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Original Research Article

Comparative Evaluation of Combined Spinal Epidural Anaesthesia versus Epidural Anaesthesia in Lower Abdominal Gynaecological Surgery: A Prospective Clinical Study

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Abstract:

Background: Regional anaesthesia has changed anaesthetic practice. Spinal and epidural anaesthesia are the two most commonly used neuraxial techniques. Each has its own benefits and drawbacks. Combined spinal-epidural anaesthesia (CSEA) was created to combine the fast onset and dense block of spinal anaesthesia with the flexibility of epidural anaesthesia. However, there is limited comparative evidence between CSEA and epidural anaesthesia (EA) in gynaecological surgery.

Aim: The goal of this study is to evaluate and compare the effectiveness and safety of CSEA and EA in lower abdominal gynaecological surgeries. We will look at drug requirements, onset and duration of pain relief, blood pressure stability, muscle relaxation, and complications.

Methods: This prospective, randomised study included 100 patients undergoing elective gynaecological surgeries. Patients were randomly divided into two groups of 50: Group CSEA (combined spinal-epidural) and Group EA (epidural). Both groups received standard premedication, monitoring during surgery, and oxygen. We assessed onset and duration of sensory and motor blocks, changes in blood pressure, quality of muscle relaxation, pain relief, total drug use, and complications. Data were analysed with statistical tests, considering $p < 0.05$ significant.

Results: Demographic and baseline characteristics were similar across groups. Group CSEA had a significantly faster onset of sensory and motor block, better muscle relaxation, and lower total drug use compared to Group EA. The duration of effective pain relief was longer in Group CSEA, requiring fewer extras. Blood pressure remained stable in both groups, although transient low blood pressure was more frequent in CSEA. Adverse events like nausea, shivering, and post-dural puncture headache were minimal and similar in both groups.

Conclusion: CSEA offers better conditions during surgery with faster onset, longer pain relief, and lower anaesthetic needs compared to EA, without compromising blood pressure safety. It may be a more effective neuraxial technique for lower abdominal gynaecological surgeries.

Keywords: Combined Spinal Epidural Anaesthesia, Epidural Anaesthesia, Gynaecological Surgery, Regional Anaesthesia, Blood Pressure Stability.

Introduction

The introduction of regional anaesthesia was a significant advancement in modern medicine, providing alternatives to general anaesthesia for major surgeries [1]. Among neuraxial techniques, spinal anaesthesia and epidural anaesthesia are the most commonly used, delivering effective sensory blockage, muscle relaxation, and pain relief after surgery [2]. Spinal anaesthesia is preferred for its quick onset, reliability, and strong motor block. However, it has limitations, including a fixed duration, lack of flexibility in block level, and a higher chance of sudden low blood pressure [3]. In contrast, epidural anaesthesia offers gradual dosing, greater blood pressure stability, and post-operative analgesia through a catheter. However, it has a slower onset, can produce uneven blocks, and requires larger drug amounts [4]. To address these issues, combined spinal-epidural anaesthesia (CSEA) was introduced by Soresi in 1937 and later popularized with the "needle-through-needle"

method [5,6]. CSEA combines the benefits of both techniques: a rapid and dense spinal block with the flexible dosing and extended pain relief of epidural anaesthesia [7,8].

Various studies in obstetric, orthopaedic, and abdominal surgeries have shown CSEA to be superior for surgical anaesthesia and pain relief after surgery [9-12]. However, few studies have looked directly at CSEA and EA in lower abdominal gynaecological surgeries, where muscle relaxation, blood pressure stability, and comfort after surgery are essential [13].

Rationale: Gynaecological surgeries often last a long time and involve significant pain during the procedure, requiring excellent muscle relaxation. Therefore, choosing the right anaesthetic technique is crucial[14].

Objective:

This study aims to evaluate and compare CSEA and EA in gynaecological surgeries regarding:

1. Total dose of local anaesthetic used.
2. Onset and duration of sensory and motor blockage.
3. Blood pressure changes.
4. Muscle relaxation and quality of pain relief.
5. Adverse effects and complications.

Materials and Methods

Study Design and Setting: We conducted a prospective, randomised clinical study in the Department of Anaesthesiology at Assam Medical College and Hospital in Dibrugarh from 2017 to 2019, after receiving ethics committee approval and written consent from participants.

Sample Size: A total of 100 patients undergoing elective lower abdominal gynaecological surgeries were included and equally divided into two groups:

- **Group CSEA (n = 50):** Received combined spinal-epidural anaesthesia.
- **Group EA (n = 50):** Received epidural anaesthesia alone.

Inclusion Criteria: Female patients aged 20 to 60 years, ASA physical status I and II, and scheduled for elective gynaecological surgery (e.g., abdominal hysterectomy, ovarian surgery, pelvic mass removal).

Exclusion Criteria: Patient refusal, contraindications to regional anaesthesia (infection at the injection site, bleeding disorders, increased intracranial pressure, severe spinal deformities), known allergies to local anaesthetics, or serious cardiopulmonary or neurological disorders.

Randomisation and Blinding: Patients were randomly assigned using computer-generated random numbers. The anaesthesiologist performing the block was not blinded, but those assessing outcomes were unaware of the group allocation.

Anaesthetic Technique

Group CSEA: The epidural space was located at L3-L4 using a Tuohy needle. A 25G spinal needle was inserted through the Tuohy needle into the subarachnoid space, and 2 ml of 0.5% hyperbaric bupivacaine was given intrathecally [15]. An epidural catheter was placed for additional top-ups.

Group EA: The epidural space was found at L3-L4 with a Tuohy needle. 15 ml of 0.5% bupivacaine was given in increments [16]. The epidural catheter was left in place for supplementation.

All patients received oxygen through nasal cannula and IV fluids.

Monitoring and Data Collection: We recorded baseline heart rate, blood pressure, respiratory rate, and oxygen saturation. Blood pressure was monitored at baseline, every 2 minutes for the first 10 minutes, and every 5 minutes during surgery[17]. Sensory block was measured using the pinprick test, while motor block was assessed using the Bromage scale (0-3). Pain relief was evaluated using a visual analogue scale (VAS).

Outcome Parameters: We looked at the onset and duration of sensory/motor block, total drug use, changes in blood pressure, and adverse effects (low blood pressure, slow heart rate, nausea, vomiting, post-dural puncture headache, shivering).

Statistical Analysis: Data were expressed as mean ± SD. We used Student's t-test for continuous variables and the Chi-square test for categorical variables. A p-value less than 0.05 was considered statistically significant.

Results

Demographic Data: Both groups were comparable with respect to age, weight, height, ASA grade, and type of surgery ($p > 0.05$).

Table 1: Demographic Profile of Patients (no citations needed)

Parameter	Group CSEA (n=40)	Group EA (n=40)	p-value
Age (years) (Mean ± SD)	40.83 ± 7.49	41.30 ± 8.57	0.7925
Weight (kg) (Mean ± SD)	55.50 ± 8.33	56.43 ± 6.29	0.430
Height (cm) (Mean ± SD)	157.80 ± 3.35	158.05 ± 6.38	0.827
ASA I: II (%)	65 : 35	67.5 : 32.5	NS
Duration of Surgery (min) (Mean ± SD)	70.38 ± 10.96	72.95 ± 13.68	0.356

Onset and Duration of Block: Sensory block onset was significantly faster in the CSEA group compared to the EA group ($p < 0.001$), consistent with findings by Rawal et al. [18] and Guedj et al. [19]. Duration of block was also longer in CSEA, similar to Holmström et al. [20] and Norris et al. [21].

Table 2: Onset and Duration of Block

Parameter	Group CSEA (Mean ± SD)	Group EA (Mean ± SD)	p-value
Onset of Sensory Analgesia (min)	8.05 ± 1.99	19.53 ± 3.05	<0.001
Duration of Sensory Analgesia (min)	87.25 ± 9.87	112.95 ± 15.73	<0.001
Total Bupivacaine Dose (mg)	45.70 ± 10.99	112.49 ± 10.05	<0.001

Haemodynamic Parameters: Both groups maintained stable haemodynamics throughout the procedure[22]. Transient hypotension occurred more frequently in the CSEA group, aligning with Bromage[23] and Coates[24]. Bradycardia was rare (2% in each group).

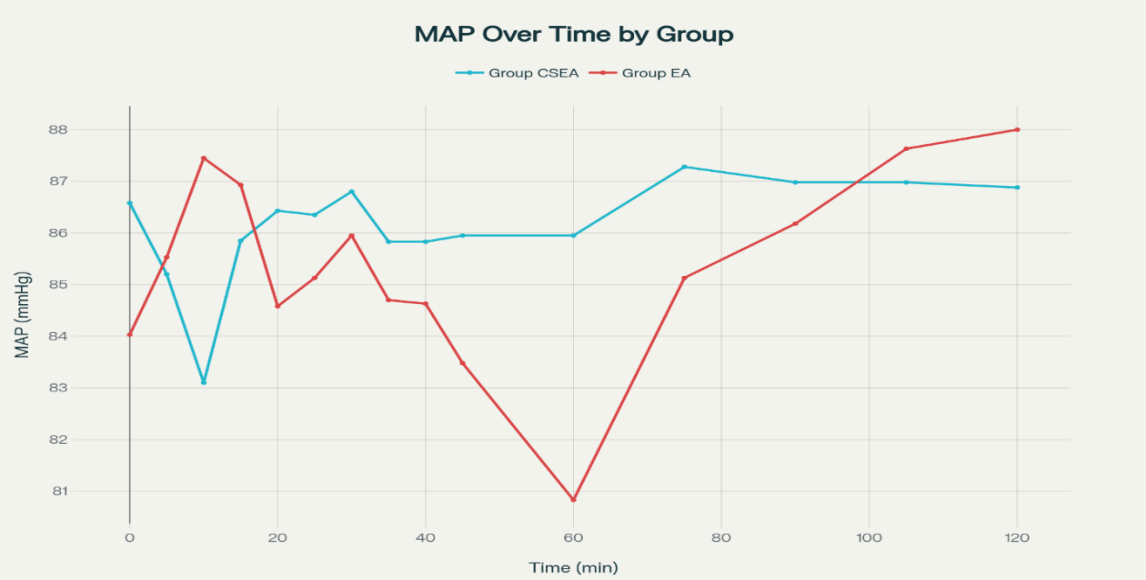

Figure 1: Mean Arterial Pressure over Time

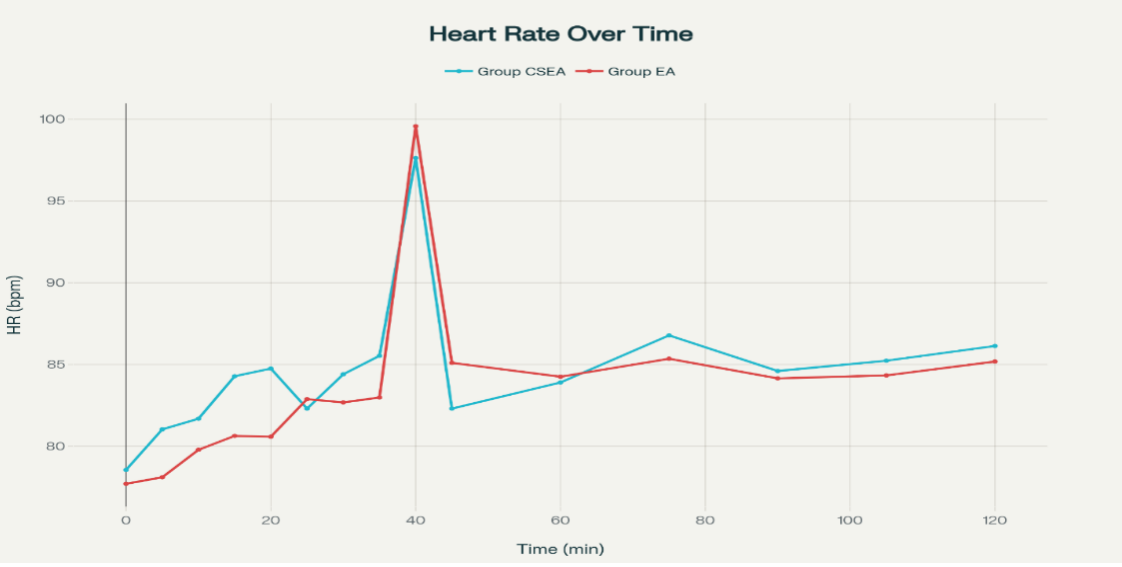

Figure 2: Heart Rate Changes

Quality of Analgesia and Muscle Relaxation: CSEA showed better motor block and lower VAS scores, comparable to McMorland et al. [25] and Lyons et al. [26].

Table 3: Quality of Analgesia (VAS scores)

Quality of Analgesia	Group CSEA (n=40)	Group EA (n=40)	p-value
Excellent	38 (95.0%)	33 (82.5%)	0.0769
Good	2 (5.0%)	7 (17.5%)	—
Fair	0 (0.0%)	0 (0.0%)	—
Poor	0 (0.0%)	0 (0.0%)	—
Total	40 (100%)	40 (100%)	—

Drug Requirement: Mean dose of bupivacaine required intraoperatively was significantly lower in the CSEA group, consistent with the synergistic spinal–epidural effect [27].

Table 4: Drug Consumption in Both Groups

Parameter	Group CSEA (Mean ± SD)	Group EA (Mean ± SD)	p-value
Total Bupivacaine Consumption (mg)	45.70 ± 10.99	112.49 ± 10.05	<0.001

Adverse Events: Incidence of nausea, vomiting, shivering, and PDPH were minimal and comparable [28]. No neurological or infectious complications were observed.

Discussion

This comparative study shows that CSEA has clear benefits over EA for lower abdominal gynaecological surgeries. CSEA led to a quicker onset of both sensory and motor block because of direct intrathecal deposition [29]. These findings are backed by Rawal et al. [18], Guedj et al. [19], Holmström et al. [20], and Norris et al. [21] CSEA also provided longer and more consistent pain relief due to its combined spinal and epidural methods [30]. This combination allows for a rapid onset and a longer duration with fewer additional doses [31]. The changes in blood pressure were minor, supporting the work of Bromage [23] and Coates [24]. The CSEA group needed smaller doses, which lowers the risk of systemic toxicity, as noted by Mc Morland et al. [25] and Lyons et al. [26] Both methods were safe and had few complications [32]. There were no observed neurological issues, and the incidence of PDPH was low.

Clinical Implications: For gynaecological surgeries that require dense relaxation and extended pain relief, CSEA is the better option [33]. EA is still helpful when gradual dose adjustment and blood pressure control are essential.

Limitations: This is a single-centre study with a small sample size. The anaesthesiologist was not blinded, and we did not assess postoperative pain relief beyond 6 hours.

Future Directions: Larger multicentre trials and studies on additions like fentanyl or clonidine in CSEA are needed [34].

Conclusion

CSEA offers a quicker onset, better muscle relaxation, longer pain relief, and a lower need for medication compared to EA, with no significant rise in complications [35]. It can be recommended as an effective and safe neuraxial technique for lower abdominal gynaecological surgeries.

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