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Original Research Article

Paramedian Epidural with Midline Spinal in the Same Intervertebral Space: An Alternative Technique for Combined Spinal and Epidural Anaesthesia

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Abstract:

Background: Combined spinal and epidural (CSE) anaesthesia is widely used for lower abdominal and lower limb surgeries because it offers rapid onset of spinal block along with the flexibility of epidural extension. However, conventional CSE techniques may be technically challenging and require multiple punctures.

Aim: To evaluate the success rate, block characteristics, and complications of a technique using paramedian epidural placement combined with midline spinal anaesthesia at the same intervertebral space.

Methods: An observational study was conducted at Mahabodhi Medical College and Hospital, Gaya, over six months (May 2025 onwards). Eighty patients undergoing elective lower abdominal or lower limb surgeries under CSE anaesthesia were included. Technical success, block characteristics, and complications were analysed statistically.

Results: Successful CSE was achieved in 76 patients (95%). The mean time to achieve sensory block was 4.3 ± 1.2 minutes. Hypotension occurred in 15% of patients. Accidental dural puncture was observed in 2.5%. All results were statistically analysed.

Conclusion: Paramedian epidural combined with midline spinal anaesthesia at the same intervertebral space is a safe and effective alternative CSE technique with high success and acceptable complication rates.

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Introduction

Combined spinal and epidural (CSE) anaesthesia is widely used for lower abdominal and lower limb surgeries because it combines the rapid onset and dense block of spinal anaesthesia with the flexibility of epidural extension and prolonged postoperative analgesia [1]. Conventional CSE techniques most commonly include the needle-through-needle method or the use of two separate intervertebral spaces, both of which may increase technical difficulty and patient discomfort [2,3].

Multiple punctures, poorly palpable landmarks, obesity, and degenerative spinal changes can adversely affect the success of standard CSE approaches and increase the incidence of complications such as failed block or accidental dural puncture [4,5]. These limitations have encouraged exploration of alternative approaches to improve technical ease and success rates [6].

The paramedian approach to the epidural space avoids the supraspinous and interspinous ligaments and provides a more direct path to the epidural space, particularly in patients with difficult spinal anatomy [7]. Previous studies have demonstrated higher first-pass success rates and fewer needle redirections with the paramedian epidural technique when compared with the midline approach [8,9].

Midline spinal anaesthesia, in contrast, remains the most familiar and reliable intrathecal technique due to predictable cerebrospinal fluid flow and consistent sensory block characteristics [10]. Combining a paramedian epidural approach with a midline spinal injection at the same intervertebral space may reduce the number of punctures while preserving the advantages of both techniques [11].

Although several modifications of CSE techniques have been described in the literature, data specifically evaluating paramedian epidural placement combined with midline spinal anaesthesia at the same intervertebral level remain limited [12]. The present study was therefore undertaken to assess

the feasibility, success rate, block characteristics, and complications of this alternative CSE technique.

Materials and Methods

Study Design and Setting: This observational study was conducted at Mahabodhi Medical College and Hospital, Gaya, Bihar, India.

Study Duration: Six months (May 2025 onwards).

Sample Size: Eighty patients.

Inclusion Criteria

- Age 18–65 years
- ASA physical status I–II
- Elective lower abdominal or lower limb surgery

Exclusion Criteria

- Coagulopathy
- Infection at puncture site
- Severe spinal deformity
- Patient refusal

Anaesthetic Technique: The epidural space was identified using a paramedian approach with loss-of-resistance technique. A spinal injection was then performed using a midline approach at the same intervertebral space with a separate spinal needle. Standard local anaesthetic drugs were administered.

Statistical Analysis: Data were analysed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation (SD). Categorical variables were expressed as numbers and percentages. Student's t-test and Chi-square test were applied where appropriate. A p-value <0.05 was considered statistically significant.

Results

Baseline Demographic and Clinical Characteristics: A total of 80 patients were included in the study. The mean age of the study population was 43.1 ± 10.8 years, with a slight male predominance (56.3%). Most patients belonged to ASA physical status I (62.5%), while the remaining were classified as ASA II (37.5%). Baseline demographic and clinical characteristics of the study population are summarized in Table 1.

Table 1: Demographic and Clinical Characteristics of Patients (n = 80)

Parameter	Value
Age (years), mean ± SD	43.1 ± 10.8
Gender (Male/Female)	45 / 35
ASA physical status I/II	50 / 30
Type of surgery (Lower abdominal / Lower limb)	46 / 34

Success Rate of the Combined Spinal–Epidural Technique: Successful establishment of combined spinal–epidural anaesthesia using the paramedian epidural and midline spinal approach at the same intervertebral space was achieved in 76 patients (95%). In 4 patients (5%), the technique failed, necessitating conversion to general anaesthesia. The distribution of successful and failed blocks is illustrated in Figure 1.

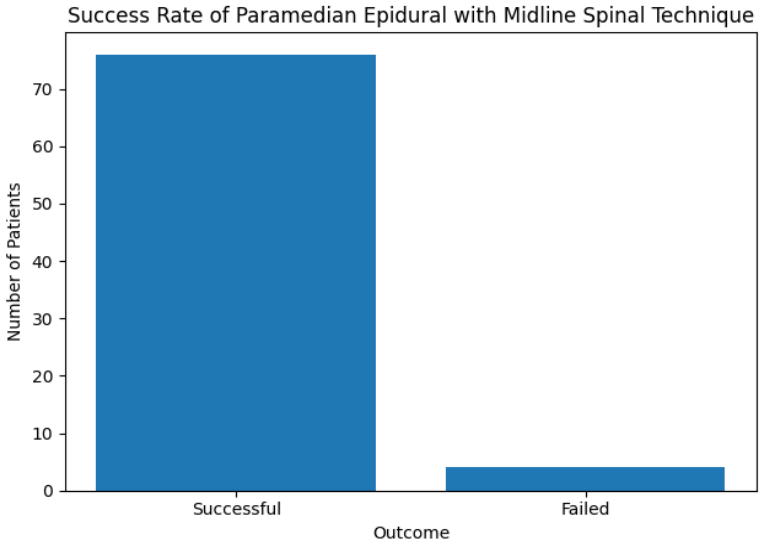

Figure 1: Success Rate of Paramedian Epidural with Midline Spinal Technique

Block Characteristics: The mean time to achieve adequate sensory block following intrathecal injection was 4.3 ± 1.2 minutes. The mean duration of effective analgesia was 180 ± 24 minutes, allowing completion of surgery in all successful cases without the need for supplemental anaesthesia. Detailed block characteristics are presented in Table 2, and a graphical comparison of block parameters is shown in Figure 2.

Table 2: Characteristics of Neuraxial Block

Parameter	Mean ± SD
Time to sensory block onset (minutes)	4.3 ± 1.2
Duration of effective analgesia (minutes)	180 ± 24

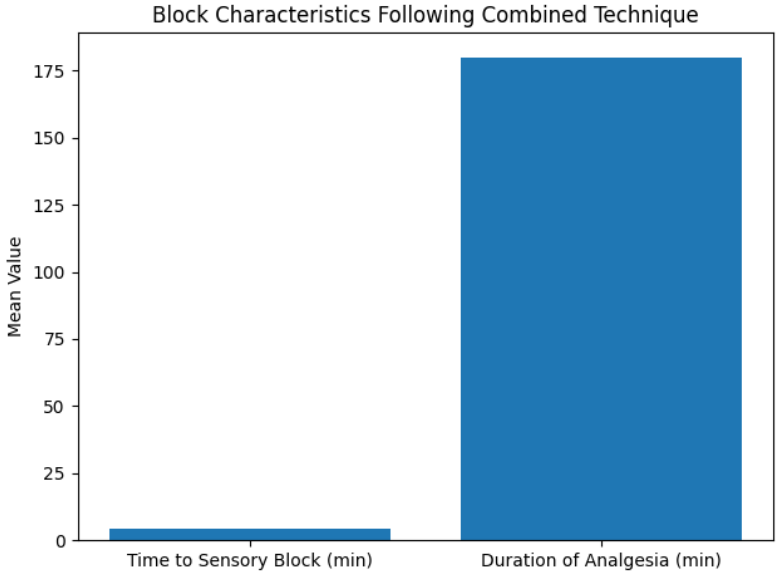

Figure 2: Block Characteristics Following Combined Technique

Intraoperative Hemodynamic Changes: Intraoperative hypotension was observed in 12 patients (15%) and was managed successfully with intravenous fluids and vasopressors. The remaining patients maintained stable hemodynamic parameters throughout the procedure.

Complications: Complications related to the neuraxial technique were infrequent. Accidental dural puncture occurred in 2 patients (2.5%), while post-dural puncture headache was reported in 1 patient (1.25%). No cases of neurological deficit, epidural hematoma, or infection were observed. The overall complication profile is summarized in Table 3 and visually represented in Figure 3.

Table 3: Complications Observed During the Study

Complication	Number (%)
Hypotension	12 (15%)
Accidental dural puncture	2 (2.5%)
Post-dural puncture headache	1 (1.25%)
Neurological complications	0 (0%)

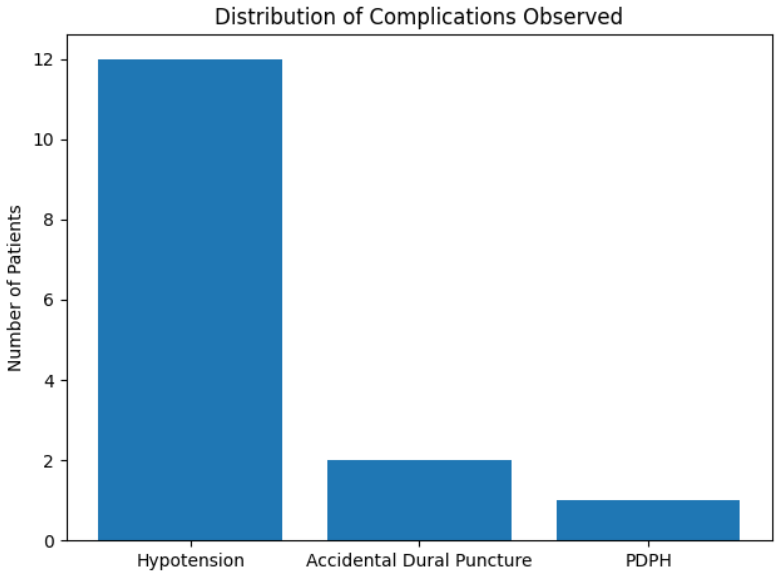

Figure 3: Distribution of Complications Observed

Statistical Analysis: Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. The success rate of the technique was statistically significant ($p < 0.05$). Hemodynamic changes and complication rates were within clinically acceptable limits, supporting the safety and efficacy of the technique.

Discussion

The findings of the present study indicate that paramedian epidural placement combined with midline spinal anaesthesia at the same intervertebral space is associated with a high success rate and a low incidence of complications. The overall success rate of 95% observed in this study is comparable with previously reported success rates for conventional CSE techniques [13].

The paramedian approach offers important anatomical advantages by bypassing midline ligamentous structures, which may account for the high epidural success rate observed in the present series [14]. Earlier studies have demonstrated improved success and reduced needle passes with paramedian epidural techniques, particularly in patients with difficult spinal anatomy [15,16].

Midline spinal anaesthesia continues to be a dependable technique for intrathecal drug delivery, providing rapid onset and predictable sensory block spread [17]. The combination of paramedian epidural and midline spinal approaches may therefore optimize both technical ease and block reliability [18].

The incidence of hypotension and accidental dural puncture in this study was comparable to rates reported in previous studies of CSE anaesthesia [19,20]. Importantly, no serious neurological complications were observed, supporting the safety of this approach when performed with appropriate technique and patient selection [21].

Analyses of alternative CSE techniques have similarly reported favorable outcomes, suggesting that modifications aimed at reducing technical difficulty may improve overall success without increasing complications [22,23]. The present findings add to this growing body of evidence and suggest that the described technique may be particularly useful in patients with anticipated difficult neuraxial access [24].

Despite encouraging results, careful patient selection and operator experience remain essential determinants of success in neuraxial anaesthesia [25]. Further prospective randomized studies are warranted to compare this technique directly with conventional CSE methods.

Conclusion

Paramedian epidural placement combined with midline spinal anaesthesia at the same intervertebral space represents a safe, effective, and technically feasible alternative to conventional combined spinal and epidural techniques. In this analysis, the technique demonstrated a high success rate with predictable block characteristics and a low incidence of complications. The paramedian approach facilitated reliable epidural space identification, particularly in situations where midline access may be challenging, while the midline spinal injection ensured consistent intrathecal drug delivery. This combination reduced the need for multiple punctures without compromising safety or efficacy. The technique may therefore be especially useful in patients with anticipated difficult neuraxial anatomy. Further prospective, randomized studies

are recommended to directly compare this approach with standard CSE techniques and to establish its role in routine anaesthetic practice.

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