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Original Research Article

ANALGESIC EFFICACY EVALUATION OF EPIDURAL BUPIVACAINE- FENTANYL AND BUPIVACAINE-CLONIDINE IN PELVIC SURGERIES: AN INSTITUTIONAL BASED STUDY

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ABSTRACT

Background: Pelvic surgery refers to a highly complex operative procedure involving the pelvic region, undertaken for both benign and malignant pathologies. The addition of opioids such as fentanyl lowers the dose of local anesthetic required and also provides superior analgesia by its action on a separate pain pathway, namely, μ-opioid receptors. Hence; the present study was conducted for analgesic efficacy evaluation of epidural bupivacaine-fentanyl and bupivacaine- clonidine in pelvic surgeries. **Materials and Methods:** A total of 100 ASA grade I and II normotensive patients, aged 45–65 years and scheduled for pelvic surgeries, were enrolled and randomized into two groups using computer-generated numbers. Group 1 received intrathecal 0.5% hyperbaric bupivacaine with clonidine, while Group 2 received the same dose of bupivacaine with fentanyl. Pre-anesthetic assessment included general, systemic, airway, and spinal examination along with baseline investigations. Postoperatively, sedation was assessed using the Ramsay Sedation Scale and analgesia was evaluated with the Visual Analogue Scale up to 24 hours. Side effects including nausea, vomiting, hypotension, bradycardia, and shivering were closely observed and treated appropriately—hypotension with fluids or mephentermine, bradycardia with atropine, and nausea/vomiting with ondansetron. All the results were recorded and analysed using SPSS software. **Result:** Group 1 showed a faster onset and longer duration of sensory and motor block, with significantly prolonged postoperative analgesia compared to Group 2. VAS scores were consistently lower in Group 1 during early postoperative hours, while complications were comparable between both groups. **Conclusion:** Clonidine proved to be a more effective adjuvant for enhancing block characteristics and pain relief.

INTRODUCTION

Pelvic surgery refers to a highly complex operative procedure involving the pelvic region, undertaken for both benign and malignant pathologies. It requires precise surgical expertise and close collaboration of a multidisciplinary team to ensure optimal safety, functional preservation, and favourable patient outcomes.[1]

Epidural anesthesia is a neuraxial technique in which anesthetic agents are delivered into the epidural space, producing sensory and motor blockade across thoracic, abdominal, pelvic, and lower limb regions. It is widely applied for surgical anesthesia, chronic pain, and spasticity control, with the added advantage of flexible drug selection and administration methods—either intermittent boluses or continuous infusion—allowing individualized patient management.[2,3] The addition of opioids such as fentanyl lowers the dose of local anesthetic required and also provides superior analgesia by its action on a separate pain pathway, namely, μ-opioid receptors.[3]

Clonidine hydrochloride, an imidazole compound with alpha-2 adrenergic agonist properties, is frequently employed as an adjuvant to local anesthetics in peripheral nerve blocks and central neuraxial blockade. After local anesthetics and opioids, it is among the most extensively investigated agents for neuraxial analgesia, with its principal antinociceptive effect attributed to spinal

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mechanisms, despite systemic administration also offering some degree of analgesia.[4]

Fentanyl is a synthetic opioid and a potent μ-receptor agonist, possessing nearly 100 times the analgesic strength of morphine. It is primarily administered intravenously but is also widely used via epidural and intrathecal routes for both acute postoperative and chronic pain control. Beyond enhancing intraoperative analgesia, fentanyl significantly decreases the requirement for additional sedative agents.[5] Hence; the present study was conducted for analgesic efficacy evaluation of epidural bupivacaine- fentanyl and bupivacaine- clonidine in pelvic surgeries.

MATERIALS AND METHODS

A total of 100 ASA grade I and II normotensive patients, aged 45–65 years and scheduled for pelvic surgeries, were enrolled and randomized into two groups using computer-generated numbers. Patients with ASA grade III/IV, significant systemic illness, contraindications to spinal anesthesia, or morbid obesity were excluded. Group 1 received intrathecal 0.5% hyperbaric bupivacaine with clonidine, while Group 2 received the same dose of bupivacaine with fentanyl.

Pre-anesthetic assessment included general, systemic, airway, and spinal examination along with baseline investigations. Standard intraoperative monitoring was ensured, preloading with Ringer lactate was given, and premedication with ondansetron and ranitidine was administered before performing spinal anesthesia under aseptic precautions. Intraoperatively, vital parameters, sensory blockade (via pinprick), and motor block (via Bromage scale) were monitored at defined intervals for two hours. Postoperatively, sedation was assessed using the Ramsay Sedation Scale and analgesia was evaluated with the Visual Analogue Scale up to 24 hours. Side effects including nausea, vomiting, hypotension, bradycardia, and shivering were closely observed and treated appropriately—hypotension with fluids or mephentermine, bradycardia with atropine, and nausea/vomiting with ondansetron. All the results were recorded and analysed using SPSS software. Chi-square test and student t test were used for evaluation of level of significance.

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

Parameter	Group 1	Group 2	p-value
Onset to peak sensory block (min)	5.98	7.31	0.000*
Onset to motor block	7.12	8.68	0.000*

Table 2: Comparison of duration of block

Parameter	Group 1	Group 2	p-value
Duration of sensory block (min)	196.2	161.7	0.003*
Duration of motor block (min)	238.1	171.9	0.002*

*Significant

Table 3: Comparison of duration of analgesia

Group	Duration of Analgesia (min)	p-value
Group 1	478.3	0.000*
Group 2	284.9	

*: Significant

Table 4: Comparison of VAS

VAS at (time)	Group 1	Group 2	p-value
1 hr	0.2	0.7	0.28
2 hr	0.9	2.8	0.00*
3 hr	0.5	5.8	0.00*
4 hr	0.9	0.9	0.77
6 hr	2.8	5.8	0.00*
8 hr	3.1	3.4	0.59
10 hr	1.8	5.8	0.00*
12 hr	2.9	5.7	0.00*
18 hr	5.4	5.8	0.18
24 hr	3.2	3.9	0.89

*Significant

RESULTS

Mean age of the patients of group 1 and group 2 was 42.8 years and 44.1 years respectively. Group 1 demonstrated a significantly faster onset to peak sensory block (5.98 min vs. 7.31 min, p = 0.000) as well as a quicker onset to motor block (7.12 min vs. 8.68 min, p = 0.000) compared to Group 2, indicating superior efficacy in achieving both sensory and motor blockade. Group 1 exhibited a markedly longer duration of both sensory block (196.2 min vs. 161.7 min, p = 0.003) and motor block (238.1 min vs. 171.9 min, p = 0.002) in comparison to Group 2. This highlights the prolonged effectiveness of Group 1 in maintaining both sensory and motor blockade. The duration of analgesia was significantly extended in Group 1 (478.3 min) compared to Group 2 (284.9 min), with a highly significant p value (0.000). This

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confirms that patients in Group 1 experienced longer-lasting postoperative pain relief. Group 1 consistently recorded lower VAS scores at 2 hr, 3 hr, 6 hr, 10 hr, and 12 hr ($p < 0.05$), indicating superior analgesic effect during these periods. At other time points (1 hr, 4 hr, 8 hr, 18 hr, and 24 hr), the differences were not statistically significant. This suggests that while both groups eventually reached comparable pain levels at later stages, Group 1 provided better analgesia in the crucial early postoperative hours. Non-significant results were obtained while comparing the complications among the two study groups.

DISCUSSION

Reduction of postoperative pain, particularly through specific analgesic protocols, can significantly lower perioperative morbidity and mortality. Acute pain is associated with serious, potentially life-threatening complications. The use of epidural anesthesia with local anesthetics not only blunts adverse physiological stress responses to surgery but also ensures superior pain control. To further enhance analgesic efficacy and limit adverse effects, several adjuvant agents—such as opioids, epinephrine, clonidine, ketamine, neostigmine, adenosine, midazolam, magnesium, verapamil, and ketorolac—have been investigated in combination with local anesthetics in the epidural space.[6-9] Hence; the present study was conducted for analgesic efficacy evaluation of epidural bupivacaine- fentanyl and bupivacaine- clonidine in pelvic surgeries.

In the present study, the mean age was comparable between Group 1 (42.8 years) and Group 2 (44.1 years). Group 1 showed a significantly faster onset of both sensory and motor block compared to Group 2. The duration of sensory and motor blockade, as well as overall analgesia, was markedly prolonged in Group 1, confirming superior efficacy. VAS scores were consistently lower in Group 1 at 2, 3, 6, 10, and 12 hours, reflecting better early postoperative pain control. At later time intervals, pain scores and complication rates were similar between the two groups. Khandarkar GL et al compared the quality of anesthesia using low-dose bupivacaine with either clonidine or fentanyl as intrathecal adjuvants. A total of 80 ASA grade I and II patients scheduled for vaginal hysterectomy were randomized into two groups. Group BC (n = 40) received 0.5% hyperbaric bupivacaine 2.8 ml (14 mg) with 25 mcg clonidine, while Group BF (n = 40) received the same dose of bupivacaine with 30 mcg fentanyl. Parameters assessed included onset and peak time of sensory and motor block, regression to L1, perioperative stability, postoperative analgesic requirement, and adverse effects. The mean onset to peak sensory (5.45 ± 0.50 min) and motor block (7.05 ± 0.22 min) were significantly faster in Group BC compared to Group BF (6.90 ± 0.38 min and 8.67 ± 0.47 min, respectively). The duration of sensory block (189.80 ± 6.49 min) and motor block (247.28 ± 8.42 min) was also longer in Group BC than in Group BF (150.23 ± 4.23 min and 197.08 ± 6.25 min, respectively). Postoperative analgesia lasted significantly longer with clonidine (495.93 ± 22.43 min) than with fentanyl (269.33 ± 17.98 min). VAS scores favored clonidine at most time intervals, except at the 4th and 18th hours where differences were not significant. Both groups remained hemodynamically stable, with no major variation in postoperative sedation or adverse effects. Both clonidine and fentanyl are effective intrathecal adjuvants to bupivacaine, enhancing block characteristics and prolonging postoperative analgesia.9 Sveticic G et al applied a method to optimize the combination of bupivacaine, fentanyl, and clonidine for continuous postoperative lumbar epidural analgesia. The authors analyzed 12 combinations with an allowed bupivacaine concentration range of 0-2.5 mg/ml, a fentanyl concentration range of 0-5 microg/ml, and a clonidine concentration range of 0-5 microg/ml. The best combinations of bupivacaine, fentanyl, and clonidine concentrations were 1.0 mg/ml-1.4 microg/ml-0.5 microg/ml, 0.9 mg/ml-3.0 microg/ml-0.3 microg/ml, 0.6 mg/ml-2.5 microg/ml-0.8 microg/ml, and 1.0 mg/ml-2.4 microg/ml-1.0 microg/ml, respectively, all producing a similarly low pain score. The incidence of side effects was low. The application of the regression model to combinations associated with high incidence of motor block successfully directed the optimization procedure to combinations within the therapeutic range.[10]

CONCLUSION

Bupivacaine with clonidine provided a faster onset, longer duration of sensory and motor block, and prolonged postoperative analgesia compared to bupivacaine with fentanyl. Overall, clonidine proved to be a more effective adjuvant for enhancing block characteristics and pain relief.

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