Print ISSN: 2321-6379
Online ISSN: 2321-595X

Original Article

Comparison of Bupivacaine with Fentanyl and Bupivacaine with Dexmedetomidine Intrathecally in Lower Abdominal Surgical Procedures

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Abstract

Introduction: Spinal block is still the first choice because of its rapid onset, superior blockade, low risk of infection from the catheter *in situ*, fewer failure rates, and cost-effectiveness. Various intrathecal adjuvants, such as morphine, fentanyl, ketamine, midazolam, and clonidine, improve analgesia quality and duration.

Aim: This study aimed to analyze bupivacaine's effectiveness with fentanyl and dexmedetomidine intrathecally in a lower abdominal surgical procedure.

Materials and Methods: Forty patients included in this study were randomly allocated to two groups (20 patients each): Group BF and Group BD. Group BF patients received 2.5 ml of 0.5% hyperbaric bupivacaine with 25 μg (0.5 cc) of fentanyl to a total volume of 3.0 ml intrathecally. Group BD 2.5 ml of 0.5% hyperbaric bupivacaine with 5 μg (0.5 cc) of preservative-free Dexmedetomidine to a total volume of 3.0 ml intrathecally. Results were analyzed statistically and discussed below.

Results: Patients in the dexmedetomidine group had a faster onset of sensory block and motor block, one patient had hypotension, three patients had pruritis, and one patient had vomiting. The mean rescue of analgesia and duration of surgery were higher in the dexmedetomidine group. In the fentanyl group, six patients had hypotension, two patients had bradycardia, and one patient had vomiting.

Conclusion: Intrathecal dexmedetomidine supplementation to spinal bupivacaine seems to be a good alternative to intrathecal fentanyl since it produces prolonged postoperative analgesia with minimal side effects, excellent quality of spinal analgesia, prolonged motor and sensory block, hemodynamic stability, and reduced demand for rescue analgesics in 24 h.

Key words: Dexmedetomidine, Fentanyl, Intrathecal, Spinal anesthesia

INTRODUCTION

Lower abdominal and lower limb surgeries may be performed under local, regional (spinal or epidural), or general anesthesia (GA), but neuraxial blockade is the preferred mode of anesthesia. A spinal block is still the first choice because of its rapid onset, superior blockade, low risk of infection from the catheter *in situ*, fewer failure rates, and cost-effectiveness, but it has the drawbacks of shorter duration of block and lack of post-operative analgesia. Spinal anesthesia is widely used in various operations because it provides adequate analgesia, muscular relaxation with simple operation, and rapid onset of action.[1] However, local anesthetics alone has a short duration and is inadequate for visceral pain.[2,3] Various intrathecal adjuvants, such as morphine, fentanyl, ketamine, midazolam, and clonidine, improve analgesia quality and duration.[4]

In recent years, intrathecal adjuvants have gained popularity to prolong the block's duration, better success rate, patient satisfaction, decreased resource utilization compared with GA, and faster recovery. Adequate pain management is essential to facilitate rehabilitation and accelerate functional

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www.ijss-sn.com

Month of Submission : 01-2021
Month of Peer Review : 01-2021
Month of Acceptance : 02-2021
Month of Publishing : 03-2021

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recovery, thus enabling patients to return to their normal activity more quickly. The quality of spinal anesthesia has been reported to improve with the addition of opioids (e.g., morphine, fentanyl, and sufentanil) and other drugs (e.g., dexmedetomidine, clonidine, magnesium sulfate, neostigmine, ketamine, and midazolam), but no drug to inhibit nociception is without associated adverse effects.[5]

Dexmedetomidine is a highly selective α2 adrenergic agonist, which has been used for premedication and as an adjunct to GA. It reduces opioids and inhalational anesthetic requirements. Intrathecal α2 receptor agonists are found to have antinociceptive action for both somatic and visceral pain.[6] Intrathecal α2 adrenoceptor agonist act by depressing C-fiber transmitters' release and hyperpolarization of post-synaptic dorsal horn neurons.[7] Reports from earlier human studies suggest that intrathecal 10 μg dexmedetomidine would produce more postoperative analgesic effect along with bupivacaine in spinal anesthesia with very few side effects.

Fentanyl is one of the short-acting narcotic analgesics with potent morphine-like action. It produces many of its clinical effects rapidly after intrathecal administration.[8] Neuroaxial administration of lipophilic opioids such as fentanyl and sufentanil tends to provide a rapid onset of analgesia. Their rapid clearance from cerebrospinal fluid may limit the cephalic spread and develop certain side effects such as delayed respiratory depression.[9]

Aim

This study aimed to analyze bupivacaine's effectiveness with fentanyl and dexmedetomidine intrathecally in a lower abdominal surgical procedure.

MATERIALS AND METHODS

This study was done in prospective double-blinded randomized manner. It was conducted at our institute between March 2017 and August 2017 after approval from the institution's ethical committee and written informed consent. 90 American Society of Anaesthesiology I (ASA-I) patients undergoing elective lower abdominal surgeries under spinal anesthesia were recruited.

Inclusion Criteria

Patients in the age group of 30 and above, both sexes, ASA–I were included in the study.

Exclusion Criteria

Hypersensitivity to the study drug, renal or hepatic dysfunction, uncontrolled labile hypertension, and diabetes mellitus were excluded from the study. Patients were randomly allocated to two groups (20 patients each): Group BF and Group BD. Group BF patients received 2.5 ml of 0.5% hyperbaric bupivacaine with 25 μg (0.5 cc) of fentanyl to a total volume of 3.0 ml intrathecally. Group BD 2.5 ml of 0.5% hyperbaric bupivacaine with 5 μg (0.5 cc) of preservative-free Dexmedetomidine to a total volume of 3.0 ml intrathecally.

Intrathecal drugs were prepared by an anesthesiologist not involved in the study and were administered by another anesthesiologist who was blinded and performed spinal anesthesia. The volume of the drug, size of the syringe, and color of the drug of interest were similar in the three groups. The final volume of injected solutions was 3.0 ml in three groups. Surgical anesthesia was graded as excellent if there was no complaint of pain at any time during surgery. Good, if there was minimal pain or discomfort, which was relieved by a small dose of iv pentazocine 0.5 mg/kg and poor if GA has to be administered.

In PACU, the pain was assessed every 15 min. When the patient reaches the pain score 2 Inj. Diclofenac 75 mg Injection was given. Duration of effective analgesia was defined as the time interval between onset of subarachnoid block and the time to reach pain score-2. Patients were shifted to the post-operative ward after complete resolution of motor blockade.

RESULTS

Patients in the dexmedetomidine group had a faster onset of sensory block and motor block. The mean rescue of analgesia, meantime for regression of motor and sensory block, and surgery duration was higher in the dexmedetomidine group [Table 1].

Sixteen patients had B3, and four patients had B2 grade of motor block in group BF. In Group BD, 17 patients had B3, two patients had B2 grade, and one patient had B1 grade [Table 2].

In Group BF, ten patients had a maximum sensory block level at level T6, even patients at T8, two patients at T10, and one patient at T12. In a group, BD, 17 patients had a maximum level of sensory block at level T6 and three patients at T8 [Table 3].

In Group BD, one patient had hypotension, three patients had pruritis, and one patient had vomiting. In Group BF, six patients had hypotension, two patients had bradycardia, and one patient had vomiting [Table 4].

DISCUSSION

The mechanism by which intrathecal α2 adrenoceptor agonists prolong the motor and sensory block of

Table 1: Characteristics of motor and sensory block

Parameters	Group BF	Group BD	*P*-value
Mean duration of surgery	74.28	78.24	0.542
Mean onset of sensory block T10	2.81	2.72	0.556
Mean onset of sensory block T6	5.11	4.81	0.172
Meantime to reach motor block	6.92	6.66	0.134
Meantime for regression of sensory block	382.82	467.23	<0.0001
Meantime for regression of motor block	241.28	286.52	0.002
Mean time for rescue analgesia	224.52	286.74	0.002

Table 2: Maximum grade of motor block

Group	B1	B2	B3	*P*-value
Group BF	0	4	16	0.428
Group BD	1	2	17	

Table 3: Maximum level of sensory block

Group	T6	T8	T10	T12	*P*-value
Group BF	10	7	2	1	0.093
Group BD	17	3	0	0	

Table 4: Side effects

Side effects	Group BF	Group BD
Hypotension	6	1
Bradycardia	2	0
Pruritis	0	3
Vomiting	1	1

local anesthetics is unknown. They act by binding to the presynaptic C-fibers and post-synaptic dorsal horn neurons. Their analgesic action results from depression of the release of C-fiber transmitters and hyperpolarization of post-synaptic dorsal horn neurons.[7] Fentanyl is an opioid analgesic generally used for pain relief together with other medications for anesthesia. It is 100 times more potent than morphine. Intrathecally, fentanyl exerts its Effect by combining with opioid μ receptors in the spinal cord's dorsal horn and may have a supraspinal spread and action.[10] Pain is frequently encountered during surgery on the female genital organs under spinal local anesthetics. Intrathecal fentanyl, when added to spinal local anesthetics, reduces significantly visceral and somatic pain, and many studies have proved this analgesic effect.[11] Intrathecal fentanyl prolongs the duration of spinal anesthesia produced by bupivacaine and lignocaine, and this effect has been shown in obstetric and non-obstetric patients undergoing various surgeries.[9] The prolongation of the duration of spinal analgesia produced by intrathecal fentanyl is not dose-related.[12]

Dexmedetomidine is a highly selective α2-adrenoreceptors agonist approved as an intravenous sedative and adjuvant to anesthesia. Dexmedetomidine, when used intravenously during anesthesia, reduces opioid and inhalational anesthetics requirements.[13]

Fukushima *et al.* administered 2 μg/kg epidural dexmedetomidine for post-operative analgesia in humans but did not report neurologic deficits.[14] Our study has shown that the addition of dexmedetomidine with hyperbaric bupivacaine significantly prolongs both sensory and motor block.

Al-Mustafa *et al.* studied the Effect of dexmedetomidine 5 and 10 μg with bupivacaine in urological procedures. They found that dexmedetomidine prolongs the duration of spinal anesthesia in a dose-dependent manner.[15]

Al-Ghanem *et al.* had studied the effect of the addition of 5 μg dexmedetomidine or 25 μg fentanyl intrathecal to 10 mg isobaric bupivacaine in vaginal hysterectomy and concluded that 5 μg dexmedetomidine produces more prolonged motor and sensory block as compared with 25 μg Fentanyl.[16]

Al-Ghanem *et al.*[16] demonstrated a significant decrease in the heart rate and mean arterial blood pressure by comparing the addition of 5 μg dexmedetomidine with intrathecal bupivacaine with 25 μg Fentanyl in the gynecological procedure. Abdelhamid also supported this, and El-Lakany[17] reported a significant decrease in the heart rate in the dexmedetomidine group on comparing the use of 5 μg dexmedetomidine with hyperbaric bupivacaine only. In our study, the fentanyl group had more side effects compared to the dexmedetomidine group.

CONCLUSION

Intrathecal dexmedetomidine supplementation to spinal bupivacaine seems to be a good alternative to intrathecal fentanyl since it produces prolonged postoperative analgesia with minimal side effects and excellent quality of spinal analgesia, prolonged motor and sensory block, hemodynamic stability, and reduced demand for rescue analgesics in 24 h.

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How to cite this article: Kulandayan S, Ravindran K. Comparison of Bupivacaine with Fentanyl and Bupivacaine with Dexmedetomidine Intrathecally in Lower Abdominal Surgical Procedures. Int J Sci Stud 2021;8(12):175-178.

Source of Support: Nil, **Conflicts of Interest:** None declared.