Section: Anaesthesiology

Original Research Article

EVALUATION OF DEXMEDETOMIDINE AND NALBUPHINE AS ADJUNCTS TO ROPIVACAINE FOR POST-OPERATIVE PAIN IN LAPAROSCOPIC CHOLECYSTECTOMY PATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Laparoscopic cholecystectomy represents a minimally invasive surgical approach for the excision of a pathological gallbladder. Dexmedetomidine is commonly used in anesthesia practice as well. Nalbuphine belongs to mixed agonist-antagonist class of opioids (κ-agonist and μ-antagonist) with better features such as prolonged duration of analgesia while avoiding the side effects. Hence, the present study was conducted for assessing and comparing the efficacy of intraperitoneal administration of dexmedetomidine and nalbuphine as adjuncts to ropivacaine for post-operative pain relief in patient undergoing laparoscopic cholecystectomy.

Materials and Methods: Present study was conducted in Department of Anaesthesiology, Maharshi Vishwamitra Autonomous State Medical College, Ghazipur, Uttar Pradesh, India. A total of 45 patients who were scheduled to undergo elective laparoscopic cholecystectomy under general anesthesia were enrolled. The participants were randomly divided into three groups, each consisting of 10 individuals. In Group 1, patients were administered a 50 ml solution containing 49 ml of 0.25% ropivacaine combined with 1 mcg/kg of dexmedetomidine. Group 2 received a 50 ml solution comprising 49 ml of 0.25% ropivacaine along with 5 mg of nalbuphine, while Group 3 was given a 50 ml solution that included 0.25% ropivacaine and 10 mg of nalbuphine. Postoperative pain was evaluated using the Visual Analog Scale (VAS). All data were analyzed using SPSS software. Chi-square test and ANOVA test were used for evaluation of level of significance.

Results: Mean age of the patients of group 1, group 2 and group 3 was 43.2 years, 40.9 years and 41.7 years respectively. Mean BMI among patients of group 1, group 2 and group 3 was 23.7 Kg/m2, 24.1 Kg/m2, and 23.9 Kg/m2 respectively. Group 2 was associated with maximum pain as assessed by VAS. Comparing the VAS among three study groups at 2 hours and 4 hours, significant results were obtained.

Conclusion: The administration of 0.25% ropivacaine combined with dexmedetomidine at a dosage of 1 mcg/kg in comparison to nalbuphine yielded the most favorable outcomes in patients.

Keywords: Laparoscopic Cholecystectomy, Dexmedetomidine, Nalbuphine.

INTRODUCTION

Laparoscopic cholecystectomy represents a minimally invasive surgical approach for the excision of a pathological gallbladder. Since the early 1990s, this method has largely supplanted the traditional open surgical technique for routine cholecystectomies.[1] Currently, laparoscopic cholecystectomy is recommended for various conditions, including acute and chronic cholecystitis, symptomatic cholelithiasis, biliary dyskinesia, acalculous cholecystitis, gallstone-induced pancreatitis, and gallbladder masses or polyps.[2] These clinical indications align with those for open cholecystectomy; however, cases involving gallbladder cancer are typically more effectively managed through open cholecystectomy.[3]

Ropivacaine is FDA-approved for surgical anesthesia and acute pain management. It is used in an epidural block for surgery. It is also used in major nerve blocks and local infiltration. In acute pain management, ropivacaine is used in epidurals (continuous infusion or intermittent bolus) for postoperative pain control. Ropivacaine is a long-acting amide local anesthetic. It exhibits a similar mechanism of action to other local anesthetics in that it reversibly inhibits sodium ion influx in nerve fibers.[4]

Dexmedetomidine is commonly used in anesthesia practice as well. It is used for procedural sedation for a variety of operations. It is also used frequently for sedation during the performance of awake intubation. It is ideally suited for this indication for the reasons stated above. Dexmedetomidine is also an adjunct infusion during general anesthesia. There is evidence that dexmedetomidine decreases postoperative pain, postoperative opioid usage, and nausea.[5]

Nalbuphine belongs to mixed agonist-antagonist class of opioids (κ-agonist and μ-antagonist) with better features such as prolonged duration of analgesia while avoiding the side effects of fentanyl such as pruritus, nausea, and vomiting.6 Hence; the present study was conducted for assessing and comparing the efficacy of intraperitoneal administration of dexmedetomidine and nalbuphine as adjuncts to ropivacaine for post-operative pain relief in patient undergoing laparoscopic cholecystectomy.

MATERIALS AND METHODS

Present study was conducted in Department of Anaesthesiology, Maharshi Vishwamitra Autonomous State Medical College, Ghazipur, Uttar Pradesh, India. A total of 45 patients, regardless of gender, aged between 20 and 60 years and classified as ASA grade I and II, were recruited for this study, all of whom were scheduled to undergo elective laparoscopic cholecystectomy under general anesthesia. The participants were randomly divided into three groups, each consisting of 10 individuals. In Group 1, patients administered a 50 ml solution containing 49 ml of 0.25% ropivacaine combined with 1 mcg/kg of dexmedetomidine. Group 2 received a 50 ml solution comprising 49 ml of 0.25% ropivacaine along with 5 mg of nalbuphine, while Group 3 was given a 50 ml solution that included 0.25% ropivacaine and 10 mg of nalbuphine. Standard multiparameter monitors were applied to record baseline parameters, including heart rate, non-invasive systolic and diastolic blood pressure, mean arterial pressure, oxygen saturation, and electrocardiogram (ECG) readings. Postoperative pain was evaluated using the Visual Analog Scale (VAS), which features a 10 cm scale indicating pain intensity from 0 cm (no pain) to 10 cm (worst imaginable pain). If the VAS score exceeded 3, postoperative pain was managed with an intravenous injection of 50 mg tramadol. All data were analyzed using SPSS software. Chi-square test and ANOVA test were used for evaluation of level of significance.

RESULTS

Mean age of the patients of group 1, group 2 and group 3 was 43.2 years, 40.9 years and 41.7 years respectively. Mean BMI among patients of group 1, group 2 and group 3 was 23.7 Kg/m2, 24.1 Kg/m2, and 23.9 Kg/m2 respectively. Group 2 was associated with maximum pain as assessed by VAS. Comparing the VAS among three study groups at 2 hours and 4 hours, significant results were obtained.

Table 1: Demographic data

Variable	Group 1	Group 2	Group 3
Mean age (years)	43.2	40.9	41.7
Males	9	10	10
Females	6	5	5
Mean BMI (Kg/m^2)	23.7	24.1	23.9

Table 2: Comparison of VAS

Time interval	Group 1	Group 2	Group 3	p-value
0 hours	1.1	1.3	1.2	0.13
1 hour	1.3	1.2	1.3	0.25
2 hours	1.5	2.1	1.6	0.00*
4 hours	1.4	2.5	1.8	0.00*
6 hours	1.9	2.1	2.0	0.19
24 hours	1.8	2.2	2.0	0.55

***: Significant**

DISCUSSION

Gallbladder disorders rank among the most prevalent health issues globally, leading to significant annual costs associated with emergency medical visits. In the realm of clinical practice, laparoscopic cholecystectomy (LC) is recognized as the standard treatment for symptomatic gallbladder conditions. This minimally invasive approach offers several advantages over traditional open cholecystectomy, including reduced incidence of wound-related complications, expedited wound healing, diminished postoperative pain, shorter hospital stays, and lower rates of morbidity and mortality. Nevertheless, LC is not without its risks, as it can lead to various intraoperative and postoperative complications (POCs). These may include both biliary and nonbiliary issues, such as potential injury to the common bile duct, which can result in bile leakage, or the migration of gallstones, leading to a range of clinical symptoms.[7,8] Dexmedetomidine was approved by the Food and Drug Administration at the end of 1999 for use in humans as a short-term medication (<24 hours) for analgesia and sedation in the intensive care unit (ICU). Its unique properties render it suitable for sedation and analgesia during the whole perioperative period. Its applications as a premedication, as an anesthetic adjunct for general and regional anesthesia, and as a postoperative sedative and analgesic are similar to those of the benzodiazepines, but a closer look reveals that the α2-adrenoceptor agonist has more beneficial side effects.[9] Nalbuphine, a semi-synthetic opioid with mixed properties of κ receptor agonist and μ receptor antagonist, provides comparable analgesic efficacy to morphine but with fewer opioid-induced adverse effects. Studies have shown that nalbuphine could be safely used as an adjuvant to prolong the duration of analgesia for subarachnoid blocks, epidural blocks and peripheral nerve blocks.[10-12]

Mean age of the patients of group 1, group 2 and group 3 was 43.2 years, 40.9 years and 41.7 years respectively. Mean BMI among patients of group 1, group 2 and group 3 was 23.7 Kg/m2, 24.1 Kg/m2, and 23.9 Kg/m2 respectively. Group 2 was associated with maximum pain as assessed by VAS. Comparing the VAS among three study groups at 2 hours and 4 hours, significant results were obtained. Deepak et al evaluated the impact of intraperitoneal administration of dexmedetomidine and nalbuphine as adjuncts to ropivacaine for alleviating postoperative pain in patients undergoing laparoscopic cholecystectomy. Group A received 0.25% ropivacaine combined with dexmedetomidine at a dosage of 1 mcg/kg, Group B received 0.25% ropivacaine with 5 mg of nalbuphine, and Group C received 0.25% ropivacaine with 10 mg of nalbuphine. Throughout the postoperative period, the mean blood pressure remained comparable across all groups, with a p-value exceeding 0.05, indicating statistical insignificance. Notably, Group A exhibited lower mean Visual Analog Scale (VAS) scores compared to Groups B and C, with significantly reduced scores observed at the fourth- and sixth-hours post-surgery. Beyond this timeframe, no significant differences in VAS scores were detected among the three groups. Patients receiving 0.25% ropivacaine with dexmedetomidine at 1 mcg/kg demonstrated the most favorable outcomes.[12] The antinociceptive effects of intraperitoneal ropivacaine plus fentanyl with ropivacaine plus dexmedetomidine in patients undergoing laparoscopic cholecystectomy was compared in a previous study conducted by Praveena BL et al. Group RF (n = 40) were given 30 mL of 0.2% ropivacaine combined with 1 μg/kg fentanyl (diluted in 2 mL normal saline) and Group RD (n = 40) were given 30 mL of 0.2% ropivacaine combined with 1 μg/kg dexmedetomidine (diluted in 2 mL normal saline) through trocars. VAS score at different time intervals, overall VAS in 24 h was significantly lower, time to first request of analgesia (min) was longest and total analgesic consumption (mg) was lowest in RD group than in RF group. The antinociceptive effect of the intraperitoneal instillation of ropivacaine in combination with dexmedetomidine is superior to ropivacaine combined with fentanyl.[13] In a similar study conducted by Panda A et al, authors assessed the efficacy of Intraperitoneal 0.2% Ropivacaine with Dexmedetomidine Versus 0.2% Ropivacaine with Ketamine in Laparoscopic Surgeries. Group 1: 30 ml of 0.2% ropivacaine with ketamine 0.5 mg/kg diluted to 1 ml; Group 2: 30 ml of 0.2% ropivacaine with dexmedetomidine 0.5 mcg/kg diluted to 1 ml; Group 3: 30 ml of 0.2% ropivacaine with 1 ml of normal saline. The postoperative analgesic duration after intraperitoneal instillation of Group 2 was longer as compared to Group 1. The total analgesic requirement was lower in Group 2 as compared to Group 1, and the p-value was significant ($p \leq 0.001$) for both parameters. They conclude that intraperitoneal instillation of local anaesthetics with adjuvants is effective for postoperative analgesia in laparoscopic surgeries, and ropivacaine 0.2% with dexmedetomidine 0.5 mcg/kg is more effective when compared to ropivacaine 0.2% with ketamine 0.5 mg/kg.[14]

CONCLUSION

The administration of 0.25% ropivacaine combined with dexmedetomidine at a dosage of 1 mcg/kg in comparison to nalbuphine yielded the most favorable outcomes in patients.

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