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Effect of Dexmedetomidine as an Adjuvant to Neuraxial Block with Bupivacaine in Lower Abdominal and Lower Limb Surgeries

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Abstract

Background: The local anesthetics are associated with relatively short duration of action which limit the technique for comparatively long duration surgery and also analgesic intervention is needed in postoperative period. Dexmedetomidine, the new highly selective α2-agonist drug, is now being used as a neuraxial adjuvant. The aim of this study was to evaluate the onset and duration of sensory and motor block hemodynamic effect, postoperative analgesia, and adverse effects of dexmedetomidine given intrathecally with hyperbaric 0.5% bupivacaine. *Materials and Methods:* The study was carried out on 60 patients of both the sexes of ASA Grade I and II physical status scheduled for lower abdominal and lower limb surgeries. Patients were allocated into two groups. Group I (Control): 15 mg hyperbaric bupivacaine + 0.5 ml saline (preservative free). Group II (Dexmedetomidine): 15 mg hyperbaric bupivacaine + 10 µg Dexmedetomidine. *Results:* Patients in dexmedetomidine group (II) had a significantly longer sensory and motor block time than patients in control Group (I). The mean time of sensory regression to S1 was 367 ± 32 min in group II and 204 ± 21 min in Group I. The regression time of motor block to reach modified Bromage 0 was 325 ± 21 min in group II and 138 ± 15 min in Group I. *Conclusions:* Intrathecal dexmedetomidine is associated with prolonged motor and sensory block, hemodynamic stability, and reduced demand for rescue analgesics.

Keywords: Dexmedetomidine; Neuraxial Block; Bupivacaine; Intrathecal; VAS (visual analogue score).

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Introduction

It is the neuraxial block which makes the surgeries possible below umbilicus in low risk and highly compromised patient with safety of patient. First planned spinal anesthesia in man was given by Bier August[1] on 16th August 1898. In Kiel when he injected 3 ml of 0.5% cocaine solution into 34 years old laborer.

Since the local anesthetics are associated with relatively short duration of action which limit the technique for comparatively long duration surgery and also analgesic intervention is needed in postoperative period. Over the last decade, there has been considerable revival of interest in the use of adjuncts to local anesthetic agents in central neuraxial blocks.[2] Newer adjuvants are therefore being investigated. Many drugs are used as an adjuvant like: Vasoconstrictor–

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adrenaline, Opioids–fentanyl, morphine, α_2 adr. agonist–dexmedetomidine, clonidine NMDA receptor antagonist–ketamine, magnesium, Ach esterase inhibitor–neostigmine, Benzodiazepines–midazolam, etc. to prolong the duration of neuraxial block and reduce the postoperative analgesic requirement.

Dexmedetomidine is an α_2 adrenergic agonist that provides sedation, and anxiolysis, It is more selective α_2 agonist. $\alpha_2 : \alpha_1$ ratio is 1600 : 1 making it complete α2 agonist[3] It was introduced in clinical practice in united states in 1999 and approved by FDA. The sedative and hypnotic effect is produced by action on α_2 receptor in locus ceruleus. The analgesic effect is produced by action on α_2 receptor in locus ceruleus and within spinal cord.[4] Despite sound level of sedation with dexmedetomidine there is limited respiratory depression providing wide safety margin. It has also been noted that α_2 agonists have analgesic effect when injected via intrathecal or epidural route.[5] Dexmedetomidine is rapidly and extensively metabolized in liver and excreted in urine and feces Dr. Rachana Joshi Dr. Jignesh Mori *et al*.[2] 2013: Concluded that 5 µg dexmedetomidine is an attractive alternative as adjuvant to spinal bupivacaine in surgical procedures especially in those that need quite long time with minimal side effects and excellent quality of spinal analgesia. Sukhminder Jit Singh Bajwa, *et al*.[6] (2011) compared the efficacy and clinical profile of dexmedetomidine and clonidine, Deepika shukla, Anil Verma, *et al*.[7] (2011) in a Comparative study of intrathecal dexmedetomidine with intrathecal magnesium sulfate found that onset of anesthesia was rapid and of prolonged duration in the dexmedetomidine group B. Maharani *et al*.[8] (2013) Compared the dexmedetomidine and buprenorphine as adjuvants to spinal anesthesia. They concluded that 10 µg of DXM seems to be a better alternative.

Aims and Objectives

To evaluate the efficacy of intrathecal dexmedetomidine 10 µg as an adjuvant to 0.5% hyperbaric bupivacaine in neuraxial block. With respect to:

- Onset and duration of sensory and motor block
- Duration of analgesia
- Hemodynamic changes
- Adverse effect of drugs
- Sedation

On the basis of above parameters overall efficacy of dexmedetomidine as adjuvant was assessed.

Materials and Methods

After obtaining ethical committee approval and informed consent from patient. the study entitled "*Effect of Dexmedetomidine as an Adjuvant to Neuraxial Block with Bupivacaine in Lower Abdominal And Lower Limb Surgeries*" was carried out on 60 patients of both the sexes between the age of 18 to 65 and of ASA Grade I & II physical status. scheduled for lower abdominal and lower limb surgeries. Patient with the history of uncontrolled labile hypertension, heart block, dys arrhythmia, on therapy with adrenergic receptor antagonist, calcium channel blocker or ACE inhibitor, addiction to narcotic, sedation, LSCS and contraindication to spinal anesthesia were not included in the study. All the patients were thoroughly examined and investigated before the surgery. These patient were premedicated with injection atropine 0.60 mg IM. 45 mints before surgery. After premedication patients were allocated into two groups. Each group consisted of 30 patients.

Group I (Control): 15 mg hyperbaric bupivacaine + 0.5 ml saline (preservative free). *Group II (Dexmedetomidine):* 15 mg hyperbaric bupivacaine + 10 µg Dexmedetomidine.

In each group equal volume was injected, i.e 3.5 ml by dilution with normal saline [preservative free]. In the operation theater pulse oxymetry (SpO_2), noninvasive blood pressure (NIBP) and ECG was monitored. Following infusion of 15 ml/kg of Ringer lactate and with sitting posture lumbar puncture was performed under strict aseptic condition at L3–L4 level, using quinckes needle of 25 gauge. After intrathecal injection patient was placed in supine and oxygen @ 3 litre/min was given via face mask.

The following parameters were observed.

1. Onset, duration and quality of anesthesia.
2. Sensory block was assessed by short hypodermic needle in midclavicular line.
3. Motor block was assessed by modified bromage scale.
4. Sedation and pain was assess by modified Ramsay scale and visual analog scale.
5. Hemodynamic changes, viz. Pulse rate, and rhythm, B.P., ECG were recorded at regular interval per op and then in post op.

6. Any other untoward incidence of nausea, vomiting, shivering, pruritis, respiratory depression and sedation were assessed.

Statistical analysis was done using the Statistical Package (SPSS15.0 Evaluation version). Data were expressed as either mean and standard deviation or numbers and percentages. Continuous covariates were compared using analysis of variance (ANOVA). The comparison was studied using the chi-square test. The *p* value reported at the 95% confidence interval. $p < 0.05$ was considered statistically significant. $p > 0.05$ was considered statistically non significant.

Results

The distribution of the patients according to their age and gender in both groups remain comparable and statistically insignificant. having *p* value >0.05 (Table 1).

The distribution according to surgery remain comparable in both groups and statistically insignificant in both groups having *p* value >0.05 (Table 2).

It is evident from the table that sedation score was more (mean 2.3–2.13) in Group II (dxm) between 60–120 min (Table 4).

Table 1: Distribution of Patients according to their Age and Gender

	Group I (Contr)	Group II (Dxm)	*p* value	
Age (Mean ± SD)	41.366 ± 6.462	40.933 ± 7.210	> 0.05	
Male	16	15	>0.05	Chi square
Female	14	15		.368

Table 2: Distribution according to Their Type of Surgery

Surgery	Group I (Control)	Group II (Dxm)	Total	chi squar	*p* value
Appendicectomy	5	6	11		
Hernioplasty	7	7	14	2.135	(>0.05)
T.A.H.	7	6	13		
V.H.	7	8	15		
Lower limb	4	3	07		

Table 3: Showing Onset and Regression of Block with duration of Analgesia

	Group I (Contr)	Group II (Dxm)	*p* value
Sensory onset up to T-10 (in seconds)	297.866 ± 35.411	164.033 ± 25.557	<0.05
Motor block to Bromage-3 (in seconds)	353.766 ± 37.414	249.866 ± 24.639	<0.05
Regression to Bromage-0 (in minutes)	138.833 ± 15.572	325.133 ± 21.013	<0.05
Sensory regression to S-1 (in minutes)	204.133 ± 21.421	367.700 ± 32.161	<0.05
Duration of analgesia (in minutes)	139 ± 14.70	299 ± 20.06	<.001

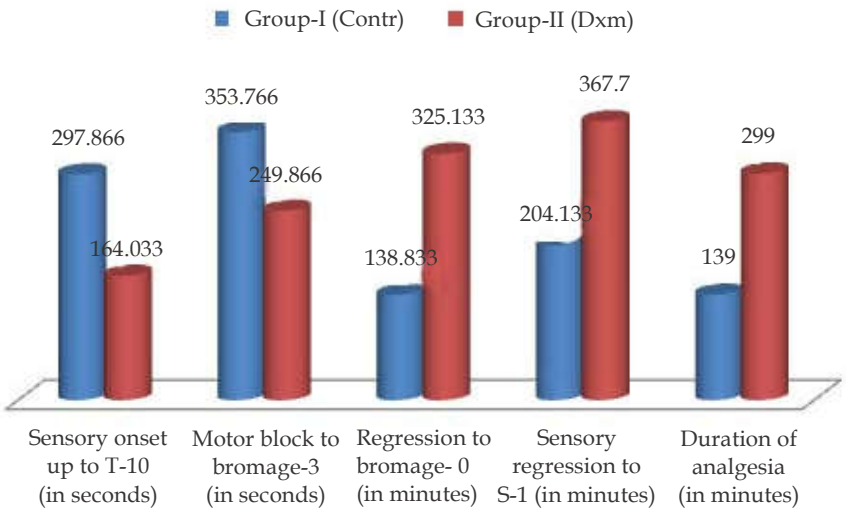

Fig. 1: Graph showing onset and regression of block with duration of analgesia

Table 4: Variation in Ramsay Sedation Score (RSS)

	Group I (Contr)	Group II (Dxm)
0 min	1 ± 0	1 ± 0
30 min	1.36 ± 0.49	1.86 ± 0.34
60 min	1.40 ± 0.49	2.30 ± 0.46
90 min	1.46 ± 0.50	2.30 ± 0.43
120 min	1.30 ± 0.40	2.13 ± 0.34
150 min	1.08 ± 0.28	1.83 ± 0.53
180 min		1.80 ± 0.50
210 min		1.66 ± 0.49
240 min		1.56 ± 0.50
270 min		1.36 ± 0.49
300 min		1.04 ± 0.20
330 min		1.0 ± 0

Table 5: Showing Variation of Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP)

Time	Systolic blood pressure (SBP)			Diastolic blood pressure (DBP)		
	Group-I (Contr)	Group-II (Dxm)	*p* values	Group-I (Contr)	Group-II (Dxm)	*p* values
0 min	129.7 ± 7.03	130.63 ± 4.89	> .05	79.56 ± 5.34	79.80 ± 5.14	> .05
5 min	120.36 ± 7.59	112.80 ± 9.05	< .05	77.26 ± 4.79	73.53 ± 3.33	< .05
10 min	114.06 ± 6.12	108.00 ± 8.40	< .05	74.03 ± 5.05	72.03 ± 2.09	> .05
15 min	115.53 ± 5.32	108.20 ± 8.26	< .05	74.53 ± 3.62	72.03 ± 2.12	> .05
30 min	118.23 ± 5.41	110.63 ± 7.73	< .05	75.46 ± 3.41	73.16 ± 2.69	> .05
60 min	120.03 ± 5.30	112.83 ± 5,91	< .05	75.93 ± 3.38	73.03 ± 2.05	> .05
90 min	122.10 ± 4.50	116.10 ± 4.46	< .05	77.66 ± 4.09	74.03 ± 1.47	> .05
120 min	125.00 ± 5.72	122.20 ± 2.00	> .05	77.70 ± 3.86	74.13 ± 1.33	> .05
150 min	126.50 ± 5.73	124.10 ± 4.37	> .05	77.80 ± 5.43	75.00 ± 2.13	> .05
180 min	127.97 ± 7.34	130.30 ± 7.34	> .05	77.36 ± 4.61	76.16 ± 2.70	> .05
210 min	128.37 ± 7.22	130.16 ± 7.50	> .05	78.07 ± 4.20	76.86 ± 5.55	> .05
240 min	129.66 ± 5.24	131.30 ± 7.60	> .05	78.33 ± 5.08	76.20 ± 5.68	> .05
270 min	128	131.10 ± 7.27		77.00	76.63 ± 5.91	
300 min		130.93 ± 7.51			76.63 ± 5.22	
330 min		131.70 ± 7.58			76.77 ± 5.12	
360 min		131.20 ± 8.09			76.20 ± 4.39	
390 min		129.36 ± 9.27			76.18 ± 3.91	
420 min		132.20 ± 6.30			76.80 ± 3.56	

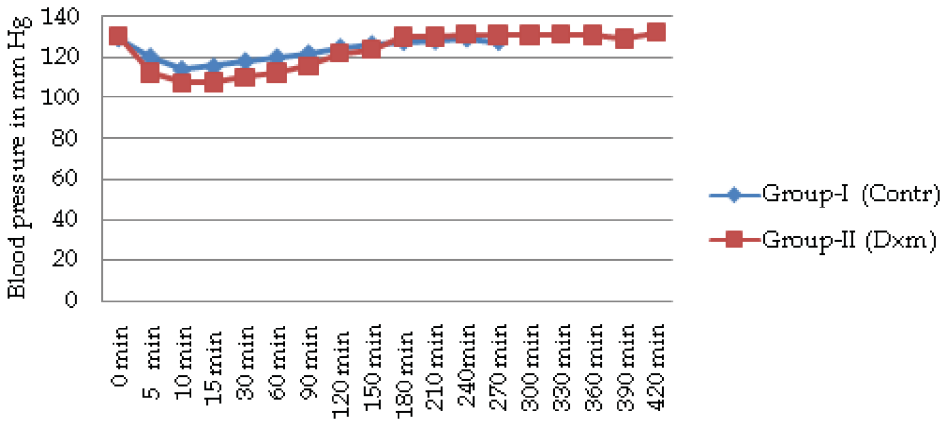

Fig. 2: Systolic blood pressure variation

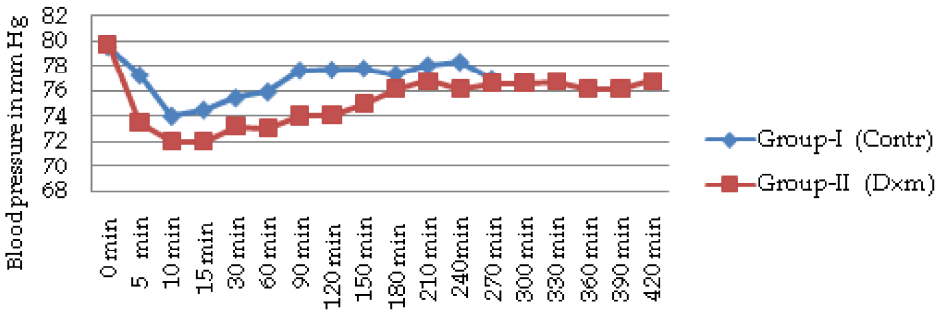

Fig. 3: Diastolic blood pressure variation

Table 6: Showing Variation in Heart Rate (HR)

Time	Heart rate (HR)		
	Group-I (Contr)	Group-II (Dxm)	P values
0 min	81.13 ± 10.48	83.73 ± 9.11	> .05
5 min	80.13 ± 10.07	82.10 ± 7.71	> .05
10 min	76.43 ± 13.30	73.96 ± 2.73	> .05
15 min	75.00 ± 8.91	73.00 ± 2.93	> .05
30 min	75.50 ± 9.27	73.10 ± 2.64	> .05
60 min	77.33 ± 8.65	75.06 ± 2.19	> .05
90 min	79.70 ± 9.47	77.03 ± 4.11	> .05
120 min	83.06 ± 9.21	80.06 ± 6.65	> .05
150 min	83.16 ± 7.87	82.00 ± 6.92	> .05
180 min	84.33 ± 9.12	82.50 ± 8.25	> .05
210 min	84.11 ± 9.85	82.96 ± 7.86	> .05
240 min	84.28 ± 7.38	82.60 ± 7.46	> .05
270 min	84.00	83.96 ± 9.08	> .05
300 min		84.00 ± 8.93	
330 min		84.00 ± 7.40	
360 min		83.55 ± 9.43	
390 min		83.45 ± 6.90	
420 min		84.20 ± 6.05	

Table 7: Side Effects

	Group I (cont)	%	Group II (dex)	%
No side effect	21	70%	24	80%
Hypotention	1	3.3%	3	10%
Nausea/Vomitting	3	10%	1	3.3%
Pruritis	1	3.3%	–	0%
Shivering	3	10%	1	3.3%
Urinary retention	1	3.3%	1	3.3%

Discussion

Base line comparison of groups according to gender was comparable among the total 60 patients.

Time of sensory onset up to T-10 (in seconds) In our study time of sensory onset up to T-10 in Group I (Contr.) was 297.88 ± 35.411 sec, in Group II (Dxm) 164.03 ± 25.55 sec. Wafiya Ramadan Mahdy, *et al*.[9] (2011) studied the effect of dexmedetomidine as adjuvant in spinal anesthesia. Their time of sensory onset was 2 ± .74 min perhaps this time is comparable with our time. That is dexmedetomidine as an adjuvant shorten the time of sensory onset.

Time of motor block onset to Bromage-3 (in seconds) In our study time of motor block onset to Bromage-3 in Group I (Contr.) was 353.766 ± 37.41 sec in

Group II (dxm) 249.86 ± 24.63 sec. Deepika Shukla, *et al.*[7] (2011) studied the effect of Dexmedetomidine as adjuvant in spinal anesthesia. Their time of motor block onset was comparable with the time of motor block onset in present study. That is dexmedetomidine as an adjuvant shorten the time of motor block onset.

Time of motor block regression to Bromage -0 (in minutes). In our study time of motor block regression to Bromage-0 in Group I (Contr.) was 138.83 ± 15.57 min and in Group II (Dxm) 325.13 ± 21.01 min. Hala EA Eid, *et al.*[10] (2011) used Dexmedetomidine as adjuvant in spinal anesthesia. Their time of motor regression was comparable with our time of motor regression. The time of motor block regression was longer in Group II (Dxm) as compared to control That is dexmed prolonged the time of motor block regression.

Time of sensory regression to S-1 (in minutes). In our study time of sensory regression to S-1 in Group I (Contr.) was 204.13 ± 21.42 min and in Group II (dxm) 367.70 ± 32.161 min. Maharani, *et al.*[8] (2013) used dexmedetomidine as adjuvant in spinal anesthesia. Their time of sensory regression was comparable with our time of sensory regression. That is dexmed prolonged the time of sensory regression.

Duration of analgesia In our study duration of analgesia in Group I (Contr.) was 139 ± 14.70 min in and Group II (dxm) 299 ± 20.06 min Maharani *et al.*[8] (2013) used dexmed with bupivacine their duration of analgesia was comparable with our time of analgesia. The analgesia was longer in group II (dxm) as compared to control group.

Hemodynamic changes Base line systolic blood pressure, diastolic pressure, heart rate, oxygen saturation were comparable. After spinal anesthesia systolic, diastolic blood pressure and heart rate, fall in each group but fall in Group II (dxm) was more as compared to Group I (cont), But after 30 min they start returning to baseline values. Though fall in blood pressure was more in Group II (dxm). Oxygen saturation was similar in both the groups. There was no statistically significant difference. Similar results were also found by G.E. Kanazi, MT. Aouad, *et al.*[11] (2006).

Sedation (Ramsay Sedation Score) Sedation score was more (mean 2.3–2.13) in Group II (dxm) between 60–120 min than Group I (mean 1.4–1.3) in between 60–120 min. Hala EA Eid, *et al.*[10] (2011) found that sedation score was more in dexmedetomidine group Rajni Gupta *et al.*[12] (2011) also found that sedation score was more in dexmedetomidine group.

VAS score The progression of VAS score was slower in Group II (dxm) than Group I (cont). Rajni Gupta, *et al.*[12] (2011) found that progression of VAS score was slow in dexmedetomidine group.

Among side effects hypotension was more common in Group II (dxm). Whereas nausea vomiting and shivering was more in Group I (cont).

Conclusion

Dexmedetomidine seems to be an attractive alternative as an adjuvant to spinal bupivacaine for long duration surgical procedures due to its profound anesthetic and analgesic properties combined with minimal side effects.

Source(s) of support: Nil

Conflicting Interest: Nil

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