

Comparison of 5µg and 10 µg of Dexmedetomidine as an adjuvant with Bupivacaine (heavy) under Spinal anaesthesia in Urological surgeries

Mahadeva Prasad DR^{1*}, Anitha Hanji S², Narasimha Gnani BC³

^{1,3}PG Student, ²Associate Professor, Dept. of Anaesthesiology & Critical Care, JJM Medical College, Davangere, Karnataka

***Corresponding Author:**

Email: drprasaddr88@gmail.com

Abstract

Objectives: This study is to know the efficacy of 5µg and 10µg of Dexmedetomidine adding to 0.5% bupivacaine (heavy) under spinal anaesthesia for urological procedures.

The purpose of our study is to know sensory onset, motor onset, sensory blockade duration, motor blockade duration, effective analgesia duration, rescue analgesia duration, VAS score, haemodynamic factors like heart rate and blood pressure and also untowards adverse effects.

Materials and Method: In a prospective randomized study, 120 patients of ASA grade I/II aged between 20 - 60 years undergoing urological surgeries were divided randomly into three groups of 40 each. Group D5- 0.5% hyperbaric bupivacaine 12.5 mg (2.5ml) + 5 µg Dexmedetomidine, Group D10- 0.5% hyperbaric bupivacaine 12.5 mg (2.5ml) + 10 µg Dexmedetomidine, Group BS- 0.5% hyperbaric bupivacaine 12.5mg + normal saline 0.5ml. Results was analysed using one way ANOVA and Kruskal wallis test. $p < 0.05$ considered statistically significant.

Results: In Dexmedetomidine groups sensory and motor blockade onset was early (Group D10>Group D5). Sensory blockade duration and motor blockade duration was increased. Effective and rescue analgesia duration was also increased in the order of Group D10>Group D5>Group BS. There was no clinically significant haemodynamic parameters alteration without any adverse effects/complication among three groups.

Conclusion: 10µg dexmedetomidine enhances the duration of analgesia and patients remained pain free for a longer period of duration in post-operative period compared to plain bupivacaine or 5µg dexmedetomidine with better haemodynamic stability with minimal or no adverse effects.

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Introduction

In 1898 Karl August Bier introduced Spinal anaesthesia technique.⁽¹⁾ The main advantages are easy to perform, conscious patients, rapid onset, cost effective and early patient recovery without side effects. This has made the spinal anaesthesia as choice in many urological procedures.

The disadvantages of spinal anaesthesia without any adjuvants are decreased duration of action, patients usually complain of uncomfortable pain in early postoperative period after its action gets over. In many previous studies spinal adjuvants such as opioids, clonidine, dexmedetomidine, ketamine and so on were used. However each drug has its own advantages, limitations, and a need for alternative methods or drugs always exist.⁽¹⁾

Dexmedetomidine, an Alpha-2(α_2) AR agonist have been preferred due to its characteristic features like sedative, analgesic, perioperative sympatholytic and haemodynamic stabilizing properties. This is a highly selective α_2 -AR agonist with a relative high ratio of α_2/α_1 activity (1620:1), ten times higher affinity for α_2 -adrenoreceptor than clonidine.^(2,3)

Our study was done to evaluate the efficacy of adding 5µg or 10µg dexmedetomidine to bupivacaine (heavy) and to compare it with that of bupivacaine alone in urological procedures in order to Onset, duration of sensory blockade and motor blockade

Analgesia-duration of effective and rescue analgesia Haemodynamic parameters like HR,BP,VAS score, side effects/ complications.

Materials and Method

120 patients with ASA 1 and 2 of 20-60 years of age were selected for urological procedures after getting approval from the hospital ethical committee. It was done at Bapuji Hospital attached to J.J.M. Medical College Davangere over a period of 18 months. Patients were allotted to groups as per computer generated randomization with each group of 40 patients.

Group D5: Patient's received 0.5% Hyperbaric Bupivacaine 12.5 mg (2.5 mL) + 5 µg(0.5ml) of dexmedetomidine intrathecally.

Group D10: Patient's received 0.5% Hyperbaric Bupivacaine 12.5mg (2.5ml) + 10µg (0.5ml) Dexmedetomidine intrathecally

Group BS: Patient's received 0.5% hyperbaric Bupivacaine 12.5 mg (2.5 mL) + Normal saline (0.5 ml) intrathecally

Inclusion criteria:

- ASA grade 1 and grade 2.
- 20 –60 yrs of age.

Exclusion criteria:

- Emergency surgeries
- Known case of allergic to local anaesthetics.

- ASA Grade 3 and Grade 4.
- Any contra indications to spinal anaesthesia.

Pre anesthetic check-up was carried out a day before surgery, the procedure explained and consent taken. Premedicated with Tab. Alprazolam 0.25mg and Tab. Ranitidine 150 mg orally 10:00 pm at night, day before surgery. The basic laboratory examination like CBC, RFT, ECG, CXR were done.

Procedure:

Intravenous line of appropriate size cannula was secured in the operating room. Preloaded as 10 ml/kg with isotonic solution. The monitors like non invasive blood pressure, ECG, SPO₂ were attached. Baseline PR, BP and SpO₂ was recorded.

Lumbar puncture was done in left lateral position by using appropriate size Quincke spinal needle (25 G) at L3-L4 intervertebral space under sterile condition. After spinal anaesthesia, patient immediately made to lie in supine position. Monitoring done with BP, pulse oximeter and electrocardiogram. Supplementary oxygen (4L/min) was given. Intraoperative fluid requirement was maintained with crystalloids.

The haemodynamic parameters like HR, BP and SpO₂ were monitored at interval of 0, 1, 3, 6, 9, 12, 15, 20, 30, 45, 60, 90, 120, 150, 180 minutes

Hypodermic needles was used to know the onset of sensory blockade. The time since injection of drug into subarachnoid space to loss of pin prick sensation at T10 segment was taken as sensory onset time. The time since injection of drug to return of needle sensation in S1 dermatomal area was taken as duration of sensory blockade.

The motor block grading was done by Bromage scale. The onset of motor blockade was taken from injections of drug into subarachnoid space to attain bromage score 3. The time since injection of drug to complete regression of motor block bromage score 0 was taken as duration of motor blockade

Visual analogue scale (VAS) score (Table 1) was used for assessing pain intensity. Patients were instructed to point out the intensity of pain on the scale 0-no pain to Scale10-worst pain.⁽⁶⁾

Table 1: Linear Visual Analog Scale(VAS) Score

VAS Score	Intensity of pain
0 – 2	No pain to slight pain
2 – 5	Mild pain.
5 – 7	Moderate pain.
7 – 9	Severe pain.
10	Worst possible pain.

The time from the intrathecal injection of drug to VAS <5 was considered as the duration of effective analgesia. The time from the intrathecal injection of drug to VAS >5 with time taken for first pain medication which are demanded by patient was considered as the duration of rescue analgesia.

Side effects like bradycardia, hypotension, respiratory depression, nausea and vomiting were monitored and treated in the recovery room.

Statistical analysis: The demographic data and parametric data were analyzed using Chi-square test and one way ANOVA test. Kruskal Wallis test for non-parametric data was used. Values were expressed as mean ± standard deviation. P < 0.05 was taken as statistically significant.

Results

The demographic details viz. Age, Sex, Height, Weight are as shown in the Table 2. These parameters are comparable across the group and there is no statistically significant differences between three groups. Table 3 shows the sensory onset, motor onset, motor recovery, sensory recovery, duration of effective and rescue analgesia.

Table 2: Linear Visual Analog Scale (VAS) score

VAS Score	Intensity of pain
0 – 2	No pain to slight pain
2 – 5	Mild pain.
5 – 7	Moderate pain.
7 – 9	Severe pain.
10	Worst possible pain.

Table 3: Demographic details

Groups	Group BS (n=40)	Group D5 (n=40)	Group D10 (n=40)	p-value
Age (Mean± SD)	35.9 ±11.5	38.6 ±10.6	36.2 ±12.2	0.451(NS)
Gender (M:F)	27:13	26:14	25:15	0.972(NS)
Mean (SD) Height	5.52± 0.32	5.42 ± 0.31	5.80 ±0.32	0.284(NS)
Mean (SD) Weight	56.8 ± 7.5	55.5 ±7.0	57.3 ± 8.2	0.461(NS)

NS- Not Significant S- Significant

The duration of effective and rescue analgesia are shown in Fig. 1.

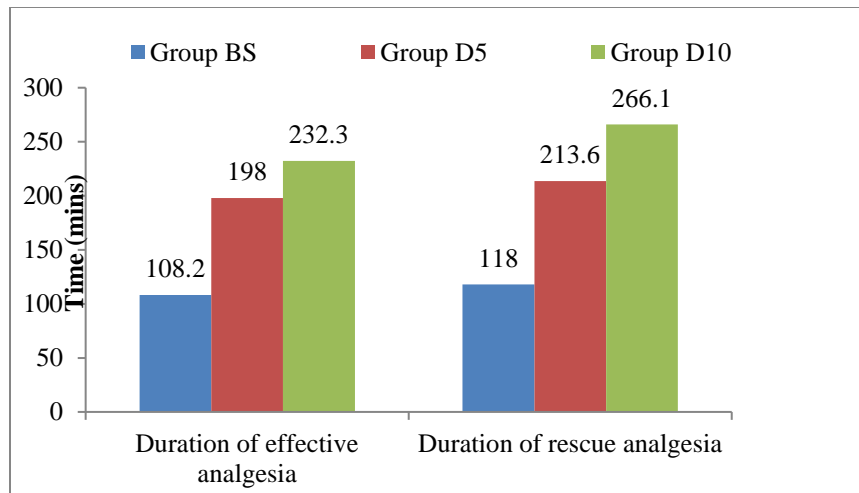


Fig. 1: Effective & rescue analgesia between 3 groups (in min)

In our study, all the groups had variation in heart rate and BP which is clinically insignificant without any significant side effects as shown in Fig. 2.

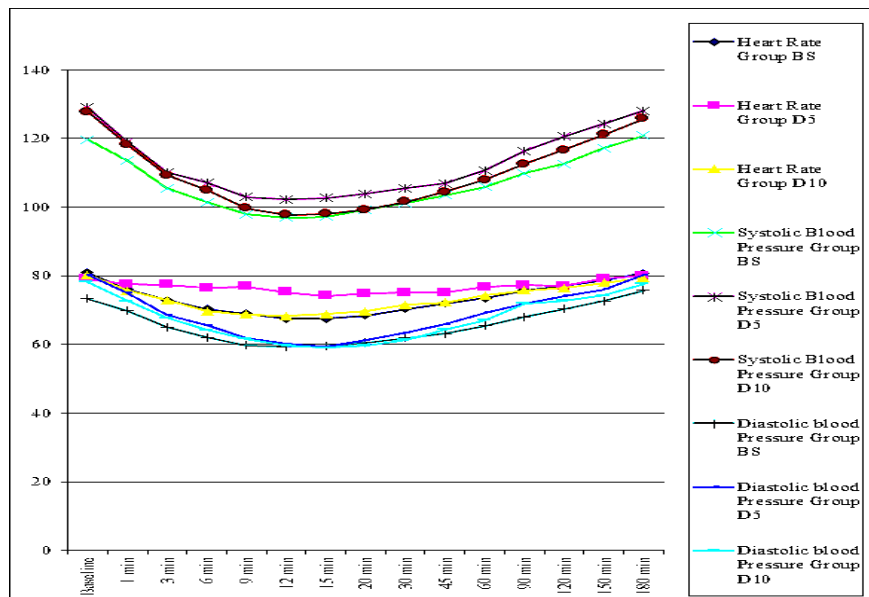


Fig. 2: Heart rate and Blood pressure among three groups

The incidence of side effects of all the three groups is shown in Table 4 and Fig. 3.

Table 4: Mean time of sensory & motor onset of study participants

Parameters	Group BS (n=40)	Group D5 (n=40)	Group D10 (n=40)	p-value
Sensory onset	8.84 ± 0.87	6.50 ± 0.71	3.88 ± 0.66	<0.05(S)
Motor onset	17.94 ± 1.04	13.02 ± 0.92	9.42 ± 0.86	<0.05(S)
Motor recovery	137.3 ± 8.16	240.6 ± 9.72	302.3 ± 11.2	<0.05(S)
Sensory recovery	161.4 ± 7.4	269.9 ± 9.1	341.9 ± 12.2	<0.05(S)
Duration of effective analgesia	108.2 ± 6.5	198.0 ± 9.7	232.3 ± 11.8	<0.05(S)
Duration of rescue analgesia	118.0 ± 7.1	213.6 ± 10.3	266.1 ± 10.5	<0.05(S)

NS- Not Significant S- Significant

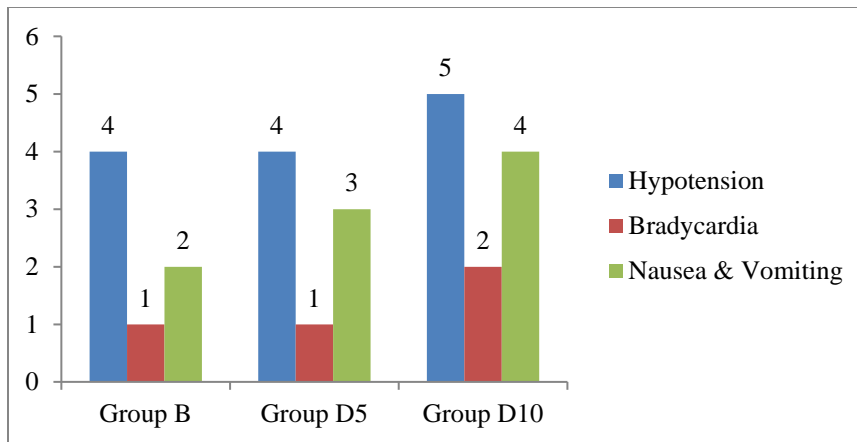


Fig. 3: Side effects profile of participants

Pain scoring was done by visual analogue scale (VAS) score. All the patients were instructed about the VAS and to point out the intensity of pain on the scale 0-no pain to Scale10-worst pain. The VAS of all three study groups is as shown in Table 5 and Fig. 4.

Table 5: Side effects profile compared between three groups

Side effects	Group BS (n=40)	Group D5 (n=40)	Group D10 (n=40)	p-value
Hypotension	4	4	5	0.919(NS)
Bradycardia	1	1	2	0.774(NS)
Nausea & Vomiting	2	3	4	0.701(NS)
Respiratory depression	0	0	0	-

NS- Not Significant S- Significant

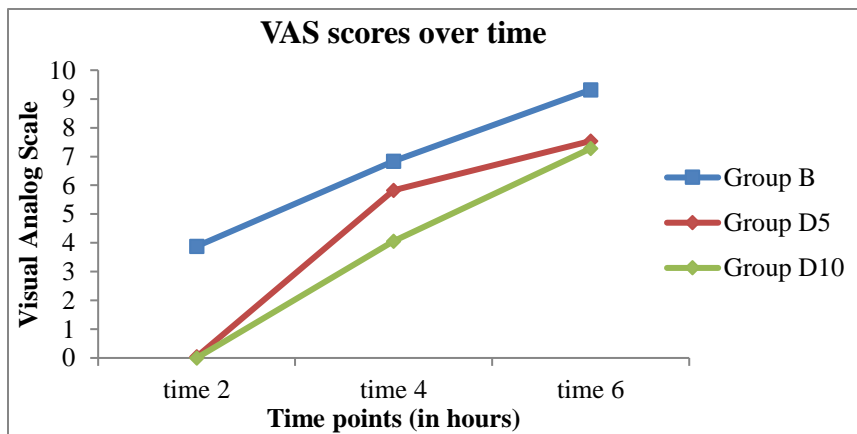


Fig. 4: VAS scores over time

Discussion

Spinal anesthesia with bupivacaine 0.5%(heavy) with adjuvant like dexmedetomidine is one of the popular method for increasing the analgesia duration. Dexmedetomidine has got sedative, analgesic, sympatholytic and hemodynamic-stabilizing properties. It is a selective α₂-Adrenergic receptor agonist with high ratio of α₂/ α₁-activity of 1620:1 as compared to 220:1 for clonidine.It lacks respiratory depression property which makes it a safe adjuvant in regional technique and many surgical procedures and also in intensive care unit.^(2,3)

It inhibits the release of C fibre transmitter and causes hyperpolarisation of post-synaptic dorsal horn neurons producing analgesia. Activation of both α₂-C and α₂-AR in dorsal horn of spinal cord (lamina II) neurons reduces transmission of pain by decreasing pro-nociceptive transmitter release (substance P, glutamate) from primary afferent terminals. It also decreases by causing hyperpolarization of spinal interneurons via G-protein-mediated activation of potassium channels. Central α₂-Adrenergic receptors activation results in predominance of parasympathetic system with blockade of sympathetic effect causes

bradycardia and hypotension which decrease surgery stress response. Thus Dexmedetomidine makes a good adjuvant for spinal anaesthesia.⁽³⁾

In our study, demographic parameters was comparable across the group and it was not significant statistically among three groups.

Our study showed the onset of sensory blockade and motor blockade was statistically significant with faster onset in group D10 than group D5 than group BS. Similar results were seen with the study of Al-Mustafa et al,⁽⁷⁾ Sherif A Abdelhamid et al.⁽⁸⁾ Thus addition of dexmedetomidine has early sensory blockade and motor blockade onset time in comparison with bupivacaine alone in dose dependent manner.

In this clinical study sensory blockade duration and motor blockade duration was significantly increased in a dose dependent manner in Group D5 and Group D10. Al-Mustafa et al,⁽⁷⁾ Shagufta Naaz et al,⁽⁹⁾ GE Hala-EA Eid et al⁽¹⁰⁾ and Kanazi et al⁽¹¹⁾ Rampal singh and Aparna Shukla⁽¹²⁾ also found the prolongation of sensory and motor blockde in their study.

In our study the duration of effective analgesia and rescue analgesia was increased in Group D10> Group D5 > Group BS, thereby additional analgesics required in post-operative period was decreased. Shagufta Naaz et al⁽⁹⁾ Rajni Gupta et al⁽¹³⁾ Ji Eun Kim et al⁽¹⁴⁾ Rachana Joshi⁽¹⁵⁾ Solanki SL et⁽¹⁶⁾ also obtained increase in analgesia duration in Dexmedetomidine group. Hence effective analgesia duration and rescue analgesia duration was significantly increased with intrathecal administration of dexmedetomidine 10 µg and 5 µg than bupivacaine alone in dose dependent manner.

Our study showed there was decrease in the VAS scores of the patients receiving dexmedetomidine 10 µg and 5 µg group than bupivacaine alone group within six hours of post operative period. So there was decreased need of analgesics with Dexmedetomidine group due to good prolonged analgesic property. Shagufta Naaz et al⁽⁹⁾ and Gehan et al,⁽¹⁷⁾ study showed that VAS score was lower in dexmedetomidine group in first 3 hour of postoperative period compared to control group and was significant. Hence effective and rescue analgesia duration prolonged and decreased requirement of systemic analgesics which is cost effective in Dexmedetomidine groups D5 and D10.

The haemodynamic parameters in our patient was stable in perioperative period in all the three groups without statistically significant adverse effects.

Hypotension and bradycardia which was found in insignificant number of patients was treated with Inj. Ephedrine (3-6 mg)iv and Inj. Atropine 0.6 mg iv respectively. Al-Mustafa et al⁽⁷⁾ and Shagufta Naaz et al⁽⁹⁾ study showed addition of dexmedetomidine to intrathecal bupivacaine can be used without significant side effects and safe as adjuvant for spinal anaesthesia. Thus addition of Dexmedetomidine 10µg as adjuvant is cost effective with least side effects.

Conclusion

Our study concluded that “The use of 10µg of intrathecal dexmedetomidine as an adjuvant to bupivacaine(heavy) in spinal anaesthesia seems to be a good alternative to other adjuvants for prolonged surgical procedures due to its increased analgesic properties with minimal side effects.”

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