

# Comparative Evaluation of Intrathecal Dexmedetomidine and Fentanyl with Hyperbaric Bupivacaine for Post-Operative Analgesia in Lower Abdominal Surgeries

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## Abstract

**Background:** Spinal anaesthesia is the fastest and most reliable form of regional anaesthesia. Additions of intrathecal adjuvants are useful for prolonging the spinal anaesthesia effects. **Subjects and Methods:** The Patients were divided in three groups; Group C (control group) = received 15 mg (3 ml) of hyperbaric bupivacaine intrathecally. Group D = received 15 mg (3 ml) of hyperbaric bupivacaine plus 4µg Dexmedetomidine intrathecally. Group F = received Hyperbaric Bupivacaine 15mg (3ml) plus 25µg fentanyl intrathecally. **Results:** For the total duration of sensory block p- value is 0.000003, which is less than 0.05 ( $\alpha$ ) and is highly significant. From the above p – value and scheffe post hoc test we conclude that the Bupivacaine + Dexmedetomidine has prolonged duration of sensory block as compared to bupivacaine alone and in combination with fentanyl. For the motor block p- value is 0.000000 and is less than 0.05 ( $\alpha$ ). It is highly significant. For the demand of Analgesic p-value is 0.0000001 and is less than 0.05 ( $\alpha$ ) i.e. there is highly significant difference between them. **Conclusion:** Intrathecal Dexmedetomidine used as an adjuvant to bupivacaine in spinal block seems to be a good alternative to intrathecal fentanyl as it produces early onset and prolonged duration of sensory and motor block without significant haemodynamic alteration and side effects.

**Keywords:** Dexmedetomidine, Fentanyl and Bupivacaine.

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## Introduction

Spinal anaesthesia is the fastest and most reliable form of regional anaesthesia. Additions of intrathecal adjuvants are useful for prolonging the spinal anaesthesia effects. Fentanyl is most widely used adjuvant intrathecally but is associated with side effects like respiratory depression and pruritus.<sup>[1]</sup> Another neuraxial adjuvant, Dexmedetomidine is highly selective  $\alpha_2$ -agonist. By virtue of its effect on spinal  $\alpha_2$  receptors, it mediates its analgesic effect. It provides adequate intraoperative and postoperative analgesia with stable hemodynamic conditions and minimal side effects.<sup>[2]</sup> Hence, the present study is undertaken to compare and evaluate the effects of dexmedetomidine and fentanyl as adjuvants to bupivacaine in spinal anaesthesia.

## Subjects and Methods

This study was carried out at JNUIMSRC Jaipur after approval from the Hospital Ethical Committee and written informed consent from the patients. ASA grade I or II patients of either sex, aged 18 to 60 years, scheduled for lower abdominal and lower limb surgery were included in the study.

Patients presenting with known contra indications to spinal anaesthesia, pregnant patients, Patients on therapy with adrenergic receptor antagonist, calcium channel blocker, and/or ACE inhibitor, with history of heart block or dysarrhythmia, hypersensitivity to any of the study drugs, who refused to consent to be part of study were excluded from the study.

The Patients were divided in three groups.

Group C (control group) = received 15 mg (3 ml) of hyperbaric bupivacaine intrathecally.

Group D = received 15 mg (3 ml) of hyperbaric bupivacaine plus 4µg Dexmedetomidine intrathecally.

Group F = received Hyperbaric Bupivacaine 15mg (3ml) plus 25µg fentanyl intrathecally.

Preloading was done with Ringer lactate solution (10 ml/kg body weight). Routine monitoring included non invasive blood pressure (NIBP), ECG, heart rate and pulse oximetry. All patients received supplemental oxygen via mask (3l/min).

After proper aseptic conditions, spinal anaesthesia was given at the level of L3-L4 interspace in sitting position using a midline approach by a 25G Quincke spinal needle. The drug was injected slowly over 10-15 seconds with the bevel of the needle pointing upwards and all patients were made supine.

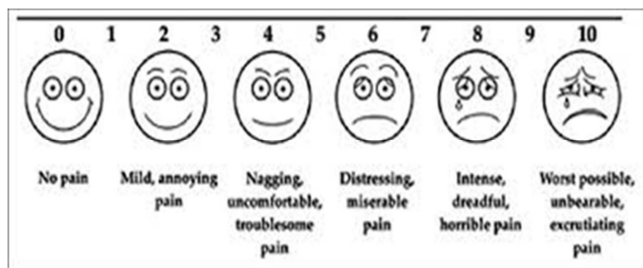
The intrathecal drug formula was prepared by a separate anaesthesiologist under strict aseptic conditions. The anaesthesiologist who administered anaesthesia was blinded to the group allocation. After administering anaesthesia the vital signs of the patient were recorded. Vitals were recorded every 2 minutes up to the 10th minute and every 5 minutes thereafter up to 20 minutes. Beyond 20 minutes the vitals were recorded every 20 minutes till the time of discharge from PACU (Post Anaesthesia Care Unit). The sensory dermatome level was assessed by loss of pin prick sensation to a 23 G hypodermic needle.

The motor dermatome level was assessed according to the Bromage Scale.<sup>[3]</sup>

- Bromage 0- Patient able to move hip, knee and ankle.
- Bromage 1- Patient unable to move hip, but able to move knee and ankle.
- Bromage 2- Patient unable to move hip and knee but able to move the ankle.
- Bromage 3- Patient unable to move hip, knee and ankle.

The sensory and motor status was assessed at 2 minutes after the spinal injection then, every 5 minutes for the next 30 minutes and thereafter every 30 minutes until the time to regression of sensory level to dermatome S2 and motor scale to bromage 0.

Time to reach the sensory block up to highest dermatome level and motor block of bromage 3 level was noted. On achieving T8 sensory blocked level, the surgical procedure was carried out. Then time to regression to dermatome S2 level and time to reach bromage 0 was noted in post-operative care unit. All durations were calculated taking the spinal injection time as time zero. Patient was discharged after the sensory block regresses to S2 level and motor block to bromage 0.



Postoperatively, the pain scoring was done by using visual analog scale (VAS)(4) (0 = no pain, 10 = severe pain), with the vital recordings of the study until the patient was discharged inj diclofenac was given intravenous as rescue analgesia when VAS was greater than 4. Time of administering the first dose of rescue analgesia was taken as the duration of postoperative analgesia due to the adjuvant.

For the purpose of the study hypotension was defined as a decrease in systolic blood pressure more than 30% of the baseline value or fall below 90 mmHg, which was treated by mephentermine 6 mg, i.v. fluids. Bradycardia was defined as heart rate less than 60/min and was treated with iv atropine 0.6mg.

Results

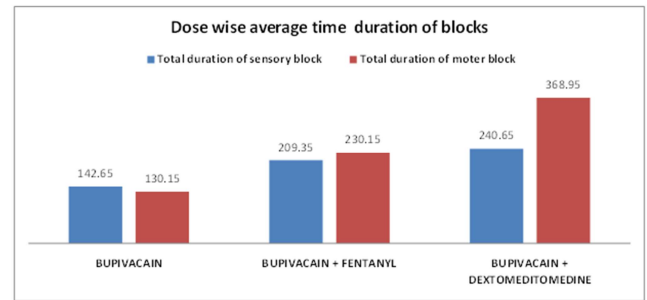


Figure 1: Duration of Block.

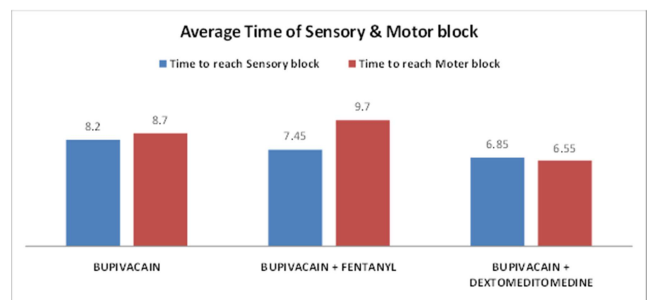


Figure 2: Average time of Sensory & Motor Block.

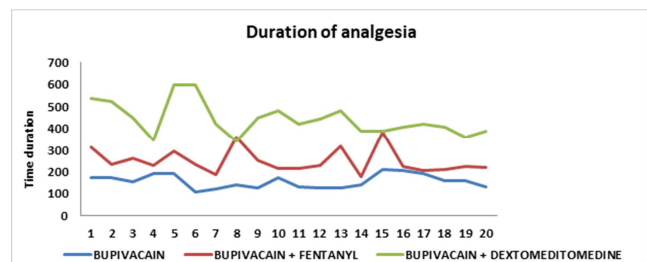


Figure 3: Duration of Analgesia.

Table 1: Patients and surgery characteristics

Variable	Bupivacaine	Bupivacaine + Fentanyl	Bupivacaine + Dexmedetomidine
Age	46.15 ± 5.08	39.10 ± 4.98	31.75 ± 5.58
Weight	64.20 ± 3.79	63.55 ± 3.40	65.20 ± 3.14
Pulse	74.05 ± 3.53	88.65 ± 5.91	83.30 ± 5.09
Blood Pressure	133.1/80.4 ± 4.93/2.67	134.8/83.05 ± 4.54/3.52	135/81.8 ± 4.55/3.66

Table 2: Block characteristics

Variable	Bupivacaine	Bupivacaine + Fentanyl	Bupivacaine + Dexmedetomidine
Time to reach T8 Sensory Block (In min.)	8.2 ± 0.6	7.5 ± 1.24	6.85 ± 1.55
Motor Block (In min.)	8.7 ± 0.9	9.7 ± 1.7	8.35 ± 3.40
Total duration of Sensory Block (In min.)	142.7 ± 10	209.4 ± 17.1	241 ± 21
Total duration of Motor Block (In min.)	130.2 ± 9.5	230 ± 26.6	369 ± 25
Duration of Surgery	63.1 ± 16.6	94.4 ± 17.4	104 ± 21.5
Demand of Analgesia	156.5 ± 13.2	250.3 ± 24	443 ± 32

For the total duration of sensory block p- value is 0.000003, which is less than 0.05 ( $\alpha$ ) and is highly significant.

From the above p – value and scheffe post hoc test we conclude that the Bupivacaine + Dexmedetomidine has prolonged duration of sensory block as compared to bupivacaine alone and in combination with fentanyl.

For the motor block p- value is 0.000000 and is less than 0.05 ( $\alpha$ ). It is highly significant.

For the demand of Analgesic p-value is 0.0000001 and is less than 0.05 ( $\alpha$ ) i.e. there is highly significant difference between them.

## Discussion

Spinal anaesthesia is useful and successful technique in all infraumbilical surgeries. Addition of adjuvants to intrathecal bupivacaine not only improves intraoperative analgesia but also prolongs post-operative analgesia with minimal side effects.

Intrathecal dexmedetomidine,  $\alpha$ -2 adrenoceptor agonist act by blocking  $\text{Na}^+$  channel and have antinociceptive action for both somatic and visceral pain.

Fentanyl as an adjuvant when given intrathecally binds to the opioid receptors or other nonspecific binding sites in the spinal cord and rostral migration occurs via the csf to supraspinal sites

Intrathecal Dexmedetomidine as an adjuvant when compared with spinal bupivacaine alone prolongs the sensory block by depressing the release of C-fiber transmitter and by hyperpolarization of post synaptic dorsal horn neuron.<sup>[5,6]</sup>

In our study the time of onset for sensory block (T-8 level) was found to be shorter in group D ( $6.85 \pm 1.55$ ) cases as compared to group F ( $7.5 \pm 1.24$ ) which was shorter than group C ( $8.2 \pm 0.6$ ) cases [Table 2 & Figure 2]. These findings are not in concordance with results of Al Ghanem et al,<sup>[7]</sup> who observed no difference in onset time in patients receiving Dexmedetomidine ( $7.5 \pm 7.4$ ), and fentanyl ( $7.4 \pm 3.3$  mt) as adjuvant to isobaric bupivacaine. ( $P = 0.95$ ).

Al Ghanem et al,<sup>[7]</sup> added intrathecal dexmedetomidine  $10 \mu\text{g}$  to bupivacaine and found early onset of sensory block to T10 level which is in concordance with our study.

In our study duration of sensory block was increased in group D ( $241 \pm 21$  min) as compared to group C ( $142.7 \pm 10$  min) and group F ( $209.4 \pm 17.1$  min) which is in concordance with study by Shukla et al.<sup>[8]</sup> In this study, dexmedetomidine ( $10 \mu\text{g}$ ) was added to bupivacaine and it produced early onset and prolonged duration of sensory and motor block with hemodynamic stability and good post-operative analgesia.

Sensory and motor block duration was prolonged with intrathecally  $10 \mu\text{g}$  dexmedetomidine in study done by Hala et al.<sup>[9]</sup>

Onset of motor block was found to be comparable in group C and group D and it was slightly prolonged in group F. (As shown in [Table 2 & Figure 2].

Total duration of motor block was found to be markedly increased in group D ( $369 \pm 25$ ) as compared to both group C ( $130.2 \pm 9.5$ ) and group F ( $230 \pm 26.6$ ) [Figure 1 & Table 2]

Al-Mustafa-et al,<sup>[10]</sup> and Al-Ghanem et al,<sup>[7]</sup> used higher of Dexmedetomidine ( $5 \mu\text{g}$  and  $10 \mu\text{g}$ ) and found

that its effect is dose dependent.

In a study done by Gupta et al,<sup>[11]</sup> motor and sensory block was prolonged with addition of  $5 \mu\text{g}$  dexmedetomidine intrathecally. The demand for post-operative analgesia was reduced in 24 hrs. It is in concordance with our study.

In our study we noted rescue analgesia was required much later in both group F ( $250.3 \pm 24$ ) and D ( $443 \pm 32$ ) group as compared to group C. ( $156.5 \pm 13.2$ ). Requirement of the rescue analgesia was markedly delayed in group D cases as compared to group F cases which support the analgesic efficacy of Dexmedetomidine as an adjuvant to bupivacaine. [Figure 3]

Similarly significant improved analgesic efficacy was seen by Gupta et al.<sup>[11]</sup> Al-Mustafa et al,<sup>[10]</sup> and Hala EA et al,<sup>[9]</sup> compared Dexmedetomidine and fentanyl as intrathecal adjuvants (p less than 0.001) and observed dose dependent prolongation of motor and sensory blockade with reduced analgesic requirement with increasing doses of intrathecal Dexmedetomidine ( $5, 10$ , and  $15 \mu\text{g}$ )

## Conclusion

In conclusion, Intrathecal Dexmedetomidine used as an adjuvant to bupivacaine in spinal block seems to be a good alternative to intrathecal fentanyl as it produces early onset and prolonged duration of sensory and motor block without significant haemodynamic alteration and side effects. It also produces excellent quality of post-operative analgesia.

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