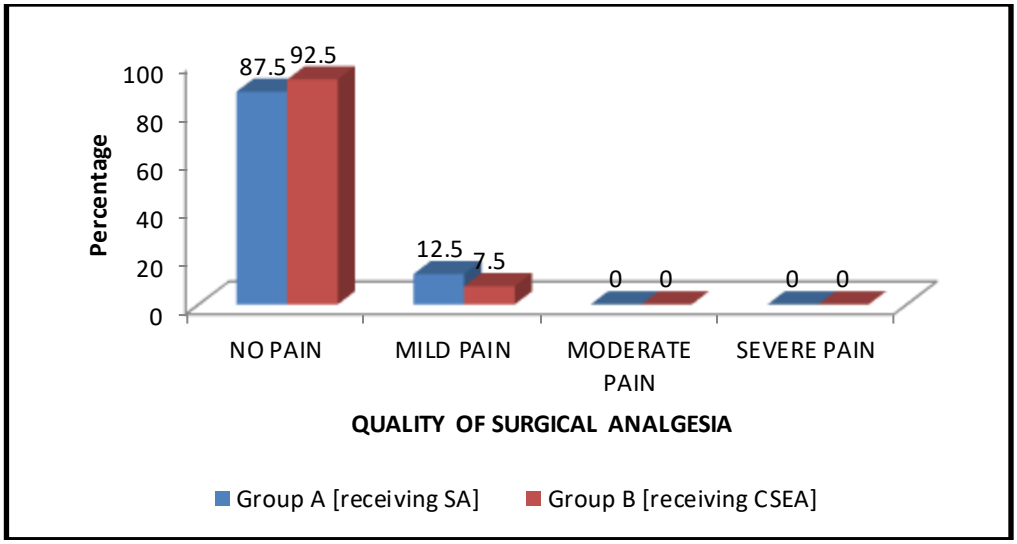


**Fig: 3-Histogram showing comparison of quality of analgesia between two groups**

The P value (0.4543) indicates no statistically significant difference in the distribution of quality of analgesia between the patients of Group A and Group B.

**TABLE- 5**

**COMPARISON OF DURATION OF ANALGESIA IN PATIENTS OF TWO GROUPS**

| PATAMETERS | GROUP A [SA] Mean±SD | GROUP B [CSEA] Mean±SD | *p value* |
|---|---|---|---|
| DURATION OF ANALGESIA[mins] VAS>4 | 136.68±11.42 | 150.75±9.51 | <0.0001 |

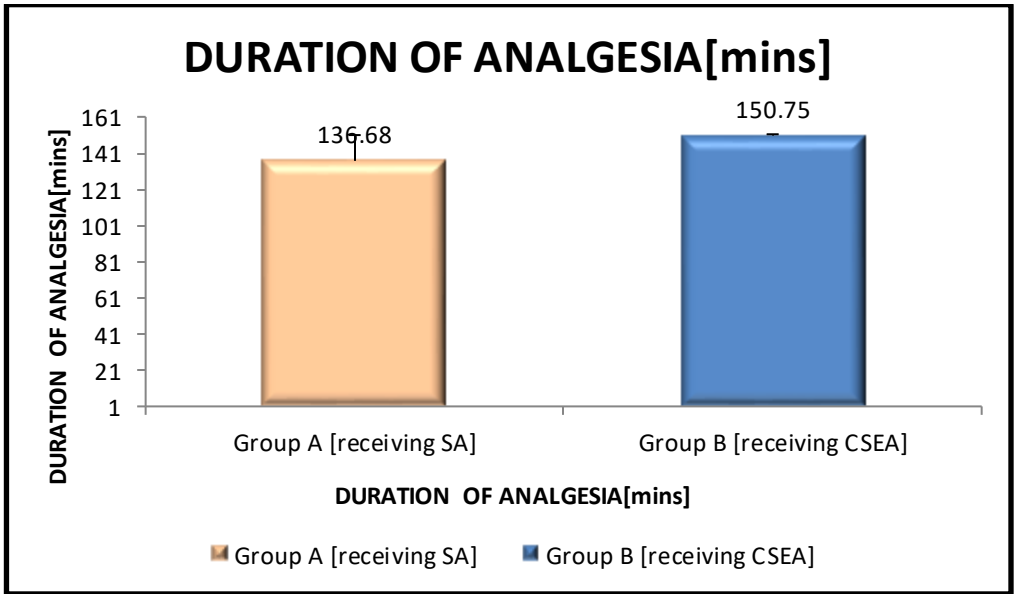


**Fig: 4-Histogram showing comparison of duration of analgesia**

p value (<0.0001) indicates a statistically significant difference in the duration of analgesia between the two groups. Based on this data, Group B (CSEA) patients show a longer mean duration of analgesia compared to Group A (SA), which is statistically significant.

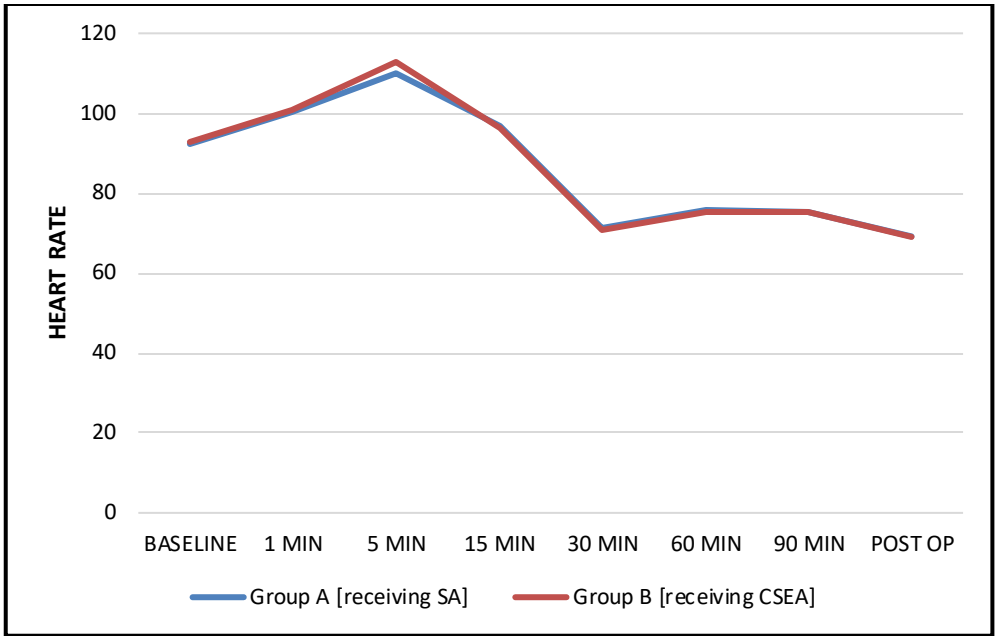


**Fig:5- Line diagram showing comparison of heart rate (Mean + SD): Basal, at 1, 5,1 5, 30, 60, 90 minutes and postoperative**

Heart rate comparisons between Group A (SA) and Group B (CSEA) showed no significant differences at most time points ($p > 0.05$), except at 5 minutes where Group B patients had a significantly higher mean heart rate ($p = 0.0255$).

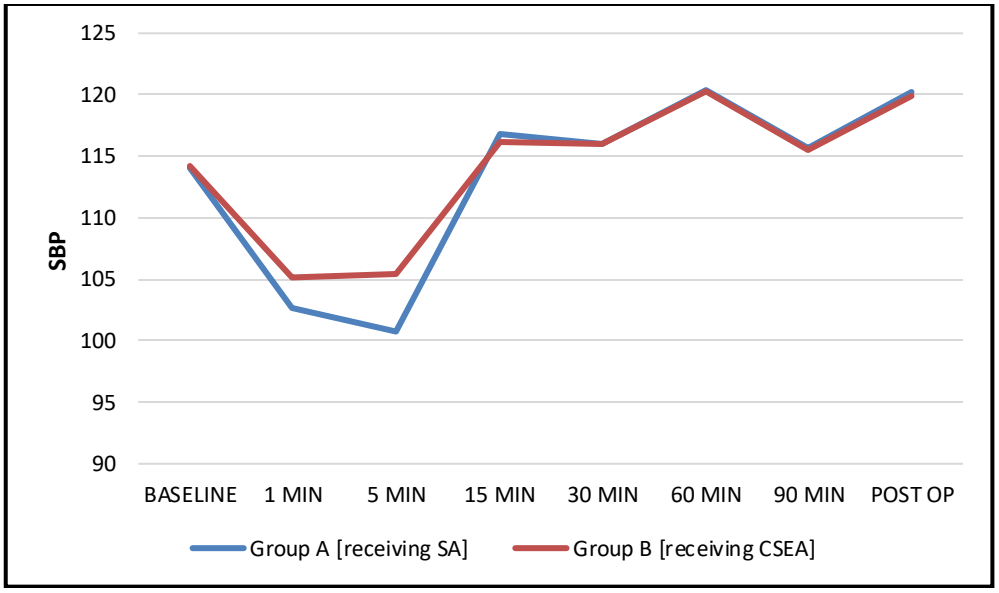


**Fig: 6- Line diagram showing comparison of systolic blood pressure (Mean + SD): Basal, at 1, 5,1 5, 30, 60, 90 minutes and postoperative**

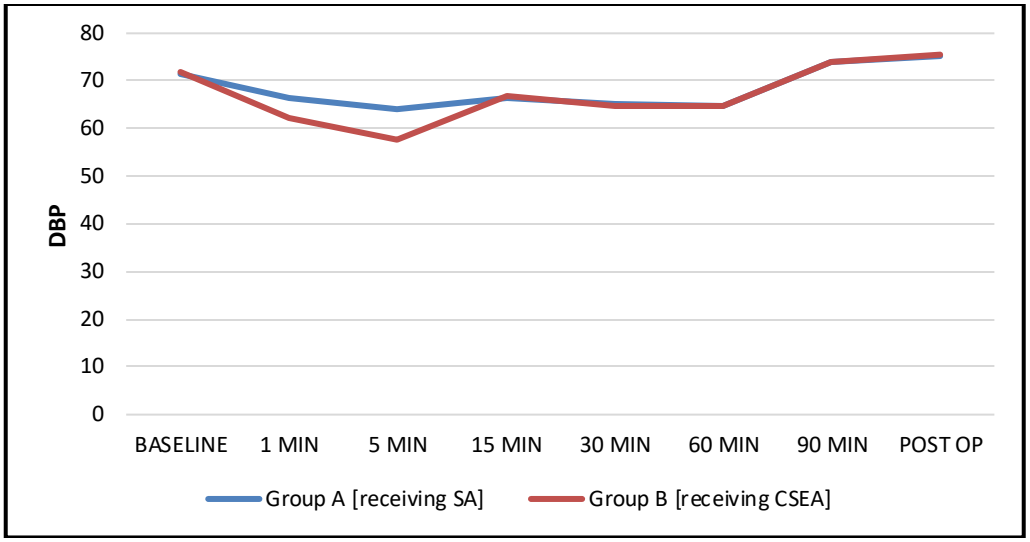


**Fig: 7 Line diagram showing comparison of diastolic blood pressure (Mean + SD): Basal, at 1, 5,1 5, 30, 60, 90 minutes and postoperative.**

The comparison of systolic blood pressure (SBP) and diastolic blood pressure (DBP) variations between Group A (receiving SA) and Group B (receiving CSEA) shows significant differences at 1 and 5 minutes post-administration. At baseline, 15, 30, 60, and 90 minutes, as well as immediate postoperatively, no significant differences were observed between the patients of two groups ($p > 0.05$).

SPO2 levels were similar between the patients of two groups throughout the measured periods.

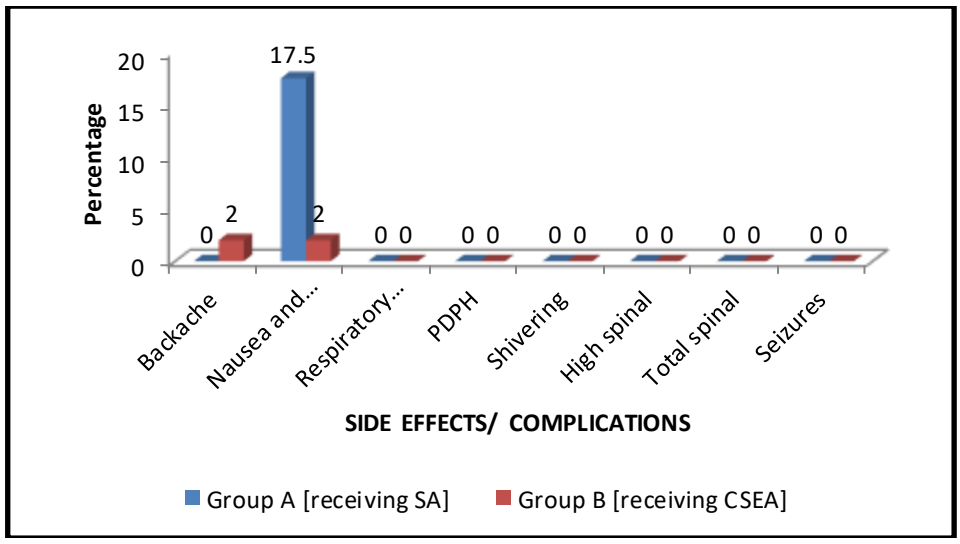


**Fig: 8 -Figure showing comparison of adverse effects between two groups**

The frequencies and percentages of each complication are provided for both groups. It shows that Group A patients experienced a higher incidence of nausea and vomiting compared to Group B patients, while 5% patients experienced backache in group B. However, all other complications were absent in patients of both groups during the study period.

**DISCUSSION**

The "Combined Spinal Epidural (CSE) technique" has sparked interest for its capacity to combine the benefits of both Epidural Anaesthesia (EA) and Spinal Anaesthesia (SA) whilst reducing their respective limitations. One notable restriction of SA is the inability to extend anaesthetic duration, which can be troublesome for surgeries that take longer than expected. The CSE approach overcomes this issue by its epidural component, which allows for extra anaesthetic doses as required. Furthermore, CSE gives better haemodynamic stability compared to SA alone, as the slow administration of anaesthetics via the epidural component helps control the haemodynamic response, minimising the occurrence of severe hypotension. This stability helps to provide a safer anaesthetic experience for patients. CSE's flexibility also helps to lessen the frequency of undesirable effects, such as nausea and vomiting following surgery (PONV), by allowing for regulated anaesthetic administration, avoiding the rapid and broad sympathetic blocking associated with SA.

In this current study, demographic data such as the patient's age, gender, height, and BMI between the two sets were equivalent is close to Talikote et al's study.

The onset of sensory block between Group A (getting spinal anaesthesia , SA) and Group B (receiving combined spinal-epidural anaesthesia, CSEA) shows no statistically significant variations across time intervals. The studies of Gallinger et al., Tomar et al and Talikota N et al had onset of sensory block slightly higher than our study.

The total mean onset time was significantly shorter for Group A at 4.43 ± 0.94 minutes, compared to 8.37 ± 1.58 minutes for Group B ($p < 0.0001$) which is consistent with the study of Sundar, Dr et al.

Our study found that CSEA provided a longer duration of analgesia, with a mean duration of 150.75±9.51 minutes compared to 143.38±14.25 minutes for SA ($p=0.0079$) which is statistically significant. Tummala V et al found duration of analgesia to be higher in CSE group than our study. In the study by Priya G et al, CSEA group had a significantly shorter duration of analgesia than our study.

Our study revealed that both techniques provided high-quality analgesia. Talikota N et al observed that "spinal block provided slightly better analgesia and muscular relaxation than CSEA.

The degree of motor block between the groups was not statistically significant ($p=0.3055$), indicating that both techniques are equally effective in achieving a high degree of motor block necessary for lower abdominal surgery. The findings are similar to the findings of Tummala V et al's and Magar JS *et al.*

Our study found CSE to be more hemodynamically stable that SA which is consistent with the findings of Imbelloni et al.

Despite a higher incidence of backache in Group B and a higher proportion of subjects reporting vomiting and nausea in Group A, there were no statistically significant differences in the occurrence of various adverse effects between the CSE and SA groups which is consistent with the findings of Sundar , et al.

**CONCLUSION**

From our observation through this study, we conclude that both combined spinal epidural anaesthesia (CSEA) and spinal anaesthesia (SA) are effective and safe for lower abdominal surgeries. However, CSEA presents several benefits over SA, such as requiring a smaller anaesthetic dose to achieve a quicker onset of sensory block, providing better haemodynamic stability, allowing for extension of the block to prolong anaesthesia duration and offering effective post-operative pain relief. These considerations are essential for anaesthesiologists when choosing the most suitable anaesthesia technique based on the surgical context and patient requirements.

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