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# AN OBSERVATIONAL STUDY OF DEXMEDETOMIDINE AND FENTANYL AS ADJUVANTS TO 0.5% HYPERBARIC BUPIVACAINE IN SPINAL ANAESTHESIA IN ELECTIVE LOWER ABDOMINAL SURGERIES

Anesthesiology

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## ABSTRACT

**Background:** Regional anaesthesia is the preferred anaesthetic technique in lower extremity, anorectal, urologic, obstetric, and lower abdominal surgeries. Co administration of adjuvant drugs improves the quality and duration of anesthesia and analgesia and patient safety. **Aim:** The aim of this observational study was to evaluate the effects of Dexmedetomidine and Fentanyl as adjuvants for spinal anaesthesia in elective lower abdominal surgeries. **Methods:** Present study was hospital based, prospective observational study, conducted in patients of age 18-60 years of either gender, ASA grade I and II, undergoing elective lower abdominal surgeries, willing to participate. 100 patients were randomly assigned into Group BF (n=50) and Group BD (n=50). Results: 100 patients were randomly assigned into Group DF (n=50) and Group BD (5=50). General characteristics of study patients such as age (years), gender (male/female), height (centimeters), weight (kilograms) and ASA grade (I/II) were comparable in both groups and difference was not statistically significant. In group BD patients onset of sensory block was significantly faster 2.62±0.56 mins ($p<0.001$) with better haemodynamic stability, intraoperative sedation, less incidence of side effects and analgesic sparing effect in post operative period when compared to group BF. **Conclusion:** Dexmedetomidine group had prolonged duration of motor block, prolonged time of two segments regression and reduced demand for rescue analgesics in 24 hrs as compared to Fentanyl.

## KEYWORDS

Dexmedetomidine, Fentanyl, Hyperbaric Bupivacaine, Spinal anaesthesia, Analgesia

## INTRODUCTION:

Spinal anesthesia is the most commonly used technique for lower abdominal surgeries as it is very economical and easy to administer. However, postoperative pain control is a major problem because spinal anesthesia using only local anesthetics is associated with relatively short duration of action, and thus early analgesic intervention is needed in the postoperative period. A number of adjuvants, such as clonidine and midazolam, and others have been studied to prolong the effect of spinal anesthesia.[1,2]

Subarachnoid blockade with 0.5% hyperbaric bupivacaine provides sensory and motor blockade for surgeries lasting for about 2 hours but co-administration of spinal adjuvants allow reduction in the required dose of local anesthetics with the advantage of generating the same degree of analgesia. Several adjuvants such as opioids and alpha-2 agonists are used to enhance the onset and duration of spinal anesthesia and sedation along with their ability to provide enhanced post-operative analgesia.[3]

Adjuvants such as Morphine, Fentanyl, Clonidine and Dexmedetomidine have been used to supplement intrathecal local anesthetics providing possible advantages, such as delayed onset of pain and reduced analgesic requirements.[4] Fentanyl is μ receptor agonist 80 times more potent than morphine as an analgesic added to spinal 0.5% heavy bupivacaine improves quality of spinal analgesia, reduces visceral and somatic pain. However their addition may have side effects like pruritus, respiratory depression, urinary retention, postoperative nausea and vomiting which limits their use.[5,6] Dexmedetomidine is a highly selective α2-adrenergic agonist, used intrathecally, found to have antinociceptive action for both somatic and visceral pain.[7] In present study we aimed to compare dexmedetomidine and fentanyl as adjuvants to 0.5% hyperbaric bupivacaine in spinal anaesthesia in elective lower abdominal surgeries at a tertiary hospital.

## METHODS:

The present study was conducted in the department of anesthesiology in Government medical collage Doda over a period of eighteen months from April 2021 to August 2022 on hundred patients of (ASA) physical status I-II of both sexes, aged between 18 and 60 years, equally divided in to two groups, Group BF (n=50), Group BD (n=50), scheduled for elective lower abdominal surgeries.

After getting approval from Institutional Ethical Committee, written informed consent was obtained from all the patients before surgery. Patients with any moderate to severe systemic disorders, patients unwilling to accept regional anesthesia, patients with any contraindication for spinal anesthesia, were excluded from the study.

A detailed history was noted and a complete general and systemic examination was done. Procedure was explained to patients and a written informed consent was taken. In surgical theatre monitors attached to record ECG, NIBP, SpO2, HR and RR. The baseline readings were noted.

**Group DD:** received 2.5ml of 0.5% hyperbaric bupivacaine with 0.5 ml of 5 mcg dexmedetomidine, total of 3ml.

**Group BF:** received 2.5 ml of 0.5% hyperbaric bupivacaine with 0.5ml of 25 mcg fentanyl, total of 3ml

The procedure began by identifying anatomic landmarks. The patient was placed in the sitting position and the line joining the superior aspect of the iliac crests posteriorly (Tuffier's line) was palpated. When the Tuffier's line crossed an interspinous space, the spinal level was identified as L3–L4 interspace. According to this land-mark, the L2–L3 interspace was identified as one inter-space above. Identification of lumbar interspaces was performed separately by a junior and senior anesthesiologist and if there was any discrepancy in the identification of lumbar interspace, the patient was excluded from the study.

All patients were then placed supine and administered air/oxygen mixture (60%: 40%) via facemask. During the procedure an electrocardiogram, the heart rate and pulse oximetry were monitored continuously. Non-invasive blood pressure was taken before the conduct of spinal anesthesia and every 5 minutes after the intrathecal injection until the end of surgery. Hypotension was defined as a decrease in the mean arterial blood pressure, more than 20% from baseline within a 5 min interval. Hypotension was treated with either fluid boluses or aliquots of intravenous mephentermine 6 mg since the efficacy of mephentermine) was recognized in earlier studies. Bradycardia was defined as heart rate less than 50 beats $min^{-1}$ and was treated with i.v. injection of atropine 0.5–1 mg. The quality of anesthesia was assessed by testing severity of intra operative pain using a 10 cm VAS, where VAS 0 meant no pain and VAS 10 worst pain

imaginable. VAS was evaluated every 5 min from the time of skin incision until the end of surgery. The use of VAS had previously been explained to each patient before surgery. VAS 1–3 was considered as mild pain, VAS 4–6 as moderate, VAS 7, 8 as severe and VAS 9, 10 as unbearable pain. Five minutes thereafter, the VAS was assessed. The height of sensory block was also noted. The level of sensory block was determined by the loss of pinprick sensation and was performed using a 22 G hypodermic needle. Sensory block level was tested every 5 minutes during the first 30 minutes after the intrathecal injection. The surgeon started all operations 30 minutes after intrathecal injection in every patient. No sensory testing was performed during surgery.

***Intraoperative parameters:***

The following parameters were studied in the intra operative period.

01. Onset and duration of sensory block: The onset at T10 of sensory block was assessed by pinprick test performed at 2, 5, 10, 15, 20, and 30 min and total duration of sensory block was noted.
02. Quality of intraoperative anaesthesia: Using a "four Grade scale". This was graded as:

Excellent: No supplementary sedative or analgesia required.
Good: Only sedative required.
Fair : Both sedative and analgesic required.
Poor : General anesthesia and tracheal intubation required.

03. Motor blockade: This was assessed by Modified Bromage Scale as under:

Grade 0: No paralysis
Grade 1: Unable to raise extended leg.
Grade 2: Unable to flex knee.
Grade 3: unable to flex ankle (complete block).

04. Alteration in vital parameters like heart rate and blood pressure.
05. Other undesirable sequelae like nausea, vomiting or any other Complication.
06. Sedation was assessed by modified Ramsay sedation score.

Modified Ramsay Sedation score.

1. Patient anxious, agitated or restless.
2. Patient cooperative, oriented and tranquil.
3. Patient responds to commands only.
4. Patient exhibits brisk response to light glabellar tap or loud auditory stimulus.
5. Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus.
6. Patient exhibits no response.

***Postoperative period:***

Patients were evaluated for 24 hours regarding total duration of analgesia, postoperative analgesia requirements and other sequelae. Postoperatively, the pain was recorded by using visual analogue scale (VAS) between 0 and 10 ( 0= no paon,10= most severe pain), initially every 1 hourly for two hours, then every 2 hourly for the next 8 hours and then after every 4 hourly till 24 hours. Injection Diclofenac (75mg) was given intramuscularly as rescue analgesia when visual analogue scale was > 4.

**Statistical analysis**

Statistical analysis was performed using the Statistical Packages for Social Science version 19 (SPSS Inc., Chicago, IL, USA). Mean and standard deviation were estimated for numeric characteristics of patients. Frequency and percentage were computed for anesthetic characteristics, and co-analgesia requirement, satisfaction of patients regarding postoperative pain management, and complication of patients. Chi-square test was applied to compare pain intensity, complication, and patient experience regarding postoperative pain management among analgesic techniques. $P \leq 0.05$ was considered as significant.

**Conflict of interest:** Nil
**Funding:** Nil

**RESULTS:**

There were no significant differences between groups for patient characteristics with regard to demographics [Table 1].

**Table 1: Demographic profile among the study population**

| Variables | Group BD | Group BF | P value |
|---|---|---|---|
| Age (Years) | 44.3±10.33 | 45.4±11.13 | >0.05 |
| Weight (kg) | 57.21±9.34 | 58.31±10.51 | >0.5 |
| ASA I/II | 21/9 | 20/10 | >0.05 |

In Group BD, the number of patients who achieved T6 were 50% and in Group BF it was 23.33%, ($p<0.05$) was statistically significant. In Group BD the number of patients which achieved T8 were 26.66% and in Group BF it was 30%, ($p>0.05$). In Group BD the number of patients with T10 were 23.33% and 46.66% in Group BF. ($p<0.05$) [Table 2].

**Table 2: Shows the distribution of cases according to maximum sensory level achieved.**

| Maximum sensory level achieved. | Group BD | | Group BF | | P value |
|---|---|---|---|---|---|
| T6 | 15 | 50% | 7 | 23.33% | 0.006 |
| T8 | 8 | 26.66% | 9 | 30% | 0.784 |
| T10 | 7 | 23.33 | 14 | 46.66% | 0.014 |
| Total | 30 | 100% | | 100% | |

The baseline mean pulse in group BD was 82.50±5.71 beats / min (bpm) and in Group B was 88.21±4.25 bpm.($p>0.05$) During intraoperative period in Group BD it was from 76.80±5.67 to 87.70±7.3 (bpm) and in Group BF it was from 80.40±4.01 bpm to 85.40±2.19 bpm. From 2 minutes to 20 minutes, there was decrease in pulse rate in Group BD. ($p<0.05$) [Table 3].

**Table 3: Shows distribution of cases as per pulse rate changes**

| Pulse rate | (Group BD) Mean±SD | (Group BF) Mean±SD | P Value |
|---|---|---|---|
| 0 min | 82.50±5.71 | 82.21±4.25 | 0.821 |
| 2 min | 84.11±5.73 | 80.34±4.02 | 0.005 |
| 4 min | 85.66±6.11 | 81.16±3.78 | 0.001 |
| 6 min | 85.95±5.84 | 82.31±3.89 | 0.006 |
| 8 min | 84.61±5.82 | 84.09±2.89 | 0.005 |
| 10 min | 83.70±7.32 | 83.34±2.78 | 0.003 |
| 15 min | 80.78±7.61 | 83.01±2.74 | 0.016 |
| 20 min | 79.27±6.72 | 83.67±2.04 | 0.051 |
| 25 min | 80.98±8.98 | 84.82±2.48 | 0.514 |
| 30 min | 83.81±5.67 | 85.22±3.05 | 0.237 |
| 45 min | 85.98±6.63 | 85.19±3.02 | 0.611 |
| 60 min | 85.15±6.23 | 88.66±2.68 | 0.754 |
| 75 min | 86.16±8.89 | 85.21±1.87 | 0.578 |
| 90 min | 87.22±7.26 | 85.38±2.21 | 0.191 |
| 105 min | 87.15±7.64 | 84.89±2.67 | 0.321 |
| 120 min | 87.68±6.68 | 85.14±2.14 | 0.054 |

The baseline mean blood pressure was 91.50±4.99 mmHg in Group BD and 95.10±5.52 mmHg for Group BF. Intraoperatively it was between 77.70±2.31mmHg and 99.69±4.51mm Hg in Group A and in Group B it was 85.22±3.81mmHg and 100.74±2.47mmHg. From 2 min to 60 min there was decrease in MBP in group BD in comparison to group BF. After 60 min both the groups were comparable ($P>0.05$) [Table 4].

**Table 4: The mean blood pressure (MBP) among the study population**

| MBP | (Group BD) Mean±SD | (Group BF) Mean±SD | P Value |
|---|---|---|---|
| 0 min | 92.51±8.1 | 95.10±8.4 | 0.071 |
| 2 min | 78.39±7.6 | 85.23±7.9 | 0.001 |
| 4 min | 77.70±6.8 | 85.59±8.9 | 0.001 |
| 6 min | 78.70±8.2 | 86.85±8.1 | 0.001 |
| 8 min | 78.32±7.9 | 88.15±6.9 | 0.000 |
| 10 min | 78.51±8.7 | 90.68±7.6 | 0.001 |
| 15 min | 76.86±7.8 | 91.89±8.2 | 0.001 |
| 20 min | 74.97±6.9 | 93.34±8.5 | 0.001 |
| 25 min | 75.74±7.6 | 94.32±8.0 | 0.000 |
| 30 min | 73.29±8.6 | 96.54±7.8 | 0.001 |
| 45 min | 78.67±8.9 | 98.40±6.8 | 0.000 |
| 60 min | 82.16±7.8 | 99.89±8.9 | 0.003 |
| 75 min | 87.55±6.9 | 98.65±8.0 | 0.687 |
| 90 min | 89.15±8.6 | 100.87±8.3 | 0.389 |
| 105 min | 90.13±8.0 | 100.65±8.1 | 0.124 |
| 120 min | 99.67±8.1 | 100.74±8.0 | 0.286 |

Time to first rescue analgesic was 968.87 ± 148.6 min in Group BD and was 211.45 ± 38.09 min in Group BF which was statistically significant

with *P* value < 0.0001. The mean duration of analgesia in Group BD was 932 ± 119.38 min, which is statistically highly significant with *P* value < 0.0001 than Group BF in which it was 413 ±28.87 min. Total consumption of analgesia in 48h was 47±31 mg in Group DF and was 138±71mg Group BF, which was statistically significant with *P* value < 0.0001. The mean duration of motor block in Group BD was 449 ± 30.9 min with *P* value of < 0.0001 which is statistically highly significant when compared to Group BF in which it was 219.37 ± 13.28 min [Fig 1].

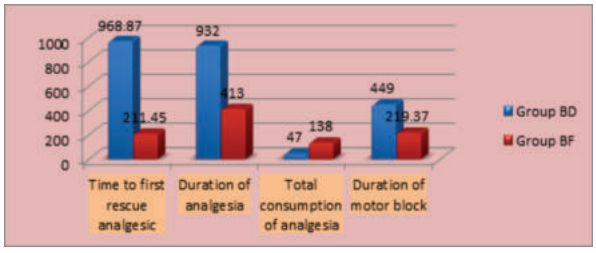


**Fig 1.** Visual analogue scale at different time intervals were statistically significantly lower at all times in Group A than Group B p-value (p<0.05) [Fig 2].

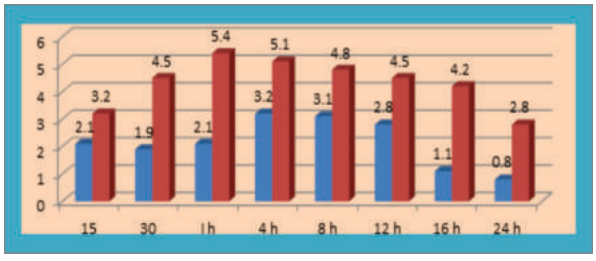


**Fig 2.** With regard to the post operative adverse effects observed among the two study groups. When compared statistically, the results were found not significant with a p value of >0.05 [Fig 3].

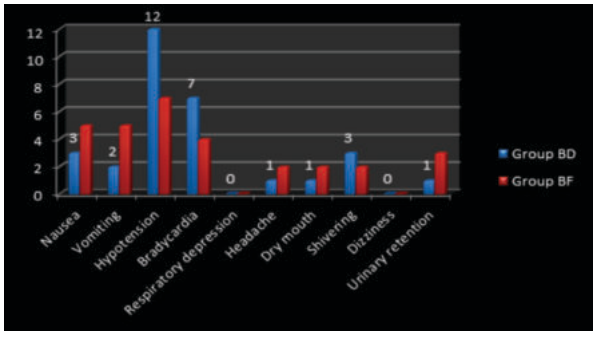


**Fig 3**

## DISCUSSION:

The mechanism by which intrathecal α 2 -adrenoceptor agonists prolong the motor and sensory block of local anesthetics is not well known. They act by binding to presynaptic C-fibers and postsynaptic dorsal horn neurons. Their analgesic action is a result of depression of the release of C-fiber transmitters and hyperpolarisation of postsynaptic dorsal horn neurons.[8] Local anesthetic agents act by blocking sodium channels. The prolongation of effect may result from synergism between local anesthetic and α 2 -adrenoceptor agonist, while the prolongation of the motor block of spinal anesthetics may result from the binding of α 2 -adrenoceptor agonists to motor neurons in the dorsal horn.[9] Intrathecal α2-receptor agonists have been found to have antinociceptive action for both somatic and visceral pain.[10] Fentanyl is a lipophilic μ-receptor agonist opioid. Intrathecally, fentanyl exerts its effect by combining with opioid receptors in the dorsal horn of spinal cord and may have a supraspinal spread and action.[11]

Post operative pain and suffering results in significant physiological, psychological, economic and social adverse effects. [12] Spinal anaesthesia is a popular technique for lower abdominal surgeries and is effective in immediate post-operative pain relief. Various analgesic regimens have been used to ensure adequate postoperative pain relief as local anaesthetics have short duration of action and potential to produce deleterious effects like cardiac arrhythmias, central nervous system depression, seizures and allergic reactions. [13-15] Co-administration of adjuvants prolong duration of sensory-motor block, limit cumulative dose requirement of local anaesthetics improve efficacy and contribute in their own special manner to potentiate analgesic effect of local anaestheticsm. [16]

Neuraxial administration of opioids as adjuvants is one method for postoperative pain management, which allows early ambulation, and decrease length of hospital stay however they are often associated with side-effects like nausea, vomiting, respiratory depression and hyperalgesia. [17,18]

Rajni Gupta, Reetu Verma, Jaishri Bogra et al., compared 5μg Dexmedetomidine with 25μg Fentanyl as adjuvants to spinal heavy bupivacaine, found dexmedetomidine is associated with prolonged motor and sensory block, hemodynamic stability, reduced demand for rescue analgesics in 24hrs as compared to Fentanyl [19] which are similar to our study. Sedation score was more in group D patients (3.8 ±0.5) as compared to group F (2.2±0.53) which is statistically significant (P<0.05). The findings correlate with our study mean sedation score in group BD (3.42 ±0.49) was significant (p<0.001) compared with group BF (2.18± 0.38), postoperative analgesic requirements in first 24hrs was significantly less in Group BD (p <.001). Incidence of nausea vomiting and pruritis was known in our study but was insignificant. α -2adrenergic agonist also have antishivering property as observed by Talkeet aland Maroof M et al., there was no incidence of shivering in our study. [20,21] Epidural dexmedetomidine α 2μg/kg for postoperative analgesia in humans did not result in any neurologic deficits [22] Fukushima et al,. Dexmedetomidine 3μg or 30μg clonidine added to13 mg spinal bupivacaine produced same duration of sensory and motor block with minimal side effects in urologic surgeries Kanazi et al., from this study, we assumed 3-5μg dexmedetomidine and 30-45μg clonidine are equipotent as adjuvants to spinal Bupivaciane. [23] Both Fentanyl and Dexmedetomidine provided good quality intraoperative analgesia, clinically better in group BD. Al-Ghanem et al., had compared 5μg Dexmedetomidine and 25μg Fentanyl as adjuvants10mg isobaric Bupivacaine in vaginal hysterectomy and concluded that 5μg Dexmedetomidine produces more prolonged motor and sensory block. These findings correlate with our study, sensory and motor block duration was significantly longer in Dexmedetomidine group (449 ± 30.9 mins, p value <0.001) and good patient satisfaction. [24] Al-Mustafa et al., studied effect of Dexmedetomidine 5μg and 10μg with Bupivacaine in urological procedures, Dexmedetomidine prolongs duration of spinal anaesthesia in a dose dependent manner and attenuates visceral pain in abdominal surgeries under spinal anaesthesia. In our study also no patient perceived visceral pain in both BD and BFgroups.[25]

## CONCLUSION:

Dexmedetomidine provides a better quality of perioperative/ intraoperative analgesia, hemodynamic stability, minimal side effects, and reduced demand for rescue analgesics in 24 hr as compared to Fentanyl. Hence, Dexmedetomidine seems to be a better choice as Intrathecal adjuvant with Bupivacaine.

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