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Original Research

A Comparative Analysis of Dexmedetomidine and Fentanyl with 0.5% Hyperbaric Bupivacaine for Spinal Anesthesia in Elective Lower Abdominal Surgeries: An Institutional Based Study

G. Prasanna Kumar[1], Komal Goel[2]

[1]Assistant Professor, Department of Anaesthesia, Rohilkhand Medical College & Hospital, Bareilly, UP, India.
[2]Assistant Professor, Department of Anaesthesia, Rajshree Medical Research Institute, Bareilly, UP, India.

Corresponding Author:
Dr. Komal Goel
Assistant Professor, Department of Anaesthesia, Rajshree Medical Research Institute, Bareilly, UP, India.
Email: goelkomu@gmail.com

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Abstract

Background: Abdominal and lower limb surgical procedures frequently lead to significant pain, which can subsequently induce rapid and shallow respiration, accumulation of secretions, and ultimately atelectasis, along with diminished patient compliance. Hence;the present study was conducted for comparative analysis of dexmedetomidine and fentanyl with 0.5% hyperbaric bupivacaine for spinal anesthesia in elective lower abdominal surgeries.

Materials &Methods: 40 ASA I, II patients scheduled for elective lower abdominal surgeries under spinal anaesthesia were enrolled. Patients were divided into two groups using a simple randomization method, corresponding to the study medications assigned to each group. Group 1 consisted of 20 patients receiving 5µg of Dexmedetomidine, while Group 2 included 20 patients administered 25µg of Fentanyl. A subarachnoid block was executed under strict aseptic conditions with the patient positioned laterally on the right side. The onset time of the T10 sensory block and the peak sensory block were recorded utilizing the pin prick method. The motor block was evaluated using the Modified Bromage scale, and the time taken to achieve a Bromage 3 motor block was documented. An intraoperative assessment of all patients was done.

Results: Mean age of the patients of group 1 and group 2 was 43.5 years and 44.9 years respectively. Majority proportion of patients were males. The mean time from injection to T10 (min) among patients of group 1 and group 2 was 2.23 minutes and 3.96 minutes respectively. The mean time from injection to highest sensory (mins) was 12.32 minutes and 11.95 minutes respectively. Regression to Bromage 3 among patients of group 1 and group 2 was 394.5 mins and 169.2 minutes respectively. Non-significant results were obtained while comparing heart at different time intervals among two study groups. Incidence of hypotension was significantly higher among patients of group 1 in comparison to group 2. Mean VAS among patients of group 1 at 6 hours, 12 hours, 18 hours and 24 hours was significantly lower in comparison to patients of group 2.

Conclusion: Block variables and Pain control was significantly better among dexmedetomidine group. however, dexmedetomidine was associated with significantly higher incidence of hypotension. Hence; further studies are recommended for better exploration of results.

Key words: Dexmedetomidine, Fentanyl, Spinal.

INTRODUCTION

Abdominal and lower limb surgical procedures frequently lead to significant pain, which can subsequently induce rapid and shallow respiration, accumulation of secretions, and ultimately atelectasis, along with diminished patient compliance. It is understandable that, in addition to concerns regarding surgical outcomes, patients primarily focus on the management of postoperative pain.[1, 2] Inadequate treatment of acute pain can have detrimental effects on patient health, particularly through the development of postoperative complications, extended recovery periods, and increased duration of hospital stays. Furthermore, this inadequacy may lead to the emergence of chronic

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pain and its associated adverse social and psychological consequences, such as dissatisfaction, anxiety, and stress, all of which can significantly affect the patient's quality of life.[3- 5]

Dexmedetomidine is a highly selective and potent agonist of the α-2 adrenoceptor, exhibiting a range of properties including sedation, analgesia, anxiolysis, sympatholysis, and a reduction in opioid requirements. This agent elicits a distinctive sedative effect characterized by a smooth transition from sleep to wakefulness, enabling patients to remain cooperative and communicative upon stimulation. Furthermore, dexmedetomidine is associated with a lower incidence of delirium compared to other sedative agents and may even serve as a preventive measure against delirium. Although its analgesic properties are relatively mild, dexmedetomidine can be effectively utilized as an adjunct in pain management.[6- 8]Fentanyl (which can also be spelled fentanil) is a potent synthetic opioid similar to morphine but produces analgesia to a greater extent. This robust pharmacologic agent is typically 50 to 100 times more potent than morphine. A dose of only 100 micrograms can produce equivalent analgesia to approximately 10 mg of morphine.[9]Hence; the present study was conducted for comparative analysis of dexmedetomidine and fentanyl with 0.5% hyperbaric bupivacaine for spinal anesthesia in elective lower abdominal surgeries.

MATERIALS & METHODS

40 ASA I, II patients scheduled for elective lower abdominal surgeries under spinal anaesthesia were enrolled. Patients were divided into two groups using a simple randomization method, corresponding to the study medications assigned to each group. Group 1 consisted of 20 patients receiving 5µg of Dexmedetomidine, while Group 2 included 20 patients administered 25µg of Fentanyl. During the pre-anesthetic evaluation, all patients underwent a thorough assessment and investigation for any systemic diseases. Pain levels were measured using the Visual Analog Scale (VAS), ranging from 0 to 10, where 0 represented no pain and 10 denoted extreme, unbearable pain. A subarachnoid block was executed under strict aseptic conditions with the patient positioned laterally on the right side. The onset time of the T10 sensory block and the peak sensory block were recorded utilizing the pin prick method. The motor block was evaluated using the Modified Bromage scale, and the time taken to achieve a Bromage 3 motor block was documented. An intraoperative assessment of all patients was done. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

RESULTS

The mean age of the patients of group 1 and group 2 was 43.5 years and 44.9 years respectively. Majority proportion of patients were males. The mean time from injection to T10 (min) among patients of group 1 and group 2 was 2.23 minutes and 3.96 minutes respectively. The mean time from injection to highest sensory (mins) was 12.32 minutes and 11.95 minutes respectively. Regression to Bromage 3 among patients of group 1 and group 2 was 394.5 mins and 169.2 minutes respectively. Non-significant results were obtained while comparing heart at different time intervals among two study groups. Incidence of hypotension was significantly higher among patients of group 1 in comparison to group 2. Mean VAS among patients of group 1 at 6 hours, 12 hours, 18 hours and 24 hours was significantly lower in comparison to patients of group 2.

Table 1: Comparison of variables in subarachnoid block

Variable	Group 1	Group 2	p-value
Time from injection to T10 (min)	2.23	3.96	0.0001 (Significant)
Time from injection to highest sensory (mins)	12.32	11.95	0.8221
Onset of Bromage 3 (mins)	10.13	10.76	0.2784
Regression to Bromage 0 (mins)	394.5	169.2	0.002 (Significant)

Table 2: Comparison of heart rate

Heart rate	Group 1	Group 2	p-value
Preoperative	83.6	82.4	0.23
2 mins	80.7	82.3	0.51
4 mins	79.5	80.4	0.28
6 mins	78.9	77.9	0.61
8 mins	80.1	78.2	0.49
10 mins	77.9	79.5	0.82
20 mins	79.2	80.7	0.33
60 mins	80.6	81.6	0.45

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Table 3: Comparison of side effects

Side effects	Group 1	Group 2	p-value
Nausea	1	3	0.251
Vomiting	3	2	0.611
Pruritis	2	1	0.818
Hypotension	8	1	0.012 (Significant)

Table 4: Comparison of VAS

VAS	Group 1	Group 2	p-value
6 hours	0.01	2.62	0.001 (Significant)
12 hours	3.12	5.17	0.000 (Significant)
18 hours	4.38	6.28	0.006 (Significant)
24 hours	2.62	4.26	0.012 (Significant)

DISCUSSION

Surgical interventions trigger a range of stress responses. Minor stressors can elicit a temporary local inflammatory reaction that may facilitate healing, whereas significant stressors can result in harmful systemic inflammation. The stress response is primarily regulated by adrenocorticotropic hormone (ACTH), which activates the adrenal cortex and enhances cortisol production. Cortisol plays a crucial role in promoting protein catabolism and gluconeogenesis. Additionally, activation of the sympatho-adrenal-medullary axis leads to elevated levels of epinephrine and norepinephrine. The physiological effects associated with the stress response encompass increased myocardial contractility, heightened oxygen demand, vasodilation in coronary and cerebral regions, retention of sodium and water, hypercoagulability, fibrinolysis, immunosuppression, susceptibility to wound infections, hyperglycemia, and diminished urinary output. These stress-mediated effects can adversely impact patient outcomes, resulting in delayed wound healing, prolonged mobilization, and extended hospital stays.[10- 12] Hence; the present study was conducted for comparative analysis of dexmedetomidine and fentanyl with 0.5% hyperbaric bupivacaine for spinal anesthesia in elective lower abdominal surgeries.

The mean age of the patients of group 1 and group 2 was 43.5 years and 44.9 years respectively. Majority proportion of patients were males. The mean time from injection to T10 (min) among patients of group 1 and group 2 was 2.23 minutes and 3.96 minutes respectively. The mean time from injection to highest sensory (mins) was 12.32 minutes and 11.95 minutes respectively. Gupta R et al evaluated the onset and duration of sensory and motor block, hemodynamic effect, postoperative analgesia, and adverse effects of dexmedetomidine or fentanyl given intrathecally with hyperbaric 0.5% bupivacaine. 60 patients were randomly allocated to receive either 12.5 mg hyperbaric bupivacaine plus 5 μg dexmedetomidine (group D, n = 30) or 12.5 mg hyperbaric bupivacaine plus 25 μg fentanyl (group F, n = 30) intrathecal. Patients in dexmedetomidine group (D) had a significantly longer sensory and motor block time than patients in fentanyl group (F). The mean time of sensory regression to S1 was 476±23 min in group D and 187±12 min in group F (P<0.001). The regression time of motor block to reach modified Bromage 0 was 421±21 min in group D and 149±18 min in group F (P<0.001). Intrathecal dexmedetomidine is associated with prolonged motor and sensory block, hemodynamic stability, and reduced demand for rescue analgesics in 24 h as compared to fentanyl.[13]

In the present study, regression to Bromage 3 among patients of group 1 and group 2 was 394.5 mins and 169.2 minutes respectively. Non-significant results were obtained while comparing heart at different time intervals among two study groups. Incidence of hypotension was significantly higher among patients of group 1 in comparison to group 2. Mean VAS among patients of group 1 at 6 hours, 12 hours, 18 hours and 24 hours was significantly lower in comparison to patients of group 2. Mahendru et al. found no significant difference in onset of motor block between dexmedetomidine and fentanyl groups. While Yektas and Ravipati reported faster onset of motor block for dexmedetomidine compared to fentanyl. Other studies have also mentioned lower time to reach the highest sensory level in dexmedetomidine compared to fentanyl. The mechanism of how dexmedetomidine prolongs sensory and motor blockade is not known. Dexmedetomidine is a highly-selective α2-adrenergic receptor agonist that causes analgesia by suppression the release of C fiber transmitters and hyperpolarization of post-synaptic neurons.[14- 18] Sachin Kothawale et al compared dexmedetomidine and fentanyl as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia in elective lower abdominal surgeries at a tertiary hospital. Onset of sensory block (sec), onset of motor block (sec), time to reach maximum level of sensory block (min) and time for highest sensory level (min) were comparable in both groups and difference was not

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statistically significant. Total duration of motor block (min), first request for rescue analgesia (min), highest sensory level achieved and time of two segments regression were better in dexmedetomidine group as compared to fentanyl group and difference was statistically significant. Dexmedetomidine group had prolonged duration of motor block, prolonged time of two segments regression and reduced demand for rescue analgesics in 24 hr. as compared to Fentanyl.[19]

CONCLUSION

Block variables and Pain control was significantly better among dexmedetomidine group. however; dexmedetomidine was associated with significantly higher incidence of hypotension. Hence; further studies are recommended for better exploration of results.

REFERENCES

1. Ahmed A, Latif N, Khan R. Post-operative analgesia for major abdominal surgery and its effectiveness in a tertiary care hospital. J Anaesthesiol Clin Pharmacol. 2013;29(4):472–7.
2. Mukiri SRKR. Int Surg J. 2015. Nov;2(4):475–9.
3. Kehlet H, Holte K. Effect of postoperative analgesia on surgical outcome. Br J Anaesth. 2001;87(1):62–72.
4. Gupta K, Maggo A, Jain M, Gupta P, Rastogi B, Singhal A. Blood glucose estimation as an indirect assessment of modulation of neuroendocrine stress response by dexmedetomidine versus fentanyl premedication during laparoscopic cholecystectomy: A clinical study. Anesth Essays Res. 2013;7:34–8.
5. Mohapatra S, Nayak SR, Jena P, Tripathy SK, Das SR. A study of changes in stress factors during elective upper abdominal surgery using different anaesthetic techniques. Int J Pharm Sci Rev Res. 2016;39:167–72.
6. Carollo DS, Nossaman BD, Ramadhyani U. Dexmedetomidine: a review of clinical applications. Curr OpinAnaesthesiol. 2008;21:457–61
7. Wunsch H, Kahn JM, Kramer AA, Wagener G, Li G, Sladen RN, et al. Dexmedetomidine in the care of critically ill patients from 2001 to 2007: an observational cohort study. Anesthesiology. 2010;113:386–94.
8. Bae HB. Dexmedetomidine: an attractive adjunct to anesthesia. Korean J Anesthesiol. 2017;70:375–6
9. Ramos-Matos CF, Bistas KG, Lopez-Ojeda W. Fentanyl. [Updated 2023 May 29]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; Available from:
10. Mohapatra S, Nayak SR, Jena P, Tripathy SK, Das SR. A study of changes in stress factors during elective upper abdominal surgery using different anaesthetic techniques. Int J Pharm Sci Rev Res. 2016;39:167–72.
11. Kahveci K, Ornek D, Doger C, Aydin GB, Aksoy M, Emre C, et al. The effect of anesthesia type on stress hormone response: Comparison of general versus epidural anesthesia. Niger J Clin Pract. 2014;17:523–7.
12. Kaur M, Singh P. Current role of dexmedetomidine in clinical anesthesia and intensive care. Anesth Essays Res. 2011;5:128–33.
13. Gupta R, Verma R, Bogra J, Kohli M, Raman R, Kushwaha JK. A Comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to Bupivacaine. J Anaesthesiol Clin Pharmacol. 2011 Jul;27(3):339-43
14. Mahendru V, Tewari A, Katyal S, Grewal A, Singh MR, Katyal R. A comparison of intrathecal dexmedetomidine, clonidine, and fentanyl as adjuvants to hyperbaric bupivacaine for lower limb surgery: a double blind controlled study. J Anaesthesiol Clin Pharmacol. 2013;29(4):496–502.
15. Yektas A, Belli E. The effects of 2 μg and 4 μg doses of dexmedetomidine in combination with intrathecal hyperbaric bupivacaine on spinal anesthesia and its postoperative analgesic characteristics. Pain Res Manag. 2014;19(2):75–81.
16. Machin D, Campbell MJ, Tan S-B, Tan S-H. Sample size tables for clinical studies: John Wiley & Sons; 2011.
17. Ravipati P, Isaac GA, Reddy PN, Krishna L, Supritha T. A comparative study between intrathecal isobaric Ropivacaine 0.75% plus Dexmedetomidine and isobaric Ropivacaine 0.75% plus fentanyl for lower limb surgeries. Anesth Essays Res. 2017;11(3):621–6.
18. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, Bulbul M, Baraka AS. Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta Anaesthesiol Scand. 2006;50(2):222–7.
19. Sachin Kothawale, Ashok Mahavir Dhonde. Comparative study of dexmedetomidine and fentanyl as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia in elective lower abdominal surgeries. MedPulse International Journal of Anesthesiology. November 2021; 20(2):63-66