ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

COMPARATIVE STUDY TWO DIFFERENT DOSES OF DEXMEDETOMIDINE AS AN ADJUVANT TO INTRATHECAL HYPERBARIC BUPIVACAINE IN INFRAUMBILICAL SURGERIES

Dr. Vikrant Prakash Keshariya,[1*] Dr. Ajita Mishra,[2] Dr. Sanjeev Kumar Agrawal[3]

[1]Assistant Professor, Department of Anaesthesiology, Shri Shankaracharya Institute of Medical Sciences, Junwani Bhilai, Chhattisgarh*

[2]Assistant Professor, Department of Anaesthesiology, Shri Shankaracharya Institute of Medical Sciences, Junwani Bhilai, Chhattisgarh

[3]Associate Professor, Department of Anaesthesiology, Shri Shankaracharya Institute of Medical Sciences, Junwani Bhilai, Chhattisgarh

Address for correspondence:Dr. Vikrant Prakash Keshariya

vikrantkeshariya@gmail.com

Submitted: 12/09/2023, Accepted: 10/10/2023, Published: 20/10/2023

Type of Study: Original Research Paper

Conflicts: Nil

==========

ABSTRACT

Background: In recent years, α- adrenoreceptor agonists like dexmedomidine and clonidine gain wide popularity as anesthetic adjuvants. Their primary mechanism is sympatholytic. They reduce peripheral norepinephrine release by the stimulation of prejunctional inhibitory α- adrenoceptors.

Aim: To compare the analgesic effect of two different doses of dexmedetomidine on intrathecal hyperbaric bupivacaine in infraumblical surgeries.

Methods: The present study was a prospective, randomized, double blind Comparative study of two doses of Dexmedetomidine 5µg and 10µg as an adjuvant to intrathecal hyperbaric Bupivacaine in infraumbilical surgeries. Study population consisted of 90 patients divided into three groups of 30 each belonging to ASA Grade I and Grade II physical status. They received 15 mg (3ml) Bupivacaine 0.5% heavy and added 0.2 ml normal saline in group C, dexmedomidine 5µg in group D5 and dexmedomidine 10µg in group D10, total volume of 3.2 ml intrathecally.

Results: Mean time for onset of sensory in study groups was singinficantly earlier than in the control group ($P < 0.001$). Mean time taken to achieve highest sensory level was significantly reduced in study groups as compared to control group ($P<0.001$). The highest sensory dermatomal level range was T4-T8 in all groups. Overall highest sensory dermatomal level achieved was comparable in all three groups but statistically not significant ($P>0.05$). The Mean duration of sensory block in study groups were significantly prolonged than control group ($p<0.001$). Mean duration of sensory block in group D10 was also significantly prolonged than group D5. Which was statistically highly significant ($p<0.001$). Time of Onset of motor blockade of study groups was significantly earlier than control group ($P < 0.001$). Between the study groups, onset of motor block in group D10 was significantly earlier than group D5 ($P < 0.001$). Mean duration of motor block in study groups were significantly prolonged as compared to in control groups ($P <0.001$). Mean duration of motor block was statistically highly significant ($P <0.001$).

Conclusion: The study concluded that when dexmedomidine was added to 0.5% hyperbaric bupivacaine for spinal anaesthesia, it provided earlier onset of sensory and motor block with

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

prolonged postoperative analgesia without producing undue side effects. The effect was more with 10μg dexmedomidine than 5 μg dexmedomidine and control group.

Keywords: ASA Grade I and II, Bupivacaine, Dexmedetomidine, Infraumblical Surgery, Sympatholytic Effect.

==========

INTRODUCTION

Central neuraxial blockade is one of the most commonly performed techniques in modern anaesthesia. In 1898, August Bier first described "cocainisation of the spinal cord". Spinal effects are produced by slow injection of a small volume of preservative free local anaesthetic solution.[1]

Postoperative pain is a major problem in infraumblical surgeries because shorter duration of subarachnoid block with only local anaesthetics. In 1979, Wang and his colleague first used intrathecal opioids for acute pain treatment.[1,2]

Opioids are commonly administered as an adjuvant, but urinary retention, respiratory depression, pruritus, and, occasionally, severe nausea and vomiting may limit their use. They also inhibit the central neural transmission in dorsal horn by presynaptic and postsynaptic mechanism.[3] They also have direct sympatholytic effect on spinal preganglionic sympathetic neurons. They also have Sedative, anxiolytic, and analgesic properties. Dexmedetomidine is a highly selective alpha-2 agonist as compared to clonidine Affinity for alpha-2 receptor of dexmedomidine is 1600:1, while in clonidine it is 200:1.[4]

Hence, it is used in clinical practice as an adjuvant to regional, local, and general anaesthesia. Dexmedetomidine is approved by the Food and Drug Administration as an intravenous (IV) additive for Intensive Care Unit (ICU) sedation, now it is widely used an adjuvant to the local anaesthetics.[5] The addition of dexmedetomidine for intrathecal local anaesthetics prolongs the duration of sensory block, motor block, and postoperative analgesia without severe sedation and respiratory depression. This effect is due to the sparing of supraspinal central nervous system. So that it reduces the requirement of immediate postoperative analgesics.[6,7]

We designed this study to evaluate and compare the effect of two different doses of intrathecal dexmedetomidine as an adjuvant to 0.5% hyperbaric bupivacaine for infraumblical surgeries with respect to sensory and motor blockade, duration of analgesia, hemodynamic changes, and adverse effects.

MATERIAL AND METHODS

This study was conducted at Department of Anaesthesiology, JLN Hospital and Research Centre, Bhilai, Chhattisgarh between the period of February 2020 and July 2020. The study was time bound, double blind, hospital based prospective, randomized, comparative clinical trial to study and compare the effects of two different doses of Dexmedetomidine used intrathecally with 0.5% hyperbaric bupivacaine in infraumblical surgeries.

Study subjects were comprised of Patients undergoing elective surgeries under subarachnoid block. The patients recruited were randomized into 3 groups: Group, C, Group D5 and Group D10, generated by the computer.

Group C Intrathecal 0.5% hyperbaric bupivacaine 3.0 ml (15.0 mg) + normal saline 0.2 ml added to make total volume 3.2 ml

Group D5 Intrathecal 0.5% hyperbaric bupivacaine 3.0 ml (15.0 mg) + dexmedetomidine 0.05ml (5μg) with sterile water 0.15 ml added to make total volume 3.2 ml

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

Group D10 Intrathecal 0.5% hyperbaric bupivacaine 3.0 ml (15.0 mg) + dexmedetomidine 0.1 ml (10μg) with sterile water 0.1 ml added to make total volume 3.2 ml

Elective surgeries of infraumblical region, ASA Grade I and II patients, Weight: 50 to 70 kg, Patients giving valid consent for research study and Surgeries lasting 60 to 180 minutes were included in the study.

Patients with contraindications for regional anaesthesia, on opioid analgesic therapy, Pregnancy, ASA Grade 3 and 4 patients, Known history of allergy/sensitivity reaction to dexmedatomidine, history of Cerebrovascular disease, Neurological disease, Respiratory disease, Ischemic heart disease, Myocardial Infarction, Renal disease and Hepatic dysfunction were excluded from the study.

Informed consent of the patient was obtained during preoperative anaesthetic check-up one day prior to surgery after explaining the patient with the patient information sheet.

The following parameters were studied in all patients, Time of onset of sensory block at T8, Highest level sensory block, Time taken to achieve the highest level sensory block, Duration of sensory block, Time of onset of motor blockade (Time to achive motor block to Bromage score 3), Duration of motor block (duration between achievement of Bromage 3 to return to Bromage 0)[8,9] and Duration of spinal analgesia.

Once highest sensory block will be achieved, sensory level will be assessed every 15 min till 2 segment regression. The duration of sensory block will be defined as the period from injection of drug to regression of two segments in the block height, evaluated by pinprick.

Vitals (H.R, SBP, MAP, DBP, SPO2) were recorded every 5 min interval for the first 30 min after intrathecal injection and thereafter every 30 min interval till the end of surgery.

Quantitative data will be analyzed by, mean, SD, unpaired ‘t’ test 30. Qualitative data was analyzed by percentage, Chi square test, fisher exact test, Statistics software SPSS 16.0.

RESULTS

The mean age of the patients in the Group C, D5, D10 were 42.7±11.29 years, 43.03±10.18 years and 47.47±7.51 years. All the groups were comparable with respect to Age (P=0.11) and hence not significant as shown in table 1. This also shows sex distribution in groups. Group C had 50% male and 50% female patients, in Group D 5 had 53.33% male and 46.67% female patients and Group D 10 had 36.67% male and 63.33% female patients. There was no significant difference between groups. (p value = 0.39). Both the groups were comparable with respect to height (P=0.63) and weight (P=0.71) and hence notsignificant.

There was no significant statistical difference was P= 0.83 in ASA grade distribution amongst the groups.

Mean time for onset of sensory in study groups was singinficantly earlier than in the control group ($P < 0.001$). Between the study groups, mean time for onset for sensory block in group D_{10} was also earlier than group D_5, which was also statistically highly significant ($P < 0.001$).

Mean time taken to achieve highest sensory level was significantly reduced in study groups as compared to control group ($P<0.001$). Mean time taken to achieve highest sensory level was also significantly reduced in group D_{10} as compared to group D_5 ($P<0.001$)

Mean duration of motor block in group D_{10} was significantly prolonged as compared to in group D_5, which was statistically highly significant ($P <0.001$). Mean duration of sensory block in study groups were significantly prolonged than control group ($p<0.001$). Mean duration of sensory block in group D_{10} was also significantly prolonged than group D_5 which was statistically highly

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

significant (p<0.001). Mean duration of motor block in study groups were significantly prolonged as compared to in control groups (P <0.001). Mean duration of motor block in group D_{10} was significantly prolonged as compared to in group D_5, which was statistically highly significant (P <0.001). Duration of spinal analgesia in study groups were significantly prolonged as compared to control group (p<0.001). Duration of spinal analgesia in group D_{10} was also prolonged as compared to group D_5, which was statistically highly significant (p<0.001) as shown in Table 2.

DISCUSSION

The present study is a randomised prospective double blind study of intrathecal bupivacaine in comparison with two different doses of dexmedetomidine in infra- umbilical surgeries.

A study done on Kapinegowda ST et al[9] in 2017 to find out the optimum dose of dexmedetomidine to be used in lower abdomen surgery intrathecally. They studied in total 100 patients, they were allocated into five groups (n=20) All patients received drug volume of 3ml containing 2.5ml of hyperbaric bupivacaine hydrochloride (12.5mg). The study groups received dexmedetomidine 5mcg (group D1), 10mcg (group D2), 15mcg (group D3) and 20 mcg (group D4) in an identical volume of 0.5ml, diluted with normal saline and added to bupivacaine in the same syringe. The control group (Group C) received 0.5ml of Normal saline added to bupivacaine.

Naaz S et al[10] in 2016 studied effect of two different doses of dexmedetomidine as adjuvant in bupivacaine induced subarachnoid block for elective abdominal hysterectomy operations. Naaz S et al[10] in 2016 studied effect of two different doses of dexmedetomidine as adjuvant in bupivacaine induced subarachnoid block for elective abdominal hysterectomy operations. Intergroup hemodynamics were comparable (p>0.05) without any appreciable side effects.

In our recent study mean time for onset of sensory block in Group C was 5.43±0.68 min, in group D5 was 4.4±0.62 mins and in group D10 was 3.67±0.61 mins. Mean time for onset of sensory in study groups was significantly earlier than in the control group (P < 0.001). Between the study groups, mean time for onset for sensory block in group D10 was also earlier than group D5, which was also statistically highly significant (P < 0.001).

Gupta M. et al[11] in 2016 studied effect of 3 different doses of intrathecal dexmedetomidine (2.5μg, 5μg, and 10 μg) on subarachnoid block characteristics particularly the duration of analgesia and differential analgesia. They also noticed onset of sensory block was significantly earlier with dexmedetomidine 10 μg compared with dexmedetomidine 5μg (P = 0.035) and 2.5μg (P = 0.010).

Kapinegowda ST et al[9] in 2017 studied to compare the effects of different doses of dexmedetomidine on intrathecal bupivacaine in infraumbilical surgeries. They found that the onset time of sensory block in Group D5 2.76±1.32, Group D10 2.45±1.50, and Group D15 1.86±0.93, which is statistically significant (P=0.025). The dosage of dexmedetomidine increased the onset time of sensory block is significantly decreased.

Highest dermatomal level of sensory block was observed in all groups.

Majority of the patients in three groups achieved the highest sensory level of T6 i.e. 20 (66.67%) patients in group D10, 25 (83.33%) patients in group D5 and 21 (70%) patients in group C.

10 (33.33%) patients achieve higher level of T4 in group D10, 5(16.67%) patients in group D5 while it was 7(23.33%) patients in group C.

2 (6.67%) patient achieved level of T8 in group C. Overall highest sensory dermatomal level achieved was comparable in all three groups but statistically not significant (P>0.05). Kapinegowda ST et al[9] in 2017 also noticed similar findings. In contrary Yektaş A et al[14] in 2014

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

found that Group 3 with 4 µg dexmedetomidine achieved a significantly higher sensory block level than group 1 and group 2 (P<0.001).

Naaz S et al[10] in 2016 have notice the time to reach highest sensory block level which was statistically significant.

In the country Kapinegowda ST et al[9] in 2017 had noticed time taken to achieve the maximum level sensory block is not statistically significant among the groups (P =0.402).

Gupta M. et al[11] in 2016 noticed that the time to attain peak sensory block level were comparable among all the groups. The time to attain peak sensory block level was earlier in group dexmedomidine 10 µg than in group dexmedomidine 2.5µg and which was statistically not significant.

Mean duration of sensory block in study groups were significantly prolonged than control group. (p<0.001). Mean duration of sensory block in group D10 was also significantly prolonged than group D5. Which was statistically highly significant (p<0.001).

Previous researches have reported similar prolongation of duration of sensory block, which are follows Naaz S et al[10] in 2016 studied that there was a dose dependent prolongation of the time to two segment sensory regression.

Gupta M. et al[11] in 2016 also confirmed highly significant difference with respect to 2 segment sensory regression time (TSSRT)

Das A et al[12] in 2015 studied that time taken for two segment sensory regression Group D5 96.66± 33.67, Group D10 116.80 ± 36.27, and Group D15 120.96 ± 30.24, (P = 0.014), which was statistically significant.

The time of onset of motor block was defined as time of injection of intrathecal drug to modified Bromage 3. The onset of motor block of study groups was significantly earlier than control group (P < 0.001). Between the study groups, onset of motor block in group D10 was significantly earlier than group D5 (P < 0.001).

Our findings are in accordance with study by Singh AK et al[13] in 2015 conducted a study of comparison of two different doses of intrathecal dexmedetomidine as adjuvant with isobaric ropivacaine in lower abdominal surgery which were statistically highly significant.

Naaz S et al[10] in 2016 had also confirmed similar findings in their study. They found that onset of motor block were statistically highly significant.

In contrary of our study Kapinegowda ST et al[9] in 2017 noticed that time of onset of motor blockade was statistically not significant (P = 0.413).

Duration of motor blockade (duration from achievement of Bromage score 3 to return to Bromage score 0). Mean duration of motor block in study groups were significantly prolonged as compared to in control groups (P <0.001). Mean duration of motor block in group D10 was significantly prolonged as compared to in group D5, which was statistically highly significant (P<0.001).

Our findings are in accordance with study of Singh AK et al[13] in 2015, noticed that duration of motor block was maximal in group B (dexmedomidine 10µg) and minimum in group C (control) (P < 0.001) which was statistically highly significant.

Naaz S et al[10] in 2016 also confirmed same findings in their study. Which were statistically significant Similar results were also demonstrated by Yektaş A et al[14] in 2014.

The duration of analgesia was defined as time from intrathecal administration of anaesthetic drugs to the first complaint of pain at the operative site. The mean time to first analgesic dose and

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

duration of spinal analgesia in study groups were significantly prolonged as compared to control group ($p<0.001$).

Our findings were in accordance with study of Naaz S et al[10] in 2016 found that mean duration of analgesia and need of first rescue analgesics were statistically significant.

Our findings are in accordance with study of Kapinegowda ST et al[9] in 2017 noticed total duration of analgesia is statistically highly significant. Similar results were also demonstrated by Yektaş A et al[14] in 2014 and Gupta M. et al[11] in 2016.

Halder S et al[15] in 2014 studied that effect of different doses of dexmedetomidine as adjuvant in bupivacaine -induced subarachnoid block for traumatized lower limb orthopaedic surgery. They concluded that sensory and motor block in group D10 ($p<0.05$) was earlier than group D5 ($p<0.05$). Our findings were similar to above studies.

CONCLUSION

We have concluded that the addition of adjuvant like dexmedetomidine to hyperbaric bupivacaine intrathecally produces a rapid onset of sensory blockade and prolonged duration of sensory and the motor block. With prolonged duration for rescue analgesia postoperatively, which is statistically significant in a dose dependent manner. Addition of 10 μg of intrathecal dexmedetomidine is associated with prolonged duration for rescue analgesia postoperatively in patients undergoing infra-umbilical surgeries without any significant increase in the incidence of side effects.

Monitoring of the somatosensory evoked potentials (SSEPs) during spinal block may be better technique for assessing the degree of sensory blockade. Therefore, further studies may be necessary to study the duration of bupivacaine induced spinal block based on subjective patient responses compared to SSEPs.

REFERENCES

1. Minagar M, Alijanpour E, Jabbari A, Rabiee SM, Banihashem N, Amri P, Mir M, et al. The efficacy of addition of dexmedetomidine to intrathecal bupivacaine in lower abdominal surgery under spinal anesthesia. Caspian JIntern Med. 2019 ;10(2):142-149.
2. Wang JK, Nauss LA, Thomas JE. Pain relief by intrathecally applied morphine in man. Anesthesiology. 1979 Feb;50(2):149–51.
3. Durant PA, Yaksh TL. Drug effects on urinary bladder tone during spinal morphine-induced inhibition of the micturition reflex in unanesthetized rats. Anesthesiology 1988 Mar;68(3):325-334.
4. Chinachoti T, Nilrat P, Samarnpiboonphol P. Nausea, vomiting and pruritus induced by intrathecal morphine. J Med Assoc Thai 2013 May;96(5):589-594.
5. Sultan P, Gutierrez MC, Carvalho B. Neuraxial morphine and respiratory depression: finding the right balance. Drugs 2011 Oct;71(14):1807-1819.
6. Karaman S, Kocabas S, Uyar M, Zincircioglu C, Firat V. Intrathecal morphine: effects on perioperative hemodynamics, postoperative analgesia, and stress response for total abdominal hysterectomy. Adv Ther 2006 Mar- Apr;23(2):295-306.
7. de Oliveira GS Jr, Balliu B, Nader A, McCarthy RJ. Dose-ranging effects of intrathecal epinephrine on anesthesia/analgesia: a meta-analysis and metaregression of randomized controlled trials. Reg Anesth Pain Med 2012 Jul-Aug;37(4):423-432.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

8. Lauretti GR, Mattos AL, Gomes JM, Pereira NL. Postoperative analgesia and antiemetic efficacy after intrathecal neostigmine in patients undergoing abdominal hysterectomy during spinal anesthesia. Reg Anesth 1997 Nov-Dec;22(6):527-533.

9. Kapinegowda ST, Anandswamy TC, Narayanappa VH, Kumar S, Hatti P. To Compare the Effects of Different Doses of Dexmedetomidine on Intrathecal Bupivacaine in Infraumbilical Surgeries: A Prospective, Randomized, Double- blind Clinical Study.Anesth Essays Res. 2017 Oct-Dec;11(4):847-853.

10. Naaz S, Bandey J, Ozair E, Asghar A. Optimal Dose of Intrathecal Dexmedetomidine in Lower Abdominal Surgeries in Average Indian Adult. *J Clin Diagn Res.* 2016;10(4):UC09–UC13.

11. Gupta M, Gupta P, Singh DK. Effect of 3 Different Doses of Intrathecal Dexmedetomidine (2.5µg, 5µg, and 10 µg) on Subarachnoid Block Characteristics: A Prospective Randomized Double Blind Dose-Response Trial. Pain Physician. 2016 Mar;19(3):E411-20.

12. Das A, Halder S, Chattopadhyay S, Mandal P, Chhaule S, Banu R.Effect of Two Different Doses of Dexmedetomidine as Adjuvant in Bupivacaine Induced Subarachnoid Block for Elective Abdominal Hysterectomy Operations: A Prospective, Double-blind, Randomized Controlled Study. *Oman Med J.* 2015;30(4):257–263.

13. Singh AK, Singh Y, Jain G, Verma RK. Comparison of two different doses of intrathecal dexmedetomidine as adjuvant with isobaric ropivacaine in lower abdominal surgery. Anesth Essays Res. 2015;9(3):343–347.

14. Yektas A, Belli E. The effects of 2 μg and 4 μg doses of dexmedetomidine in combination with intrathecal hyperbaric bupivacaine on spinal anesthesia and its postoperative analgesic characteristics. Pain Res Manag. 2014;19(2):75–81.

15. Halder S, Das A, Mandal D, Chandra M, Ray S, Biswas MR, et al. Effect of different doses of dexmedetomidine as adjuvant in bupivacaine –induced subarachnoid block for traumatized lower limb orthopaedic surgery: a prospective, double-blinded and randomized controlled study. J Clin Diagn Res. 2014 Nov;8(11):GC01-6.

TABLES

Table 1: Demographics and ASA grade in study subjects

Patient profile	Subgroup	Group D_{10} N=30	Group D_5 N=30	Group C N=30	P value
Age in years	21-30	6(20%)	1(3.33%)	5(16.67%)	0.11
	31-40	5(16.67%)	4(13.33%)	9(30%)	
	41-50	11(36.67%)	15(50%)	7(23.33%)	
	51-60	8(26.67%)	10(33.33%)	9(30%)	
	Total	30(100%)	30(100%)	30(100%)	
	Mean Age in years	47.47±7.51	43.03±10.18	42.7±11.29	
Sex	Male	11(36.67%)	16(53.33%)	15(50%)	0.39
	Female	19(63.33%)	14(46.67%)	15(50%)	
	Mean Height (cm)	161.53±4.15	160.43±5.2	160.97±3.9	0.63
	Mean Weight (kg)	58.9±4.57	59.33±4.19	58.33±5.3	0.71

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE 10, 2023

ASA Grade	I	12 (40%)	14 (46.67%)	14 (46.67%)	0.83
	II	18 (60%)	16 (53.33%)	16 (53.33%)	

Table 2: Showing mean time of onset of sensory block in groups

Assessment of sensory block		Group D_{10} (N=30)	Group D_5(N=30)	Group C (N=30)	P value
Mean time of onsetof sensory Block (min) Mean ± SD		3.67±0.61	4.4±0.62	5.43±0.68	<0.001
Mean time to reachhighest level (min) Mean ± SD		6.57± 0.86	7.47±0.57	12.53±1.8	<0.001
Highest level ofsensory block	T4	10(33.33%)	5(16.67%)	7(23.33%)	0.17
	T6	20(66.67%)	25(83.33%)	21(70%)	
	T8	0(0%)	0(0%)	2(6.67%)	
Mean duration of sensory block (min) Mean ± SD		120.83±12.87	112.67±7.16	87.83±9.8	<0.001
Mean time of onset (Time to reach Bromage 3) (min) Mean ± SD		9.5±1.31	10.47±1.31	12.03±2.34	<0.001
Mean Duration of Motor block (min) Mean ± SD		485.33±23.3	329±24.68	202.17±12.84	<0.001
Duration of spinal analgesia (min) Mean ± SD		515.33±16.97	420.6±44.41	227.67±16.33	<0.001