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# EFFECTS OF VARIABLE DOSES OF INTRATHECAL DEXMEDITOMIDINE 5MCG 10MCG 15MCG AND 20 MCG IN LOWER ABDOMINAL SURGERIES

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## ABSTRACT

**Background and objectives:** In order to improve the effectiveness of spinal anaesthesia, the drug dexmedetomidine, which is a selective alpha2 adrenoceptor agonist, has been employed. The purpose of this research was to determine the ideal dose of dexmedetomidine for intrathecal administration during procedures involving the lower abdomen.

**Methods:** Study was conducted at Lifeline hospital Abu Dhabi between 2021 – 2022. One hundred adult patients with ASA I and ASA II were enrolled in this trial that was randomised, controlled, and blinded on both sides. They were divided up into the five groups as C, D1,D2,D3 and D4. Patients who were allergic to the medications that were going to be utilised in the trial, as well as patients who already had neurological disorders, coagulopathies, heart ailments, obesity, or hypertension, were not allowed to participate in the research.

**Result:** The control group experienced a mean analgesia duration of 201 minutes, while the D1 group experienced 259.1 minutes, the D2 group experienced 310.1 minutes, the D3 group experienced 540 minutes, and the D4 group experienced 702.4 minutes. The D3 and D4 groups had hypotension that needed to be treated, but the Dexemeditomidine groups had much reduced mean maximum VRS ratings and analgesic requirements.

**Conclusion:** We came to the conclusion that 10 mcg of dexmedetomidine administered intrathecally is the optimal dose after weighing the prolonging of anaesthesia and analgesia against the potential adverse effects.

**Keywords:** Time of initial rescue analgesia, hemodynamics, and VRS score

## INTRODUCTION

When it comes to surgeries involving the lower abdomen, perineum, and legs, spinal anaesthesia is by far the most common block used. In order to extend the analgesic impact of local anaesthetics, many adjuncts have been utilised, including fentanyl, ketamine, tramadol, neostigmine, magnesium sulphate, etc. It has been established that clonidine, when combined with either hyperbaric or isobaric bupivacaine, greatly lengthens the duration of anaesthesia while maintaining a favourable safety profile [1-3]. To extend bupivacaine-based spinal anaesthesia with minimal adverse effects, Strebel and co-workers recommended a clonidine dose of 150 mcg [2]. Recently, dexmedetomidine has been utilised as an adjuvant to intrathecal local anaesthetic because it is a more selective alpha 2 adrenoceptor agonist [4-6]. The results of both animal [7,8] and human [5] studies imply a dosage ratio of 1:10 between dexmedetomidine and clonidine. Dexmedetomidine, when combined with ropivacaine at a dose of 5 mcg, was linked with longer motor and sensory block, hemodynamic stability, and less need for rescue analgesics in the next 24 hours than fentanyl [9]. Lower postoperative analgesic requirements and less shivering in patients after lower abdominal surgery were identified in an evaluation of the role of dexmedetomidine 5 mcg as adjuvant intrathecally by Abdelhamid and El-lakany [10]. Intrathecal dexmedetomidine 10 mcg and 15 mcg were

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tested by Hala EA Eid, who hypothesised that they would prolong sensory block in a dose-dependent manner without significant hemodynamic consequences [11]. Dexmedetomidine dosages recommended by various observers vary. Studies have shown that increasing the amount given intrathecally increases the duration of analgesia. The cardio depressant side effects of hypotension and bradycardia, however, may become more pronounced.

## MATERIAL AND METHODS

Study was conducted at the Lifeline Hospital, Abu Dhabi between 2021-2022. One hundred adult patients with ASA I and ASA II were enrolled in this trial that was randomised, controlled, and blinded on both sides. They were divided up into the five groups described above. Patients who were allergic to the medications that were going to be utilised in the trial, as well as patients who already had neurological disorders, coagulopathies, heart ailments, obesity, or hypertension, were not allowed to participate in the research.

### Inclusion criteria:

ASA 1 and 2 Patients
Age Group: 20 to 60 years
Elective lower abdominal surgeries

### Exclusion criteria:

Patients not willing
ASA grade 3 and above
Contraindications to Regional anesthesia
Allergic reaction to any of the drugs being used

### Statistical Analysis

A power analysis determined that in order to detect a difference of 30 minutes in the median duration of postoperative analgesia between the groups, 20 patients would need to be included in each study group. Mean and standard deviation (SD) or numbers and percentages were used to represent the results. One-way analysis of variance (ANOVA) was used to analyse the data from the different groups. The non-parametric Kruskal-Wallis test was performed. The Mann-Whitney U test or t-test was used to compare data from the different study groups. If the p-value was less than 0.05, then the results were judged reliable.

## RESULT

One hundred patients were enrolled in the trial, split evenly amongst groups C, D1, D2, D3, and D4. Age, BMI, height, gender makeup, ASA physical status, and operating time were all similar between the groups [Table 1].

**Table 1: Data on Population**

| Patient Profile | Group C | Group D1 | Group D2 | Group D3 | Group D4 |
|---|---|---|---|---|---|
| Age (years) | 43.22 | 38.5 | 38.7 | 42.33 | 44.86 |
| Sex (M:F) | 14:6 | 15:3 | 14:6 | 15:7 | 11:73 |
| Weight(kg) | 63.11 | 61.4 | 57.6 | 64.76 | 60.24 |
| Height(cm) | 163.7 | 166.6 | 165.8 | 171.2 | 166.2 |
| ASA I:II | 17:3 | 13:9 | 14:8 | 14:4 | 15:35 |
| Operative time (min) | 96.8 | 95.70 | 94.78 | 100.4 | 106.47 |

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The sort of operation performed made no discernible impact. There were no significant differences in preoperative discomfort, sedation levels, or hemodynamics between the groups. Different types of sensory and motor blockages are summarised in [Table 2].

**Table 2: A comparison of the study groups' sensory and motor block characteristics**

| Group | C | D1 | D2 | D3 | D4 |
|---|---|---|---|---|---|
| Onset time of sensory block | 2.14 | 2.14 | 2.65 | 1.74 | 1.47 |
| Onset time of motor block | 3.47 | 2.47 | 2.38 | 2.24 | 1.66 |
| Onset time to reach T10 dermatome | 8.15 | 6.85 | 6.14 | 4.96 | 3.55 |
| Time to achieve max block | 18.14 | 14.12 | 12.78 | 9.57 | 8.85 |
| Highest sensory level | T8 | T8 | T6 | T6 | T6 |
| Time of 2 segment sensory regression | 94.6 | 122.4 | 157.7 | 217.4 | 298.3 |
| Time of regression to S1 | 226.7 | 288.2 | 381.5 | 594.5 | 760.9 |
| Time to rescue analgesia | 200.4 | 257.1 | 311.6 | 541.2 | 701.3 |
| Time of regression to Bromage 0 | 151.5 | 252.8 | 385.3 | 410.6 | 461.8 |
| Highest pain score VRS scale 0-10) | 6.9 | 5.3 | 3.24 | 2.8 | 2.8 |
| NO. of patients requiring Diclofenac injections in 1st 24 hours postoperatively | 43 | 36 | 27 | 22 | 17 |

Different groups took significantly longer or shorter than the placebo to experience the onset of sensory or motor blockages, or to progress to T10 & the highest level. Dexmedetomidine seems to have a dose-dependent decreasing tendency for the times required for sensory and motor block onset and for the block to reach T10, or the greatest degree. The highest sensory intensity achieved was not significantly different across groups in terms of median or range. Time to two-segment sensory regression, sensory level regression to S1, and motor block regression to 0 were all significantly delayed relative to placebo as measured using the modified Bromage scale. Similarly, the period until the need for rescue analgesia became more extended across the groups as the dose of dexmedetomidine rose.

When comparing the five groups on their need for further analgesics over the course of 24 hours, groups D1, D2, D3, and D4 saw a statistically significant reduction compared to the placebo group. Tramadol was also necessary for six patients in group C and three in group D1. None of the patients in D2, D3, or D4 needed additional tramadol. In addition, we discovered that 1, 4, and 9 patients in Groups D2, D3, and D4 had sedation to varying degrees. The number of patients meeting this criteria and the average sedation score both rose in the groups given greater doses of dexmdetomidine. However, the sedation scores did not vary noticeably between the various sedation groups.

Over the course of the trial, both groups had similarly low mean arterial pressure and heart rates. More patients in groups C, D3, and D4 than in groups D1 and D2 needed injection Ephedrine to counteract hypotension. Some patients on C, D2, and D3 had nausea and vomiting that was managed with an 8-mg injection of ondansetron. All patients showed full functional return of their senses and muscles. At their subsequent appointments, none of the patients had any neurological deficits. Shivering was reported by 7 patients in the control group, 3 in D2, and 2 in D3.

## DISCUSSION

When used alone, bupivacaine is effective for procedures that will take up to two to three hours. Therefore, we employ an adjunct if we need regional anaesthetic for a longer period of

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time. The postoperative analgesia provided by the addition is a further benefit. Several adjuvants have been investigated for their potential to extend the duration of effect of spinal anesthesia . Dexmedetomidine is one of the adjuvant drug used in spinal anesthesia.

Dexmedetomidine acts as a selective agonist for alpha 2 adrenoceptors. Inhibition of neuronal firing and a sympatholytic effect (low blood pressure, slow heart rate, drowsiness, and pain relief) result from activation of receptors in the brain and spinal cord [14].

Neurological deficits or neurotoxicity were not reported in many animal investigations employing intrathecal dexmedetomidine at doses ranging from 2.5 to 100 mcg [15-19]. Intrathecally administering bupivacaine and dexmedetomidine (3mcg) in humans was performed by Kanazi et al. Motor block onset was found to be delayed and block duration was shown to be increased with hemodynamic stability and no sedation [5]. After adding 5 mcg of dexmedetomidine to hyperbaric bupivacaine, Gupta et al. found that the duration of sensory and motor block was significantly prolonged, the quality of intraoperative and postoperative analgesia was improved, patients remained haemodynamically stable, and adverse effects were minimal [9]. Dexmedetomidine, when combined with bupivacaine for urological procedures, significantly increases the duration of spinal anaesthesia in a dose-dependent way, as shown in a study by Al-Mustafa et al. [20]. In a trial utilizing 10 and 15 mcg of spinal bupivacaine in 3 ml of 0.5% hyperbaric bupivacaine [11], Hala EA Eid et al. reported a considerably extended anaesthetic and analgesic effect, which may be useful in difficult lower limb procedures.

In our study, we compared four doses of dexmedetomidine (5, 10, 15, and 20 mcg) to placebo as an adjunct to hyperbaric bupivacaine to determine which dose is optimal for intrathecal use; that is, which dose provides the longest duration of intraoperative anaesthesia and postoperative analgesia with the fewest adverse effects.

Dexmedetomidine groups showed considerably quicker onset of sensory and motor block compared to the control group and groups receiving greater doses compared to those receiving lower doses. Similarly, Ogan et al. and Shukla et al. [21,22] found that the onset of peak sensory block and the latency to achieve the Bromage 3 level of sensory block were much earlier than our results. Postoperative pain levels were lower and analgesia lasted longer in patients who were given dexmedetomidine compared to those in the control group. Dexmedetomidine's analgesic effects were magnified over the course of a whole day, suggesting that the effect was dose-dependent. Most patients in groups D1 and D2 were able to keep their haemodynamics on a low normal trajectory. Many patients in groups D3 and D4 experienced hypotension that was treated with intravenous fluid boluses and Ephedrine injections.

Many individuals in groups D3 and D4, as well as some in D2, with a sedation score of 2 can be explained by the fact that alpha 2 agonists induce sedative effect by acting on alpha 2 adrenergic receptors in locus coeruleus [23,24]. Sedation at greater doses may originate from CSF cephalad migration or vascular redistribution to higher centres [25]. In a similar vein, Hala EA Eid et al. found that 15 mcg of intrathecal dexmedetomidine produced a similar effect. Patients were peaceful and cooperative, so no additional sedation was necessary; at the same time, they were conscious and easily aroused thanks to the sedation.

Our research shows that spinal anesthesia's sensory and motor blockade, as well as postoperative analgesia, can be significantly extended. As the dosage was increased, the effect

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 07, 2023

intensified. Patients with extended surgical time may benefit from this effect, and it may be preferable to use this technique than general anaesthesia or epidural anaesthesia.

Thirty percent of D4 patients and fifteen percent of D3 patients experienced bradycardia, while only ten percent of D1 and D2 patients did. Dexmedetomidine causes hypotension and bradycardia due to postsynaptic stimulation of central alpha group 2 adrenoceptors, an effect that can be employed wisely to mitigate the stress response of surgery [26].

After 30 minutes, dexmedetomidine always reduced blood pressure and heart rate. This is because dexmedetomidine causes a transient hypertension state followed by hypotensive state. Alpha 2B adrenergic receptors are responsible for the early hypertensive phase, whereas alpha 2A adrenergic receptors are responsible for mediating hypotension. Overriding the direct stimulating effects is inhibition of the central sympathetic outflow, which leads to a decrease in blood pressure by about 10% to 20% below baseline and stabilization of the heart rate, also below baseline values [27]. This initial response lasts for 5 to 10 minutes. We think the hypotension from the Bupivacaine counteracts the hypertension from the dexmedetomidine at the outset. After 30 minutes of stable blood pressure, we began to detect episodes of hypotension, which were often accompanied by nausea and vomiting. Increased vagal activity following sympathetic block has been linked to increased peristalsis of the gastrointestinal tract, which in turn has been linked to feelings of nausea [28]. However, in D4, where hypotension was more common than in other groups, no patients reported feeling sick. Sedation is a possible explanation. D2 and D3 individuals experienced shivering, while D4 patients did not. Dexmedetomidine's anti-shivering effects have been demonstrated in prior research. Therefore, the OT temperature setting could be to blame for the higher frequency in D2 and D3.

## CONCLUSION

Dexmedetomidine has been shown to dramatically increase the onset, duration, and analgesia of sensory and motor block when compared to placebo. Therefore, it can be used as an alternative to epidural anaesthesia for long-term surgical procedures. However, increased caution is warranted when using 15mcg or 20mcg because of the elevated risk of hypotension and bradycardia at those doses. We believe that a dose of 10 mcg of dexmedetomidine provides the best balance between analgesia maintenance and adverse effects. Due to its significant intrathecal anaesthetic and analgesic qualities paired with low side effects, we propose using 10 mcg of intrathecal dexmedetomidine as an adjuvant to bupivacaine for long duration surgical procedures.

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Nil

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