ORIGINAL RESEARCH PAPER

Anaesthesiology

COMPARATIVE EVALUATION OF COMBINED SPINAL EPIDURAL ANESTHESIA AND GENERAL ANESTHESIA IN OPEN APPENDECTOMY: AN OBSERVATIONAL STUDY

KEY WORDS: Open appendectomy, combined spinal epidural anesthesia, general anesthesia, postoperative pain, hemodynamic stability, postoperative nausea and vomiting.

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ABSTRACT

Open appendectomy is one of the most frequently performed emergency surgical procedures, traditionally carried out under general anesthesia. However, the increasing use of regional anesthetic techniques, particularly Combined Spinal Epidural Anesthesia (CSEA), has created interest in comparing its effectiveness with that of general anesthesia (GA). This observational study aimed to compare the intraoperative hemodynamic stability, postoperative pain control, and incidence of postoperative nausea and vomiting (PONV) between CSEA and GA in open appendectomy. Fifty patients aged 20–40 years, classified as American Society of Anesthesiologists (ASA) grade I or II, were randomly allocated into two groups: Group A (n=25) received CSEA, while Group B (n=25) received GA. Vital parameters including systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate, and oxygen saturation were monitored throughout the intraoperative period. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at 1, 2, 3, and 4 hours after surgery, and PONV incidence was recorded. Results showed that CSEA provided better intraoperative hemodynamic stability, with significantly more stable blood pressure and heart rate values compared to GA. Postoperative pain scores were considerably lower in the CSEA group at all assessment intervals, indicating superior analgesia. Furthermore, patients in the CSEA group experienced a reduced incidence of postoperative nausea and vomiting, contributing to improved patient comfort and faster recovery. The study concludes that CSEA is a safe and effective alternative to GA for open appendectomy, offering distinct advantages including enhanced hemodynamic stability, superior postoperative pain control, reduced incidence of PONV, and potentially shorter hospital stays. These findings support the use of CSEA as a preferred anesthetic technique in suitable patients undergoing open appendectomy.

INTRODUCTION:

Appendectomy remains one of the most commonly performed emergency surgical procedures worldwide, primarily indicated for acute appendicitis. Despite the increasing use of laparoscopic techniques, open appendectomy continues to be widely practiced, especially in developing countries and in cases of complicated appendicitis or peritonitis where laparoscopic intervention may not be feasible. The choice of anesthesia plays a critical role in determining perioperative outcomes, including intraoperative stability, postoperative pain management, and recovery.

Traditionally, general anesthesia (GA) has been the standard technique for open appendectomy due to its ability to provide adequate airway protection, profound muscle relaxation, and optimal surgical conditions. GA, however, is associated with certain drawbacks, including hemodynamic fluctuations, postoperative nausea and vomiting (PONV), delayed return of bowel function, and prolonged recovery time. Additionally, GA requires airway manipulation, which may pose risks in patients with respiratory comorbidities or difficult airway anatomy.

On the other hand, Combined Spinal Epidural Anesthesia (CSEA) has emerged as a versatile regional anesthesia technique that combines the rapid onset and dense block of spinal anesthesia with the ability to prolong anesthesia and provide postoperative analgesia through an epidural catheter. CSEA has been successfully used in various lower abdominal and lower limb surgeries. Its advantages include better hemodynamic stability, reduced intraoperative stress response, superior postoperative pain control, early ambulation, reduced opioid requirements, and lower incidence of PONV. By avoiding airway instrumentation, CSEA also minimizes the risk of airway-related complications.

Several studies have demonstrated that CSEA can provide surgical conditions comparable to GA for procedures such as appendectomy, hernia repair, and cesarean section, especially when performed by experienced anesthesiologists. However, its use requires technical expertise and understanding of both spinal and epidural anesthesia.

The present study was designed to compare the efficacy and safety of CSEA versus GA in patients undergoing open appendectomy, focusing on intraoperative hemodynamic stability, postoperative pain (measured by VAS scores), and the incidence of PONV. By evaluating these parameters, the study aims to provide valuable insights into the potential benefits of CSEA over GA, supporting evidence-based decisions to enhance perioperative care and improve patient outcomes in open appendectomy.

LITERATURE REVIEW:

Several studies have examined the efficacy of regional anesthesia in abdominal surgeries and compared it to general anesthesia. Gabriel et al. (2020), in a prospective study on patients undergoing open appendectomy, found that spinal anesthesia was associated with better pain control, fewer postoperative complications, and shorter hospital stays compared to GA. Their study highlighted the feasibility of using regional techniques even in emergency procedures. Rajesh et al. (2012) assessed the role of CSEA in laparoscopic appendectomy in adults and concluded that CSEA with hyperbaric bupivacaine and fentanyl was safe, provided adequate anesthesia, and allowed rapid recovery.

Vandermeersch et al. (2005) discussed the global increase in the use of CSEA, particularly in orthopedic and obstetric procedures, due to its rapid onset, effective analgesia, and the ability to prolong anesthesia using the epidural catheter. They emphasized the flexibility of CSEA, making it a preferred technique in various surgical specialties. Smith et al. (2023) reviewed the role of GA in modern surgical practice, underlining its importance but also cautioning about potential complications such as airway trauma, postoperative nausea, and hemodynamic fluctuations.

Broadbent et al. (2000) examined the accuracy of identifying lumbar interspaces for neuraxial blocks, recommending lower lumbar puncture levels to reduce neurological risks. Their findings reinforce the importance of anatomical knowledge for the safe administration of CSEA. Ong and Sashidharan (2007) provided a comprehensive description of the CSEA technique, highlighting its benefits of rapid spinal block onset with the prolonged analgesic effect of an epidural catheter, thus combining the advantages of both techniques.

Additionally, comparative studies in different surgical populations have demonstrated that regional anesthesia leads to better postoperative outcomes, including reduced opioid consumption, lower incidence of nausea and vomiting, and improved patient satisfaction. These findings suggest that CSEA could be a viable alternative to GA for open appendectomy, provided patients are appropriately selected and the technique is performed by experienced anesthetists.

AIMS AND OBJECTIVES:

Aim: To compare the effects of Combined Spinal Epidural Anesthesia (CSEA) and General Anesthesia (GA) in patients undergoing open appendectomy in terms of intraoperative hemodynamic stability, postoperative pain relief, and postoperative complications.

Objectives:

1. To evaluate and compare intraoperative hemodynamic parameters (SBP, DBP, MAP, HR, and SpO_2) between patients receiving CSEA and GA.
2. To assess postoperative pain at specific intervals using the Visual Analogue Scale (VAS) in both groups.
3. To compare the incidence of postoperative nausea and vomiting (PONV) between the two groups.
4. To analyze overall postoperative recovery and identify the anesthetic technique associated with better patient outcomes.

MATERIALS AND METHODS:

This observational study was conducted on 50 patients aged 20–40 years with ASA grade I or II who were scheduled for open appendectomy. Patients were randomly divided into two groups of 25 each: Group A received Combined Spinal Epidural Anesthesia (CSEA) and Group B received General Anesthesia (GA). Ethical clearance was obtained from the institutional review board prior to commencement.

Inclusion Criteria:

- Patients aged between 20–40 years
- ASA physical status grade I or II.
- Patients scheduled for open appendectomy.

Exclusion Criteria:

- Patients below 20 years or above 40 years.
- ASA grade III and IV.
- Patients with contraindications to neuraxial anesthesia or GA.
- Patients refusing to participate.

Preoperative Assessment: All patients underwent a thorough preoperative evaluation including medical history, physical examination, airway assessment (Mallampati score, mouth opening, neck movement), and relevant investigations such as hemoglobin, renal function tests, coagulation profile, ECG, and urine analysis.

Monitoring: Intraoperative monitoring included heart rate, systolic and diastolic blood pressure, mean arterial pressure, oxygen saturation, and ECG. These parameters were recorded at baseline and at regular intervals during surgery.

Anesthetic Technique: Group A received CSEA using hyperbaric bupivacaine with placement of an epidural catheter for potential supplementation. Group B received GA with intravenous induction, muscle relaxation, endotracheal intubation, and maintenance with oxygen, nitrous oxide, and inhalational agents.

Postoperative Assessment: Pain was assessed using the Visual Analogue Scale (VAS) at 1, 2, 3, and 4 hours postoperatively. The incidence of postoperative nausea and vomiting was also recorded.

Statistical Analysis: Data were analyzed using SPSS software. Continuous variables were expressed as mean ± standard deviation. A p-value < 0.05 was considered statistically significant.

RESULTS:

A total of 50 patients aged 20–40 years with ASA grade I and II were enrolled and equally divided into two groups: Group A (CSEA) and Group B (GA).

Demographic Distribution

Age Distribution: In Group A, 52% were aged 20–30 years and 48% were aged 30–40 years. In Group B, 60% were aged 20–30 years and 40% were aged 30–40 years.

Gender Distribution: Group A consisted of 52% males and 48% females, while Group B had 44% males and 56% females.

Hemodynamic Parameters

Systolic Blood Pressure (SBP): Group A consistently showed slightly higher but more stable SBP values compared to Group B. At baseline, SBP was 120±6.32 mmHg in Group A and 115±10 mmHg in Group B (p=0.0398). The difference remained significant at 5, 10, 15, 30, and 60 minutes.

Diastolic Blood Pressure (DBP): Group A maintained higher DBP throughout, with significant differences at baseline (74.8±7.54 vs 70±8.88, p=0.0448) and most subsequent intervals.

Mean Arterial Pressure (MAP): MAP was also significantly higher in Group A at baseline (91.76±7.66 vs 86.74±9.66, p=0.0473) and remained so at all time points.

Heart Rate (HR): Group A showed lower heart rate values compared to Group B. At baseline, HR was 77.2±8.81 bpm in Group A and 84±12.36 bpm in Group B (p=0.0298). This trend persisted at 10 and 15 minutes.

Oxygen Saturation (SpO_2): SpO_2 values were comparable between both groups and were statistically non-significant at most intervals.

Postoperative Pain (VAS Scores)

VAS scores were significantly lower in Group A at all time intervals. At 1 hour, pain scores were 0.08±0.39 in Group A versus 1.36±1.74 in Group B (p=0.0001). This difference remained significant at 2, 3, and 4 hours.

Postoperative Nausea and Vomiting (PONV)

PONV incidence was lower in Group A. 88% of patients in Group A had no PONV compared to 64% in Group B. Mild PONV was seen in 12% of Group A and 24% of Group B, while 12% of Group B experienced moderate to severe PONV.

Table 1: Age Distribution

Age Group	Group A (n, %)	Group B (n, %)
20–30	13 (52%)	15 (60%)
30–40	12 (48%)	10 (40%)

Table 2: Gender Distribution

Gender	Group A (n, %)	Group B (n, %)
Male	13 (52%)	11 (44%)
Female	12 (48%)	14 (56%)

Table 3: Mean Systolic Blood Pressure (mmHg)

Time	Group A Mean±SD	Group B Mean±SD	p-value
Baseline	120±6.32	115±10	0.0398*
5 min	124.9±8.99	119±9.99	0.033*
10 min	122.6±8.49	117±11	0.0495*
15 min	121.6±9.35	115±14.52	0.0556*
30 min	121±7.74	116±10	0.0538*
60 min	120±6.32	114±12	0.0318*

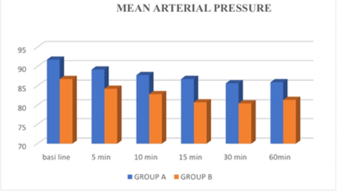
Table 4: Mean Diastolic Blood Pressure (mmHg)

Time	Group A Mean±SD	Group B Mean±SD	p-value
Baseline	74.8±7.54	70±8.88	0.0448*
5 min	75.2±6.14	69.2±12.04	0.0312*
10 min	72.6±6.11	70.4±10.76	0.3784
15 min	75.4±5.98	69.8±12.3	0.0461*
30 min	67.6±9.06	60.8±12.1	0.0291*
60 min	68.8±7.64	63.4±9.66	0.0332*

Table 5: Mean Arterial Pressure (mmHg)

Time	Group A Mean±SD	Group B Mean±SD	p-value
Baseline	91.76±7.66	86.74±9.66	0.0473*
5 min	89.2±6.84	84.24±10.15	0.0483*
10 min	87.76±6.32	82.84±9.94	0.0421*
15 min	86.76±6.86	80.72±12.59	0.0404*
30 min	85.64±7.26	80.44±10.61	0.0487*
60 min	85.92±7.77	81.36±8.31	0.0507*

Figure 1: Mean Arterial Pressure

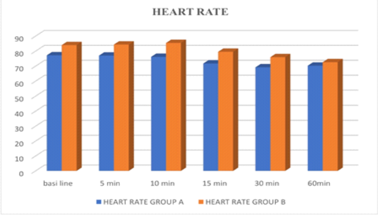


This Graph Shows the Mean Arterial Pressure between Group A and Group B. They were comparable and the results were statistically significant

Table 6: Mean Heart Rate (bpm)

Time	Group A Mean±SD	Group B Mean±SD	p-value
Baseline	77.2±8.81	84±12.36	0.0298*
5 min	77±10.86	84.36±15.27	0.0553
10 min	76.16±12.03	85.44±17.75	0.0449*
15 min	71.72±11.48	79.56±15.18	0.0449*
30 min	69.2±12.13	75.96±12.46	0.0578
60 min	70.28±13.17	72.6±9.06	0.4716

Figure 2: Mean Heart Rate

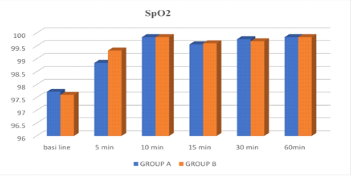


This Graph Shows the Mean Heart Rate between Group A and Group B. They were comparable and the results were statistically significant.

Table 7: Saturation (SpO2)

TIME	GROUP A		GROUP B		P	SIGNIFICANT
	MEAN	SD	MEAN	SD	VALUE	
baseline	97.72	1.07	97.6	0.93	0.674	Non significant
5 min	98.84	1.25	99.32	1.92	0.1286	Non significant
10 min	99.84	0.54	99.84	0.54	0.0036	SIGNIFICANT
15 min	99.56	1.13	99.6	0.97	0.8937	Non significant
30 min	99.76	0.64	99.68	0.92	0.7227	Non significant
60min	99.84	0.54	99.84	0.54	0.7227	Non significant

Figure 3: Saturation (Spo2)

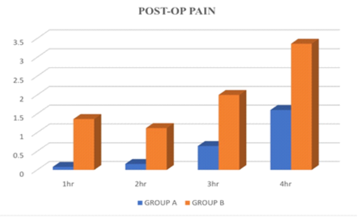


This Graph Shows the saturation (SpO2) between Group A and Group B. They were comparable and the results were statistically non-significant.

Table 8: Postoperative Pain (VAS Scores)

Time	Group A Mean±SD	Group B Mean±SD	p-value
1 hr	0.08±0.39	1.36±1.74	0.0001*
2 hr	0.16±0.54	1.12±0.99	0.0001*
3 hr	0.64±0.93	2±1.97	0.0030*
4 hr	1.6±1.38	3.36±1.93	0.0005*

Figure 4 : Postoperative Pain



This Graph Shows the post-operative pain between Group A and Group B. They were comparable and the results were statistically significant.

Table 8: Postoperative Nausea and Vomiting (PONV)

Outcome	Group A (n, %)	Group B (n, %)
No PONV	22 (88%)	16 (64%)
Mild PONV	3 (12%)	6 (24%)
Moderate/Severe PONV	0 (0%)	3 (12%)

Summary

The results show that patients in the CSEA group had more stable hemodynamics, significantly lower pain scores postoperatively, and a reduced incidence of PONV compared to those in the GA group. These findings suggest that CSEA provides better perioperative outcomes for open appendectomy.

DISCUSSION

General anesthesia (GA) is conventionally preferred for intra-abdominal surgeries because it provides airway protection, adequate muscle relaxation, and better surgical exposure, especially in complex cases. However, advances in regional anesthesia have made Combined Spinal Epidural Anesthesia (CSEA) a viable alternative for many abdominal procedures, including laparoscopic surgeries and selected cases of peritonitis. In the present study, even patients with complicated conditions were successfully operated under CSEA without any compromise in surgical exposure, patient safety, or operative outcomes.

CSEA offers several advantages over GA, such as faster recovery, early ambulation, improved oral intake, and shorter hospital stays, all of which were evident in our study with statistically significant differences. By reducing the requirement for systemic opioids, CSEA also helps in effective postoperative pain management and lowers the incidence of opioid-related side effects. Although GA may still provide better muscle relaxation for highly complex procedures, our findings indicate that for non-complex open appendectomy performed by experienced surgeons, operative time and surgical outcomes are not significantly affected by the use of CSEA.

In our study, 50 ASA grade I and II patients were randomly divided into two groups: Group A (CSEA) and Group B (GA). The analysis of intraoperative hemodynamics revealed that parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and heart rate (HR) were more stable in the CSEA group, while oxygen saturation (SpO_2) remained comparable between both groups. Postoperative pain scores and the incidence of postoperative nausea and vomiting (PONV) were also significantly lower in Group A. These findings are consistent with previous research that supports the use of regional anesthesia to achieve better perioperative outcomes, improved patient comfort, and reduced hospital stay.

Although the popularity of CSEA has grown in the last two decades, it is a technically more complex procedure requiring in-depth knowledge of spinal and epidural anesthesia techniques. The variability in its usage among anesthesiologists may reflect concerns about potential complications. Nonetheless, studies have shown that CSEA provides surgical conditions comparable to single-shot spinal anesthesia while allowing flexibility for prolonged analgesia.

CONCLUSION

This study demonstrates that Combined Spinal Epidural Anesthesia (CSEA) provides better intraoperative hemodynamic stability, improved postoperative analgesia, and a lower incidence of postoperative nausea and vomiting compared to General Anesthesia (GA) for open appendectomy. Patients in the CSEA group had faster recovery, early ambulation, and shorter hospital stays.

CSEA can be considered a safe and effective alternative to GA in appropriately selected patients undergoing open appendectomy. However, successful implementation requires technical expertise and proper patient selection. Future multicenter randomized controlled trials with larger sample sizes are recommended to further validate these findings and to establish standardized protocols for the use of CSEA in abdominal surgeries.

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