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# Effect of adding 5-µg Dexmedetomidine vs 10 µg Dexmedetomidine to Intrathecal Bupivacaine in Infraumbilical Surgeries

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## Abstract

**Background:** Subarachnoid anaesthesia is now used primarily for infraumbilical surgery. The relatively short duration of analgesia, which was a limiting factor, is eliminated by mixing an adjuvant with intrathecal bupivacaine. Our objective is to determine the optimal intrathecal dexmedetomidine dosage to be used during infraumbilical surgery in conjunction with 0.5% hyperbaric bupivacaine. **Material and Methods:** A parallel group, double blind, randomised controlled experiment was conducted at Department of Anaesthesia, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram, Andhra Pradesh, with 60 adult patients scheduled for infraumbilical surgery under subarachnoid block. Each person received 3.2 mL (16.0 mg) of 0.5% hyperbaric bupivacaine. Groups D5.0 and D10.0 (n = 30 each) additionally received intrathecal doses of 5.0and 10.0 µg of dexmedetomidine as an adjuvant. Vital signs, information regarding the onset and duration of the sensory and motor block, time to attain peak level of sensory and motor blockade, the time to first rescue analgesia, the total duration of analgesia and other details were recorded at regular intervals. Postoperative analgesia was assessed using a visual analogue scale at 15 and 30 minutes, then every 30 minutes for the following two hours, and then every hour for the following six hours. Sedation, hypotension, and bradycardia were among the adverse effects that were noted as needing rapid medical intervention. **Results:** The maximum sensory level reached by Group D10.0 was higher than that of the other group. There was a significant and dose-dependent reduction in the mean time to peak sensory block (3.9 and 2.9 min; P 0.001) and peak motor block (5.6and 4.8 min; P 0.001) and a prolongation of postoperative analgesia duration (206.9 and 244.0 min) with increasing doses of dexmedetomidine (5.0and 10.0 µg) respectively. Hemodynamic effects and adverse outcomes were similar between the two groups. **Conclusion:** Intrathecal dexmedetomidine (10.0 µg) extends the duration of postoperative analgesia in spinal anaesthesia when used as an adjuvant to 0.5% hyperbaric bupivacaine (16.0 mg). Despite the small absolute changes, the results are better compared to dosage of 5 µg as an adjuvant intrathecally to 0.5% hyperbaric bupivacaine.

**Keywords:** Bupivacaine, dexmedetomidine, infraumbilical surgery, postoperative analgesia, subarachnoid block.

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## Introduction

The most common adverse effect of spinal anaesthesia is hypotension, which is directly linked to increased rates of morbidity and mortality.[1,2] Studies have shown that lowering the amount of intrathecal local anaesthetic administered can dramatically cut down on the number of patients who experience spinal-induced hypotension. On the other hand, one of the limitations of using this approach was that it could only produce anaesthesia and analgesia for a moderately short amount of time.[3,4] Many different kinds of adjuvants, such as fentanyl, sufentanil, and epinephrine, amongst others, have been suggested as a means of overcoming this drawback and helping to prolong anaesthesia and analgesia.[5-7] On the other hand, research has shown that these adjuvants are linked to a number of adverse effects that are not desirable. Despite the fact that it was claimed to increase the amount of time that spinal anaesthesia lasted without causing any additional adverse effects, magnesium sulphate did not succeed in our earlier research in reducing the required dose of intrathecal bupivacaine.[8-10] Dexmedetomidine is also used as an adjuvant,[11] and has the ability to extend the amount of time that a spinal, paravertebral nerve, or transversus abdominis plane block and is effective in relieving patient's pain.[12-16] We arrived at the conclusion that the value of the ED95 (95% effective dosage) of spinal hyperbaric bupivacaine could possibly be lowered by the injection of Dexmedetomidine intrathecally. This research was conducted with the intention of determining the effective dose (ED95) of intrathecal hyperbaric bupivacaine with or without Dexmedetomidine as an adjuvant in spinal anaesthesia.

## Material and Methods

After ethics committee clearance and signed informed consent, 60 patients scheduled for elective infraumbilical surgeries were enrolled in this study.

### Study subjects:

These 60 patients were randomized using a computer-generated table into two groups of 30 patients each as follows.

Group D5.0: Patients in this group received 3.2 ml of 0.5% hyperbaric bupivacaine + 5µgof Dexmedetomidine intrathecally.

Group D10.0: Patients in this group received 3.2 ml of 0.5% hyperbaric bupivacaine + 10µgof Dexmedetomidine intrathecally.

### Following criteria were adopted for selecting the patients:

### Inclusion criteria:

1) Patients of age 18yrs to 65yrs
2) ASA physical status I and II

### Exclusion criteria:

1) Lack of written or informed consent
2) Hypersensitivity to the study drug
3) Bleeding diathesis
4) ASA III and IV
5) Local site infection
6) Patient with abnormal spinal anatomy

### Anesthetic technique:

Drugs and equipment necessary for resuscitation and general anesthesia administration were kept ready. After shifting the patient to the OT all ASA standard monitors were attached. An I.V. line was secured with 18G cannula. An autoclaved spinal tray was used. Patient was put

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in sitting /lateral position and under aseptic precautions 25 G spinal needle was introduced and sub arachnoid block was performed at L3-L4 intervertebral space using one of the two study drugs as an adjuvants along with hyperbaric bupivacaine i.e., Group D5.0 patients received 3.2 ml of 0.5% hyperbaric bupivacaine + 5µgof Dexmedetomidine intrathecally and Group D10.0 patients received 3.2 ml of 0.5% hyperbaric bupivacaine + 10µgof Dexmedetomidine intrathecally.

- The onset of sensory and motor blockade was noted.
- The time to attain peak level of sensory and motor blockade was noted.
- Fluid management: crystalloids iv fluids were given intraoperatively according to holiday segar formula.

**Postoperatively the following were monitored:**

- Total duration of analgesia as per time to the requirement of first analgesic rescue.
- Duration of motor blockade was calculated from the onset of loss of any voluntary motor movement to the appearance of first voluntary movement postoperatively and complications if any.

**Statistical analysis**

The demographic information, procedure duration, onset of sensory and motor block, onset time to the maximum level of the block, duration of the sensory block, and analgesia were all analysed using the Student's t test. The greatest level of sensory block was established using the Mann-Whitney U test and reported as a median (range). The degree of patient satisfaction and side effects were examined using chi-square analysis (rate). Kaplan-Meier survival analysis was used to look at how long spinal analgesia lasted. Graph Pad Prism 5 was used to do the statistical analysis. A difference with a P value of 0.05 or less was deemed significant.

## RESULTS

**Table 1: Patient demographic and surgical data**

| | **Dexmedetomidine5µg group (n=30)** | **Dexmeditomidine10µg group (n=30)** | **P-value** |
|---|---|---|---|
| Age(y) | 26±3 | 25±4 | 0.43 |
| Height(cm) | 164±3 | 163±3 | 0.41 |
| Weight(kg) | 73±4 | 72±3 | 0.84 |
| Duration of surgery(min) | 44±7 | 46±8 | 0.42 |

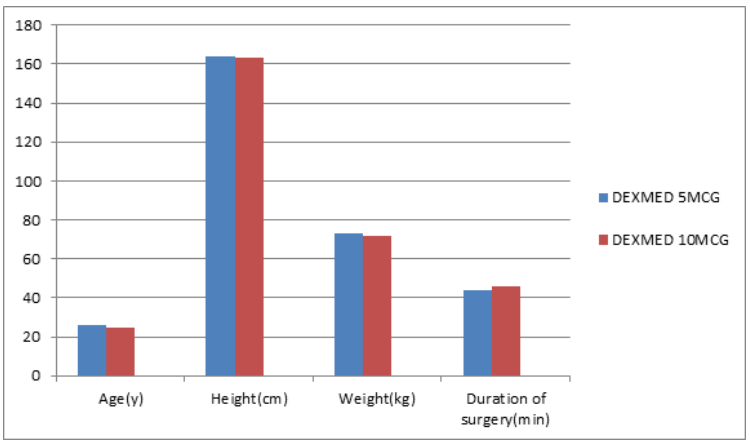

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**Table 2: Characteristics of spinal anaesthesia in patients with effective anaesthesia**

| PARAMETER | Dexmedetomidine group 5µg (n=30) | Dexmedetomidine group10µg (n=30) | P-value |
|---|---|---|---|
| Onset time to$T_{10}$ (min) | 3.9±1.1 | 2.9±1.3 | >0.05 |
| Time to highest level | 13.7±4.8 | 11.7±4.0 | >0.05 |
| Duration (min) | 110.3±35.3 | 67.5±31.2 | <0.05 |
| Onset time (min) | 5.6±2.1 | 4.8±1.9 | >0.05 |
| Duration of analgesia (min) | 206.9 | 244.0 | <0.001 |

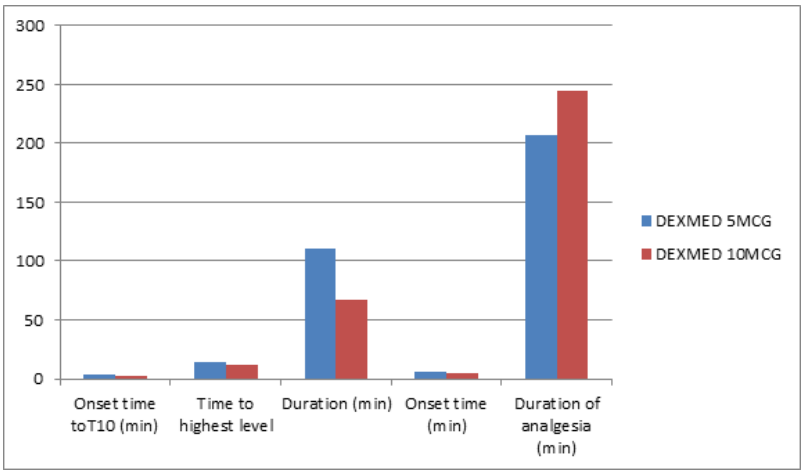
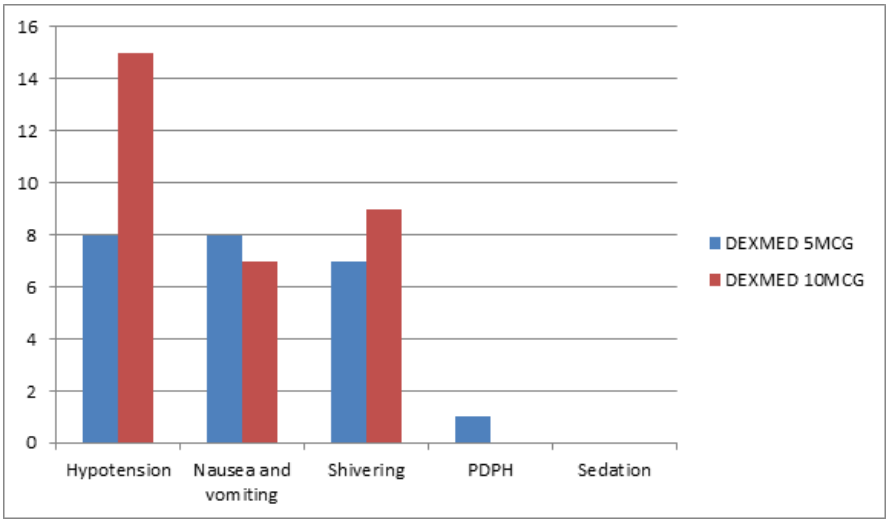



**Table 3: Side effects of anaesthesia.**

| | Dexmedetomidine 5µg group (n=30) | Dexmeditomidine 10µg group (n=30) | P-value |
|---|---|---|---|
| Hypotension | 8(18) | 15(33) | 0.09 |
| Nausea and vomiting | 8 (18) | 7(16) | 0.78 |
| Shivering | 7(16) | 9(20) | 0.58 |
| PDPH | 1(2) | 0 | 0.32 |
| Sedation | 0 | 0 | 1 |



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## DISCUSSION

We decided to use 10 μg Dexmedetomidine as an adjuvant of bupivacaine for this study because, according to the authors of a number of earlier studies, it is possible for 10 μg Dexmedetomidine to lengthen the duration of spinal analgesia. In light of the fact that infra umbilical surgeries is a relatively quick procedure and in accordance with the findings of our earlier research, we determined that effective anaesthesia consisted of a bilateral T5 or higher sensory block level that was achieved within ten minutes of the administration of the drug with no additional epidural anaesthetic being required for intraoperative pain relief.[17-19] In our study, onset time in Dexmedetomidine 5μg group was 3.8 ± 1.1 (min) while that of Dexmedetomidine 10μg group was 2.9 ± 1.3 (min). Also, duration of analgesia (min) in Dexmedetomidine 5μg group was less (206 .9 ± 45.4) as compared to Dexmedetomidine 10μg group (244.0 ± 31.6). Even side effects prevailing in Dexmedetomidine 5μg group were at low scale as compared to Dexmedetomidine 10μg group, as such with Hypotension in 8 and 15 cases respectively.

According to the findings of Singh, R. P. et al., 2021 reported the ED95 for bupivacaine was 8.4 mg (95% confidence interval, 6.5–13.8 mg) in the Dexmedetomidine 5 μg group and 12.1 mg (95% confidence interval, 8.3–312.8 mg) in the Dexmedetomidine 10μg group. 5 μg Dexmedetomidine has been shown to decrease the ED95 of hyperbaric bupivacaine by 31% in patients undergoing infra umbilical surgeries. This is the first paper that we are aware of in which it was discovered that 5 μg Dexmedetomidine decreased the ED95 of hyperbaric bupivacaine.[20] In addition, we demonstrated that administration of 10μg Dexmedetomidine reduced the quantity of consumed recovered tramadol while simultaneously extending the duration of sensory blockade and analgesia. This was comparable to a number of investigations that took place in the past. Samantaray et al. discovered that adding 5 μg Dexmedetomidine increased the duration until the first rescued analgesic request by approximately 120 minutes and decreased the analgesic demand by 24 hours. This was in comparison to adding saline or midazolam, both of which decreased the analgesic demand. During the dose-response study, the researchers found that the addition of Dexmedetomidine caused a dose-related prolongation of analgesia for a longer period of time. According to Qi and colleagues, Dexmedetomidine was comparable to morphine in that it prolonged the effects of the analgesic and reduced the likelihood that adverse reactions would occur. Anaesthetists frequently make use of dexmedetomidine, which is a highly selective alpha-2-adrenergic receptor (2-AR) agonist. This medication is utilised not only because of its sedative, analgesic, and sympatholytic effects, but also because of its haemodynamic stabilising properties.[21]

Choudhary, et al., 2018, in this particular research endeavor, described the improved anaesthetic efficacy as well as the prolonged duration of postoperative analgesia. To begin, a number of researchers believe that the action of 2-AR in the body causes vasoconstriction caused by Dexmedetomidine, which, in turn, may help to prolong the duration of analgesia. By combining clonidine and epinephrine with local anesthetics, Eledjam and colleagues were able to demonstrate that clonidine exerts its effects not via vasoconstriction but rather via 2-AR agonists. It's possible that Dexmedetomidine could work through the same mechanism as 2-AR agonists that clonidine does. Yoshitomi et al. later hypothesised in a pig investigation that Dexmedetomidine may improve local anaesthetic activity by the action of 2-AR. Dexmedetomidine may augment the spinal block through a synergistic interaction between sodium channels and 2-AR antagonists, which could lead to a decrease in the amount of local anaesthetics needed to achieve successful spinal anaesthesia for some surgical operations.[22]

Soori, et al., 2020 reported the effectiveness of Dexmedetomidine as an adjuvant in spinal anaesthesia has been the subject of numerous investigations. Even at a high dose of 20 g/kg of Dexmedetomidine delivered with ropivacaine in sciatic nerve blocks in rats, a preclinical

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study indicated that the addition of Dexmedetomidine to ropivacaine lengthens the duration of the sensory blockade while exhibiting minimal neurotoxicity. The author discovered that intrathecal Dexmedetomidine can cause antinociception in rats without showing any histological indications of spinal cord injury in a different animal investigation. Furthermore, 48 hours following acute spinal ischaemia in rats, Goyagi et al. found that continuous intravenous Dexmedetomidine infusion can enhance neurological and histological outcomes. No reports indicating a neurological impairment associated to intrathecal Dexmedetomidine were discovered in our clinical experience. Dexmedetomidine appears to be a safe intrathecal adjuvant because no unexpected neurological symptoms or signs were observed.[23]
In this study, the adverse effects experienced by the two groups were comparable. However, there was a modest reduction in the incidence of hypotension in the Dexmedetomidine 5 μg group compared to the Dexmedetomidine 10 μg group, which indicated that lowering intrathecal local anaesthetic can lessen the incidence of spinal-induced hypotension.

## CONCLUSION

The study showed higher success rate for using dexmedetomidine 10μg group rather than the dexmedetomidine 5μg as adjuvants for 0.5% hyperbaric bupivacaine. When given intrathecally at a dose of 10 μg together with bupivacaine, dexmedetomidine increased the antinociceptive effects of hyperbaric bupivacaine by 31% in spinal anaesthesia for patients undergoing infra umbilical operations.

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