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Original Research

Comparison of analgesic efficacy of epidural bupivacaine- fentanyl and bupivacaine- clonidine in pelvic surgeries

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ABSTRACT:

Background: The present study was conducted for assessing the analgesic efficacy evaluation of epidural bupivacaine-fentanyl and bupivacaine- clonidine in pelvic surgeries. **Materials & methods:**A cohort of 100 normotensive adult patients classified as American Society of Anesthesiologists (ASA) physical status I and II, within the age range of 45–60 years, and scheduled to undergo elective pelvic surgical procedures were prospectively recruited for the study. Participants were randomly allocated into two intervention arms using a computer-based randomization sequence. Patients in Group A received intrathecal administration of 0.5% hyperbaric bupivacaine combined with clonidine, whereas those in Group B were administered an identical concentration and volume of hyperbaric bupivacaine supplemented with fentanyl.All subjects underwent a comprehensive preanesthetic evaluation, encompassing general physical assessment, detailed systemic examination, airway evaluation, and focused spinal assessment, in addition to baseline laboratory investigations. Postoperative sedation levels were systematically quantified using the Ramsay Sedation Scale, while postoperative analgesic efficacy was serially assessed employing the Visual Analogue Scale over a 24-hour observation period. All collected data were systematically documented and subjected to statistical analysis using SPSS software. **Results:**Group A achieved sensory and motor blockade earlier and maintained a significantly prolonged block duration compared with Group B ($p = 0.000$). Additionally, Group A exhibited enhanced postoperative analgesia, reflected by lower VAS scores during the early and intermediate postoperative periods, with no significant differences observed during the late postoperative phase. **Conclusion:**Clonidine demonstrated superior efficacy as an adjuvant in improving neuraxial block quality and augmenting analgesic effectiveness.

Key words: Epidural, Bupivacaine, Fentanyl, Clonidine

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INTRODUCTION

Caudal analgesia represents the most widely utilized regional anesthetic technique in pediatric surgical practice, owing to its technical simplicity, high success rate, and reliable postoperative pain control. Traditionally, opioids administered either alone or in combination with local anesthetic agents have been shown to enhance the quality and duration of caudal analgesia in children. However, the use of neuraxial opioids is frequently accompanied by undesirable adverse effects, including postoperative nausea and vomiting, pruritus, urinary retention, and, more critically, the risk of dose-dependent respiratory depression, which may be potentially life-threatening in the pediatric population.[2- 5]

Clonidine, a selective alpha-2 adrenergic receptor agonist, has emerged as an effective analgesic adjuvant for the management of both acute and chronic pain states. When administered via neuraxial routes, clonidine produces analgesia through inhibition of nociceptive transmission at the spinal level, although the magnitude and duration of analgesic effect have been reported to vary across studies. Importantly, clonidine has been demonstrated to significantly potentiate postoperative analgesia when combined with local anesthetic agents or opioids, particularly when delivered through extradural or intrathecal pathways.[3- 6]A major advantage of clonidine over opioids is the absence of opioid-related adverse effects such as respiratory depression, pruritus, and urinary retention. Nevertheless, clonidine is not entirely devoid of side effects; its pharmacodynamic profile is associated with central sedation and dose-dependent hemodynamic alterations, including hypotension and bradycardia. Despite these effects, clonidine continues

to be regarded as a valuable alternative neuraxial adjuvant in pediatric caudal analgesia, offering effective pain control with a more favorable safety profile when judiciously administered.[5- 7]Hence; the present study was conducted for assessing the analgesic efficacy evaluation of epidural bupivacaine-fentanyl and bupivacaine- clonidine in pelvic surgeries.

MATERIALS & METHODS

A cohort of 100 normotensive adult patients classified as American Society of Anesthesiologists (ASA) physical status I and II, within the age range of 45–60 years, and scheduled to undergo elective pelvic surgical procedures were prospectively recruited for the study. Participants were randomly allocated into two intervention arms using a computer-based randomization sequence. Patients in Group A received intrathecal administration of 0.5% hyperbaric bupivacaine combined with clonidine, whereas those in Group B were administered an identical concentration and volume of hyperbaric bupivacaine supplemented with fentanyl.

All subjects underwent a comprehensive preanesthetic evaluation, encompassing general physical assessment, detailed systemic examination, airway evaluation, and focused spinal assessment, in addition to baseline laboratory investigations. Postoperative sedation levels were systematically quantified using the Ramsay Sedation Scale, while postoperative analgesic efficacy was serially assessed employing the Visual Analogue Scale over a 24-hour observation period. Perioperative and postoperative adverse effects, including nausea, emesis, arterial hypotension, sinus bradycardia, and post-anesthetic shivering, were meticulously monitored and managed according to standard anesthetic protocols. Hypotension was corrected with intravenous fluid boluses or mephentermine administration, bradycardia was treated with atropine, and nausea or vomiting was managed using ondansetron. All collected data were systematically documented and subjected to statistical analysis using SPSS software.

RESULTS

The time to achieve peak sensory block was shorter in Group A (5.45 minutes) compared with Group B (7.29 minutes), and this difference was highly significant (p = 0.000). Similarly, the onset of motor block occurred earlier in Group A, with a mean onset time of 6.94 minutes, whereas Group B required 8.44 minutes to develop motor blockade. This difference was also statistically significant (p = 0.000), indicating a faster onset of neuraxial blockade in Group A.The mean duration of sensory block was significantly longer in Group A (202.8 minutes) compared with Group B (153.8 minutes), with a p-value of 0.000. Likewise, the duration of motor block was prolonged in Group A, averaging 249.5 minutes, in contrast to 189.4 minutes in Group B. This difference was also statistically significant (p = 0.000), suggesting that Group A provided a more sustained neuraxial block than Group B.At 1 hour postoperatively, pain scores were lower in Group A than Group B; however, the difference was not statistically significant (p = 0.12). From 2 to 6 hours postoperatively, Group A consistently demonstrated significantly lower VAS scores compared with Group B (p = 0.00), indicating superior analgesic efficacy during the early postoperative period. At 8 hours, the difference in VAS scores between the two groups was not statistically significant (p = 0.44). At 10 and 12 hours, Group A again showed significantly lower pain scores compared with Group B (p = 0.00). At later time points, 18 and 24 hours, the VAS scores were comparable between the two groups, with no statistically significant differences observed (p = 0.28 and p = 0.12, respectively). Overall, these findings suggest that Group A provided more effective postoperative analgesia, particularly during the early and intermediate postoperative periods.

Table 1: Comparison of onset of sensory block and onset of motor block

Parameter	Group A	Group B	p-value
Onset to peak sensory block (min)	5.45	7.29	0.000*
Onset to motor block	6.94	8.44	0.000*

*Significant

Table 2: Comparison of duration of block

Parameter	Group A	Group B	p-value
Duration of sensory block (min)	202.8	153.8	0.000*
Duration of motor block (min)	249.5	189.4	0.000*

*Significant

Table 3: Comparison of VAS

VAS at (time)	Group A	Group B	p-value
1 hr	0.3	0.8	0.12
2 hr	0.8	2.9	0.00*
3 hr	0.6	4.5	0.00*
4 hr	0.8	3.7	0.00*

6 hr	3.1	4.9	0.00*
8 hr	3.6	3.3	0.44
10 hr	2.3	4.8	0.00*
12 hr	2.2	4.9	0.00*
18 hr	4.5	4.8	0.28
24 hr	3.8	3.7	0.12

*Significant

DISCUSSION

In the present study, the time to achieve peak sensory block was shorter in Group A (5.45 minutes) compared with Group B (7.29 minutes), and this difference was highly significant (p = 0.000). Similarly, the onset of motor block occurred earlier in Group A, with a mean onset time of 6.94 minutes, whereas Group B required 8.44 minutes to develop motor blockade. This difference was also statistically significant (p = 0.000), indicating a faster onset of neuraxial blockade in Group A.The mean duration of sensory block was significantly longer in Group A (202.8 minutes) compared with Group B (153.8 minutes), with a p-value of 0.000. Likewise, the duration of motor block was prolonged in Group A, averaging 249.5 minutes, in contrast to 189.4 minutes in Group B. This difference was also statistically significant (p = 0.000), suggesting that Group A provided a more sustained neuraxial block than Group B.At 1 hour postoperatively, pain scores were lower in Group A than Group B; however, the difference was not statistically significant (p = 0.12). Krishnamoorthy K et al conducted a prospective evaluation to assess the effectiveness of epidural clonidine as an adjuvant for enhancing intraoperative and postoperative analgesia, while also analyzing its sedative profile and associated adverse effects. The study included forty patients classified as ASA physical status I and II who were scheduled for elective lower limb orthopedic procedures. Participants were allocated into two groups: the study group received epidural clonidine at a dose of 50 µg diluted to 1 mL, administered with the initial epidural dose, whereas the control group received 1 mL of normal saline along with the first epidural injection. Intraoperative and postoperative hemodynamic parameters were monitored, and analgesic efficacy was assessed using the verbal rating scale (VRS), along with sedation scoring and documentation of postoperative rescue analgesic requirements. Rescue analgesia was administered when the VRS score reached 1. The findings demonstrated that the addition of clonidine to epidural bupivacaine significantly enhanced analgesic quality, as evidenced by lower pain scores, prolongation of the time to first rescue analgesic requirement, and a reduction in total postoperative analgesic consumption, without producing clinically significant hemodynamic disturbances. Furthermore, the sedative effect of clonidine was considered advantageous during the intraoperative period. The authors concluded that epidural clonidine provides prolonged, high-quality analgesia accompanied by an acceptable level of sedation and minimal adverse effects, supporting its utility as an effective neuraxial adjuvant.[10]

In the present study, from 2 to 6 hours postoperatively, Group A consistently demonstrated significantly lower VAS scores compared with Group B (p = 0.00), indicating superior analgesic efficacy during the early postoperative period. At 8 hours, the difference in VAS scores between the two groups was not statistically significant (p = 0.44). At 10 and 12 hours, Group A again showed significantly lower pain scores compared with Group B (p = 0.00). At later time points, 18 and 24 hours, the VAS scores were comparable between the two groups, with no statistically significant differences observed (p = 0.28 and p = 0.12, respectively). Overall, these findings suggest that Group A provided more effective postoperative analgesia, particularly during the early and intermediate postoperative periods.Chopra P et al. performed a prospective, randomized, double-blind clinical investigation to determine whether the addition of a low dose of clonidine (30 µg) to an intrathecal bupivacaine–fentanyl combination enhances spinal anesthetic and analgesic efficacy without increasing adverse effects, in comparison with bupivacaine–fentanyl or bupivacaine–clonidine regimens. The study enrolled 75 patients classified as ASA physical status I–II, aged 45–65 years, scheduled for vaginal hysterectomy with pelvic floor repair or non-descent vaginal hysterectomy under subarachnoid block. Participants were allocated into three groups: Group BF received hyperbaric bupivacaine with fentanyl 15 µg, Group BC received hyperbaric bupivacaine with clonidine 30 µg, and Group BCF received hyperbaric bupivacaine combined with both fentanyl 15 µg and clonidine 30 µg, with the total intrathecal volume standardized to 2.8 mL across all groups. The investigators assessed the duration of sensory and motor blockade, duration of effective analgesia, time to two-segment regression, perioperative hemodynamic parameters, postoperative pain scores, and supplemental analgesic requirements. The results demonstrated that the duration of effective analgesia, sensory and motor block, and time to two-segment regression were significantly prolonged in the combined bupivacaine–fentanyl–clonidine group compared with the bupivacaine–clonidine group ($p \approx 0.002$), and were also significantly longer in the bupivacaine–clonidine group compared with the bupivacaine–fentanyl group ($p \approx 0.01$). Additionally, the incidence of intraoperative pain and the requirement for postoperative rescue analgesics within

the first 24 hours were significantly higher in the bupivacaine–fentanyl group than in the other groups ($p \approx 0.01$), while hemodynamic stability was comparable among all groups. The authors concluded that intrathecal administration of low-dose clonidine (30 μg) as an adjunct to a bupivacaine–fentanyl mixture significantly enhances the duration and quality of spinal anesthesia and postoperative analgesia in gynecological surgeries without compromising hemodynamic safety.[11]

CONCLUSION

Clonidine demonstrated superior efficacy as an adjuvant in improving neuraxial block quality and augmenting analgesic effectiveness.

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