Original Research Article

Evaluation of the effect of intravenous dexmedetomidine on spinal anaesthesia with 0.5% hyperbaric bupivacaine

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Abstract

Aim: The present study was designed to evaluate the effects of single bolus dose of intravenous Dexmedetomidine on spinal anaesthesia and analgesia in patients undergoing below umbilical surgeries with 0.5% Hyperbaric Bupivacaine. **Methods:** Sixty patients posted for below umbilical surgeries were randomly allocated to two groups. Group D - single bolus dose of 0.5mcg/kgof Dexmedetomidine and Group C - 100 ml of normal saline. Variation in the sensorimotor parameters, effect on sedation and side effects wererecorded. **Results:** The onset of sensory and motor block was significantly earlier in Group D (2.20 ± 0.80 min, 2.17±0.53 min) as compared to Group C(4.33 ± 0.84 min, 3.87 ± 0.62 min). Sedation score and incidence of bradycardia was high in Group D when compared to Group C. **Conclusion:** Single bolus dose of IV Dexmedetomidine prior to spinal anaesthesia prolongs the duration of sensory block and duration of analgesia with satisfactory arousable sedation and acceptable side effects.

Keywords: Bupivacaine, dexmedetomidine, spinal anaesthesia, below umbilical surgery.

Introduction

Spinal anaesthesia (SA) is a commonly used regional anesthesia technique to provide sensory and motor blockade in the large part of the body with a lesser amount of drug, hence very popular for below umbilical surgeries as it is economical and easy to perform. The intrathecal local anesthetic 0.5% hyperbaric bupivacaine is appropriate for a surgery lasting for 2 to 2.5 hours. Intrathecal hyperbaric bupivacaine alone is not sufficient to produce postoperative analgesia and hence some adjuvant may have to be added along with local anesthetic.

Numerous adjuvants are used intrathecally such as magnesium sulphate, fentanyl, buprenorphine[2] to prolong the duration of subarachnoid block and to achieve the longer perioperative analgesia[3]. Previous studies suggest that the alpha 2 adrenoceptor agonists such as, clonidine and dextmedetomidine have been used intrathecally as an adjuvant to spinal anaesthesia and was found to prolong the duration of sensory and motor block[4]. Dextmedetomidine is more suitable adjuvant to spinal anesthesia and used for their sedative, analgesic, and perioperative sympatholytic and cardiovascular stabilizing effects with reduced anesthetic necessities due to its more relative α 2 adrenoceptor agonist activity (1620:1) as compared to clonidine (220:1).

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The α 2 adrenoceptor are found in many sites throughout the body including central nervous system (CNS), spinal, and peripheral tissues. In CNS, the highest densities of α 2 receptors are found in the locus ceruleus, an important modulator ofobservation. Presynaptic activation of the α 2A -adrenoceptors in the locus ceruleus inhibits the release of norepinephrine (NE) and results in the sedative and hypnotic effects. Earlier report suggested a significant prolongation in the duration of sensory and motor block with dexmedetomidine used as intrathecal additive for 0.5% heavy bupivacaine[5].

We wanted to investigate the influence of administering a calculated dose of patients received 0.5microgram/kg dexmedetomidine in 100ml normal saline by IV infusion over 10 minutes on the sensorimotor effects following subarachnoid anesthesia with 3ml of 0.5% hyperbaric bupivacaine. The primary aim of this study was to evaluate the effect of intravenous dexmedetomidine on spinal anaesthesia with 0.5% hyperbaric bupivacaine with respect to block characteristic, duration of analgesia and level of sedation. We also evaluated the effect of this supplementation on hemodynamic variables and adverse effects if any.

Materials and methods

This prospective randomized study was conducted at Department of Anesthesia and Critical Care, at Jawaharlal Nehru Medical College and Hospital, Bhagalpur. The study was approved by the institutional research and ethical committee. The study was conducted between September 2019 and March 2020. An informed and written consent was taken from the participating subjects prior to the commencement of the study.

Before including the patients for the study, all the patients were explained about the procedures and a written informed consent was obtained. The 60 patients who were planned to undergo surgery under spinal anaesthesia were randomly divided in to two groups andnamely Group D (Dexmedetomidine) and Group C (Control).

Selection of cases

Patients posted for below umbilical surgeries of American Society of Anesthesiologists (ASA) Class I/II Age group of 18–60 years of both sex. Height of the patient between 150 and 180 cm. Duration of surgery < 3 hours

Exclusion criteria

All contraindication to spinal anaesthesia Patient on sedative medications/ opioids/ antidepressants prior to surgery Patients are having Cardiovascular, Pulmonary, Renal, Hepatic abnormalities. Obese patient Patients allergic to study drug or H/O any allergy

Study design

Patients in the study group (Group D) received dexmedetomidine infusion of 0.5 µg/kg in 100 ml normal saline over 10 min and patients in the control group (Group C) received saline infusion over 10 min. After the completion of the infusion and skin infiltration with 2% lidocaine, a 25G Quincke's needle was inserted at the L3-4 interspace in the midline. After confirming the free flow of CSF, subarachnoid block was performed with 3ml of 0.5% bupivacaine in both groups.

Demographic data

The demographic data for all the patients were compared with regards to age, height, weight, sex and ASA physical status.

Sensorymotor parameters

Onset of sensory block was defined as the time between the intrathecal administration of anaesthetic solution and absence of pain at the T10 dermatome. Sensory block was assessed by loss of sensation to pin prick using 25G sterile needle along the midline. The assessment started immediately after turning patient to supine position and continued every minute till loss of sensation to pinprick at T6 level. This was considered as time for maximum sensory blockade. The two segment regression time was defined as the time taken for sensory blockade to regress two segments from the maximum level of sensory blockade.

The assessment of onset of motor block was started immediately after turning the patient to supine position and continued every minute till Bromage score of 3 was reached and the duration of motor block was taken as the time from intrathecal injection to return of Bromage score of 0[6]. The level of sedation score was assessed by on 6 point Ramsay sedation score[7].

On completion of surgery, the vital signs and oxygen saturation were recorded till recovery of patients from anaesthesia. The duration of analgesia was measured the time between the intrathecal administration of anaesthetic solution and the first supplementation of rescue analgesic when patient complained of pain in the postoperative period. Rescue analgesia was given in the form of inj. diclofenac sodium 75 mg intramuscular.

Hemodynamic variables

The Systolic, Diastolic and Mean Arterial blood pressure, pulse rate and oxygen saturation were recorded at 0, 5th min and thereafter every 5 min up to 30 min and then every 10 min up to 90 min, a total of 13 intervals.

Adverse effects

For this study, hypotension was said to have occurred if the MAP fell less than 60 mmHg value and was treated with 100% O_2, increasing the infusion rate of IV fluids and Inj. Ephedrine in incremental doses of 6mg.The bradycardia was defined as heart rate less than 50 min and was managed with intravenous atropine in incremental doses of 0.6mg. Complications such as hypotension, bradycardia, nausea, vomiting, shivering, urinary retention and headache were noted and treated accordingly.

Statistical analysis

The statistical analysis was done using the statistical programming software Statistical Package for the Social Sciences - SPSS Statistics (version 16- SPSS Inc., Chicago, Illinois, USA). Baseline variables between the two groups were compared using Chi-square test. The mean of two groups were compared using student t-test. The probability value $p < 0.05$ is considered as statistically significant.

Results

Demographic data of all patients were compared with regards to age, height, weight, sex and ASA physical status. The p values between the two groups were not statistically significant **(Table 1)**.

Table 1: Demographic data Comparison

S.No	Demographic Data		Group D(n=30)	Group C(n=30)	p Value
1	Age(years)	Mean	43.97	43.10	0.786
		S.D	12.93	11.65	
2	Height(cm)	Mean	160.37	159.57	0.571
		S.D	4.61	6.16	
3	Weight(kg)	Mean	58.63	59.47	0.634
		S.D	8.23	4.81	
4	Sex (M / F)	Number	27/3	22/8	0.095
		Percentage	90/10	73.3/26.7	
5	ASA (I / II)	Number	11/19	10/20	0.787
		Percentage	36.7/63.3	33.3/66.7	

Sensorymotor parameters

The sensorimotor parameters following subarachnoid anesthesia are summarized in Table 2. The time of onset of sensory block at T10 level, the time for maximum sensory block to T 6 level and the time of two segment regression were noticed as faster in all Group D(2.20± 0.80, 4.80 ± 0.92 &114.83 ± 12.69) when compared to the Group C(4.33±0.84, 6.63± 0.66 and 86.83 ± 12.28) respectively. Furthermore, the average time taken for the onset of motor block, the mean duration of motor block and the mean duration of analgesia were noticed as longer in all Group D (2.17 min, 143.00 ± 12.07 and 223.83±12.64) when compared with that of Group C (3.87 min, 111.67 ± 9.40 and 180.83 ±17.27) respectively. The difference was highly significant (p value= 0.000).

Table 2: Sensorimotor parameters following subarachnoid anesthesia					
PARAMETER	**GROUP(n=30)**	**RANGE**	**MEAN**	**SD**	**'P' value**
Time of onset of sensoryblock at T 10 level (min)	D	1-4	2.20	0.80	0.000
	C	3-5	4.33	0.84	
Time for maximum sensory block to T 6level(min)	D	3-6	4.80	0.92	0.000
	C	6-8	6.63	0.66	
Two segment regressiontime (min)	D	90-150	114.83	12.69	0.000
	C	60-105	86.83	12.28	
Time of onset of motorblock (min)	D	1-3	2.17	0.53	0.000
	C	3 – 5	3.87	0.62	
Duration of motor block(min)	D	120-160	143.00	12.07	0.000
	C	95-130	111.67	9.40	
Duration of Analgesia(min)	D	200-240	223.83	12.64	0.000
	C	150-210	180.83	17.27	

Levelofsedation

Patients in the study groups who received intravenous dexmedetomidine were noted to be more sedated as compared to the control group. The Ramsay sedation score was recorded at different time intervals from 30,60,120 to 240 min and observed the values between 2.93±0.64 to 3.47±0.57 for Group D and between 2.10±0.30to 2.60±0.49 for the Group C.

Adverse effects

The incidence of adverse effects was summarized in Table 3. The Group D patients developed bradycardia, while maximum of Group Cpatients had hypotension. Likewise, post-op shivering and vomiting was experienced more in Group C patients and all the adverse effects were treated accordingly.

Table 3: Adverse effects following intravenous dexmedetomidine and subarachnoid anesthesia					
Adverseeffect	**Group D**		**Group C**		**P value**
	Number	**Percentage**	**Number**	**Percentage**	
Hypotension	2	6.66	10	33.33	0.010
Bradycardia	6	20	0	0	0.010
Nausea	1	3.33	4	13.33	0.161
Vomiting	1	3.33	2	6.66	0.554
Post-op shivering	0	0	3	10	0.076

Discussion

The results of our study indicate that intravenous dexmedetomidine premedication hastened the onset of sensory and motor blockade during subarachnoid block with bupivacaine has been most extensively used for below umbilical surgeries because of its simplicity, reliability and minimal exposure to depressant drugs. However, a single intrathecal injection of bupivacaine alone provides analgesia for only 2 – 2.5 hours. Most patients require further analgesia during post operative period. The prolonged analgesic action attained by α 2 adrenergic agonist acts by binding to post synaptic dorsal neurons and to the C- fibres in the pre synaptic region[8].

In this study the 3 ml of 0.5% hyperbaric Bupivacaine was used in both groups. Based on the previous study report,[9,10] we have chosen the 3 ml of 0.5% hyperbaric Bupivacaine with 0.5 mcg / kg dexmedetomidinewas used in both groups and found as similar result.

Dexmedetomidine infusion used as a loading dose has been found to prolong the duration of analgesia and motor blockade in the present study. Al-Mustafa *et al*[11]. also observed there was prolongation of sensory motor blockade with a similar dose of dexmedetomidine. In another study observing the effect of dexmedetomidine infusion on spinal anaesthesia with ropivacaine, it was observed that dexmedetomidine bolus of 1 mcg/kg followed by infusion at 0.4 mcg/kg/h prolonged the duration of sensory and motor regression[12]. Recently, administration of a single bolus of 1 mcg/kg, and 0.5 mcg/kg,[13] also were reported to prolong the duration of analgesia and sensory blockade. The duration of sensory block and analgesia in ourstudywere comparable with previous reported studies despite using alower initial loading dose of 0.5 mcg/kg.

Dexmedetomidine action on locus ceruleus produces sedation resembling normal sleep and the maximum Ramsay sedation score was greater in dexmedetomidine group than in control group. Similar results have been reported by Harsoor *et* al.,[10*]* andTiwari *et al*,.[15]in theirstudies.

Conclusion

The present study concludes that when a single loading dose of dexmedetomidine 0.5µgm/kg was hastened the onset and prolonged the duration of sensory and motor block of patients undergoing below umbilical surgeries under hyperbaric bupivacaine spinal anaesthesia. Dexmedetomidine also provides prolonged duration of analgesia, satisfactory level of sedation, stable hemodynamics with acceptable adverse effects during intra and post operative periods on comparing with control group.

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