ORIGINAL ARTICLE CODEN: AAJMBG

Efficacy of epidural clonidine versus dexmedetomidine in postoperative analgesia with bupivacaine in total abdominal hysterectomy

C. Nandhini[1], S. Dhanasekar[2*], A. Niranjan Kumar[2] and Charumathi Dhanushkodi[3]

[1]Anaesthetist, Government Headquarters, Gudiyatham, Vellore, Tamil Nadu, India, [2]Department of Anaesthesiology, Government Raja Sir Ramaswamy Mudaliar (R.S.R.M) Lying-in Hospital, Cemetery Road, Chennai-600013, Tamil Nadu, India and [3]Department of Public Health Dentistry, Sree Balaji Dental College and Hospital, Velachery Main Road, Pallikaranai, Chennai-600 100, Tamil Nadu, India

Received: 17th June 2025; ***Accepted:*** 20th September 2025; ***Published:*** 01st October 2025

Abstract: *Introduction:* This study compares the efficacy of clonidine and dexmedetomidine as adjuvants to epidural bupivacaine for postoperative analgesia in patients undergoing total abdominal hysterectomy. *Methods:* Sixty female patients scheduled for elective surgery were randomly assigned to two groups. Group C received clonidine (1 mcg/kg) with 0.125% bupivacaine, and Group D received dexmedetomidine (0.5 mcg/kg) with 0.125% bupivacaine epidurally. Postoperative pain was assessed using the Visual Analogue Scale (VAS), and the need for rescue analgesia, hemodynamic parameters, sedation levels, and adverse effects were recorded. *Results:* Both groups were comparable in demographics. Group D showed significantly lower VAS scores between the 5th and 8th postoperative hours ($p<0.001$), indicating superior analgesia. Time to first rescue analgesia was longer in Group D. Hemodynamic stability was better maintained with dexmedetomidine, with fewer instances of hypotension requiring vasopressors. *Conclusion:* Dexmedetomidine as an adjuvant to epidural bupivacaine provides better postoperative an algesia and hemodynamic stability compared to clonidine. It appears to be a more effective choice for prolonged pain relief after total abdominal hysterectomy.
Keywords: Clonidine, Dexmedetomidine, Postoperative Analgesia, Total Abdominal Hysterectomy, Adjuvant Analgesia.

Introduction

Postoperative pain is a common but often poorly managed condition, with 80% of patients experiencing pain after surgery and less than half reporting adequate pain relief [1]. Poor pain control can lead to complications such as longer hospital stays, increased healthcare costs, and chronic pain. Effective pain management is essential to prevent these issues, especially in surgeries like hysterectomy, which is the second most common procedure after caesarean sections. Abdominal hysterectomies are known to cause significant pain, leading to delayed recovery, a higher risk of venous thromboembolism, and increased patient dissatisfaction [2].

Uncontrolled pain after surgery not only affects patient comfort but also contributes to serious health issues such as hypertension, respiratory problems, poor wound healing, and chronic pain syndrome. While opioids are widely used for pain management, they come with significant side effects, including respiratory depression, nausea, and addiction risk. Moreover, in resource-limited settings, the high cost and lack of accessibility make opioids a less feasible option for postoperative pain control [3]. Epidural anesthesia offers an effective alternative. Since its development in the early 20th century by pioneers like Jean-Anthanase Sicard, Fernand Cathelin, and Fidel Pagés Miravé, epidural analgesia has become a key tool in postoperative pain management. It blocks afferent nerve signals from the surgical site to the brain, reducing pain and perioperative stress. This reduction in stress decreases the risk of complications and aids recovery [2, 4].

Epidural analgesia is particularly effective compared to other pain management techniques, such as intravenous analgesics or transversus abdominis plane (TAP) blocks. It provides superior pain control and helps prevent complications by reducing the body's stress response during and after surgery. Additionally, using adjuvants like fentanyl or alpha-2 adrenergic agonists (e.g., dexmedetomidine, clonidine) in epidural anesthesia can further enhance its effectiveness and reduce the need for systemic opioids [5-6].

Beyond pain control, epidural anesthesia offers several benefits, such as improved muscle relaxation, reduced opioid use, and maintenance of consciousness with protective airway reflexes intact. These advantages make it a valuable tool in reducing postoperative complications and improving recovery outcomes [7]. Thus, this study aims to assess the efficacy of epidural clonidine versus dexmedetomidine as adjuvants to epidural bupivacaine in postoperative analgesia following hysterectomy.

Material and Methods

This prospective, randomized, double-blind study was conducted on 60 patients scheduled for elective abdominal hysterectomy at a tertiary care hospital. Approval was obtained from the Institutional Ethical Committee, and all patients provided informed consent. Abnormal uterine bleeding, Uterine fibroids, and endometriosis are the indications of a Total Abdominal Hysterectomy. Female patients aged 18 to 65 years, classified as ASA I or II, and scheduled for elective hysterectomy were included in the study. Exclusion criteria included patient refusal, bleeding disorders, allergy to local anesthetics, sepsis or inflammation at the injection site, hemodynamic instability, severe hypovolemia, and significant spinal deformities, among others.

Patients were randomly assigned to two groups of 30 each using computer-generated random numbers. Group C received 0.125% bupivacaine mixed with clonidine at 1 mcg/kg, while Group D received 0.125% bupivacaine mixed with dexmedetomidine at 0.5 mcg/kg. Both groups received a total volume of 10 ml epidurally. During the pre-anaesthetic visit, patients were informed about the study and educated on the Visual Analogue Scale (VAS) [8] for pain assessment. They were instructed to remain nil per oral for 8 hours before surgery. An anaesthesiologist, not involved in the study, prepared the drug mixtures. In the operating room, standard monitoring was conducted, including pulse oximetry, non-invasive blood pressure measurement, and electrocardiography.

After preloading intravenous fluids, the epidural space was identified at the T12-L1 level using the loss-of-resistance technique, and the catheter was placed at the T10 level. Spinal anaesthesia was administered with 4 ml of 0.5% hyperbaric bupivacaine at the L3-L4 space.

A sensory level of T6 was established and verified before surgical commencement, as evidenced by loss of fine touch sensation. Intraoperatively, upon return of sensation to the T10 dermatome, sensory assessment was conducted using cold stimulation, following which epidural infusion was initiated.

Pain was evaluated using the VAS, and sedation was assessed using the Modified Ramsay Sedation Scale [9]. Hemodynamic parameters (heart rate, blood pressure, SpO2) were monitored, and adverse effects, including bradycardia, hypotension, nausea, vomiting, and pruritus, were recorded for 8 hours postoperatively. Rescue analgesia was provided with 100 mg epidural tramadol if needed. The duration of analgesia was defined as the time between the epidural bolus and the first request for rescue analgesia.

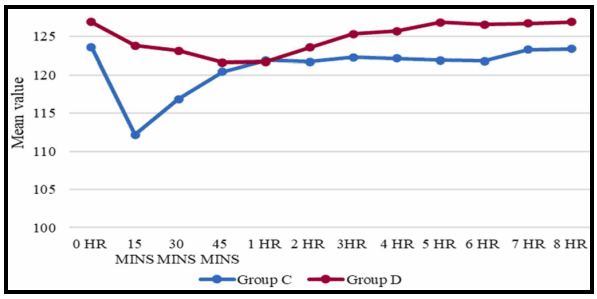
Data was collected and entered into an Excel sheet and analysed using IBM SPSS software version 26. The data was analysed for normality using the Kolmogorov-Smirnov test and Mann Whitney U test and Chi Square test was used to compare the parameters of Group C and Group D.

Results

The mean age of group C was 55.73 ± 7.39 and that of group D was 53.73±7.12 with p- p-valueas 0.290.considering the hemodynamic parameters, heart rate and diastolic blood pressure did not show any statistical difference whereas the systolic blood pressure

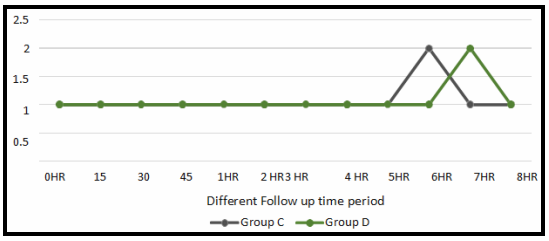
showed a significant difference at 15 minutes with mean SBP in Group D as 123.80± 11.62 mmHg whereas in Group C it was 112.20± 13.15 mmHg (Fig-1).

Fig-1: Comparison of mean systolic blood pressure between two Groups (N=60)



The VAS score showed a significant difference only at after 4th hour till the 8th hour. (p-value<0.05) (Fig-2) whereas RASS score did not show any significant difference. At 15 minutes the requirement of Vasopressor was for 4 patients (13.3%) in Group C whereas it was not needed for Group D patients which shows a statistically significant difference of 0.038.

Fig-2: Comparison of median VAS score between two Groups (N=60)



The need for rescue analgesia was for 12 patients (40%) at 5 hours in Group C whereas there is no need in Group D which showed a significant difference (<0.001). This difference was significant even at 6th hour, 7th hour and 8th hour. The occurrence of postoperative nausea and vomiting PONV among both the groups was similar and it did not show any statistically significant difference (Table -1 and 2).

Table -1: Comparison of rescue analgesia with Two groups (N=60)

Time of Occurrence	Rescue analgesia	Group C	Group D	Total	p-value
5 Hour	No	18(60%)	30(100%)	48(80%)	<0.001*
	Yes	12(40%)	0(0%)	12(20%)	
6 Hour	No	12(40%)	30(100%)	42(70%)	<0.001*
	Yes	18(60%)	0(0%)	18(30%)	
7 Hour	No	30(100%)	13(43.3%)	43(71.7%)	<0.001*
	Yes	0(0%)	17(56.7%)	17(28.3%)	
8 Hour	No	30(100%)	18(60%)	48(80%)	<0.001*
	Yes	0(0%)	12(40%)	12(20%)	

*Statistically significant

Table-2: Comparison of PONV with Two groups (N=60)

Time of Occurrence	PONV	Group C	Group D	Total	p-value
30 mins	No	30(100%)	29(96.7%)	59(98.3%)	0.313
	Yes	0(0%)	1(3.3%)	1(1.7%)	
45 mins	No	30(100%)	28(93.3%)	58(96.7%)	0.150
	Yes	0(0%)	2(6.7%)	2(3.3%)	
2 hours	No	30(100%)	29(96.7%)	59(98.3%)	0.313
	Yes	0(0%)	1(3.3%)	1(1.7%)	

Discussion

The study aimed to compare the postoperative analgesic efficacy of epidural clonidine versus dexmedetomidine as adjuvants to 0.125% bupivacaine in patients undergoing total abdominal hysterectomy. Specifically, the study focused on assessing postoperative pain using the Visual Analogue Scale (VAS), the timing and need for rescue analgesia, hemodynamic changes, and the incidence of side effects such as hypotension, bradycardia, nausea, and vomiting. The demographic characteristics of the two study groups, such as age and American Society of Anesthesiologists (ASA) physical status, were similar and not statistically significant. This similarity in baseline demographics ensured that the study's outcomes could be attributed to the effects of clonidine and dexmedetomidine rather than patient variability.

The systolic blood pressure (SBP) measurements taken during the postoperative period showed no statistically significant differences between the two groups at most time points. However, at the 15-minute mark, there was a statistically significant difference between the groups, with a noticeable drop in SBP in the clonidine group. This transient hypotension may be attributed to clonidine's known sympatholytic properties, which lead to reduced vasomotor tone and lower blood pressure. Similarly, the diastolic blood pressure (DBP) readings postoperatively showed no significant differences between the two groups, indicating that both agents maintained stable hemodynamic profiles for most of the observation period.

One of the critical findings of the study was the need for rescue analgesia. While the need for rescue analgesia was similar between the groups during the first four hours postoperatively, a significant difference emerged from the fifth hour onward. Patients in the dexmedetomidine group required rescue analgesia significantly later than those in the clonidine group, indicating that dexmedetomidine provided longer-lasting postoperative pain relief. The VAS scores also reflected this trend, with lower pain scores in the dexmedetomidine group from the fifth hour onward. This finding suggests that dexmedetomidine offers superior analgesia compared to clonidine in the later stages of postoperative recovery. This is similar to that of Das et al. study where fentanyl was used as a adjuvant and dexmedetomidine prolonged sensory/motor blocks with delayed need for analgesics [10].

The requirement for vasopressor support, which was monitored to assess hemodynamic stability, showed no significant differences between the groups except at the 15-minute mark, where the clonidine group required more vasopressor intervention. This aligns with clonidine's hypotensive effect, which can necessitate vasopressor use to maintain adequate blood pressure, particularly in the immediate postoperative period. In contrast, dexmedetomidine demonstrated better hemodynamic stability, as evidenced by the lower need for vasopressors.

Sedation, another important factor in postoperative recovery, was assessed using the Ramsay Sedation Scale. Both groups exhibited similar sedation scores throughout the observation period, indicating that clonidine and dexmedetomidine provided comparable levels of sedation. This suggests that both agents are suitable for patients requiring sedation during the postoperative period without causing excessive drowsiness. This is similar to that of Naithani et al. (2015) study conducted on 40 female patients to assess the dose-dependent effects of intrathecal dexmedetomidine with isobaric bupivacaine during spinal anesthesia for hysterectomy. Both the doses (3µg and 5 µg) had similar block characteristics and postoperative analgesia, but 5 µg caused hypotension and sedation [11].

In terms of adverse effects, the incidence of postoperative nausea and vomiting (PONV) was monitored, and no significant differences were noted between the two groups. This indicates that both clonidine and dexmedetomidine, when administered epidurally with bupivacaine, did not significantly increase the risk of PONV. The overall safety profile of both drugs was acceptable, with no reports of severe side effects such as respiratory depression or excessive sedation.

The study's findings are consistent with existing literature. Rao et al. (2018) found that adding 7.5 µg clonidine to hyperbaric bupivacaine increased analgesia duration without significant hemodynamic impact [12]. Arunkumar et al. in 2015[13] observed that dexmedetomidine and clonidine were effective adjuvants to ropivacaine for epidural anesthesia whereas in the present study 0.5 µg/kg of dexmedetomidine epidurally provided effective analgesia with stable hemodynamics, outperforming clonidine.

When considering the two agents' relative merits, dexmedetomidine appears to offer a more favorable profile for postoperative pain management after hysterectomy. It provides longer-lasting analgesia, reduces the need for additional pain medications, and maintains hemodynamic stability with minimal side effects [14-15]. Clonidine, although effective, may be associated with more significant hypotension, requiring closer hemodynamic monitoring and vasopressor support.

Conclusion

The study demonstrates that dexmedetomidine when used as an adjuvant to epidural bupivacaine, offers superior postoperative pain relief compared to clonidine. Its longer duration of action, better hemodynamic stability, and lower requirement for rescue analgesia make it a preferable option for managing postoperative pain in patients undergoing total abdominal hysterectomy. However, both agents were generally well-tolerated, and the choice between them may depend on individual patient factors, such as baseline blood pressure and the risk of hemodynamic instability. Further research with larger sample sizes may be warranted to confirm these findings and explore their implications in other surgical populations.

Financial Support and sponsorship: Nil

Conflicts of interest: There are no conflicts of interest.

References

1. Imani F, Rahimzadeh P. Gabapentinoids: gabapentin and pregabalin for postoperative pain management. *Anesth Pain Med.* 2012; 2(2):52-53.
2. Gan TJ. Poorly controlled postoperative pain: prevalence, consequences, and prevention. *J Pain Res.* 2017; 10:2287-2298.
3. Apfelbaum JL, Chen C, Mehta SS, Gan TJ. Postoperative pain experience: results from a national survey suggest postoperative pain continues to be undermanaged. *Anesth Analg.* 2003; 97(2):534-540.
4. Khanduri KC. Regional anaesthesia techniques for orthopaedic surgery. *Med J Armed Forces India.* 2008; 64(2):108-110.
5. Barash P, Cullen BF, Stoelting RK, Cahalan M, Stock MC, Ortega R. Handbook of clinical anesthesia. *Lippincott Williams & Wilkins.* 2013; 634-640.
6. Davies NJH, Cashman JN. Lee's synopsis of anaesthesia [Internet]. *Elsevier Health Sciences.* 2005; 342-348.
7. Chen Y, Zhang YH, Bie BH, Zhao ZQ. Sympathectomy induces novel purinergic sensitivity in sciatic afferents. *Acta Pharmacol Sin.* 2000; 21(11):1002-1004.
8. Langley GB, Sheppeard H. The visual analogue scale: its use in pain measurement. *Rheumatol Int.* 1985; 5(4):145-148.
9. Dawson R, Fintel NV, Nairn S. Sedation assessment using the Ramsay scale: Rachel Dawson and colleagues review the reliability of tools for assessing sedation and how these differ from methods of measuring consciousness. *Emerg Nurse.* 2010; 18(3):18-20.
10. Karmakar M, Das A, Pal S, Rudra J. Comparison of the dexmedetomidine and clonidine as an adjuvant to bupivacaine on duration of analgesia, motor and sensory blockade and the intraoperative hemodynamic profile of patients. *Int. J. Life Sci. Biotechnol. Pharma. Res.* 2023; 12(2):773-780.
11. Naithani U, Meena MS, Gupta S, Meena K, Swain L, Pradeep DS. Dose-dependent effect of intrathecal dexmedetomidine on isobaric ropivacaine in spinal anesthesia for abdominal hysterectomy: Effect on block characteristics and hemodynamics. *J Anaesthesiol Clin Pharmacol.* 2015; 31(1):72-79.
12. Rao A. A Comparative Clinical Study between Intrathecal Hyperbaric Bupivacaine 0.5% with Fentanyl and Hyperbaric Bupivacaine 0.5% with Nalbuphine in Trans Abdominal Hysterectomy Surgeries [Internet] [PhD Thesis]. *Rajiv Gandhi University of Health Sciences (India).* 2018.
13. Arunkumar S, Kumar VH, Krishnaveni N, Ravishankar M, Jaya V, Aruloli M. Comparison of dexmedetomidine and clonidine as an adjuvant to ropivacaine for epidural anesthesia in lower abdominal and lower limb surgeries. *Saudi J Anaesth.* 2015; 9(4):404-408.
14. Sun S, Wang J, Bao N, Chen Y, Wang J. Comparison of dexmedetomidine and fentanyl as local anesthetic adjuvants in spinal anesthesia: a systematic review and meta-analysis of randomized controlled trials. *Drug Des Devel Ther.* 2017; 11:3413-3424.
15. Kroin JS, Buvanendran A, Beck DR, Topic JE, Watts DE, Tuman KJ. Clonidine prolongation of lidocaine analgesia after sciatic nerve block in rats

is mediated via the hyperpolarization-activated cation current, not by α-adrenoreceptors. *J Am Soc Anesthesiol.* 2004; 101(2):488-494.

Cite this article as: Nandhini C, Dhanasekar S, Niranjan Kumar A and Dhanushkodi C. Efficacy of epidural clonidine versus dexmedetomidine in postoperative analgesia with bupivacaine in total abdominal hysterectomy. *Al Ameen J Med Sci* 2025; 18(4):301-306.

*All correspondences to: Dr. S. Dhanasekar, Assistant Professor, Department of Anaesthesiology, Government Raja Sir Ramaswamy Mudaliar (R.S.R.M) Lying-in Hospital, Cemetery Road, Chennai-600013, Tamil Nadu, India. Email: dr.dhanasekar89@gmail.com