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Comparative Study of Epidural Clonidine versus Tramadol as Adjuvants to Bupivacaine for Postoperative Analgesia.

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ABSTRACT

Background: Epidural anesthesia with adjuvants enhances postoperative analgesia and reduces systemic analgesic requirements. Among commonly used agents, clonidine and tramadol have shown promising results when combined with bupivacaine.

Aim: To compare the efficacy of clonidine and tramadol as adjuvants to epidural bupivacaine in terms of onset, duration of sensory and motor blockade, hemodynamic stability, and postoperative analgesia.

Methods: A prospective, randomized, single-blind study was conducted on 134 patients (ASA I–II) undergoing lower abdominal and lower limb surgeries. Patients were divided into two groups:

- **Group A:** Bupivacaine + Tramadol
- **Group B:** Bupivacaine + Clonidine

Primary outcomes included onset and duration of block, VAS score, and rescue analgesia requirement.

Results: Faster onset of sensory block in clonidine group ($p<0.001$). Longer duration of analgesia in tramadol group ($p<0.001$). Lower VAS scores initially in clonidine group. Reduced rescue analgesic requirement in tramadol group. Hemodynamic stability better with clonidine

Conclusion: Clonidine provides faster onset and better hemodynamic stability, whereas tramadol offers prolonged postoperative analgesia and reduced analgesic requirement.

KEYWORDS: Epidural Analgesia, Clonidine, Tramadol, Bupivacaine, Postoperative Pain, Adjuvants, Pain Management, Regional Anesthesia, Analgesic Efficacy, Duration of Analgesia, Hemodynamic Stability, Side Effects

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INTRODUCTION

Effective postoperative pain control is crucial to reduce stress response and improve surgical outcomes. Epidural anesthesia using local anesthetics such as bupivacaine is widely practiced. However, addition of adjuvants enhances analgesic efficacy and prolongs duration of action.

Clonidine, an α2-adrenergic agonist, provides analgesia via central and peripheral mechanisms, whereas tramadol acts as a weak μ-opioid agonist with monoaminergic activity. Both drugs are commonly used epidural adjuvants.

This study evaluates and compares these two agents as adjuvants to bupivacaine.

AIMS AND OBJECTIVES

1. To evaluate efficacy of clonidine as epidural adjuvant
2. To evaluate efficacy of tramadol as epidural adjuvant
3. To compare hemodynamic parameters
4. To assess postoperative analgesia and side effects

MATERIALS AND METHODS

- **Study Design:** Prospective, randomized, single-blind
- **Sample Size:** 134 patients
- **Study Groups:**
  - Group A: Bupivacaine + Tramadol (2 mg/kg)
  - Group B: Bupivacaine + Clonidine (2 µg/kg)

Inclusion Criteria

- Age 18–60 years
- ASA I–II
- Elective lower abdominal/lower limb surgeries

Exclusion Criteria

- Cardiac disease, renal/hepatic dysfunction
- Coagulopathy
- Infection at injection site

Assessment Parameters

- Sensory block (pinprick)
- Motor block (Bromage scale)
- Pain (VAS score)
- Hemodynamics (HR, MAP, SpO_2)

OBSERVATIONS AND RESULTS

Table 1: Study Group Distribution

Group	Drug Combination	n (%)
Group A	Bupivacaine + Tramadol	67 (50%)
Group B	Bupivacaine + Clonidine	67 (50%)

Table 2: Demographic Characteristics (Summary)

Parameter	Group A	Group B	p-value
Age (years)	40.5 ± 10.6	38.6 ± 12.7	>0.05
Weight (kg)	55.3 ± 5.1	55.1 ± 5.5	>0.05
Gender (M/F)	51/16	49/18	>0.05

1. Sensory Block

Parameter	Group A	Group B	p-value
Onset (min)	12.12	10.92	<0.001
Duration (min)	164.35	160.53	<0.001

Faster onset with clonidine. Longer duration with tramadol

2. Motor Block

No significant difference (p>0.05)

3. Hemodynamic Parameters

- Pulse rate & MAP significantly lower in clonidine group after 45 min
- Indicates better stability

4. VAS Score

Time	Group A	Group B	Significance
Immediate	Higher	Lower	Significant
24 hrs	Lower	Higher	Significant

Clonidine better early. Tramadol better long-term.

5. Rescue Analgesia

Parameter	Group A	Group B	p-value
Time to first dose (min)	241	218	<0.001
Total doses	1.45	2.53	<0.001

Tramadol significantly reduces analgesic requirement

DISCUSSION

The present study demonstrates that both clonidine and tramadol are effective adjuvants to epidural bupivacaine, but they differ in their pharmacodynamic profiles.

Clonidine significantly reduced onset time of sensory block due to its action on α2 receptors in dorsal horn neurons, enhancing local anesthetic action. Similar findings were reported by Amitha et al. (2019) and Pandit et al. (2021), who observed improved hemodynamic stability and faster onset with clonidine [1,2].

Tramadol, on the other hand, prolonged postoperative analgesia due to its dual mechanism involving opioid receptor activation and inhibition of monoamine reuptake. Studies by Sutariya et al. (2016) and Mahdi et al. (2020) also demonstrated superior duration of analgesia with tramadol [3,4].

The hemodynamic stability observed with clonidine aligns with its sympatholytic action, reducing heart rate and blood pressure without causing respiratory depression [5].

VAS scores in the early postoperative period were lower with clonidine, suggesting better immediate analgesia, whereas tramadol provided sustained analgesia up to 24 hours, reducing rescue analgesic requirement significantly.

Thus, findings are consistent with existing literature, supporting the complementary roles of both drugs.

CONCLUSION

- Clonidine provides:
  - Faster onset
  - Better hemodynamic stability
  - Improved early analgesia

- Tramadol provides:
  - Longer duration of analgesia
  - Reduced analgesic requirement

Tramadol is superior for prolonged postoperative pain relief, while clonidine is preferable for rapid onset and stability.

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